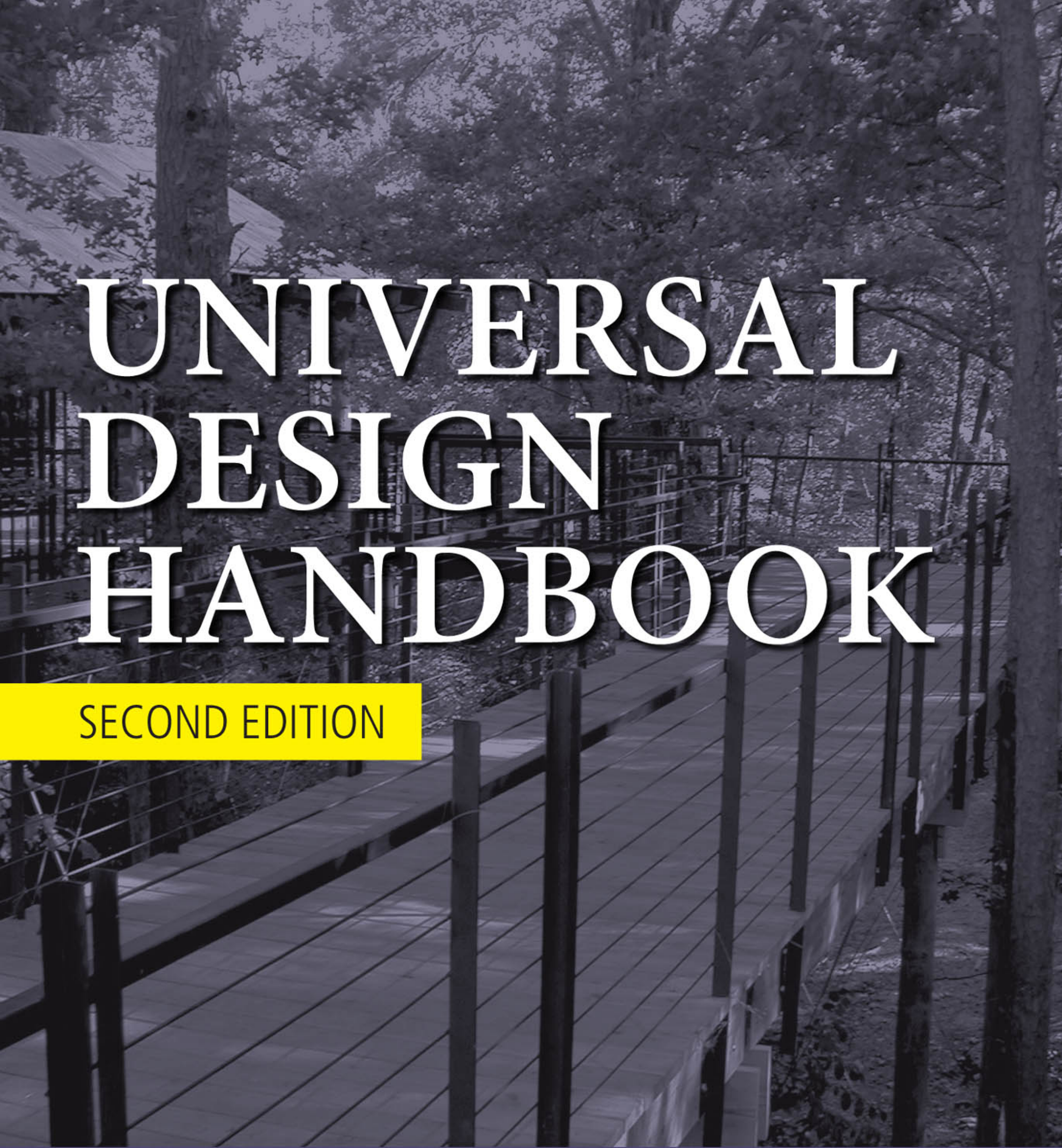

UNIVERSAL DESIGN HANDBOOK

SECOND EDITION

WOLFGANG F. E. PREISER, Editor-in-Chief
KORYDON H. SMITH, Senior Editor

Foreword by Robert Ivy, FAIA, Vice President and Editorial Director, McGraw-Hill Construction Media, and Editor-in-Chief, *Architectural Record*

UNIVERSAL DESIGN HANDBOOK

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Jon Christophersen has worked as an architectural researcher at SINTEF Byggforsk (formerly the Norwegian Building Research Institute) for a couple of decades. In addition to being a central figure in the universal design field in Norway, he has authored numerous publications on housing quality, accessible housing, and special needs housing. He has contributed to several books on inclusive design and has edited an internationally acclaimed book on universal design education. He has presented numerous papers at international conferences and is a frequent speaker and lecturer. Recent work includes articles on the history of universal design in Norway and dwelling adaptations/solutions for severely handicapped people. A paper on the latter subject was awarded a prize for "excellent paper" at the 2nd International Universal Design Conference in Kyoto, 2006. (CHAP. 42)

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Margo Vreeburg Izzo, with a Ph.D. in special education from The Ohio State University and an M.A. in vocational special education from George Washington University, is the associate director of the Nisonger Center at The Ohio State University, Columbus. She is principal investigator of over $3 million worth of projects awarded from the National Science Foundation and U.S. Department of Education. Recent publications include "Supported eText: Effects of Text-to-Speech on Access and Achievement for High School Students with Disabilities" in the *Journal for Special Education Technology* (with A. Yurick and B. McArrell), and "Universal Design for Learning: The Faculty Perspectives," in *Journal of Postsecondary Education and Disability* (with A. Murray and J. Novak). (CHAP. 39)

Edwina Juillet, who in 2000 retired from a 30-year career in health care risk management, continues professional activity as an independent consultant and advocate. Her interest in fire/life safety and emergency preparedness for persons with disabilities had its genesis in 1974 after the Rehabilitation Act was signed into law. This began her avocation with the focus on issues of emergency evacuation of persons with disabilities through research, codes/standards, training, publications, and coalition building. She is known as the cofounder of the National Task Force on Fire and Life Safety for People with Disabilities in 1978. (CHAP. 8)

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Ingrid Krauss studied product and process design at the Berlin University of the Arts before taking up freelance work as a designer and supporting various design and research projects. She joined the International Design Center Berlin in 2007, where she conducted the research project "Stimulating Economic Growth and Employment by Orienting Businesses and Economic Policy towards the Design for All Concept" and is now managing the project "Competence Network Universal Design." (CHAP. 13)

Yael Danieli Lahav is a faculty member of the School of Architecture at the Ariel University Center of Israel, where she teaches courses in architectural design and planning regulations. Lahav's scholarship focuses on universal design and inclusive urban planning. In addition, Lahav serves as the municipal coordinator for accessibility at the City of Jerusalem, where she is actively involved in the transformation of local urban design policy. Lahav earned a bachelor of architecture degree at the Technion–Israel Institute of Technology at Haifa and an M.A. in urban geography at the Hebrew University at Jerusalem. (CHAP. 16)

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Jack L. Nasar is a professor of city and regional planning at The Ohio State University. He is a fellow of the American Institute of Certified Planners; he has a Ph.D. in man-environment relations from Pennsylvania State University, a master's in urban planning from New York University, and a bachelor's in architecture from Washington University, St. Louis. His books include *Designing for Designers: Lessons Learned from Schools of Architecture* (edited with W. F. E. Preiser and T. Fisher); *Universal Design and Visitability: From Accessibility to Zoning* (edited with J. Evans-Cowley); *Environmental Aesthetics: Theory, Research, and Applications;* and *The Evaluative Image of the City, Design by Competition: Making Design Competitions Work.* Dr. Nasar received a Distinguished Alumni award from Washington University School of Architecture and the Environmental Design Research Association's Career and Achievement Awards. (CHAPS. 39, 41)

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Rosemarie Rossetti, Ph.D., is president of Rossetti Enterprises, Inc. She and her husband, Mark Leder, built the Universal Design Living Laboratory (www.UDLL.com), a national demonstration home and garden in Columbus, Ohio. This home showcases universal design and green building practices. Dr. Rossetti is an internationally known speaker, author, and consultant. As a person who uses a wheelchair, Dr. Rossetti knows firsthand how universal design provides access, convenience, comfort, and safety—making life easier. Her presentations help builders, architects, and interior designers integrate universal design and green building features into their projects. Since March 2006, her "Accessible Home" column has been published in *Action Magazine*, a national publication of the United Spinal Association. (CHAP. 45)

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Jim Sandhu, of Inclusive Design Research Associates, chaired the European Ministerial Conference on e-Inclusion on December 2, 2008. He has been a key player in inclusive design in Europe since 1972 with about 300 publications and 80 public domain designs. He has been a consultant to the World Bank, the British government, the European Standardisation Institute, and a wide range of programs for the European Commission, including

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Korydon Smith is a tenured associate professor in the Fay Jones School of Architecture at the University of Arkansas. Professor Smith teaches courses in architectural design, theory, and methods. Dr. Smith's primary scholarship investigates the roles that design and design education play among marginalized groups, resulting in a wide variety of publications, continuing education seminars, and consulting. Smith holds a professional M.Arch degree, with a concentration in architectural theory and design, from the State University of New York at Buffalo, as well as a doctoral degree in higher education leadership from the University of Arkansas. (EDITOR, CHAPS. 20, 28, 43).

Aaron Steinfeld, Ph.D., is a systems scientist in the Robotics Institute (RI) at Carnegie Mellon University. He received his B.S.E., M.S.E., and Ph.D. degrees in industrial and operations engineering from the University of Michigan and completed a postdoctoral program at U.C. Berkeley. Dr. Steinfeld is the codirector of the Rehabilitation Engineering Research Center on Accessible Public Transportation (RERC-APT) and the area lead for transportation-related projects in the Quality of Life Technology Engineering Research Center (QoLTERC). His research focuses on operator assistance under constraints, i.e., how to enable timely and appropriate interaction when technology use is restricted through design, tasks, the environment, time pressures, and/or user abilities. (CHAP. 31)

Edward Steinfeld, D.Arch., AIA, is founding director of the Center for Inclusive Design and Environmental Access (IDEA), professor of architecture at the University at Buffalo–State University of New York, and a registered architect in New York State. Dr. Steinfeld's research focus is universal design, human factors, and social theory and design. He is widely published and has served as an expert accessibility consultant for the World Bank, the U.S. Department of Justice, the U.S. Department of Housing and Urban Development, and other agencies. His awards include a Distinguished Professor Award from the Association of Collegiate Schools of Architecture, a National Endowment for the Arts Design Research Award, and two Progressive Architecture Applied Research awards. Dr. Steinfeld completed his doctoral and postprofessional studies at the University of Michigan and holds a professional degree in architecture from Carnegie Mellon University. (CHAP. 19)

Molly Follette Story, Ph.D., is president of Human Spectrum Design and is an expert in universal design of products and usability of medical instrumentation. Dr. Story coordinated and coauthored the *Seven Principles of Universal Design*, coauthored *The Universal Design File: Designing for People of All Ages and Abilities*, and was coeditor of *Medical Instrumentation: Accessibility and Usability Considerations*. She holds six utility patents and has served as a consultant to companies including Kaiser Permanente, Sunrise Medical, Abbott Diabetes Care, Inverness Medical, Midmark Corporation, Maytag Corporation, and MasterCard Worldwide. She has conducted research at the University of California, Berkeley, North Carolina State University, and Western University of Health Sciences. Dr. Story is a member of HFES, AAMI, RESNA, and AAMI's Human Factors Engineering Committee. She has been an invited speaker in the United States, Japan, Germany, and England and has served as a juror for numerous design competitions. She has degrees from Princeton University (B.S.E.), Stanford University (M.S.), and the University of California, Berkeley (M.S. and Ph.D.). (CHAPS. 4, 32)

Susan S. Szenasy is editor-in-chief of the award-winning *METROPOLIS* magazine of architecture and design. Since 1986, she has led the magazine in landmark design journalism, achieving domestic and international recognition. Szenasy sits on the boards of the Council for Interior Design Accreditation, FIT Interior Design, the Center for Architecture Advisory Board, and the Landscape Architecture Foundation, and she is internationally recognized as an authority on sustainability. She has been honored with two IIDA Presidential Commendations, is an honorary member of the American Society of Landscape Architects and the American Institute of Architects, New York City, and was the 2008 recipient of the American Society of Interior Designers Patron's Prize and Presidential Commendation. Susan was a co-recipient of the 2007 Civitas August Heckscher Award for Community Service and Excellence. She holds an M.A. in modern European history from Rutgers University and honorary doctorates from Kendall College of Art and Design, the Art Center College of Design, and the Pacific Northwest College of Art. (CHAP. 2)

Beth Tauke is an associate professor in the School of Architecture and Planning at the University at Buffalo–State University of New York. She directs university education activities for the Center for Inclusive Design and Environmental Access (IDEA), is the director of the Universal Design International University Education

Consortium, and one of the coeditors of Universal Design Education Online. In addition, she has published many journal articles and book chapters and coedited the book *Universal Design: New York*. Professor Tauke's major awards include a National Institute for Architectural Education Award, the American Collegiate Schools of Architecture Robert R. Taylor Award for Diversity in Design, the Lily Endowment Teaching Fellowship, a National Endowment for the Arts (NEA) Universal Design Leadership Grant, an NEA Creation and Presentation Grant, and the State University of New York Chancellor's Award for Excellence in Teaching. (CHAP. 27)

Margaret H. Teaford is an associate professor in the occupational therapy division at The Ohio State University where she teaches courses in gerontology and universal design. Her research focuses on caregiving and home modifications. Dr. Teaford earned her B.A. in history from Mount Holyoke College, M.S. in urban and regional planning from the University of Wisconsin, and Ph.D. in human development and family science from The Ohio State University. (CHAP. 29)

Laura M. Terry is an associate professor in the Fay Jones School of Architecture at the University of Arkansas, where she teaches courses in beginning architectural design and experimental drawing and directs the Camp Aldersgate Design-Build Program. The program has been recognized in *Dwell* magazine in September 2006, and the Tree House was number 20 on the *Metropolitan Home* Design 100 List in June 2008. She has raised over $70,000 in grants and donations to support the program. She received a B.S. in environmental design from Auburn University and an MFA in painting from the Savannah College of Art and Design. (CHAP. 40)

Jennifer Webb, Ph.D., is an associate professor of interior design at the University of Arkansas. Her professional work has been in the corporate and health care sectors, and this experience has directly influenced her teaching and research efforts. Dr. Webb has written about the effects of the interior environment on human behavior, particularly regarding older adults in congregate living settings. Her goal is to improve users' health, safety, and welfare in interior settings through teaching and research. (CHAP. 43)

Brent T. Williams, Ph.D., certified rehabilitation counselor, is an associate professor and the program coordinator for the Rehabilitation Education and Research Program at the University of Arkansas. In addition to his research and teaching efforts, Dr. Williams has over two decades of experience serving the wider community of persons with disabilities as a service provider, agency administrator, and board member. Dr. Williams has authored journal articles and book chapters, and he has made presentations across a broad spectrum of subjects, including disability and social justice, the role of not-for-profit community-based rehabilitation agencies, and the societal and fiscal costs of noninclusion for persons with disabilities. (CHAP. 43)

Leslie C. Young, director of design, R. L. Mace Universal Design Institute, is a professional designer, technical writer, and specialist with a 25-year multidisciplinary background in accessible and universal design. She has spent much of her career developing technical print and media materials translating law and regulation into practical design solutions. Her career efforts have been focused on community and residential design, museums, and state and federal accessibility compliance. She coauthored the *Fair Housing Act Design Manual* for the U.S. Department of Housing and Urban Development. After working 10 years at the North Carolina State University Center for Universal Design, in 2008 she became the director of design at R. L. Mace Universal Design Institute, a nonprofit organization dedicated to promoting the concept and practice of accessible and universal design in housing, public-use buildings, and outdoor and urban environments. (CHAP. 24)

Susan Zavotka is an associate professor in the Department of Consumer Sciences at The Ohio State University, where she teaches courses in residential interior design and visual merchandising. Dr. Zavotka's research focuses on aging and design, particularly as they relate to the use of universal design features in residences. She is actively involved in a universal design education community outreach program that provides workshops and home assessments. Dr. Zavotka has earned a B.S. in home economics education, an M.S. in interior design, and a Ph.D. in instructional design from The Ohio State University. (CHAP. 29)

FOREWORD

Imagine the first edition of the *Universal Design Handbook* like a small stone thrown into a pond. As it struck, it spread its initial message, asking that we change our design focus to allow for the full range of potential in every human being. Undergirded by concurrent regulations, this initial phase raised designers' consciousness and helped change our attitudes toward a more humane way of planning.

After the initial splash, the movement rippled out, becoming not only accepted, but more integrated with other areas of design far beyond its beginnings in the disability movement. Today, schools of architecture, the design profession, and public policy reflect universal design principles. While far from ideal, this point of view has found support in federal funding, research, and public policy as it evolved from a segregated sensibility to the design mainstream.

As the circles spread, the subject enlarged to include social and scientific concerns relevant to our environmentally challenged era. Today, conversations regarding universal design often incorporate questions of social justice, sustainability, and environmental matters: How equitable, or flexible, or intuitive or perceptible, or tolerant of human frailty should any given solution be, so as not to disadvantage any user? Levers, for example, allow a range of persons easy access to doorways, where gnarly or precious knobs, handsome perhaps, but hard to manipulate, might unintentionally exclude a segment of the population.

Demographics insist that this generation of baby-boomers will live longer, posing questions not only of accessibility on a hitherto unanticipated scale, but environmental questions that follow. Lighting, acoustics, control systems, air quality—designers set the parameters that affect all these areas, and all affect the total environment. Houses for this generation can be one-time throwaways, or allow for aging in place, reducing our consumption of building materials and supplies and making lesser demands on planet Earth.

As this second edition exhibits, the movement's ripples have spread into an international concern, with major economies engaged in the debate and discussion of universal design, whether in books like this, on the Web, at university gatherings, chapter meetings, or conferences. Our challenge will be to keep design concerns clearly focused and pragmatic enough to allow practical solutions for the real world. This generation and the next must be able to articulate universal design tenets clearly and articulately enough to share its pressing story. The ripples are expanding. Will they gain force or dissipate in the face of obstacles?

Robert Ivy, FAIA
Vice President and Editorial Director,
McGraw-Hill Construction Media,
and Editor-in-Chief, *Architectural Record*

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PREFACE

The first edition of the *Universal Design Handbook* was published in 2001. At the time, it was greeted with great enthusiasm in countries around the world, and the publisher celebrated the release by organizing a special exhibit at the Designing for the 21st Century Congress in Montreal, Canada. The book was translated into Japanese and published by Maruzen in Tokyo in 2003.

This second edition of the *Universal Design Handbook* is a more user-friendly version of the handbook. Seventeen new author groups were recruited for this edition.

The editor-in-chief for the first edition of the *Universal Design Handbook* was Wolfgang F. E. Preiser and the senior editor was Elaine Ostroff. The book was dedicated to Ronald L. Mace, FAIA, who had coined the term *universal design* in the mid-1980s. For the second edition, Korydon H. Smith served as senior editor.

The second edition is organized as follows: Introduction; Part 1: Premises and Perspectives; Part 2: Principles, Standards, and Guidelines; Part 3: International Perspectives; Part 4: Public Spaces, Private Spaces, Products, and Technologies; Part 5: Education and Research; Part 6: The Past and Future of Universal Design; and Part 7: Epilogue.

Contributors to this edition of the *Universal Design Handbook* come from many countries, including the United States, United Kingdom, Norway, Germany, France, Italy, Japan, India, Israel, and Brazil.

The second edition of the *Universal Design Handbook* includes updated chapters as well as new chapters. For example, the growth and development of universal design in Japan are impressive, as evidenced by their 2006 International Conference on Universal Design held in Kyoto. About 3500 attendees were registered for the conference sessions, and approximately 13,000 people visited the exhibit, which showcased a strong dedication of Japanese industry to the concept of universal design. This included automotive design, product design, and information technology, with industry giants such as Sony and Panasonic being strongly represented. This example and others are highlighted in Chap. 1 of this book, as well as throughout the second edition.

Like the first edition, the second edition of the *Universal Design Handbook* provides both newcomers and experts with useful information on universal design to be incorporated into a variety of teaching, research, and professional practice endeavors.

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ACKNOWLEDGMENTS

The first edition of the *Universal Design Handbook* was published in 2001. Its editors, Preiser and Ostroff, wish to acknowledge the crucial role of the National Endowment for the Arts (NEA) and the National Institute on Disability and Rehabilitation Research (NIDRR) in supporting universal design through their policies as well as grants for education, research, product development, technical assistance, and promotion. The impact of both agencies is reflected in the work of a number of the authors from several countries. In addition to their research and program support, both agencies have used their position to inform other government agencies and the public about universal design. Three national Rehabilitation Engineering Research Centers on universal design are now in place, with NIDRR support. Two on the built environment are the Center for Universal Design at North Carolina State University and the RERC on Universal Design, University at Buffalo. The RERC on Information Technology Access is at the Trace Research and Development Center, University of Wisconsin, Madison.

The editors of the second edition, Preiser and Smith, greatly appreciate the contributions of the author teams. They worked diligently, often rewriting their chapters several times to reach the clarity that reflects the excellence of their work.

Thanks are also owed to the persons who got the editors interested in the field of accessible and universal design in the first place and to the agencies which helped sustain that interest through grants and other support.

In the case of Editor-in-Chief Preiser, the National Science Foundation (NSF) assisted research leading to the publication of *Public Building Accessibility: A Self-Evaluation Guide* by the University of New Mexico School of Architecture and Planning in 1978, authored by Gray, Gendron, Heath, Green, Fish, and Johnson. This guide would allow businesses, hospitals, or any organization to check out their facilities for accessibility without necessarily hiring consultants. Later, the NEA provided several grants to help develop an electronic Guidance System for Visually Impaired Persons for buildings and the campus of the University of New Mexico, as seen in "A Combined Tactile/Electronic Guidance System for Visually Impaired Persons in Indoor and Outdoor Spaces," by Preiser, in *Design for Disabled Persons*, published by Freund Publishing House in 1988. Thanks go to Ray Marshall, coordinator for special services at that university, for his excellent cooperation and for providing subjects for the research that led to a prototype of that guidance system. Preiser also thanks William Davis at the New Mexico School for the Visually Handicapped in Alamogordo, New Mexico, for assisting in the testing and research, which was awarded the 1984 *Progressive Architecture* Annual Award in Applied Research.

Senior Editor Smith is extremely appreciative of the experience to work on this second edition, with gratitude to the previous editors for that opportunity. Likewise, Smith is grateful for the support of administrators, faculty members, and staff members at the Fay Jones School of Architecture at the University of Arkansas, in addition to the continued sponsorship of various agencies in Arkansas, including Arkansas Rehabilitation Services, Arkansas Department of Human Services, UAMS Partners for Inclusive Communities, Arkansas Development Finance Authority, Arkansas AARP, and others. Finally, Smith would like to make special note of the treasured mentorship and friendship of Beth Tauke, lead author of Chap. 27, whose combined energy, sincerity, empathy, and perception have inspired all who have known her.

Editor-in-Chief Preiser acknowledges the role that previous Senior Editor Elaine Ostroff and present Senior Editor Korydon Smith played in recruiting authors into this book project. More particularly, Ostroff's national and international network reflects her work of more than 30 years in the field of accessibility and in universal design, and her knowledge of this emerging field was invaluable in the editorial process. Ostroff, the founding director of Adaptive Environments (now the Institute for Human Centered Design) in Boston, developed the Universal Design Education project noted throughout the handbook, and was instrumental in organizing the international conferences "Designing for the 21st Century," held in New York City in 1998, Providence, Rhode Island, in 2000, and Rio de Janeiro in 2004. The growing number of presenters and attendees is evidence of the fact that universal design is sweeping the world as a movement, apparently unstoppable and particularly significant in aging societies.

Preiser and Smith wish to thank the many individuals and organizations that helped shape this book as well as refine the emphasis of its contents. Given the handbook's global scope, a number of difficulties had to be overcome, ranging from communications in general, to an equitable editorial process, which recognizes regional and cultural differences in universal design, as well as accessibility for persons with disabilities in different countries. Perhaps the most important source of inspiration and continuing involvement in the field of universal design has been students and colleagues of Preiser and Smith over the course of the past decades. Without their help and genuine care, it would not have been possible to carry out this and numerous other projects.

Preiser and Smith thank Joy Bramble, senior editor at McGraw-Hill, for shepherding the daunting process of creating this handbook on universal design. Likewise, Deepti Narwat Agarwal, senior project manager at Glyph International, Noida, India, was a true facilitator in managing the book production, including copy editing, as well as the page composition and proofing process for McGraw-Hill.

Finally, Preiser and Smith must recognize the invaluable and unending support that their spouses, Cecilia Fenoglio-Preiser and Julie Haase-Smith, provided throughout this challenging project.

INTRODUCTION

Wolfgang F. E. Preiser and Korydon H. Smith

A CENTURY'S WORTH OF CHANGE

Since the publication of the first edition of the *Universal Design Handbook* in 2001, the world of design has seen major transformations. In less than a decade, the world has experienced a century's worth of change, the scope and diversity of which were unimaginable in 2001. Social, technological, economic, environmental, and legal changes have altered both the philosophical discourses and the physical practices of design disciplines at all scales.

In 1900, only 13 percent of the world's population lived in urban areas. In 2005, the world's population reached the tipping point, as 49 percent of people lived in urban areas. With the publication of this book, the scale has shifted, and for the first time in world history, more people live in urban areas than nonurban areas (United Nations, 2008). As cities have grown, how have the roles of designers changed?

In 2006, the world output, a chief measure of the worldwide economy, reached 59 trillion international dollars, a growth of 4.8 percent from the previous year (World Bank, 2008). East Asia and the Pacific "increased their share of global output from 9 percent to 14 percent." The gains, however, were short-lived. As economies, such as that of the United States, slid downward throughout 2008, politicians around the globe assured their constituents that the downturn would be temporary. By the beginning of 2009, nations around the world were experiencing the greatest economic hardships since the Great Depression. The year 2009 showed the first decline in world output on record. Asia was hardest hit, as countries such as Japan saw a 40 percent decline in exports in January 2009 compared to the previous year (World Bank, 2009). What effects have these economic shifts had on design?

Worldwide health has also been a major concern over the past decade. Throughout 2009, the World Health Organization (2009) scrambled to combat the swine flu (H1N1) pandemic, as more than 200 countries and territories had laboratory-confirmed cases of the virus. Likewise, since 2001, regions throughout the world were also struck by numerous natural disasters. In December 2004, a tsunami struck Indonesia, killing nearly one-quarter million people. In August 2005, hurricane Katrina struck the Gulf Coast of the United States, flooding most of New Orleans and causing more than $80 billion in damages. The largest percentages of Katrina fatalities were older adults and people with disabilities. In May 2008, just months prior to the Summer Olympics, earthquakes devastated the Sichuan Province of China, leaving 5 million people homeless. In the same month that year, Myanmar lost more than 100,000 citizens to cyclone Nargis. In early 2010, earthquakes also destroyed much of urbanized Haiti, killing tens of thousands of people and leaving millions homeless. If these regions were designed differently, how might the outcomes be different?

In spite of these catastrophes, lots of technological progress has been made since the first edition of the *Universal Design Handbook*. Apple, for instance, released the iPod in late 2001, selling nearly 200 million since that time. Google and YouTube have become household names. Toyota, in 2006, released the first mainstream hybrid SUV, the Highlander, following its decade of success with the Prius hybrid. Space exploration reentered popular conversations, as the exploration rover Spirit touched down on Mars in January 2004 and has been sending data back to Earth ever since. The list of medical and assistive technologies invented since 2001 is too staggering to mention. Nevertheless, *Time* magazine's Best Invention of 2008, an at-home DNA test, illustrates that advanced medical technologies are being taken out of experimental research and are entering mainstream consumer markets. Similarly, the digital revolution has impacted a number of subcultures. For instance, as reported by Aviv (2009), less than 10 percent of legally blind Americans now read Braille, which is attributable to digitized text and which signals a shift back to an oral culture. What roles did designers play in the technological advancements of the past decade, and how have various cultures changed as a result?

Social advancements were also made in the past decade. In regard to universal design, in 2000, the United Nations (U.N.) appointed Miloon Kothari, an architect from India, as its first Special Rapporteur on Adequate Housing. During his eight-year term, Kothari's office drafted the first U.N. resolutions on housing. Kothari helped substantiate the importance of housing as "a vital element for achieving socially, economically and environmentally sustainable development" and that a home "is a key element for fostering family integration, contributing to social equity and strengthening of the feeling of belonging, security and human solidarity" (United Nations, 2004). More particularly, the rights of persons with disabilities were included in these seminal U.N. resolutions: "Persons with disabilities have particular needs in regard to . . . the full and equal realization of adequate housing as a component of the right to an adequate standard of living" (United Nations, 2004). On December 10, 2008, little more than a month after the United States elected the first black (biracial) President in its history, Barack Obama, the United Nations celebrated the 60th anniversary of The Universal Declaration of Human Rights. The United Nations reaffirmed its focus on "dignity" for "all members of the human family" and for "freedom, justice and peace in the world," values and nomenclature that are at the heart of universal design. In the past decade, has the world become more conscious of the necessity of good design?

All the aforementioned have furthered the importance of universal design education and practice. As stated by both Ostroff (in Chap. 1) and Preiser (2009), a paradigm shift in design is evident, and universal design appears to be at the center. Universal design (UD) concepts have gained significant traction worldwide, as evidenced in recent years by the emergence of the Design for All Foundation in Spain, Universal Design GmbH in Germany, the Global Universal Design Commission in the United States, Design for All Europe in Ireland, the Design for All Institute of India, and numerous others. UD is not a trend but an enduring design approach that assumes that the range of human ability is ordinary, not special. UD is a concept about making media, products, buildings, and infrastructure for the widest range of human needs, preferences, and functioning.

Newcomers to universal design concepts and its parallels—inclusive design, design for all, etc.—will find this book useful in understanding the origins and definitions of UD provided in the early chapters. As they progress, they will find real-world exemplars that further articulate the realm of UD across design disciplines. Readers familiar with UD will find a great number of updates and breaking developments since the first edition was published. The overarching goal of the second edition of the *Universal Design Handbook* is to provide students, advocates, policy makers, and design practitioners with a theoretical grounding and practical guide on the physical and social roles of design.

As such, the second edition of the *Universal Design Handbook* brings together a rich variety of expertise from around the world to discuss the extraordinary growth and changes in the universal design movement. This edition builds upon the foundational work of the latter part of the twentieth century, and it adds to the work of the many scholars and practitioners who have contributed to this field since the first edition was published in 2001. The structure of the second edition is discussed below, which is followed by a prospectus on the future for universal design.

STRUCTURE OF THE SECOND EDITION

A primary goal in developing this second edition of the *Universal Design Handbook* was to provide a user-friendly guide to universal design without compromising the breadth of topics covered. Like the first edition, this edition contains an international mix of authors. In addition, it contains a combination of updated and new chapters. The chapters are concise and highly focused, providing insight for both newcomers to universal design and experts in the field. The chapters have been organized into seven parts, moving from the most comprehensive to the most specific topics. A synopsis of each part and chapter follows.

Part 1: Premises and Perspectives

The chapters in Part 1 provide a historical and theoretical context for universal design. In Chap. 1, "Universal Design: An Evolving Paradigm," Elaine Ostroff offers a brief background on universal design and recent international developments. Susan Szenasy situates universal design within the broader realm of sustainable design in Chap. 2, "Toward Social, Economic, and Environmental Sustainability." In Chap. 3, "Universal Design and the Majority World," Singanapalli Balaram discusses the growing chasm between developed and developing nations and the role that universal design plays. This part establishes a foundation upon which the remainder of the book builds.

Part 2: Principles, Standards, and Guidelines

Part 2 encompasses the development of performance-based criteria and guidelines for universal design in varied settings. Molly Follette Story describes the developmental process and articulation of "The Principles of Universal Design" in Chap. 4. In Chap. 5, "United Nations Convention on the Rights of Persons with Disabilities," John Mathiason discusses the role of the United Nations in the furthering of universal design concepts worldwide. John Salmen, in Chap. 6, "U.S. Accessibility Codes and Standards: Challenges for Universal Design," examines the relationship between formal, legal design standards, such as those defined by the Americans with Disabilities Act, and the more speculative concepts of universal design. The implications of prominent legal cases in the United States regarding accessibility in public theaters and stadiums are presented by Sanjoy Mazumdar and Gilbert Geis in Chap. 7, "The ADA and Accessibility: Interpretations in U.S. Courts." In Chap. 8, "Life Safety Standards and Guidelines," Jake Pauls and Edwina Juillet illustrate the importance of not only access but also egress and other safety concerns relating to universal design. Richard Duncan, Barbara Brenny, and Hugh Kelsey demonstrate an alternative framework for defining, structuring, and implementing universal design concepts in Chap. 9, "The Universal Design Thesaurus: Creating a Descriptive Language for Our Field."

Part 3: International Perspectives

Part 3 includes analyses of historical and contemporary issues in universal design from seven different countries. In Chap. 10, Olav Rand Bringa, Einar Lund, and Kristi Ringard describe "Norway's Planning Approach to Implement Universal Design." Satoshi Kose, in Chap. 11, explores "The Impact of Aging on Japanese Accessibility Standards." Louis-Pierre Grosbois discusses "The Evolution of Design for All in Public Buildings and Transportation in France" in Chap. 12, including several exemplars of the movement. Ingrid Krauss, in Chap. 13, discusses "Manifestations of Universal Design in Germany." In Chap. 14, Marcelo Pinto Guimarães explores an alternative approach to disability policy and design in "Writing Poetry Rather Than Structuring Grammar: Notes for the Development of Universal Design in Brazil." Assunta D'Innocenzo and Annalisa Morini define "Accessible Design in Italy" in Chap. 15. Finally, "Planning Accessibility in the Old City of Jerusalem" is described by Avi Ramot, Yael Danieli-Lahav, and Judith Bendel in Chap. 16.

Part 4: Public Spaces, Private Spaces, Products, and Technologies

Part 4, "Public Spaces, Private Spaces, Products, and Technologies," of the *Universal Design Handbook* discusses exemplars of universal design. This part is divided into three subsections. Like the overall structure of the book, these subsections move from the large-scale, public design realm, to the small-scale, private realm of design, and finally to discussions of products and technologies.

The first subsection, concerning public spaces, contains seven chapters. In Chap. 17, "Creating an Accessible Public Realm," Sandra Manley discusses universal design at the macroscale. John Petronis and Robert Robie, in Chap. 18, "A Capital Planning Approach to ADA Implementation in Public Educational Institutions," highlight the importance of universal design in higher education settings, and they provide a framework for strategic planning. Chapter 19, "Universal Design in Mass Transportation," authored by Edward Steinfeld, illustrates the significance of clarity convenience, and safety in navigating through large, mass-transit terminals. Wolfgang Preiser and Korydon Smith, utilizing a variety of exemplars, provide an overview of "Universal Design at the Urban Scale" in Chap. 20. In "Designing Inclusive Experiences," Chap. 21, Roger Coleman explores a creative reenvisioning of the design of future consumer environments. Susan Goltsman discusses the importance of play in child development and articulates principles for designing exterior play spaces in Chap. 22, "Outdoor Play Settings: An Inclusive Approach." Strategies for accommodating employees with diverse physical, cognitive, and perceptual needs are defined by James Mueller in Chap. 23, "Office and Workplace Design."

The second subsection, "Private Spaces," provides several new chapters. Housing design is the focus. In Chap. 24, Leslie Young describes "Universal Housing: A Critical Component of a Sustainable Community." Jordana Maisel, in Chap. 25, "The Evolution of Universal Design in Housing in the United States: Toward Visitability and Pattern Books," provides an overview of recent U.S. housing legislation and how it may be addressed in community planning and design. An in-depth look at the design goals and features of his own home is provided by John Salmen in Chap. 26, "A Home for the Next 50 Years: Remodeling for Aging Boomers Demonstrates Universal Design in Arts and Crafts Detailing." Beth Tauke and David Schoell, in Chap. 27, "The Sensory House," provide an innovative exploration of the roles that sensory and cognitive perception play in housing design. In Chap. 28, "Diversity and Equality in Housing: Designing the Arkansas Proto-House," Korydon Smith discusses how the ideals of universal design and site-specific design can be brought together.

The third and final subsection, "Products and Technologies," contains seven chapters, ranging from product design to media design. In Chap. 29, "Selling Builders and Remodelers on Universal Design," Margaret Teaford, Susan Zavotka, and Christine Price describe how to develop outreach programs involving builders and remodelers, product retailers, universal design experts, and consumers. Abir Mullick, in Chap. 30, describes the design principles of "Universal Bathrooms." Aaron Steinfeld reconsiders automobile design in Chap. 31, "Universal Design of Automobiles," providing a number of design principles and suggestions. Molly Follette Story and James Mueller, in Chap. 32, articulate the importance of the "Universal Design of Products." In Chap. 33, "Accessibility of the World Wide Web: Technical and Policy Perspectives," Judy Brewer discusses principles for website and digital media design. Trisha O'Connell and Larry Goldberg, in Chap. 34, "Universal Design in Media," describe the roles of visual and acoustic information in the design of various media technologies, such as DVDs. Finally, in Chap. 35, Charles Hitchcock discusses how to design "Digital Content for Individuals with Print Disabilities," the contents of which form the underpinning for the digital version of this book.

Part 5: Education and Research

Part 5 explores current and emerging research and teaching in universal design. In Chap. 36, "Inclusive Design Research Initiatives at the Royal College of Art," Jeremy Myerson and Yanki Lee describe a creative research and design agenda, which partners academicians, students, and industry. Valerie Fletcher discusses "An International Web-Based Collection of Universal Design Exemplars" in Chap. 37. Wolfgang Preiser, in Chap. 38, "Toward Universal Design Performance Assessments," articulates the importance of developing a more formalized assessment mechanism for universal design, and he explores what it might contain. In Chap. 39, "Universal Design for Learning in the College Classroom," Margo Vreeburg Izzo, Steven Rissing, Christopher Andersen, Jack Nasar, and L. Scott Lissner collaborate in discussing the principles of universal design learning (UDL) and defining how teachers can incorporate UDL into their daily teaching practices. An innovative design-build program, involving architecture students and a summer camp for children with disabilities, is discussed by Laura Terry in Chap. 40, "Camp Aldersgate: A New Model for Architectural Education." In Chap. 41, Jack Nasar begs the question, "Are Retrofitted Wheelchair Entries Separate and Unequal?" Jon Christophersen and Karine Denizou, in Chap. 42, "Guidepaths in Buildings," discuss the importance of way-finding and the role that various architectural and signage elements play, especially for persons with visual impairments. In Chap. 43, "Redefining Design and Disability: The Person-Environment Fit Model," Jennifer Webb, Brent Williams, and Korydon Smith discuss how universal design ideals may transform attitudes, policies, and practices in the future, proposing a new conceptual framework of design and disability.

Part 6: The Past and Future of Universal Design

Part 6 of this book contains one chapter. In Chap. 44, "The Rhinoceros Syndrome: A Contrarian View of Universal Design," Jim Sandhu develops a metaphorical account of the history of universal design, which is meant to leave the reader with a set of questions regarding the history and prospects of universal design.

Part 7: Epilogue

The second edition of the *Universal Design Handbook* concludes with a personal account of the suddenness of disability, the immediate life changes that occur, and the role that one's home plays. In Chap. 45, "My Story," Rosemarie Rossetti describes her personal experiences with disability and the actions she took to design and build a home—the UD Living Laboratory—that not only meets her needs but also serves as an exemplar of universal design.

THE NEXT DECADES OF CHANGE

Given the century's worth of change over the past decade, it is uncertain what the coming decades will bring. Canton (2006) states, "Tracking the future, figuring out what is going to happen when, is as much art as science." Given that design is the synthesis of the two—art and science—undoubtedly designers will play a central role in facilitating and responding to change.

In 2000, the world's population was slightly more than 6 billion. It is anticipated that by 2025 there will be more than 8 billion people living on Earth (United Nations, 2009). Growth will be highest in less-developed nations. For example, by the end of the twenty-first century, Europe's share of the world's population will be cut in half, dropping from 12 percent to less than 6 percent, while Africa's share will double, to possess one-quarter of the world's people (United Nations, 2009). India, Pakistan, Nigeria, the United States, and China, respectively, will experience the largest population growths, while Niger, Yemen, Somalia, Uganda, and Mali, respectively, will experience the fastest rates of growth over the coming decades. As population centers change, what roles will designers play?

From 2000 to 2050, the number of persons 80 years of age and older will increase by 446 percent, with the greatest increases (more than 700 percent) in less-developed regions of the world. Simultaneously, the world's population density will rise from 46.5 to 68.4 persons per square kilometer. In 2050, Niger will hold the lowest median population age, 20.0, while Japan's median age will be more than double that at 53.2. By 2050, Japan's life expectancy will rise to nearly 90 years of age (United Nations, 2009). With these changes, the number of persons with disabilities will also grow. What roles will designers play?

Although there is no definitive authority, some estimates suggest that by the time this book is published, India will hold the largest number of English-speaking persons in the world, barely edging out the United States and nearly double the number of English speakers in United Kingdom. On the other hand, China has the largest number of Internet users in the world, 253 million, followed by the United States, Japan, India, and Germany. In the future, however, the rankings may change. For instance, while the United States has seen a 130 percent increase and China has seen a 1000 percent increase in Internet users from 2000 to 2008, Pakistan has experienced a growth of nearly 13,000 percent during the same time period (Internet World Stats, 2008). As technology and language patterns change, what roles will designers play?

In addition to these changes, the coming decades will bring further economic, cultural, and technological changes. Climate change and energy consumption will become more central discourses. Human rights, as well, will be part of a growing international debate. In the opening chapter to the first edition of the *Universal Design Handbook*, Ostroff discussed the "new paradigm" of universal design. At that time, the aspiration of universal design was to integrate into mainstream media, product, architectural, urban, regional, and other design practices. Although that goal has yet to be fully achieved, that ambition needs to be elevated. Universal design concepts hold the promise not only to impact the design disciplines but also to influence local and international policies and attitudes. As stated by Lebbon (2002) in a review of the first edition of this book, "The fact that it covers a wide set of issues across the various design communities is especially useful as it helps designers and researchers place their own practice and interests in context with approaches in other design fields." Similarly, in the next decades, the merits of universal design—and the value of this book—will be measured according to its integrative capacity: the ability to synthesize with parallel design concepts, such as green building, as well as the ability to engender a new global paradigm.

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UNIVERSAL DESIGN HANDBOOK

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P · A · R · T 1

PREMISES AND PERSPECTIVES

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CHAPTER 1
UNIVERSAL DESIGN: AN EVOLVING PARADIGM

Elaine Ostroff

1.1 INTRODUCTION

On March 30, 2007, the United Nations gathered 82 signatories on the opening day of the first comprehensive human rights treaty of the twenty-first century. This was the highest number of opening day signing countries in the history of UN conventions. In addition, it was the fastest negotiated human rights treaty in UN history. On July 30, 2009, the United States became the 142d country to sign and, on September 23, Monaco became the 143d signatory. By the end of 2009, three-quarters of the world's countries had signed. United Nations' press releases called the outcomes of the convention "a paradigm shift" (United Nations, undated). What was the convention? Did it address poverty, genocide, hunger, health? No, it was the Convention on the Rights of Persons with Disabilities (CORD).

During the past 35 years, the social definitions and concepts of disability have changed radically. The World Health Organization's classification system (WHO, 2002) has shifted from exclusively emphasizing the medical model, which views disability as a feature of the person, to the social model that sees disability resulting from an interaction of people with the environment. The recognition of the power of environmental factors to enable or disable a person highlights the challenge for designers and advocates. Likewise, the approach to design that accommodates people with functional limitations has changed from narrow code compliance to meet the specialized needs of a few to a more inclusive design process for everybody. Contrary to the assumption that attention to the needs of diverse people limits good design, the results of imaginative designers around the world reveal a wide range of applications that delight the senses and lift the human spirit when "universal design" is integral. With initiatives such as the UN CORD, universal design (UD) is gaining growing importance. In fact, UD was included in the UN CORD action plan. Building upon Ron Mace's (1985) definition of UD, the action plan included the following: "'Universal design' means the design of products, environments, programmes and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design" (National Disability Authority, n.d.). This marks one of several milestones in the evolution of the universal design paradigm, which are highlighted in this chapter and which have led to the emergence and evolution of the universal design paradigm.

1.2 WHAT IS A PARADIGM?

A paradigm is an overarching theoretical framework or system of beliefs and values. Paradigms may be formal or informal. Kuhn (1962) stated that paradigms are often guided by traditions and not an established or agreed upon set of "rules." According to Hatch (2002),

> When you are standing within the circle of logic created by the assumptions of your paradigm, the positions taken by those working in other paradigms simply do not make sense. Paradigms are indeed completing ways of thinking about how the world is or is not ordered, what counts as knowledge, and how and if knowledge can be gained.

Similarly, Rifkin (1980) stated:

> The most interesting aspect of a society's world view is that its individual adherents are, for the most part, unconscious of how it affects the way they do things and how they perceived the reality around them. A world view is successful to the extent that it is so internalized, from childhood on, that it goes unquestioned.

As such, paradigm shifts are relatively rare. The reliance on traditional results is commonly referred to as *paradigm paralysis*. This is especially the case in many design professions, where tradition, convention, and history play a significant role. Moreover, designers are notoriously autobiographical in their approaches to design. Frank Lloyd Wright (1953), e.g., stated: "It has been said that were I three inches taller (I am 5′ 8½″ tall), all my houses would have been quite different in proportion. Perhaps." This autobiographical thinking perpetuates the rarity of paradigm shifts. Paradigms, as well as paradigm shifts, may be represented by a variety of physical or nonphysical artifacts. Language is among the most common markers of paradigms. This is true of the emergence and evolution of the universal design paradigm, as discussed below. Likewise, as stated by Preiser (2009), this new paradigm may be marked by a shift in what is most valued, a change from "mechanization" to "living systems," such that "information and knowledge is the new currency."

1.3 THE EMERGENCE OF THE UD PARADIGM

Worldwide there are two major, distinctive threads that can be traced to the emergence of the UD paradigm: (1) the legislative measures that included specialized requirements to accommodate people with disabilities, primarily affecting the larger-scale built environment, and (2) the nonregulated market-driven responses to an aging society, primarily relating to products. In the United States, e.g., concerns regarding social justice led to civil rights legislation in the 1950s and 1960s. In Japan, on the other hand, there was economic pressure to address the massive challenge of being the fastest-aging country in the world.

The U.S. Supreme Court's 1954 decision *Brown vs. Board of Education* established the precedent that "separate is not equal." This precedent of equal opportunity in education is the milestone that established the beginning of an approach to design that respects all users. The Supreme Court's decision was followed by the race-based civil rights movement of the 1960s that led to far-reaching federal civil rights legislation, which included the right to vote and nondiscrimination in housing. This inspired the disability rights movement that began in the 1970s and led to the federal legislation that prohibited discrimination based on disability. The initial legislation in 1973 included accessibility requirements for facilities built with federal funds. Later, the Fair Housing Amendments Act and the Americans with Disabilities Act included much of the built environment, regardless of the funding source. These design requirements were rarely considered during the design process, usually added later in a code compliance effort. The design corollary of "separate is not equal" is accessibility features that are thoughtless add-ons. They have a stigmatizing quality similar to the segregated "back of the bus" practices that were once the norm in the United States.

In Japan, the momentum toward universal design has been fueled by economic as well as social interests. Since 1997, in response to Japan's aging demographic, both government and business saw the challenges and opportunities of this trend (Kose, 2001). Housing, product design, health care, and other services needed rethinking. At the 2002 International Conference on Universal Design in Yokohama, there was a call for a new, business-oriented organization to be formed, the International Association of Universal Design (IAUD). Similarly, the United Kingdom has been a generative place for design innovations in response to aging demographics, with a developing program of academic-industry-government partnerships, such as DesignAge at the Royal College of Art in London (see Chap. 21).

The emergence of universal design thinking can be witnessed in nations and regions throughout the world, including, but not limited to, Australia, Brazil, Canada, France, Germany, India, Ireland, Israel, Italy, the Netherlands, Norway, Southeast Asia, and Switzerland (see Preiser and Ostroff, 2001). As such, there are significant cultural differences in how the movement has evolved in each country, but the similarities are more apparent than the differences as they transcend national laws, policies, and practices. Some of these cultural differences are evident in terminology. There has also been a developmental change in the language used in some countries, not only reflecting the evolution from initial efforts to remove barriers that exclude people to a more inclusive design approach, but also changing social policies and growing globalization.

The terms *barrier-free design, accessible design, inclusive design, design-for-all*, and *universal design* hold somewhat divergent historical and cultural meanings in what Iwarsson (2005) collectively refers to as the *enabler concept*. Universal design was first used and promoted in the United States by Mace in 1985 to communicate a design approach that could be utilized by a wider range of users. The seven Principles of Universal Design (see Chap. 4), developed in 1997 by the Center for Universal Design with a group of U.S. experts, articulated a process by which to define and evaluate the usability of design elements. The seven principles were a tool that invited adaptation; the initial introductory material invited the user to create additional guidelines that would extend the utility of the principles. Awareness of the seven principles is evident worldwide. They were translated into 11 languages by proponents in France, Germany, Indonesia, Japan, Italy, Korea, Netherlands, Norway, Portugal, Spain, and Sweden (Center for Universal Design). Although Sandhu's concern in Chap. 44 that the seven principles are not useful to or applicable to the "majority world" (i.e., developing countries) is important, there is actually some evidence of their use in several countries in the majority world. Delegates from Africa who participated in the 2000 conference on universal design in Providence, RI, e.g., spoke about the waste when World Bank funds were used to build schools that did not respond to the seven Principles of Universal Design. Likewise, delegates from Lebanon spoke about the importance of the reconstruction in Beirut that had a high level of accessibility, which made the war-torn city more usable by everyone. Nevertheless, UD is still relatively young in terms of transfer of technology, and it is generally not incorporated into the policies of the economic development sources for developing economies.

Universal design remains the dominant terminology in Japan, although increasingly in the United States it is used interchangeably with *inclusive design. Design-for-all* and *inclusive design* have become the prevailing terms in the United Kingdom and much of northern and central Europe, although the Council of Europe uses universal design in many of its resolutions (Council of Europe, 2007). Although other terms in the United States are frequently used, such as *life-span design* and *transgenerational design*, Mullick and Steinfeld (1997) explained that UD's focus on social inclusion is what separates it from these other terms. Similarly, Weisman (2001) contended that there is no separation between human health, environmental health, and social justice. As such, *social sustainability* has emerged in the United States and Japan as terminology that places universal and inclusive design under the umbrella of sustainable design (Fletcher, 2008). Likewise, Walsh (2001) encouraged the European disability agenda to incorporate concepts of sustainable development in its mission, a notion paralleled by Szenasy in Chap. 2, and illustrated by Fletcher in Chap. 37.

Notwithstanding the importance of Mace's contribution, the underlying concepts of UD were evident earlier (e.g., Bednar, 1977; Harrison, 1971). The initial term used around the world was *barrier-free design,* and it related to efforts that began in the late 1950s to remove barriers for "disabled people" from the built environment. An international conference held in Sweden in 1961 cited extensive efforts throughout Europe, Japan, and the United States, primarily by rehabilitation organizations, to "reduce the barriers to the disabled" (International Society for Rehabilitation of the Disabled, 1961). This phrase was later replaced with the term *accessibility,* which focused on issues of mobility, such as wheelchair access, in many countries. In the United States, *accessible design* became more widely used than *barrier-free design* in the 1970s. It was and is still very much linked to legislative requirements in the United States. *Accessibility*, however, has a very different meaning for some European experts. For example, to Wijk (1996), *accessibility* is the umbrella concept for all parameters that influence human functioning in the environment. In some European countries, e.g., in Norway, universal design has been increasingly used since 1997 (Bringa, 2001). The distinction in terminology is blurred, and the terms in current use illustrate the overarching paradigmatic shift in design thinking—from a lack of awareness of the restrictive and emancipatory roles that design plays, to an awareness and elimination of environmental barriers, and beyond that to a concept of designing, at the outset, for the widest range of potential users.

Unfortunately, the term *universal design* has been inappropriately adopted by some architects, especially in the United States, as a trendy synonym for compliance with the Americans with Disabilities Act. Welch and Jones (1999) note: "This indicates that significant systemic and attitudinal barriers stand in the way of real change."

1.4 THE EVOLVING PARADIGM OF UD

Beyond terminology, the basic premises and aspirations of UD continue to be transformed. These transformations are evident in a variety of policies, practices, and exemplars throughout the world. The morphology of universal design is most clearly evident in three primary areas—education, business, and society—as discussed below.

Universal Design and Education

Universal design has become widely used as an approach to teaching and learning. Frank Bowe's (1999) book *Universal Design in Education: Teaching Non-traditional Students* was the first application of the principles of UD to learning. His book is highlighted in Universal Design Education Online as an example of inclusive teaching techniques, based on his own experience as a professor of education at Hofstra University. Bowe's approach responds to the need for more inclusive teaching as it relates to people of different cultures, ages, and learning styles, as well as his own needs as a deaf professor. He stated:

> Most teachers cannot individualize instruction for so many diverse learners. What they can do is present material in multiple ways. Is it really necessary for teachers to present the great bulk of our instruction via speech? Isn't there a way, or aren't there several ways, for us to offer much of the same material visually (in print, on disk, etc.)? Of course, the obverse obtains as well: Must we assign only printed materials for student reading? Can't we find audible (spoken) versions, too, and make those available for people who need or prefer them?

David Rose's research in cognitive neuroscience was a significant underpinning to his early thinking about the use of digital media in teaching children with disabilities (Rose and Meyer, 2005). He cofounded the Center for Applied Special Technology (CAST) in 1984 as an assistive technology project to develop and apply technologies that would enable students with disabilities to access a print-based curriculum. Over the years, CAST shifted their attention to transforming the curriculum—the methods and the materials—so that it could respond to the needs of diverse learners. What began as an approach to reading is now an acclaimed national resource on Universal Design for Learning (UDL). The National Center on Universal Design in Learning includes guidelines for UDL in three main areas: representation, expression, and engagement (Chap. 39). Universal Design for Instruction (UDI) is another approach that focused on college instruction for diverse learners (McGuire and Scott, 2006). UDI provides a framework for college faculty to incorporate inclusive strategies in their teaching. The dissemination of UDI was enhanced through the leadership and advocacy of the Association on Higher Education and Disability (AHEAD), a professional North American association of postsecondary disability service providers at colleges and universities. AHEAD began an initiative in 2001 to educate disability service professionals about promoting universal design in learning, the built environment, and policies. The goal was to make policies and practices more inclusive, by working as allies with faculty and administrators to reach more students rather than a "one-at-a-time" model of service and curriculum delivery.

Another approach involves raising awareness of diversity in the professions, to improve the practice of universal design. Access to Design Professions is a project directed by the author at the Institute of Human Centered Design in Boston and supported in part by grants from the National Endowment for the Arts. The project was developed in 1999 as a living memorial to the late Ron Mace, to support the participation of people with disabilities in the design profession. John Kemp (2002) expressed the need clearly:

> When designers with disabilities participate in the planning and design of schools, housing, landscapes, and workplaces, we gain a combination of personal experience of disability and professional design skills. When that happens, pluralism in functional use of structures and products isn't an afterthought; it is integrated into the fundamentals of design and subsequent use. And, aesthetically, our pluralistic world needs new challenges and new ideas that incorporate beauty with function. These solutions to accommodate diversity might possibly come slowly from educated non-disabled designers, but the process will be more elegant and coherent when designers with disabilities are involved from the start. It also makes the shift from them and us to we.

Beth Tauke's award-winning Diversity and Design course, a general education course at the University at Buffalo, has engaged over 200 students each semester since 2002. It introduces students to eight issues of diversity—race, ethnicity, gender, class, age, physical ability/disability, mental ability/disability, and religion—and the multiple realms of design—media, product, architectural, and urban design. The course, described in Universal Design Education Online (Tauke, 2004), "focuses on the relationship of design to the changing nature of . . . society" and is open to students in all academic majors.

Universal Design and Business

Not unlike the sustainability movement, universal design has seen a growing presence in business and industry. In 1996, Japanese travel agencies began to organize tours for business and government representatives seeking information on UD to Adaptive Environments, which was cofounded by the author in 1978 in Boston and which is currently named the Institute for Human Centered Design. Within a three-month period four groups of 20 or more people crowded into the organization's conference room. In 1997, after spending the first of three annual tours throughout Japan, the author learned of both the intense concern evidenced by the government as well as the intense interest of businesses, manufacturers, and designers regarding the growing "silver market." Japan launched a universal design magazine in 1997 that is still being published. In June 1998, when Adaptive Environments initiated an International Conference on Universal Design of Information, Products, and Environments at Hofstra University, over 100 participants came from Japan. Japan held its first international conference on UD in Yokohama in 2002 and held the inaugural seminar of the International Association of Universal Design (IAUD) in 2003. The Declaration of Inauguration noted that it was "seeking the popularization and the realization of universal design." His Imperial Highness Prince Tomohito opened the seminar, along with other dignitaries, including the Minister of Economy, Trade, and Industry. IAUD is comprised of over 144 of the world's major corporations headquartered in Japan and has a growing agenda and a strong mass media strategy. In addition to the sophisticated business response, the Japanese public has been very responsive. At the 2006 International Conference in Kyoto, more than 14,000 people visited the Exhibition Hall, and IAUD officially announced participation from 29 countries or regions. There were 3360 registered attendees for the conference itself (Kawahara, 2009).

The Royal College of Art in the United Kingdom is the world's only wholly postgraduate university-level institution of art and design. It has pioneered partnerships between businesses, users, and young designers that have become a "springboard for innovation" (see Coleman, Chap. 21). Beginning with DesignAge in 1991, the collaborations benefited both business and the consumers. Coleman highlights the generative strategies that were developed and grew with the establishment of the Helen Hamlyn Center at the Royal College of Art. The Research Associates Programme teams new graduates with industry or voluntary sector groups, and it has worked with more than 70 organizations worldwide since it started in 1999.

Inclusive design is seen as a positive aspect of business strategy and design practice in the United Kingdom (Clarkson et al., 2003). British Telecommunications (BT) has made a strong commitment to inclusive design and commissioned the Design Toolkit, an interactive web-based tool to assist designers in creating better products with greater user satisfaction and greater commercial success. The Helen Hamlyn Center also sponsors the INCLUDE Conference, an international biennial event that engages business executives in the early morning briefing sessions as part of the schedule that celebrates the involvement of users in research and design.

Universal Design and Society

Internationally there are stellar governmental approaches to establish universal design as an integral component of an overall planning and/or design process. This holistic approach is reflected by the comprehensive work of the Norwegian government that began in 1997 (Bringa, 2001) with the goal of creating a high-level strategy that supported accessibility as a component of general planning at all administrative levels. The success of this comprehensive planning strategy is reported in a recent publication *Universal Design as a Municipal Strategy* (Ministry of the Environment, 2009). Since 2005, 17 Norwegian municipalities have been involved in a national development project under the auspices of the Ministry of the Environment. The report shares what the municipalities have learned and is available in both Norwegian and English.

On another continent, the state of Queensland in northeastern Australia has been a growing source of experience about an integrated model of housing development. Queensland promotes the broadened concept of sustainability, and it has long advocated the triple bottom-line concept of sustainability: environmental, social, and economic sustainability. The Smart and Sustainable Homes program is part of the Queensland Public Works Department. The program began within the Department of Housing in 2000 and moved to the Public Works Department for greater impact. Developed in response to the growing concerns over greenhouse gases, the program is involved in a continuing research effort to test the underlying assumptions of their tripartite model. The program has a strong educational component. Model homes across the state illustrate differing responses to climatic conditions of dwellings, and there is a website with extensive resources that can be freely downloaded.

Another integrated approach is taken by the government-supported Commission for Architecture and the Built Environment (CABE) in the United Kingdom. Begun in 1999, CABE is the government adviser on architecture, urban design, and public space. Their responsibility is to improve the quality of people's lives by design. CABE does this by "advising, influencing and inspiring" architects, planners, designers, developers, and clients, offering them guidance on projects that will shape lives. In addition to a staff of 135 people in London, CABE sustains a network of designers who are available for design assistance. Their freely available publications and websites include guidance on Inclusion by Design, looking at the design of buildings and spaces as they influence the quality of people's lives.

In the United States, however, there is nothing comparable to initiatives in Australia or the United Kingdom, although there are two federal agencies that play a generative role in universal design. The National Endowment for the Arts is a small federal agency with an Office for AccessAbility. Since 1989, the Office for AccessAbility has generated some significant work by a wide array of players in the United States by convening an interagency task force on universal design, several national summit meetings, and modest annual grants for Leadership in Universal Design. The case study collection described in Chap. 38 was initiated with seed money from these annual grants. The U.S. Department of Education, through its National Institute on Disability and Rehabilitation Research (NIDRR), has been funding research in universal design since 1987, such as the research that led to the seven Principles of Universal Design.

1.5 CONCLUSION

In London in 1974, Jim Sandhu taught a course for architects and industrial designers entitled "Design for the Non-Average," in which he urged his students to "examine the relationship between the design process and the built environment from the viewpoint of a range of users: those with special needs and those who are average" (Chap. 44). Ray Lifchez was teaching architecture in Berkeley, California, at around the same time. His architecture studio engaged consultants with disabilities, requiring and inspiring the students to think of "people unlike themselves" as they designed (Lifchez, 1986). On a local scale, among two small groups of students, these approaches exemplified a new way of thinking about design in relation to diverse users. These two instances and the aforementioned milestones, taken together, represent the paradigm shift now known as universal design. Their collective inertia has effectively challenged the hidden assumptions that designers hold, and has significantly altered the way many designers—as well as policy makers, educators, and the public—think and act.

Nevertheless, these modest approaches are still a relatively unique component of mainstream design. There are only a handful of universities around the world where universal design, or inclusive design, or design for all is even an elective within the professional curriculum. The enthusiasm among business and government leaders and designers in Japan is unique. Now, in this time of a wide range of global crises—a global economic recession, world climate change, and international political strife—the rare instances of inspired teaching and market-driven promotion are not sufficient. There is a confluence of factors generating the need for systemic change that will lead to more universally designed products, environments, and amenities within a context of socially, environmentally, and economically sustainable design.

Until universal/inclusive design is infused in preprofessional and continuing education, the attitudes of designers will limit their understanding and appreciation of diversity. They will continue to shape their designs for a mythical average norm, creating barriers that exclude the contributions and participation of millions of people all over the world. The growing passion for environmental sustainability in design education must be incorporated with social and economic issues and knowledge of the global community. This broadened approach to design education must begin in elementary school in order for people to see that design matters. People must learn from one another, sharing the range of design education strategies that will flourish at the grassroots level all over the world, from urban to rural settings, and from less developed to more developed economies. Design education must be more inclusive and more diverse, reflecting the range of people who design affects. Educational strategies will have an impact on future businesses as well. Until consumers—from the buyer of personal products to municipal, state, and federal leaders—have more grounded experience in the power of design as a tool to enrich lives, people will not get the design they need and deserve. The collaborations between design students, users, design firms, and corporations that have been developed by the Royal College of Art and the Helen Hamlyn Center provide a model of reflective practice that will generate more responsive, human-centered design at all levels.

Another private-sector strategy to develop a certification and rating process for universal design of both buildings and practitioners, following the model of LEED for sustainable design, is currently underway. The Global Universal Design Commission has been working on standards for UD, using a consensus model with design professionals. This is responsive to those who want to see some type of certification, aligned with training programs and a validation process (as discussed in Chap. 13). Design standards, in this author's opinion, are not effective by themselves. Standards, which are minimums, often become the maximum effort. Universal design requires integration as a process within the sustainable design framework and mainstream design thinking.

There are continued disagreements on what universal design "really is," but the discourse has significantly changed. A search on Google in December 2009 resulted in more than 18 million results; there were nearly 14 million results in a search for images. The nuances are not there, but there is evidence of what Goldsmith (2001) described as the bottom-up approach: an assumption that we are designing for everyone and that design can be broadened and adapted to meet the needs of people with disabilities. This is the major shift from the approach of designing for people with disabilities as a separate, specialized population. The challenge is for everyone to create sustainable communities in which people and the environment are protected.

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CHAPTER 2
TOWARD SOCIAL, ECONOMIC, AND ENVIRONMENTAL SUSTAINABILITY

Susan S. Szenasy

2.1 INTRODUCTION

In 2008, when Barack Obama won the U.S. Presidential election, he called the citizenry to action. "I will ask you," he said on November 4, "to join in the work of remaking this nation the only way it's been done in America for two-hundred and twenty-one years—block by block, brick by brick, calloused hand by calloused hand." In the days and months that followed, a new national ethos began to take shape, with words such as *community, service*, and *sustainability* helping to define the twenty-first-century trajectory. Although these words were part of a growing dialogue among citizens, designers, and policy makers for decades, all of the sudden these words invaded the culture at large.

Beginning with the first phase of the modern environmental movement in 1972, when oil shortages forced Americans to pay closer attention to their resources, green advocates have talked about the triple bottom line—economy, ecology, and equality—with increased frequency, although much of this discussion lost steam as the economy boomed in the 1980s. Then with the passage of the Americans with Disabilities Act (ADA) under the first Bush administration, civil rights was pulled into the national dialogue and the equity portion of the triple bottom line gained some traction. But all too often compliance with the ADA rarely led to thoughtful, systems-oriented design solutions, thus crippling equality. Access to the physical environment, to a livelihood, and to information continued to be elusive for large portions of the population the world over.

While the greens charged ahead and began to redefine land and water use in terms of expanding worldwide needs, universal design principles, by and large, remained on the sidelines of the cultural discourse. There are some global exceptions to this very American attitude; e.g., stress on youth, vigor, and wealth tends to minimize the less than perfect ideal. Cultures that respect age and wisdom tend to be a bit more forgiving. In fact, "a recent poll found that a stunning 72 percent of all Japanese citizens were familiar with the term 'universal design.' What percentage of Americans, we wonder, would claim familiarity with the term? 'Oh, God,' [someone] groused. 'Less than 1 percent.' And all of them, we're guessing, are faithful readers of AARP" (LaBarre et al. 2009).

As the word *sustainability* gained currency, it pointed away from piecemeal solutions embodied in the term *green design* and toward solutions that recognized the need to consider the long-range survival of the species. This way of thinking requires thoughtful stewardship of the resources that sustain life on earth, which, in turn, is shaping the twenty-first-century ethos: planning for mixed-use communities where diverse ages, races, and abilities are welcomed; where access to mass transit, clean water and air, and goods and services are considered part of everyone's civil rights; where ideas about sharing rather than hoarding are discussed; where celebrating the individual does not preclude caring for the welfare of all.

In this brave new world of connectivity, where systems thinking, rather than small fixes, is embraced by designers as well as policy makers, it looks like a meaningful integration of all aspects of sustainability—social, economic, and environmental—might be achieved. A new generation of design activists—tech-savvy, environmentally aware, socially sensitive, politically connected—is looking for meaningful work. These designers, like others before them who entered the professions because they wanted to make the world a better place, are not just talking about making a change; they are implementing major changes in the marketplace. What gets designed, who the design client is, and what a diverse population needs, not just what it wants, are being discussed with growing vigor.

2.2 SIGNS OF DESIGN ACTIVISM

In 2008, two major conferences, one organized by the U.S. Green Buildings Council (USGBC), the other by the American Institute of Architects (AIA), served as a call to action for building and design professionals to protect the environment and safeguard humanity everywhere.

Greenbuild, the USGBC's annual convention, had more than 30,000 people in attendance from 80 different countries. "Revolutionary Green," the theme of the gathering, examined the many different actions each professional can take to combat climate change. Explored in detail were the ways and means of designing high-performance buildings, which can lead to the creation of green jobs, which, in turn, play a role in converting a stock of energy-guzzling buildings into fuel-saving, healthy places to live, work, and play.

More importantly, this was the year Greenbuild came out as a powerful advocacy group for people, not things. Throughout the conference, the words *social equity* rang out, recalling the revolutionary movements that created the democracies of Europe and America starting in the eighteenth century. The Boston Tea Party and the fall of the Berlin Wall were cited. "We the people," the preamble to the U.S. Constitution, was mentioned. But the most dramatic sign that social, economic, and environmental sustainability was now inextricably intertwined in shaping the ethos of the twenty-first century was the presence of a soft-spoken man known for his work as a human rights advocate. In his keynote address, South African Archbishop Desmond Tutu defined the economic and social reality of the globally connected age: "There is enough in our world for everyone's need, but not enough for everyone's greed," he said reminding the gathered that if we build structures "that are friendly to the people, to the wind, to the sun," we are saying that "this global village is sustainable" (Greenbuild, 2008).

The more than 20,000 architects and allied professionals who attended the AIA convention, themed "We the People," were barraged with statistics that dramatized the new realities of the twenty-first century: "Sixty percent of American kids walked to school in 1973; today that number is down to 13 percent. In 1980, 61 percent of households were composed of a married couple with children; today that group is a minority. A typical suburban house uses three times more BTUs than an urban apartment does. The two largest segments of the U.S. population—baby boomers, at 77 million, and millennials, at about 76 million—are choosing to live in cities, and many of these households are made up of one or two people" (Szenasy, July 2008).

This dramatically reshaped society calls out for designers, developers, and policy makers to rethink everything, from housing to schools, from parks to stores, and from transportation to communication. The convention emphasized the need for more thoughtful land use, away from sprawl and toward the design of transit-based, dense urban neighborhoods, where food, culture, education, recreation, and health care are within easy access to a highly diverse population of many ages, ethnicities, abilities, and incomes. It turns out that "We the people" is a much more complex lot than what you find in a gated community or around a suburban cul-de-sac.

Perhaps the most visible movers and shakers in the universal design movement are the baby boomers, the folks who brought America sex, drugs, and rock and roll. They defined the way we protest political wrongs and helped create the current, unsustainable, hyper-consumer culture. Now and in the future, their needs stand to reshape the built environment for all. For instance, those who design boomers' homes recommend fixes such as wider doorways, sensor units, slip-resistant flooring, and dimmers. Homes located in easily accessible neighborhoods with elevators, oversized windows, ramps and/or level entrances, and well-lit sidewalks built within easy access to public gathering places are non-age-specific. And everyone's pocketbook, including retired boomers', benefits from such energy miser moves as state-of-the-art insulation and Energy Star–rated appliances.

The worldwide recession—the financial/banking/real estate/manufacturing crisis—is also redefining public policy and design response. Articles appear in daily papers about how the faltering economy is good for design that "thrives on change," writes Alice Rawsthorn (2008). Design, she adds, "has an important role to play. Designers are adept at analyzing problems from fresh perspectives, and applying lateral thinking to develop ingenious solutions. They also excel at simplifying complex issues . . . collaborating with other disciplines. . . .The recent changes within design itself make those skills more useful. The 20th century model of design was devoted to the creation of things—both objects and images—but designers are now also applying their expertise to systems."

This systems thinking is also helping push universal design solutions to the highest levels to date. In way-finding, for instance, a systems thinker would never simply specify elevators or hotel room doors with Braille signs, although this solution is within the letter of the ADA law. A systems-thinking designer, or, more likely, a collaborative group of design specialists working with the consultants in the social sciences, would enlist all the senses to help people get to that Braille sign. In interior design schools, some serious attention is being paid to designing for all the senses. At an annual symposium, Aftertaste3, produced by the interior design department of New York's Parsons, The New School for Design, an interdisciplinary group of speakers probed how architectural interiors would be enriched by providing experiences in sights, sounds, scents, and touch (Aftertaste3, 2009). Such richly nuanced environments would certainly appeal to all kinds of users and would help those with special needs find their way.

2.3 DESIGN ACTIVISTS BROADEN THEIR PRACTICE AND OUTREACH

"Their professional code of ethics obliges architects and interior designers to work for the benefit of human health, safety, and welfare. Starting in 2009, architects will be required by their national trade organization to earn eight HSW—health, safety, and welfare—credit hours (out of an annual total of 18, which now also includes four units in sustainable design, a new category) to keep their professional standing" (Szenasy, October 2008). While improving user experience is often discussed by designers who work for wealthy homeowners, corporations, and institutions, these designers touch the lives of only an elite and comparatively small group of users. While there is no doubt that ergonomically correct, aesthetically pleasing, and high-function environments work to benefit human health, safety, and well being, design activists ask frequently, How deeply are designers actually reaching into the lives of the population as a whole?

The high-end design practices—be they large, multioffice, multidisciplinary consultants or small, boutique firms—no longer define the full concerns of the design community. Their trickle-down theory of design is challenged by a new generation of practitioners who seek to engage a wider segment of the public, with products, buildings, interiors, parks, transportation, and communications that expand the definition of the traditional design client. These socially and environmentally concerned designers and their students flock to such museum shows as Design for the Other 90%, held recently at the Cooper-Hewitt National Design Museum, and Into the Open: Positioning Practice, the focus of the U.S. pavilion on design activism at the 2008 Venice Biennale.

In fact, socially concerned, environmentally savvy design is now a full-fledged movement; it has been codified and documented in such books as *Design Like You Give a Damn* (Stohr and Sinclair, 2006), *Expanding Architecture: Design as Activism* (Bell and Wakeford, 2008), and *Design Revolution* (Pilloton, 2009); it is discussed at annual student conferences such as the ninth Structures for Inclusion conference (2009), which explores, as its 2009 promotion stated, "the process of community-based practice through architecture and design, and, ultimately, how to insert oneself into the cycle of thought and action."

Community outreach activists working in neighborhoods, which have not been on the design radar in the past, are now doing nationally recognized work. For instance, Sustainable South Bronx, led by the inimitable Majora Carter, an environmentalist, is at the forefront of advocating something called *asset-based design*, a new approach to working with communities. Rather than going into a neighborhood with admittedly good intentions of serving the "needy," asset-based designers engage the people who live there to find out what kinds of skills and resources exist in the community, then work to get these locals actively involved in creating their own environment, for their own special needs. Here, we often see the designer as social facilitator, as creative coordinator, and as systems thinker.

This kind of expanded design activity can take many forms. For instance, in Chicago, architect and activist Roberta Feldman joined with residents of North Lawndale, a neighborhood down on its luck and left out of the American dream, to save some 2000 historic Greystones, a unique part of the city's grand architectural heritage. Together, they created a grassroots campaign to catalog buildings and develop a plan for the neighborhood's future growth. By publishing a beautiful and useful book that documented the town houses, originally built for prosperous urbanites a century ago, Feldman and Wheaton (2007) brought the joys and triumphs and cultural connectivity of historic preservation to a whole new audience, mostly low-income African Americans.

Such programs speak to the need for new approaches to design education, be it conducted in neighborhoods or in universities. In architecture schools, design-build programs have been more or less tolerated since the 1960s, when socially conscious boomers, such as Steve Badanes, started turning elite architecture students into community activists. In addition to learning the practicalities of making a building, understanding the materials and processes, and being intimately connected to their site, design-build students get to know their clients' attitudes and needs, economic and social resources, concerns and aspirations. In the process, students build emotional and ethical bridges across economic and social divides.

Public servants, too, are known to take on the activist mantle. Janette Sadik-Khan, the transportation commissioner of New York City, with advice from Jan Gehl, Denmark's urban design guru, is working to give the city's streets back to the people, a reaction to the unhealthy crowding created by chronic traffic jams. To quote Jan Gehl's (1987) study, as reported in the *Architect's Newspaper* blog (Galef, 2008): "telltale signs of poor-quality street life: pedestrian crowding, low frequencies of stationary activities, and low proportions of children and elderly on the sidewalks." To Sadik-Kahn this degraded street life was a signal to reverse New York's damaged public spaces, while creating conditions that attract the best and the brightest now flocking to global cities. In addition to working on improving New York's wide streets and bike lanes, last summer the commissioner's guerilla troops claimed sections of Broadway and, overnight, surprised some neighborhoods with areas to sit, read, eat, or socialize in the middle of traffic, protected by large planters and rocks.

2.4 LEARNING THE MANY LESSONS OF INTEGRATION

Nearly 20 years after a segment of the design community began making places and products universally accessible, while another segment built its knowledge of green design, in 2008, the two knowledge areas converged in Access Living, a Chicago nonprofit that employs people with disabilities. In a city known for its strong commitment to green development, LCM Architects found that green design can also be universal design. Green strategies such as site selection (near public transit), energy-saving sensors that balance natural and artificial light, and zoned ventilation systems also worked well, respectively, for the transportation, visual navigation, and body comfort of people across a range of abilities. As encouraging as this is, the integration is incomplete and needs much more research, analysis, and understanding. "We learned that what works for one disability doesn't work for another," said Richard Lehner, a partner in the firm (Meyers, 2007).

"That's nowhere more apparent than in the flooring. LCM discovered through research that carpeting, contrary to popular belief, serves people with MCS [multiple chemical sensitivities] by trapping contaminants that would otherwise remain airborne. It also offers traction for people using canes" (Meyers, 2007). But those in wheelchairs find it hard to navigate on the carpet, and those with epilepsy can get seizures from some patterns. The architects ended up using a recycled-content carpet with a tight surface and a muted pattern while creating contrast in the hallways to help guide employees with visual impairments.

"'It's inevitable that two most powerful design trends of our day—sustainability and universal access—will merge and change how things are done,' says architect and planner Doug Farr, who chairs [the USGBC's] LEED for Neighborhood Development, the first LEED program to devote a credit to universal accessibility" (Meyers, 2007).

This small and imperfect example of the interconnectedness of human needs—and the design skills that serve them—is part of a grassroots, worldwide movement that Paul Hawken calls the largest in human history. Hawken (2008) describes it as "coherent, organic, self-organized congregations involving tens of millions of people dedicated to change." He sees it as being supported by three strong roots: environmental activism, social justice initiatives, and indigenous cultures' resistance to globalization. Everywhere, people of all cultures, ages, and abilities are looking to connect with the web of life; they "'share' a basic set of fundamental understandings about the earth, how it functions, and the necessity of fairness and equity for all people dependent on the planet's life giving systems" (Hawken, 2008).

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CHAPTER 3
UNIVERSAL DESIGN AND THE MAJORITY WORLD

Singanapalli Balaram

3.1 INTRODUCTION

Today, in many parts of the world, there are indications that universal design is going to stay. The presence of universal design, however, is not uniform. In the economically divided world of haves and have-nots, the situation of have-nots often goes unnoticed. This chapter discusses the world of the have-nots as a means to assess the current situation of universal design. The focus is on India, an exemplar of this economic divide.

3.2 TERMINOLOGY

Ways of saying are ways of seeing. Terms influence, positively or negatively, people's attitudes toward a subject. Hence, it is necessary to clarify the importance of terms used in this chapter, as terms are crucial in forming or removing an intellectual or emotional bias. There are four words that are used most frequently, which need to be released from an associative bias.

The first term among these is *third world*, which refers to the relatively poorer countries in the world. But, in fact, the generalized usage of *third* and *first* discriminates the two, projecting the former as deficient in more ways than one. A better way of referring is to consider the number of people belonging to a country as important and use the term *majority world* in place of *third world.* The second term is *development*. Used in the context of developing countries, it is very general and loaded with negative connotations such as something inferior in every way. In this chapter, the developed and developing countries will be called, appropriately, *industrialized* and *industrializing* countries. The third term is *advanced countries,* which discriminates, implying unfairly that the other countries are backward and showing them in a poor light. Hence, the term *advanced countries* will not be used in this chapter. Finally, one must recognize that cultural diversity and cultural traditions continue to influence people's present lives. Countries rich in cultural traditions and diversity are referred to as *tradition-bound countries* in this chapter.

3.3 DEFINING UNIVERSAL DESIGN IN THE MAJORITY-WORLD CONTEXT

Universal design argues for the importance of wholesomeness and the importance of making, through design, the so-called weak component in the society as strong as every other part. Universal design for majority-world countries can then be defined as a concept that not only extends beyond issues of accessibility of the built environment, but also covers the social, cultural, and economic issues, which are major influences in uniting normal people and people with different physical, mental, or psychological abilities. Universal design should be accepted as an *approach that values and celebrates human diversity*.

3.4 DEMOGRAPHIC SITUATION

According to United Nations' estimates, the world elderly population constituted 14.8 percent of the total world population in 1985. While the elderly population in industrialized countries is expected to increase by 77 percent over 1985 figures, the comparative percentage increase in majority-world countries is approximately 207. The aging scenario in India is alarming, with 70 million elderly people above the age of 60 years as of 2000, which is projected to reach 177 million by 2025.

In the case of disability, India already has one-third of the world's disabled population and one-half of the world's blind population, and these figures are increasing. While an accurate census is difficult due to huge and illiterate village populations, an approximate 63 million people in India suffer from impairment in physical or mental form.

3.5 TRADITIONS OF UNIVERSAL DESIGN

Universal design is a term coined by the late Ronald Mace in the 1980s. But it is an ancient concept that has been extant in cultures such as those in India for ages. For instance, India has the marvelous tradition of wearing unstitched, uncut garments, which continues even today in the new millennium and is certain to continue in the future. These garments have reached perfection in design and have become timeless classics. Two such examples are the *sari* and *dhoti*, which are extremely elegant and highly functional and can be worn in infinite ways to suit the occasion. There are codes of wearing. Judged by the way it is worn, the same cloth creates a strong identity as to the wearer's caste, community, social status, and even marital status. These garments are also highly symbolic. While being worn, they can serve other functions, such as carrying a child, carrying objects, and so on. When they are not being worn, these garments can be put to other uses, such as a baby swing, packing material, and the like. The same cloth can be worn by everybody, irrespective of the age, physical dimension, or temporary or permanent disability.

3.6 SOCIOCULTURAL PROMINENCE

Although the joint family system is on the decline due to urbanization, it is still largely present in the villages, which constitute 80 percent of India's population. In Indian cities, there are homes for the aged and for the disabled, but these are occupied primarily by either the orphaned or the poor of society. A majority of the population would consider it an extremely unsocial act to send their disabled or elderly relative to institutional care. Society would consider it an affront to their status to do so. As a chain effect, the quality of institutional care has also remained very poor.

There are traditional festivals in India that encourage full participation of people with diverse abilities and ages. For instance, at *Garba*, a community dance festival in Gujarat, people, irrespective of gender and age, dance before the goddess. The dance is in circular form, which is infinite and nondiscriminating.

In India, when a person reaches age 60, it is celebrated with an important traditional ceremony called *shashti purti* (meaning *the completion of 60*). In Chinese thought, the family is the fundamental social unit, not the individual. The family is hierarchically organized, where elders are placed high. Within such a close-knit family system, individuals have a duty toward one another, whether they are elderly or socially disadvantaged.

3.7 MAJOR CONCERNS

India can be taken as an example of a highly populated, tradition-bound country in the process of industrialization whose concerns, as outlined below, are similar to those in many other majority-world countries.

Integration

In countries such as India, the joint family system exists. But this is threatened by urbanization and the attitudes of the younger generation, which are becoming influenced by the industrialization and lifestyles of the industrialized countries. More important than discrimination is the segregation from the rest, and the lack of purpose and participation in the family, which can lead to great psychological trauma and barriers for most people.

Communication

Indian tradition of oral communication still plays an important role as two-thirds of the total Indian population is illiterate. Therefore, written communication and print media have very little effect on the majority of the people. Visual communication is obviously better. But, like written communication, visual communication also requires visual literacy on the part of the people with whom one is communicating. For example, even if there were good maps and signage systems, the Indian people prefer to ask directions at a nearby shop. A country with a tradition such as this can be addressed in this way. The designers have to learn the language of the masses to be able to communicate using signs they understand and methods they accept. If the designers use oral communication instead of visual communication, perhaps it could evolve to be a universal design that caters to both the literate and the illiterate. One fact that proves this argument is the high rate of success of songs and music in popular Indian films.

Living

The wheelchair is ever present, yet it is unusable in rural India due to uneven natural and designed terrain. Indian villagers do not sit on any kind of chair at home. They squat on the floor. They need a different kind of mobility device that operates at ground level. One of the innovations that has been tried is to take the traditional Indian wooden seat (called a *patla* in the local language, Gujarati), and add wheels, brakes, and other necessary conveniences to it. This could be a universal design, because impaired, as well as unimpaired, people could use the *patla* as they have done in the past.

Function

Most of the artificial feet in the world are not actually feet but boots that are partially covered by the trousers. This gadget is unusable by 80 percent of the Indian people who are farmers. The farmers do not wear trousers; instead, they wear a dhoti, which is lifted up for convenience of work in the fields, exposing the leg to just above the knee. Besides this, the farmers often have to work in mud with their bare feet, they have to climb trees with their bare feet, and they have to perform many actions with their bare feet. As a solution to this, and to avoid discrimination, an Indian doctor, P. K. Sethi, developed a foot (popularly known as the *Jaipur foot*) that looks very real. At the same time, it is flexible enough to allow the user to climb a tree or to work in mud and water.

Production

Although the country is on the road to industrialization, vast numbers of village craftspeople remain without work. These artisans' skills can be used in producing devices for persons with disabilities, as well as older adults. The advantage of utilizing village artisans is that the products they create can be maintained on a sustainable basis without depending on the city-based workshops.

Acceptance

In tradition-bound countries such as India, people do not readily accept new devices. For instance, antipollution masks introduced by a corporation were rejected by the people because they resembled a pig face and the pig is a cultural taboo. The product must also cater to a cross section of people across religious affinities. In a country such as India where, more often than not, religion dominates the people's minds, a design like the preceding one not only alienates the design profession there, but also has lasting effects. First, it reaffirms the belief that "old is gold and new is trash." Second, it might prevent any further acceptance of any redesigned product in the future. There is a need to conduct extensive market research to find out and determine what is acceptable to the majority of the population.

3.8 AREAS OF DESIGN INTERVENTION

A very important role can be played by the designers in the majority-world countries, as they have the advantage of not knowing the mistakes that the industrialized countries have committed. By seizing the opportunity the majority-world designers can be role models for others to correct the mistakes. The following areas could be considered a major thrust for designers in these countries:

1. Educating for the future
2. Positive thinking by user groups
3. Increasing the usability range

Educating for the Future

Change in societal attitude is a slow process and requires a long time for new concepts to be accepted. The establishment has already set notions and definite views about several aspects of life and does not accept change readily, no matter how persuasive the communication is. It is, therefore, advisable to foster positive attitudes toward people who are aged, disabled, disadvantaged, and so forth, from a very young age to the child as part of his or her regular education in schools, colleges, and universities. Children are the future society. It is less difficult and more effective to mold a young mind, and a better generation will soon make up the world. In majority-world countries where most children do not go to school, nonformal methods and nonformal educational devices, such as toys, games, and dolls, could be specially designed and employed.

Positive Thinking by User Groups

Communication is interpersonal, and it works both ways. When there is a need for change in the attitude of one group that is at the receiving end, a corresponding change in the attitude of the other group at the originating end is necessary. While members of the public need to change their attitudes toward people of diverse abilities, persons of diverse abilities also need to change their own attitudes about others and about themselves. A poor and low image of oneself results in suspicion of others and their motives. Such suspicions hamper one from joining society as an equal member. To be treated equally and to have access to equal opportunities, the fear of acceptance has to be dispelled by the individual.

Equal opportunities should not be mistaken for *same* opportunities. A visually impaired person cannot compete with an able-bodied person in a typing job, and a hearing-impaired person cannot compete with an able-bodied person in a telephone operator job. The visually impaired, however, can compete equally with able-bodied people in a telephone operator job, and the hearing-impaired person can compete equally with able-bodied people in the typing job. Nonaverage people should be seen as people with different capabilities rather than people with lesser capabilities.

Increasing the Usability Range

There are many ways in which universally designed products and environments can foster equality. The usability range of any product or service will increase once we view universal design as more than mere access. Segregation in any form means discrimination, which means nonequality and nondemocracy. Therefore, for the good of universal design, it is essential to minimize the specialized products for special groups. Adding value into usual products by adding universal features would increase the product's *usability range*. By sharing interests, closeness also develops among groups of diverse abilities, which is the basis for a healthy society.

Bridging the Gap between People

There is a need for products that act as a bridge between different people and their needs, whether that difference is cultural or physical. A project by a student at the National Institute of Design bridges another gap. It is a hand printer that can be used both by a person who is visually impaired and by one who is not. It is a Braille-cum-English printer that allows written communication between people with different abilities. Another good universal concept is the design of embossed and scented greeting cards, which would bring joy to people of diverse abilities.

3.9 NEW DEVELOPMENTS

In the recent past, India made astounding progress in areas such as economy and information technology, but it still has a long way to go in basic areas such as education, health, and infrastructure. Most of the initiatives in universal design are due to either voluntary organizations' or private organizations' efforts than the government policies.

One of the landmark developments in Indian design is the passing of a bill by the Indian Parliament on National Design Policy in February 2007. This bill addressed many important policy areas of design but unfortunately made no mention of universal design. Many Indian designers were disappointed with such omissions and expressed this to the Indian government.

Design for All Institute of India was established four years ago. It puts out monthly newsletters on the Internet. Print copies are also available on request. It is guest edited by an eminent designer each month and brings readers up to date on various developments in universal design around the world. It is a small but significant development in spreading awareness of universal design around the country. The presence of the Design for All Institutes newsletter on the Indian designers' online forum Designindia@yahoogroups.co.in is a good means to encourage Indian designers to remember this important aspect in whatever project they are handling.

Indian corporate awareness of universal design has resulted in the major Indian industry "Tata" establishing a research chair on universal design at the National Institute of Design, the premier design institute in India. This is the first time in India such universal design research is being conducted on a continuous basis. Under this scheme, various student diploma projects in the area of universal design would be funded, and eminent scholar designers would be invited to do research on chosen areas of universal design.

Public awareness has also caused many national public projects, such as Delhi's and Bangalore's underground rail systems, to make stations accessible to all people, including people with disabilities. Many public building projects have started getting the accessibility audit done by competent organizations. Such audit teams are usually composed of people with disabilities to ensure that significant problems are addressed.

Many young designers in the majority world are aware of universal design, and many design institutions organize conferences on universal design. Although there is a lot of enthusiasm and goodwill toward universal design in education, it is mostly ad hoc. Progressive institutions, such as the National Institute of Design, the National Institute of Fashion Technology, and D. J. Academy of Design, are involving students with disabilities in design education. But the performance of the students with disabilities is poor, because they have not been given any help to compensate for physical and cognitive impairments.

There is a need for educational policy regarding the integration of students with disabilities. Funding provisions need to be made for speech experts, sign language interpreters, and new techniques and technologies for imparting knowledge. The good news is that the media of design education are more about making than reading or writing, lessening the effects of some impairments.

India, like many other largely populated countries, is struggling with employment, health, and educational problems. It is a reality that necessitates the furthering of universal design concepts and solutions. Despite the slow advancement of UD in India, this author is optimistic about the future. The younger generation is aware of universal design, and they are showing very sincere interest in its future progress.

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P · A · R · T 2

PRINCIPLES, STANDARDS, AND GUIDELINES

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CHAPTER 4
THE PRINCIPLES OF UNIVERSAL DESIGN

Molly Follette Story

4.1 INTRODUCTION

The Center for Universal Design at North Carolina State University defined *universal design* as "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design" (Connell et al., 1997). Among the international community, there are multiple names for and definitions of universal design. Some are broader, others are narrower, and still others emphasize certain aspects over others; but consensus is unnecessary. Differing terminology is a sign of healthy engagement with the concept, of practitioners seeking wording that is useful for a variety of specific purposes. Regardless of wording, the goal is profound: we can and should make our human-made world as accessible and usable as possible for as diverse a user population as possible.

4.2 WHY CREATE PRINCIPLES OF UNIVERSAL DESIGN?

Early in its history, the universal design concept suffered from a lack of established criteria that defined what makes a design most broadly usable. Instead, universal design was most often communicated through presentation of examples that demonstrated specific aspects of the concept, without concrete descriptions of requisite characteristics (e.g., Universal Designers and Consultants, 1996).

Before the Principles of Universal Design were written, only limited accessibility criteria were available, and these were found in a few U.S. and international codes and standards. Some criteria were provided by accessibility building codes, such as those contained in the U.S. Americans with Disabilities Act Accessibility Guidelines (ADAAG). Other criteria were provided by standards for accessibility of electronic and information technologies, such as Section 508 of the 1998 amendments to the Rehabilitation Act in the United States. Other sets of usability (not accessibility) criteria were available in some American National Standards Institute (ANSI) and International Standards Organization (ISO) standards, but most were quite limited in scope. The most general, ISO 13407, Human-Centered Design Processes for Interactive Systems, defined a process for involving end users in the design process but did not provide design guidance. ISO 9241, Ergonomic Requirements for Office Work with Video Display Terminals, included discussion of dialogue principles (Part 10) and guidance on usability (Part 11). ANSI/HFES 200, Human Factors Engineering of Software User Interfaces, provided design requirements and recommendations that were intended to increase the accessibility, learnability, and ease of use of software, but hardware was not specifically addressed.

Typically, if accessibility was considered at all, these standards provided only minimum requirements to accommodate people with disabilities (basic accessibility) and fell substantially short of ideal conditions (both good accessibility and usability). The limitations of such prescriptive standards are discussed in Chap. 6, "U.S. Accessibility Codes and Standards: Challenges for Universal Design." As discussed in Chap. 7, "The ADA and Accessibility: Interpretations in U.S. Courts," standards such as the ADA also applied to only a limited set of specific products and environments. Guiding principles were needed that articulated the full range of criteria for achieving universal design for all types of designs, as well as clarified how the concept of universal design might pertain to specific designs under development and suggested how usability of those designs could be maximized.

4.3 THE PRINCIPLES OF UNIVERSAL DESIGN

From 1994 to 1997, the Center for Universal Design conducted a research and demonstration project funded by the U.S. Department of Education's National Institute on Disability and Rehabilitation Research (NIDRR). The project was titled "Studies to Further the Development of Universal Design" (project no. H133A40006). One of the activities of the project was to develop a set of universal design guidelines. The resulting Principles of Universal Design were as follows:

Principle 1: Equitable Use

Principle 2: Flexibility in Use

Principle 3: Simple and Intuitive Use

Principle 4: Perceptible Information

Principle 5: Tolerance for Error

Principle 6: Low Physical Effort

Principle 7: Size and Space for Approach and Use

Each of these principles was defined and then expanded in a set of guidelines describing key elements that should be present in a design adhering to the principle (see Table 4.1).

The purpose of the Principles of Universal Design and their associated guidelines was to articulate the concept of universal design in a comprehensive way. The principles reflected the authors' belief that basic universal design principles applied to all design disciplines, including those that focused on built environments, products, and communications. The principles were intended to guide the design process, allow systematic evaluation of designs, and assist in educating both designers and consumers about the characteristics of more usable design solutions (Story et al. 1998; Center for Universal Design, 2000a; Mueller, 1997).

The authors of the Principles of Universal Design envisioned that beyond the principles and guidelines, two additional levels of detail would eventually be developed. If level 1 were conceptual principles and level 2 were design guidelines, level 3 would be compliance tests (e.g., Center for Universal Design, 2000b) and level 4 would be design strategies. The tests in level 3 might be in the form of questions that would allow designers to query a design for universal usability. Level 4, which would offer strategies for meeting the guidelines and passing the tests, would have several discipline-specific branches. For example, for Principle 3, Simple and Intuitive Use, the level 4 design strategies might describe the following:

- For architecture—methods of creating clear environmental way-finding features
- For products—methods of applying the concepts of correspondence and cognitive mapping to user interfaces
- For software—methods of supporting broadly accessible user interaction modes

TABLE 4.1 The Principles of Universal Design, Version 2.0 (Connell et al., 1997)

Principle 1: Equitable Use
The design is useful and marketable to people with diverse abilities.
Guidelines:
1a. Provide the same means of use for all users: identical whenever possible; equivalent when not.
1b. Avoid segregating or stigmatizing any users.
1c. Make provisions for privacy, security, and safety equally available to all users.
1d. Make the design appealing to all users.
Principle 2: Flexibility in Use
The design accommodates a wide range of individual preferences and abilities.
Guidelines:
2a. Provide choice in methods of use.
2b. Accommodate right- or left-handed access and use.
2c. Facilitate the user's accuracy and precision.
2d. Provide adaptability to the user's pace.
Principle 3: Simple and Intuitive Use
Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
Guidelines:
3a. Eliminate unnecessary complexity.
3b. Be consistent with user expectations and intuition.
3c. Accommodate a wide range of literacy and language skills.
3d. Arrange information consistent with its importance.
3e. Provide effective prompting and feedback during and after task completion.
Principle 4: Perceptible Information
The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
Guidelines:
4a. Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information.
4b. Maximize "legibility" of essential information.
4c. Differentiate elements in ways that can be described (i.e., make it easy to give instructions or directions).
4d. Provide compatibility with a variety of techniques or devices used by people with sensory limitations.
Principle 5: Tolerance for Error
The design minimizes hazards and the adverse consequences of accidental or unintended actions.
Guidelines:
5a. Arrange elements to minimize hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated, or shielded.
5b. Provide warnings of hazards and errors.
5c. Provide fail-safe features.
5d. Discourage unconscious action in tasks that require vigilance.
Principle 6: Low Physical Effort
The design can be used efficiently and comfortably and with a minimum of fatigue.
Guidelines:
6a. Allow user to maintain a neutral body position.
6b. Use reasonable operating forces.

(*Continued*)

TABLE 4.1 The Principles of Universal Design, Version 2.0 (Connell et al., 1997) (*Continued*)

Principle 6: Low Physical Effort
6c. Minimize repetitive actions.
6d. Minimize sustained physical effort.
Principle 7: Size and Space for Approach and Use
Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.
Guidelines:
7a. Provide a clear line of sight to important elements for any seated or standing user.
7b. Make reach to all components comfortable for any seated or standing user.
7c. Accommodate variations in hand and grip size.
7d. Provide adequate space for the use of assistive devices or personal assistance.

 Major funding provided by the National Institute on Disability and Rehabilitation Research, U.S. Department of Education.

4.4 EXAMPLES OF THE PRINCIPLES OF UNIVERSAL DESIGN

It is useful to illustrate the Principles of Universal Design with examples. Each of the designs presented here demonstrates a good application of one of the guidelines associated with the principles. The design solutions included here are not necessarily universal in every respect, but each is a good example of a specific guideline and helps to illustrate its intent.

Principle 1: Equitable Use

The design is useful and marketable to people with diverse abilities.

- In other words, designs should appeal to diverse populations and offer everyone a comparable and nonstigmatizing way to participate.

The water play area in a children's museum shown in Fig. 4.1 simulates a meandering brook and invites enjoyment for everyone in and around the water. It is appealing to and usable by people who are short or tall, young children or older adults.

Principle 2: Flexibility in Use

The design accommodates a wide range of individual preferences and abilities.

- In other words, designs should provide for multiple ways of doing things. Adaptability is one way to make designs universally usable.

A medical examination table that adjusts in height can be lowered so that it is easier for the patient to get onto and off of the table; it can also be raised so that it is easier for the health care provider to examine and treat the patient at a level that is most effective and comfortable for him or her and the specific procedure (Fig. 4.2).

Principle 3: Simple and Intuitive Use

Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

FIGURE 4.1 "Meandering brook" at children's museum invites participation.

Long description: The photo shows a water play area in the sunshine outside a children's museum. It has multiple pools of varying heights that have curving side walls. The water in the pools cascades from one pool to the next. A number of plastic balls float in the pools. Many people are playing in the water and with the balls. Some people are standing, bending over, or sitting next to the pools. Some of the children are standing or crouching in the pools.

- In other words, make designs work in expected ways.

The prototype electronic thermostat designed at the Center for Universal Design provides information in visual, audible, and tactile formats (Fig. 4.3). The functions are clearly laid out and labeled; readouts are provided in both digital format (visible) and analog format (visible and tactile); and the thermostat's voice output (audible) helps users know what is happening when they push the buttons. For example, when the user presses one of the directional keys, which has a raised tactile arrow, the thermostat announces "72 degrees." If the user keeps the down-pointing arrow depressed, the thermostat will count down: "71, 70, 69, 68, . . ." When the user lets go, the thermostat repeats "68 degrees." The other control buttons would also trigger the thermostat to speak.

FIGURE 4.2 Height-adjustable exam table suits a wide range of patient and health care professional users.

Long description: The photo shows the side view of a height-adjustable medical examination table. The table is set to its lowest height and is in a flat position. A man sits on the end of the table with his hands on the surface and feet flat on the floor. A walker stands on the floor in front of him.

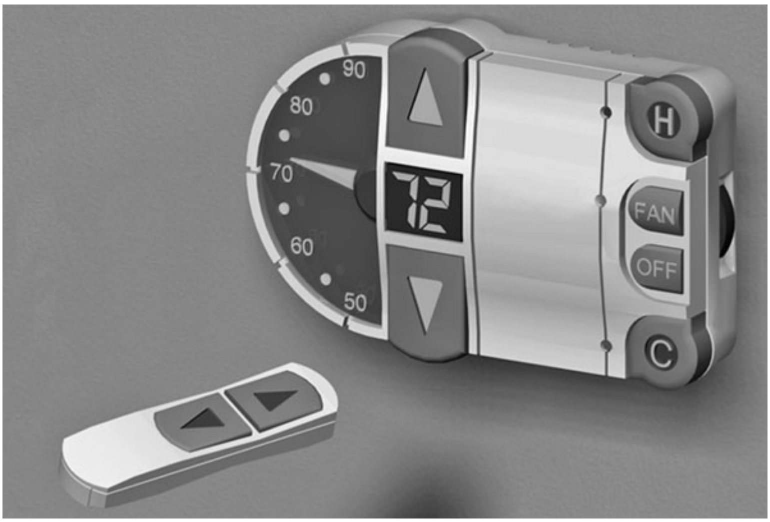

FIGURE 4.3 Prototype thermostat design by the Center for Universal Design.

Long description: The photo shows a computer rendering of a prototype thermostat and its remote control. The left end of the thermostat is a semicircular, high-contrast analog gauge that displays the temperature with a needle that points to a value between 45° when straight down to 95° when straight up. To the right, in the middle of the thermostat body, is a large digital display that shows 72°. Above the display is a large tactile button with an upward-pointing triangle, and below it is a button with a downward-pointing triangle. In the upper corner of the right edge of the thermostat is a large, round, tactile button labeled H for heat, and in the lower corner is a corresponding button labeled C for cool. Between these two buttons are two other buttons, labeled FAN and OFF. The remote control has only two large, tactile buttons, grouped closer to one end, with triangles that point up and down.

FIGURE 4.4 Subway fare machines with high-contrast and tactile lettering and audible output on demand.

Long description: The photos show close-up views of a subway fare vending machine. The machine surface is black, information on it is presented in white uppercase and lowercase lettering and raised black uppercase lettering, and it has a button that is labeled "Push for audio."

Principle 4: Perceptible Information

The design communicates necessary information to the user, regardless of ambient conditions or the user's sensory abilities.

- In other words, designs should provide for multiple modes of output.

The subway fare machine shown in Fig. 4.4 provides tactile lettering in all-capital letters, which is easier to feel with the fingertips, and high-contrast printed lettering in capital and lowercase letters, which is easier to see with low vision. The fare machine also offers a push button for selecting instructions to be presented audibly for users with vision impairments. Redundant audible feedback is also helpful for people with disabilities that affect cognitive processing.

Principle 5: Tolerance for Error

The design minimizes hazards and the adverse consequences of accidental or unintended actions.

- In other words, designs should make it difficult for users to make a mistake; but if users do, the error should not result in injury to the person or the product.

The dead-man switch, activated by a secondary bar that runs parallel to the handle of some power lawn mowers (Fig. 4.5), requires the user to squeeze the bar and the handle together to make the mower blade spin. If the two are not held together, the blade stops turning.

Principle 6: Low Physical Effort

The design can be used efficiently and comfortably and with a minimum of fatigue.

- In other words, designs should minimize strain and overexertion.

FIGURE 4.5 The “dead-man” switch on a lawn mower handle requires conscious use.

Long description: The photo shows the handle portion of a lawnmower. The handle is made of metal tubing, which is bent down on the sides and attaches to the mower body. A U-shaped bar is connected to the tubing on the sides near the handle and is spring-loaded to rest in a position away from the handle. The user must squeeze the bar against the handle for the mower blade to operate.

FIGURE 4.6 Computer hardware can be configured with a microphone to work with voice recognition software.

Long description: The photo shows a laptop computer setup with multiple peripheral devices. The computer is open, and a microphone sits to the right side.

FIGURE 4.7 Lowering one section of the nurses' station counter in a hospital suits the needs of visitors who are shorter or seated in a wheelchair or scooter.

Long description: The photo shows a nurses' station in a hospital. Most of the counter is raised to standing elbow height, but one section in the middle is cut away, which exposes the desk surface behind. A woman sits at the desk, interacting with a small girl in front of the station who is wearing a hospital gown.

A microphone and voice recognition software on a computer (Fig. 4.6) eliminate the need for highly repetitive keystrokes or manual actions of any kind. This feature accommodates disabilities of the hand and also reduces repetitive stress injuries to the hand.

Principle 7: Size and Space for Approach and Use

Appropriate size and space is provided for approach, reach, manipulation, and use regardless of the user's body size, posture, or mobility.

- In other words, designs should accommodate variety in people's body sizes and ranges of motion.

Reception desks that have counters at multiple heights (Fig. 4.7), for example, 28-in. high for sitting and 36-in. high for standing, accommodate people of varying heights, postures, and preferences.

4.5 CONCLUSION

The efforts described in this chapter to create a set of Principles of Universal Design were an attempt to articulate a concept that embraces human diversity and applies to all design specialties. It is important to recognize, however, that while the principles are useful, they offer only a starting point for the universal design process. By its nature, any design challenge can be successfully addressed through multiple solutions. Choosing the most appropriate design solution requires an understanding of and negotiation among inevitable tradeoffs in accessibility and usability. This demands a commitment to soliciting user input throughout the design process. It is essential to involve representative users in evaluating designs during the development process to ensure that the needs of the full diversity of potential users have been addressed.

The Principles of Universal Design helped to articulate and describe the different aspects of universal design. The principles' purpose was to guide others, and in spite of their general nature, they have proved useful in shaping projects of various types all over the world. It is the author's hope that they will continue to support and inspire ongoing advancement in the field of universal design.

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CHAPTER 5
UNITED NATIONS CONVENTION ON THE RIGHTS OF PERSONS WITH DISABILITIES

John Mathiason

5.1 INTRODUCTION

When the *Universal Design Handbook* was first published, the agreed international norms for the rights of persons with disabilities were the United Nations Standard Rules for the Equalization of Opportunities for Persons with Disabilities. In the intervening period, as a result of pressure from organizations of persons with disabilities, the United Nations adopted a new human rights treaty, the United Nations Convention on the Rights of Persons with Disabilities. These include policies for universal design.

5.2 BACKGROUND

The United Nations Convention on the Rights of Persons with Disabilities was adopted by the General Assembly on December 13, 2006 and entered into force on May 3, 2008. It was the culmination of a long process of defining the rights of persons with disabilities. There was always a recognition that these persons were included in the United Nations Declaration on Human Rights, but that more needed to be done to ensure that these rights were exercised. As such, it joined a series of human rights conventions that provided a binding programmatic and policy basis for state actions that would permit enjoyment of rights.* As of September 2009, the convention had 142 signatories and 66 ratifications. For states that have ratified the convention, it is legally mandatory; for those that have signed, the country has specified an intention to ratify. For the rest, the convention, and the Standard Rules that preceded it, is a normative guide.

The need for global standards was recognized for many years, first by persons with disabilities themselves and then by policy makers in all countries. The United Nations Standard Rules for the Equalization of Opportunity for Persons with Disabilities, adopted by the United Nations General Assembly in 1993, were a response to this need.

The Standard Rules provided a politically agreed consensus on the basis of which the convention could be elaborated. The applicability of the convention and the Standard Rules to universal design can be understood in terms of the origins, limitations, content, and monitoring of the Standard Rules. This chapter provides an overview of these elements.

*The others included the United Nations Conventions to Eliminate Racial Discrimination, on the Elimination of all Forms of Discrimination against Women, Rights of the Child, Rights of Migrant Workers and Their Families.

5.3 THE PROCESS TOWARD A CONVENTION

The issue of disability had been on the United Nations' social development agenda since the beginning of the organization. Its original focus, like that of most countries, was on disabled veterans, soldiers who had been wounded in World War II. Nonveteran, nonmale persons with disabilities were largely invisible. It was assumed that the rights of persons with disabilities were protected by the human rights standards expressed in the Universal Declaration of Human Rights adopted by the United Nations in 1948.

As the twentieth century progressed, more and more human rights advocates recognized that detailed norms would have to be agreed upon if the rights of particular segments of the population were to be adequately protected. Perhaps the first to recognize this were advocates for women's human rights, who sensed that the mere prohibition of discrimination on the basis of gender was not sufficient to promote enjoyment of other human rights. Advocates for the rights of persons with disabilities took note of these developments. They pressed successfully in the United Nations General Assembly to have 1982 designated as International Year for Disabled Persons. The end result of the year was the drafting of a World Plan of Action Concerning Disabled Persons and its adoption by the General Assembly. The World Plan mentioned accessibility mostly in terms of stating that human settlements, transportation, and information should be accessible, but not elaborating further.

By 1988, there was a concern among the members of the community concerned with disability that the World Plan was not functioning as well as it should and that member states were not taking it seriously. At a meeting of the Commission for Social Development, delegates from Sweden and Italy worked together so that their delegations pushed for an international human rights convention for persons with disability, but this was not strongly supported. As a compromise the Commission for Social Development decided to begin the process of drafting an intermediate type of human rights document, a declaration that would try to specify what states should do but would not have the status of a treaty. The commission proposed that a process begin to draft what were called Standard Rules for the Equalization of Opportunities for Persons with Disabilities, using the World Plan as its basis.

The process of negotiating the text included full participation of representatives of international nongovernmental organizations (NGOs) concerned with disability such as Disabled Peoples' International, the World Blind Union, and the World Federation of the Deaf, either as nongovernmental organizations or in national delegations. As a result, the draft text reflected much of the views held by organizations representing persons with disabilities.

The content of the rules was negotiated rather quickly, partly because many of the rules were vague and subject to interpretation but also because most of the negotiators were genuinely committed to the cause of disability.

Instead of being concerned with the content of the rules, the main debates in the committee were focused on the monitoring mechanism. The persons with disability wanted a monitoring committee to be funded from the regular budget of the organization. Governments, especially those that were major contributors to the UN budget, were opposed to additional expense. The end result was a compromise creating the post of Special Rapporteur, an independent, outside expert who could report on the extent to which the Standard Rules were implemented.

5.4 THE CONVENTION

The Standard Rules do not have the same status as a convention. In international treaty law, a convention is mandatory for all states that become party to it. Drafting and ratifying an international convention is usually lengthy. In most countries, an international convention takes on the same status as domestic law adopted by Parliament, and in most countries acceptance of an international convention means that all national laws, regulations, and procedures have to be brought into conformity with the convention. Governments are not legally obligated to implement the rules' provisions. Rather, they accept a moral obligation to implement as many of the provisions as they can.

Organizations of persons with disabilities were increasingly concerned about the vagueness of the Standard Rules. In 2000, the main global NGOs held a summit in Beijing, China, where they adopted the Beijing Declaration that called on governments "to immediately initiate the process for an international convention." The next world human rights conference, on racial discrimination at Durban in 2001, included in its declaration language urging governments to consider negotiating a convention.

In his address to the General Assembly shortly thereafter, the President of Mexico, Vicente Fox, proposed the establishment of a special committee to draft a broad, comprehensive international convention to promote and protect the rights and dignity of disabled persons.* As a result, the General Assembly established an ad hoc committee to negotiate the convention. The resolution was sponsored by developing countries. No developed country (other than Mexico) was a sponsor.

The negotiations proceeded over five years in the ad hoc committee. Over the period, there were regional meetings to discuss the convention. The sessions moved deliberately to deal with issues, many of which were complex. Among the last issues to be agreed was a definition of disability, and the solution was to avoid a definition. Other sections were more precise. An agreement was reached on the text of the convention and it was adopted in December 2006 by consensus.

5.5 BASIC DEFINITIONS AND OBLIGATIONS

A fundamental question for policy is the definition of *disability.* It is the basis for determining what "reasonable accommodations" must be made. It sets the conditions around which accessibility must be designed and built. The rules reflected a consensus on definition that could be reached in the early 1990s and define *disability* as different functional limitations occurring in any population in any country of the world through physical, intellectual, or sensory impairment; medical conditions; or mental illness that may be permanent or transitory in nature. The rules also define the term *handicap* as the loss or limitation of opportunities to take part in the life of the community on an equal level with others. It describes the encounter between the person with a disability and the environment.

The convention largely dealt with these definitional issues by ignoring them in the section of the convention entitled Definitions. Instead, Article 1, which sets out the purpose of the convention, states:

> Persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others.

The definition solves a number of problems by repeating the impairments listed in the Standard Rules, specifying that they are long-term (rather than transitory) and conditioning them in terms of barriers. The definition gives considerable scope for national legal definitions.

Universal design is given a significant place in the convention by being included in the basic definitions found in Article 2:

> "Universal design" means the design of products, environments, programmes and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. "Universal design" shall not exclude assistive devices for particular groups of persons with disabilities where this is needed.

Universal design should be read in the context of "reasonable accommodation," another concept discussed at length in the Standard Rules. Article 2 of the Convention states:

> "Reasonable accommodation" means necessary and appropriate modification and adjustments not imposing a disproportionate or undue burden, where needed in a particular case, to ensure to persons with disabilities the enjoyment or exercise on an equal basis with others of all human rights and fundamental freedoms.

*http://fox.presidencia.gob.mx/en/activities/speeches/?contenido=258&pagina=3

For the convention to be implemented, states' parties accept certain general principles that set out their obligations. The most general of these is one common to most human rights conventions specified in Article 4, that states' parties undertake to adopt all appropriate legislative, administrative, and other measures for the implementation of the rights recognized in the present convention.

A number of rather specific principles are directly relevant to universal design. They include the obligation to undertake or promote research and development of universally designed goods, services, equipment, and facilities, which should require the minimum possible adaptation and the least cost to meet the specific needs of a person with disabilities, to promote their availability and use, and to promote universal design in the development of standards and guidelines.

5.6 ACCESSIBILITY IN THE CONVENTION

Standard Rule 5 concerns accessibility. This highlights the central role of accessibility in achieving equalization of opportunities and says that states should recognize the overall importance of accessibility in the process of the equalization of opportunities in all spheres of society. For persons with disabilities of any kind, states should introduce programs of action to make the physical environment accessible and should undertake measures to provide access to information and communication.

This carried over to the convention as Article 9 on accessibility. The general obligation is

1. To enable persons with disabilities to live independently and participate fully in all aspects of life, States Parties shall take appropriate measures to ensure to persons with disabilities access, on an equal basis with others, to the physical environment, to transportation, to information and communications, including information and communications technologies and systems, and to other facilities and services open or provided to the public, both in urban and in rural areas. These measures, which shall include the identification and elimination of obstacles and barriers to accessibility, shall apply to, inter alia:

(a) Buildings, roads, transportation and other indoor and outdoor facilities, including schools, housing, medical facilities and workplaces

(b) Information, communications and other services, including electronic services and emergency services

The convention and the rules' focus are on the role of the state rather than on society generally and try to specify what states can do, within the limitations of state roles. Government responsibility is clearer in terms of physical environment than in terms of information and communication. Both aspects, however, are relevant to universal design. If principles of universal design are included in all government regulations of the physical environment in all countries, clearly accessibility will be enhanced. Similarly, if Principles of Universal Design are included when information and communication systems are developed, accessibility will be ensured. The convention states that governments have a responsibility to legislate accessibility standards to

(a) Develop, promulgate and monitor the implementation of minimum standards and guidelines for the accessibility of facilities and services open or provided to the public

(b) Ensure that private entities that offer facilities and services which are open or provided to the public take into account all aspects of accessibility for persons with disabilities

The rules did not specify whether the standards and guidelines should be applied only to new construction or should involve retrofitting old constructions. Persons with disabilities were clear in their belief that the standards should apply to all areas within the purview of governments, and this is now incorporated into the convention.

The convention specifies that states should provide training for stakeholders on accessibility issues facing persons with disabilities. It is clear that a number of means are available, including codifying, assembling, and distributing information; ensuring that accessible design is included in the curricula of architectural and engineering schools; and including knowledge about accessibility in certifying examinations for professionals.

The accessibility norms regarding communication are focused on ensuring that information presentation designs accommodate various disabilities. The rule states that states should develop strategies to make information services and documentation accessible for different groups of persons with disabilities. States should encourage the media, especially television, radio, and newspapers, to make their services accessible and should ensure that new computerized information and service systems offered to the general public either are made initially accessible or are adapted to be made accessible to persons with disabilities. The convention contains numerous similar provisions although not in the same detail as the rules.

The accessibility norms in the rules emphasize accessibility to public spaces but are less clear on norms and standards that can be applied in, e.g., private housing or nonpublic aspects of the private sector. These are areas where implementation of universal design would be encouraged only indirectly by the rules or the convention.

5.7 IMPLEMENTATION MEASURES

While the convention has fewer details, the part of the rules dealing with implementation measures includes a number of norms that have relevance for universal design and its implementation, emphasizing the importance of action at the local level and the need to support local programs by preparing and disseminating material on accessibility, among other things.

Rule 14, on policy making and planning, states that the ultimate responsibility of states for the situation of persons with disabilities does not relieve others of their responsibility. Anyone in charge of services, activities, or the provision of information in society should be encouraged to accept responsibility for making such programs available to persons with disabilities and that public policies and programs should reinforce this.

5.8 MONITORING MECHANISM

Implementing the international norms in the context of universal design involves more than knowing the convention and the Standard Rules. It involves using them to obtain leverage to influence public policy and private attitudes in favor of actions that will improve accessibility. This means taking advantage of the monitoring mechanisms found in the convention.

International human rights treaties inevitably have monitoring mechanisms that are instruments for implementation. The convention establishes two types of monitoring mechanisms. First, at the national level, Article 33 specifies that states' parties shall, in accordance with their legal and administrative systems, maintain, strengthen, designate, or establish, within the state party, a framework, including one or more independent mechanisms, as appropriate, to promote, protect, and monitor implementation of the present convention. These mechanisms are expected to provide a venue for groups and individuals to review government compliance with obligations under the convention, including those related to universal design.

Second, at the international level the Committee on the Rights of Persons with Disabilities has been established and, like other human rights treaty bodies, will review periodic reports by states' parties of their compliance with obligations. The first of these reports for each state party is due within two years of ratification of the convention and thereafter every four years. The monitoring body will review the reports in what is usually termed a *constructive dialogue* where the experts ask questions and make suggestions on how the state can improve its implementation of the convention's provisions.

For most human rights treaty bodies, the review process provides an opportunity for national and international groups to provide information that can help focus the dialogue and thereby influence national implementation.

5.9 CONCLUSIONS

When the only international norms on disability were the Standard Rules, the task of those advocating for universal design was more complex since the rules were only morally, rather than legally, binding. The entry-into-force of the convention provides more substantive guidance on national obligations, a legal basis for action, and a set of institutions that can be used to ensure that states' parties live up to their obligations.

Persons interested in both universal design and the implementation of international norms for equalization of opportunities for persons with disabilities should make an effort to understand the convention and the Standard Rules and find ways to apply them to their particular circumstances. If their country is not a party to the convention, they should work to have it ratify and once it has done so, use the monitoring mechanisms to advance the cause of universal design.

5.10 RESOURCES

High Commissioner for Human Rights, United Nations. http://www.ohchr.org/EN/HRBodies/CRPD/Pages/CRPDIndex.aspx

Persons with Disabilities, United Nations. www.un.org/esa/socdev/enable/

CHAPTER 6
U.S. ACCESSIBILITY CODES AND STANDARDS: CHALLENGES FOR UNIVERSAL DESIGN

John P. S. Salmen

6.1 INTRODUCTION

The United States has been a crucible for the birth of the universal design movement. The Americans with Disabilities Act (ADA) has brought great attention to the concept of accessibility. Some people would like to see a similar regulatory approach applied to universal design; however, the lessons learned in the United States indicate that effective implementation of accessibility codes and standards is dependent upon the education of and the availability of appropriately formatted information to those who must create or implement the design. This chapter highlights the regulatory processes that result in prescriptive standards, contrasts these with performance criteria, and identifies the challenges facing designers and developers in an increasingly global economy.

6.2 BACKGROUND: ACCESSIBILITY VERSUS UNIVERSAL DESIGN

There is a profound difference between universal design and accessibility. Accessibility is a function of compliance with regulations or criteria that establish a minimum level of design necessary to accommodate people with disabilities. Universal design, however, is the art and practice of design to accommodate the widest variety and number of people throughout their life spans. It can be thought of as the process of embedding choice for all people into the things we create. As more is learned about human needs and abilities, and as technologies develop, the practice of universal design improves, evolves, and changes. In truth, it might be better to think of this field as "universal designing," so as to focus on the decision-making process rather than on some end product that may be improved in the future. The term *universal designing* was coined in 1997, by Edward Steinfeld, during a meeting of faculty and advisers to the Universal Design Education Project (see Fig. 6.1) in Boston, Massachusetts (Steinfeld, 2008).

The more designers know about users, the better they can design. But no one person can ever "know it all." This reality demands collaborative efforts among designers, environmental decision makers, and users as the diversity and complexity of our global society increase. In this fluid context, it is necessary to establish flexible criteria for what constitutes a universal design, allowing universal design to lead the march toward an ever-receding goal of increasingly good design that modifies the environment to fit the needs of its users.

FIGURE 6.1 Universal design education project meeting.

Long description: This photo shows meeting attendees gathered around two tables and turning to face the camera.

6.3 HISTORY OF ACCESSIBILITY CODES IN THE UNITED STATES

Accessibility codes are a relatively new phenomenon, appearing only in the last 40 years of the twentieth century. The first accessibility technical standard in the United States was American National Standards Institute (ANSI) A117.1, Specifications for Making Buildings and Facilities Accessible to and Usable by the Physically Handicapped, published in 1961. While ANSI A117.1 (1961) was not immediately adopted, it became the model for nearly all the accessibility codes and regulations that followed.

Accessibility standards were a direct outgrowth of the changing demographics that followed advances in medical technology. Medical technology allowed many people to live who otherwise would have died in World War II, the Korean war, and the polio epidemic of the early 1950s (see Fig. 6.2). For the first time in history, there was a large population of young Americans using wheelchairs. Public and private efforts for veterans and other survivors provided rehabilitation and educational opportunities, resulting in a large, well-educated population of young people with disabilities who would not accept discriminatory practices that limited their participation in society. They took advantage of the changing landscape of U.S. politics and opinion, inspired by the civil rights movement of the 1960s that culminated in the passage of the landmark U.S. Civil Rights Act of 1964. That was the first legislation prohibiting discrimination based on race; it established the foundation for future civil rights–based laws. With technical standards available and the nondiscrimination concept affirmed, accessibility regulations development began.

Laws, Regulations, and Standards

In the United States, there are currently three formal levels of guidance that affect the accessibility of the built environment—laws, regulations, and standards. Laws are promulgated by a legislative body such as the U.S. Congress or a state legislature to address a public concern. The ADA was passed in 1990 by the U.S. Congress to address discrimination against people with disabilities. Regulations are usually created by an enforcement agency of a government entity to implement a law. Standards are technical criteria defining compliance for an issue area. Standards that have received broad input

FIGURE 6.2 Korean war soldier.

Long description: This photo from the Korean war shows a U.S. soldier, from his chest up, aiming a rifle from a bunker through the grass. Mountains are in the background.

during their development are considered to be more dependable, credible, and authoritative. One balanced process that ensures consideration of all input is called *consensus-based standards making*, in which all affected parties have input and a vote on the standard.

ANSI A117.1—Where It All Started

After the development of the first ANSI standard in 1961, technical criteria of accessibility were incrementally refined and expanded over time, through a back-and-forth process between private organizations and federal agencies. On the private side, the ANSI A117 standard was referenced or adopted for most of the construction regulations known as model building codes. On the federal side, the ANSI standard was also used as a basis for regulations, including the Minimum Guidelines and Requirements for Accessible Design (MGRAD) in 1981, the Uniform Federal Accessibility Standard (UFAS) in 1985, and the ADA Accessibility Guidelines (ADAAG) in 1991.

ANSI versus ADAAG

From 1994 to 1996, the ANSI A117 Committee and the ADAAG Review Federal Advisory Committee established by the Access Board, which were simultaneously revising both the ANSI A117.1 standard and the ADAAG, worked together to substantially harmonize the format, organization, and technical requirements of the two documents. This resulted in a 1998 version of the ANSI standard and a corresponding set of proposals for revisions to the ADAAG, which were published as the 2004 ADAAG in July of that year.

State and Local Building Codes

Disability and accessibility advocates have been especially effective at the state and local levels as code officials grapple with the needs of citizens with disabilities to ensure access through building codes and statutes. During the 1970s, state and municipal building authorities adopted their own versions of the early ANSI A117.1 standards, often influenced by anecdotal but emotionally persuasive evidence presented by local advocates as missing criteria that are necessary to make buildings accessible. Unfortunately, almost no two versions were alike, and the plethora of regulations led to a design and construction nightmare in the 1970s and 1980s when developers, designers, and manufacturers were unable to standardize any design details that could remain the same across state borders, and sometimes between localities within the same state (see Fig. 6.3).

FIGURE 6.3 Bathroom with a vertical grab bar.

Long description: A photo of an accessible toilet with two horizontal grab bars that are positioned on the walls behind and beside the toilet. On the wall beside the toilet there is a vertical grab bar above the horizontal grab bar and a toilet paper dispenser below the horizontal grab bar.

In the early 1990s, the differences between accessibility codes diminished as states and localities adopted without modification later versions of ANSI A117.1 and the 1991 ADAAG. In 2000, the International Code Council replaced the three previously competing "national" building codes with the International Building Code (IBC). The IBC adopted ANSI A117.1 (1998 and later versions) as its accessibility criteria, resulting in widespread adoption of a consistent set of criteria that is very similar to the 2004 ADAAG. Most states and municipalities have adopted the IBC or the 1991 ADAAG, However, at the turn of the millennium, it is still impossible for a single design to be placed anywhere in the United States, because in almost every instance, states and municipalities have continued to add local amendments and interpretations to "enhance" their access requirements. The unfortunate result of these enhancements is the creation of ambiguity and conflict.

How Minimums Become Maximums

Accessibility regulations typically establish minimum criteria that are often perceived as or become absolutes, or maximums, in the building industry. Often, when facing compliance with a regulation that is not part of the intended development program, building owners or developers tend to provide no more space, material, or equipment than is needed. Designers are subsequently directed to be as efficient as possible and to design no more than the regulations require. This forces the designers to design the facility to the minimum requirements, resulting in the minimums becoming the maximums.

Civil Rights versus Building Codes

The ADA is a civil rights law. The civil rights terminology of the ADA states that all people, regardless of their abilities, should have access to goods and services provided by businesses. The regulations promulgated by the Department of Justice and the technical assistance for voluntary compliance are intended to provide guidance to building designers and owners on how to meet the broad civil rights requirements of the law. This places a difficult responsibility on designers and building owners, who, for the most part, have never studied law or civil rights interpretations.

Designers and building owners are responsible for providing facilities and spaces that are safe for the public to use, and they rely on the building codes to guide them in this mandate. The civil rights nature of the ADA and the resemblance of its criteria to building codes lead many to believe that compliance with only the letter of the law will ensure compliance. Sometimes, unfortunately, this is not the case. When faced with ADA Title III lawsuits, U.S. courts are often turning to the spirit rather than the letter of the law (see Chap. 7 by Mazumdar and Geis).

The problem is exacerbated by the fact that the ADA enforcement agency, the Department of Justice (DOJ), does not provide definitive interpretations unless legal action is underway. Even if a state building code has been certified by the DOJ as meeting or exceeding the minimum requirements of the ADA standards, local building officials are not empowered to allow variances from the design criteria. Furthermore, these officials' interpretations can be challenged if the DOJ, in responding to a complaint, believes that the ADA civil rights requirements have not been met. However, if a DOJ-certified building code is followed, that fact can be used as rebuttable evidence if a complaint is filed.

This situation makes the practice of architecture and the operation of buildings increasingly difficult and costly. There is little certainty of compliance, outside of literal adherence to the prescriptive criteria, and great risk of legal action by anyone who feels that the design or operation of the facility creates an environment that limits his or her "equal enjoyment" and thus violates his or her civil rights. In the lawsuit cases of *PVA v. Ellerbe Beckett* and *Lara et al. v. Cinemark USA, Inc.,* designers and developers who had followed the letter of the law in the design of arenas and stadium theaters (and, in the Cinemark case, had complied with a DOJ-certified building code) were sued by disability advocates. The advocates maintained that the location of the seats did not provide a "comparable line of sight" to that provided to standing spectators in the arena and most of the other attendees in the cinemas (see Fig. 6.4).

FIGURE 6.4 Accessible seating at a stadium-style movie theater.

Long description: This photos show three people (Cynthia Buddington, Connie Caldwell, and Kermit Mohn of Montgomery County, Maryland) sitting side by side in the front row of a movie theater with stadium-style seating behind them. Two of the people use wheelchairs and are sitting next to each other in the theater's wheelchair seating locations. One person is sitting in the adjacent companion seating location.

6.4 PERFORMANCE VERSUS PRESCRIPTIVE CRITERIA

For many years, a debate has been ongoing in the U.S. design and construction community regarding the best format for building codes—performance or prescriptive. Simply stated, performance codes identify the ultimate operation or function of an element or space, whereas prescriptive codes explain to a greater or lesser degree how a space or element must be designed to satisfy the codes. For example, a performance code might say that a wall assembly must be able to withstand a fire for a specific period of time. A prescriptive code would say that the wall must be constructed of specific materials organized in a specific design, such as two layers of ½-inch gypsum wallboard over a 4-inch metal stud wall.

It is often easier to write performance criteria, because the concept of how an element or space should operate usually can be easily described. However, it is often more difficult to evaluate and enforce performance criteria because the designer or building official must understand how all the individual elements work and how they work with one another as a system. As building technology becomes increasingly sophisticated, materials and assemblies of materials may have characteristics that are not readily apparent or easily understood.

Prescriptive codes, on the other hand, are very tedious to develop and write because the language must be exact and yet applicable to a broad variety of situations. Prescriptive codes are easier to follow and enforce because they require less understanding of the function or purpose of the design and rely instead on evaluation of whether the design complies with the written letter of the law. U.S. accessibility codes have tended to be prescriptive. On the contrary, the Global Universal Design Commission's voluntary Universal Design Standards are performance-based standards.

Disability advocates have argued that there is a large information gap between people with disabilities and the design and construction industry, regarding the needs and abilities of people with disabilities. This gap makes it difficult, they argue, for designers to produce designs that meet the intent of performance-based codes. Disability advocates also prefer prescriptive standards because they give clear evidence of compliance or discrimination. This argument is also presented by building officials who desire easily interpreted and therefore easily enforceable standards.

Unfortunately, prescriptive criteria can stifle design creativity. Where the design of a facility or element is rigidly specified, there is little opportunity for investigation of alternative or innovative designs, or use of new materials or products, without risking misinterpretation and noncompliance. Although there are sections in most accessibility codes that allow equivalent designs, there is no generally accepted methodology to determine what is equivalent. Section 2.2 of the ADA standards accepts equivalent facilitation, which is stated as follows: "Departures from particular technical and scoping requirements of this guideline by the use of other designs and technologies are permitted where the alternative designs and technologies used will provide substantially equivalent or greater access to and usability of the facility." Few building owners or design firms have the knowledge base to be confident in attempting an alternate design. The GUDC voluntary Universal Design Standards are performance-based and encourage innovation by rewarding alternative solutions that increase usability.

6.5 THE FUTURE OF STANDARDS

Existing prescriptive accessibility standards have not encouraged designers to practice universal design. There is hope that the performance-based GUDC voluntary Universal Design Standards can depend on free market demand to create an environment in which universally designed facilities are recognized, appreciated, and sought.

6.6 CONCLUSION

It is the author's opinion that most building designers, developers, and construction professionals lack an understanding of the changing needs and abilities of our society, and thus of how to develop appropriate universal design solutions. The present generation of designers and facility owners and operators has had little involvement with and, consequently, little understanding of the needs of the growing populations of aging people or of people with disabilities. The problem would be more easily resolved if responsibility for environmental decisions that impact users were centralized. With the civil rights nature of the ADA, however, the range of environmental decision makers expands dramatically, as does legal risk. Maintenance workers can unwittingly replace a movable trash receptacle in a position where it blocks an accessible route, thus negating the carefully designed plans of the architect. A new sales clerk can inadvertently violate the civil rights of a person with a disability by placing a promotional display on the lowered writing surface portion of a checkout counter required for use by people of short stature or customers who use wheelchairs.

Further regulation will never resolve these types of problems. The only long-term solution is appropriately targeted educational materials and programs. Architects and sales clerks need very different kinds of information and education, yet they both need education. Designers of amusement parks need information that is different from that needed by designers of multifamily housing. Naval architects attempting to design more accessible cruise vessels have concerns and constraints that are vastly different from those of landscape architects who are designing interpretive trails in a national forest.

While basic principles, such as the turning radius of an average wheelchair, may be the same everywhere, the information needed by individuals who are expected to apply that information is very different. Anyone who has studied accessibility standards will recognize that parts of them are difficult to understand, even for people who are familiar with accessibility criteria. Finding all the information that is appropriate for the specific situation of concern can sometimes be difficult and frustrating. There are times when an obscure though important section is pointed out only after the design is constructed. As information technology becomes increasingly sophisticated, it is possible to format and deliver appropriate types and levels of information for each person along the environmental decision-making chain. When designers need technical criteria or examples, they should be cross-referenced and easily available, just as when maintenance workers are replacing a lavatory, they should be able to easily find the correct mounting height without having to search through volumes of technical criteria. Once society begins to develop appropriate informational and educational tools, there will be more widespread accessibility, and, eventually, a demand by consumers for the superior performance of universal design will overtake the need for prescriptive standards.

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CHAPTER 7
THE ADA AND ACCESSIBILITY: INTERPRETATIONS IN U.S. COURTS

Sanjoy Mazumdar and Gilbert Geis

7.1 INTRODUCTION

Shouldn't buildings be designed to provide satisfactory access for all who might need or desire to utilize and enjoy the facilities and what goes on in them? The terms *accessibility* and *universal design* point to the compelling need to accommodate persons using wheelchairs, those with vision or hearing difficulties, and those unable to operate components of built environments, such as door handles and light switches. There is a tendency in the United States to remedy problems and achieve desired goals by means of public policy devices such as laws and regulations. The Americans with Disabilities Act (ADA) (42 U.S. Code §§ 12181–12189) was enacted into law to end discrimination against persons with disabilities.

Key questions are: What does the ADA mandate? How have U.S. courts interpreted and applied the law? How is building accessibility being addressed in regard to persons who use wheelchairs? How have architects responded to the need for universally desirable and accessible environments?

A number of ADA-based lawsuits, most notably in regard to wheelchair patrons, have been adjudicated. Among the more contentious issues have been the ambiguity and vagueness of the language of the law, the oversight and shortcomings of government authorities entrusted with enforcement responsibility, contradictory judicial rulings, and the persistence on the part of many architects to make accessibility a legal rather than a professional issue. Together, these have contributed to the planning and construction of facilities that failed to satisfactorily meet ADA standards.

Title III of the ADA deals with public and commercial buildings and facilities. The design of sports and entertainment venues is the focus here, since a large number of particularly significant decisions have dealt with these types of facilities.

The ADA legal cases examined here illustrate the complexity of the factual situations that led the parties to seek relief, and what they regarded as justice, from the courts. The cases also highlight the uneasy relationship between the architectural profession and laws that bear on it or, arguably, do not require the profession's obedience.

In the United States, Congress has the sole power to enact laws that apply to the entire country. Once passed by both houses of Congress, the bill must be signed by the President to become law. Where appropriate, administrative agencies of the government are given the duty of developing detailed regulations and an enforcement process.

7.2 THE AMERICANS WITH DISABILITIES ACT

The ADA took effect on 26 January 1993. It decreed:

> No individual shall be discriminated against on the basis of disability in the full and equal enjoyment of the goods, services, facilities, privileges, advantages, or accommodations of any place of public accommodation by any person who owns, leases (or leases to), or operates a place of public accommodations [42 U.S.C. §12182(a), §303(a)].

But the ADA is imprecise about several matters. Practitioners and architects attempting to adhere to the law might have difficulties even if they consult an attorney (see also Mazumdar and Geis, 2000). Take, for example, the requirement that accommodations be "readily accessible and usable." How readily need access be to meet this stipulation? If a person using a wheelchair must enter building A and traverse through a second-story crosswalk to get into building B, is this in accord with the law? There also has been uncertainty as to whether the number of required wheelchair locations could include those not providing a line of sight that is unobstructable by spectators in front standing up, and about concerns such as dispersal, integration, and companion seats.

7.3 DEPARTMENT OF JUSTICE GUIDELINES

The ADA was viewed primarily as a civil rights law, and so Congress delegated the tasks of developing detailed regulations and guidelines and enforcement to the Department of Justice (DOJ). Justice considerations were decreed to take precedence over financial considerations.

For existing structures, DOJ guidelines identify 21 illustrative examples of matters that it considers important for complying with ADA accessibility standards, noting as well that full compliance is not required where an entity can demonstrate that what is required is structurally infeasible. These are (1) installing ramps; (2) making curb cuts in sidewalks and entrances; (3) repositioning shelves; (4) rearranging tables, chairs, vending machines, and other furniture; (5) repositioning telephones; (6) adding raised markings on elevator control buttons; (7) installing flashing alarm lights; (8) widening doors; (9) installing offset hinges to widen doorways; (10) eliminating a turnstile or providing an alternative accessible path; (11) installing accessible door hardware; (12) installing grab bars and toilet stalls; (13) rearranging toilet positions to increase maneuvering space; (14) insulating lavatory pipes under sinks to prevent burns; (15) installing a raised toilet seat; (16) installing a full-length bathroom mirror; (17) repositioning the paper towel dispenser in the bathroom; (18) creating designated accessible parking spaces; (19) installing an accessible paper cup dispenser at an existing inaccessible water fountain; (20) removing high-pile, low-density carpet; and (21) installing vehicle hand controls [28 CFR 36 §36.304(a) Auxiliary Aids & Services (1991/2001):567–568].

For new and renovated facilities, the ADA regulations mandate the number of accessible locations for assembly areas. This is referred to as the *one percent plus one* formula for fixed seating capacity over 500.

Controversy ensued when in 1994 the Department of Justice inserted the following provision in its *Technical Assistance Manual* (TAM).

> . . . in assembly areas where spectators can be expected to stand during the event or show being viewed, the wheelchair locations must provide lines of sight over the spectators who stand. This can be accomplished in many ways, including placing wheelchair locations at the front of a seating section, or by providing sufficient additional elevation for wheelchair locations placed at the rear of seating sections to allow those spectators to see over the spectators who stand in front of them (U.S. DOJ 1994b: §III-7.5180: 13 insert in TAM Nov. 1993 §III-7.5180: 64).

The most vexing issue was whether the added guideline was merely an extension and/or clarification of a prevailing rule, and therefore not bound by the Administrative Procedures Act (APA) procedures, or a new rule that needed to have adhered to APA requirements of prior publication and solicitation of comments.

Even if the rule were legitimate, matters still remained unclear. Could posting signs telling persons not to stand if they were seated in front of a wheelchair spectator achieve satisfactory sightlines? Could locations be arranged so that if not occupied by wheelchair patrons, in-fill seats could be sold to ambulatory spectators? Approval of any of these alternatives, which were rejected by the courts, would have meant significant additional yearly income for the arena owners.

7.4 ADA ARENA AND THEATER LAWSUITS

It has been against this background that cases have come for adjudication to federal district and appellate courts. The following review highlights substantive issues regarding the quest for the implementation of accessibility.

Typically, individuals with disabilities or disability advocacy organizations fighting, on their behalf, for what they believed were their legal rights brought cases to the courts. The DOJ filed very few cases. The defendants were the designers, owners, and operators of the facilities. They sought to have the law clarified and to avoid the considerable expenses to redesign and modify the facilities. Architects typically sought to be removed from the lawsuits on the reasoning that the law did not intend to hold them liable (Mazumdar and Geis, 2003). In *amicus curiae* briefs the American Institute of Architects (AIA) adopted a two-pronged approach declaring, on one hand, that it was dedicated to seeing that persons with disabilities were provided with appropriate environments and, on the other, arguing that architects should not be held responsible for buildings not complying with ADA requirements.

MCI Center, Washington, D.C. (1996)

This district court case, involving a sports arena, was the first ADA adjudication dealing with assembly facilities. Complainants were the Paralyzed Veterans of America (PVA) and four persons with disabilities. They argued that the number of wheelchair locations was insufficient, that most of these were located in the upper "nosebleed" sections of the arena, that they were not acceptably distributed or integrated with other seating, and that only a small number had unobstructable sightlines. The plaintiffs insisted that the phrase *design and construct* included architects and that since constructors rarely also design the building, a rule imposing liability on persons who perform both tasks would be essentially useless.

Among the eight defendants including owners, engineers, contractors, and operators were the designers of the MCI Center, Ellerbe Becket Architects and Engineers (EBAE). Ellerbe Becket's lawyers filed a motion to dismiss, claiming that the ADA did not hold architects liable for errors of commission or omission and that generally architects and engineers do not have ultimate control over the design and construction of a project. In an *amicus curiae* brief the AIA endorsed this position and cited the considerable cooperation AIA members had provided the government in establishing ADA standards and claimed that drafters of the bill had "intentionally omitted language . . . which might have encompassed architects and design professionals within the list of responsible parties" (*PVA v. EBAE P.C.,* 1996a: 41). Judge Thomas E. Hogan agreed and dismissed Ellerbe Becket from the lawsuit (*PVA v. EBAE P.C.,* 1996a: 2, 1996b).

The defendants also argued that the unobstructable lines of sight (ULOS) guideline the plaintiffs relied on (related to TAM cited earlier) had not been properly developed and was therefore inapplicable. The designers' lawyers contended that providing wheelchair sightlines over standing spectators would give those using wheelchairs a superior view.

Judge Hogan ruled in favor of ULOS, even if it was necessary to offer the wheelchair patrons enhanced views compared to other spectators. Nonetheless, the judge stated that case had been difficult for him because the defendants had acted in good faith, but concluded that they should have used better judgment (Mazumdar and Geis, 2002).

Both parties, unsatisfied, took their case to the next court in the judicial hierarchy, the appellate court. This court essentially endorsed the district court opinion, but noted that substantial compliance with the law meant that not every wheelchair seat must have an unobstructed view over persons standing (*PVA v. D.C. Arena, L.P.,* 1997: 583).

The U.S. Supreme Court denied *certiorari*, i.e., declined to hear the case, and thereby allowed the earlier decisions to prevail (*PVA v. D.C. Arena, L.P.,* 1998).

Rose Garden Arena, Portland, Oregon (1997)

Among the numerous issues raised in the Rose Garden case were whether clustering 33 wheelchair places on the highest level of the upper section, where there were no other fixed seats, violated ADA's integration or dispersal requirements; whether locating wheelchair seating in the corners of the end zones satisfied the horizontal and vertical dispersal regulation; whether required companion seats needed to be fixed and whether these could be in front and behind the wheelchair positions instead of side by side. Other questions also were raised: Was the DOJ guideline regarding ULOS over standing spectators a valid regulation? Were executive suites required to have wheelchair-accessible seats, and were these suites required to have visual alarms? Were camera operator areas required to have accessible seats? Did selling permissible in-fill seats on a permanent basis violate the number of wheelchair locations required? There also were numerous issues involving passages, concessionaire stands, and toilets.

Judge Donald C. Ashmanskas ruled that each ticket category was required to have a proportionate number of wheelchair spaces and that the clustering of such spaces on the uppermost level "makes a mockery of the ADA dispersal requirement," nor did it satisfy "the requirement that wheelchair spaces must be an integral part of the overall seating plan" (*Independent Living Resources v. Oregon Arena Corporation,* 1997:712; 1998). He upheld the "one percent plus one" formula and decreed that, despite the accompanying loss of 790 seats for ambulatory persons, fixed side-by-side companion seats for those using wheelchairs were demanded by the law, and ruled that such seats need not be bolted to the floor, but that they could be padded folding chairs by Clarin.

Regarding dispersal, Judge Ashmanskas permitted a 10 percent variation from the standards and, in contrast to Judge Hogan, declared that the lines of sight requirement over standing spectators had not been properly promulgated and that therefore he would not require it. But the plaintiffs agreed in negotiations to provide sightlines over standing customers for wheelchair attendees, likely fearing that an appellate court would make them do so. Unlike Judge Hogan, Judge Ashmanskas believed that the defendants had acted calculatedly with an eye on the bottom line. He also turned sarcastic in regard to the defendant's claim that the claimants might be excessively advantaged under ADA requirements, noting that people were not hurrying to undergo amputations in order to qualify for such preferential treatment. Judge Ashmanskas took the step of visiting the site and thereafter offered detailed rulings on the large number of contested points, including that Title III of the ADA requirements including formulaic number of accessible seats applied to suites and camera operator areas, and that suites needed to provide law-mandated visual alarms.

Broward County Arena, Sunrise, Florida (1997)

This case, concerning an ice hockey stadium, was filed before construction had begun. The plaintiffs claimed that they had adequate reason, based on earlier performances, to believe that Ellerbe Becket would not adhere to ADA standards. Ellerbe Becket filed a motion to dismiss, claiming that the ADA did not hold architects liable.

Judge Jose A. Gonzalez, unlike Judge Hogan, declared that if architects were not liable under an interpretation of "design and construct," then nobody could be held responsible for faults in new commercial facilities and dismissed Ellerbe's motion (*Johanson v. Huizenga Holdings, Inc.,* 1997).

Blockbuster-Sony Entertainment Centre, Camden, New Jersey (1997)

In this outdoor setting two issues were prominent. One was ULOS or enhanced lines of sight. A second was accessibility to outdoor seating areas.

In district court, Judge Joseph E. Irenas, in concordance with Judge Ashmanskas and unlike Judge Hogan, ruled that the ULOS requirement was not binding on the builders because it had not been properly developed and it was adopted after the Entertainment Center construction had begun. He declared that the "comparable lines of sight" could not be interpreted to mean lines over standing spectators. Further, he denied the request to have the lawn area accessible (*Caruso v. Blockbuster-Sony Entertainment Centre,* 1997).

At the appellate court, Judge Samuel Alito agreed with the district court ruling regarding lines of sight, but declared that accessible routes to assembly areas outside the Centre were required (*Caruso v. Blockbuster-Sony Music Centre,* 1999).

United States v. Ellerbe Becket, Minneapolis, Minnesota (1997)

In 1996, the federal Department of Justice filed suit in Minneapolis, alleging that Ellerbe Becket had engaged in a pattern of violations of ADA regulations in the designs of half a dozen sports arenas by failing to provide wheelchair users with ULOS, among other deficiencies (*United States v. Ellerbe Becket,* 1997a). Again Ellerbe Becket asked to be dismissed (*United States v. Ellerbe Becket,* 1997c). Once more the AIA filed a brief supporting Ellerbe Becket, this time in conjunction with the Associated General Contractors of America. It read: "Throughout its 138-year history, the AIA has represented the interests and concerns of the architectural profession in every state and legislative body in the country" (*United States v. Ellerbe Becket,* 1997b: 3). The AIA was dedicated to protecting its members; Congress' interest, however, as read by the courts, lay in enabling persons with disabilities.

When Judge John R. Tunheim rejected the argument that the ADA did not apply to architects (*United States v. Ellerbe Becket,* 1998) Ellerbe Becket entered into a negotiated settlement with the government. It did not concede legal responsibility, but agreed to adhere to the dictates of the ADA in its future designs, including providing unobstructed sightlines (*United States v. Ellerbe Becket,* 1998). The Building and Owners and Managers Association, pleased with the decision, claimed that architects were in the best position to make certain that laws pertaining to construction are obeyed (Winston, 1997). In the consent decree the DOJ specified the dimensions of wheelchair seating and for obtaining ULOS. Nonetheless, the reliance on detailed specification can inhibit creativity and innovation (Mazumdar and Geis, 2003; Salmen 2001).

3Com Park at Candlestick Point, San Francisco, California (1993–1996)

In a settlement agreement with the Department of Justice, the city of San Francisco agreed to install in Candlestick Park, used for baseball and football games, 61 new wheelchair and companion seats (not folding chairs); renovate the restrooms; install 25 assistive listening devices; upgrade signage and parking spaces; and train the staff in nondiscriminatory service for persons with disabilities, among other actions (*United States and the Disability Rights Education and Defense Fund v. City and County of San Francisco*, 1996).

Cinemark USA, El Paso, Texas (2000), and Others

Motion picture theaters had elected, beginning in 1995, to provide stadium-style seating with a slope of 12 to 18 inches between rows. An arrangement with the front rows allocated to persons in wheelchairs at first had the imprimatur of the courts (*Lane v. Cinemark USA,* 2000). Soon thereafter, however, several other courts rejected this approach. One noted that that the vertical angle of view from the front rows averaged 42° compared to 20° in other seats, despite industry guidelines that take 35° or more to be uncomfortable. The judge observed that the rows nearest the screen were uncomfortable and discomforting locations, and that wheelchair patrons were unable to slump in their seats or recline their bodies in order to adjust to the awkward viewing angle (*Oregon PVA v. Regal Cinemas, Inc.,* 2004*;* see also *United States v. AMC Entertainment, Inc.,* 2002*; United States v.*

Cinemark, 2004*; United States v. Hoyts Cinema Corp.,* 2003; for commentaries see Driver, 2006; Radu, 2005; Beasley and Davies, 2001). Also important was the horizontal angle requiring head movement from side to side.

Market Place Cinema, Riverside, California (2001)

John Lonberg and Ruthee Goldkorn, both wheelchair patrons, sued the owner of Market Place Cinema—a multiplex facility containing four auditorium-style and two stadium-style theaters—and architects Salts, Troutman and Kanshiro, Inc. (STK) under the ADA, claiming that the theaters did not contain adequate wheelchair space and had inadequate lines of sight, unsatisfactory restroom stalls, wheelchair-inaccessible emergency exits, and too steep a ramp leading out of the theater. Judge A. Howard Matz, later affirmed by the ninth circuit court, found that "an architect was not included among the parties liable for design and construct discrimination under 42 U.S.C.S. § 12183(a)" (*Lonberg v. Sanborn Theaters, Inc.,* 2001).

7.5 CONCLUSION

This review of sports and entertainment arena court cases raises a number of important issues about the law, court decisions, and nondiscriminatory design.

Although the ADA produced many benefits (Beasley and Davies, 2001), full accessibility for persons with disabilities still has not been achieved. In the United States, the preference for use of the law to change behavior has had several problems as described elsewhere (Mazumdar and Geis, 2000, in press a), and implementing universal design principles through legislative action could be similarly ineffectual. The tripartite division of responsibility for lawmaking by Congress, detailed regulations by administrative agencies, and interpretations enforcement by the courts have not been fully effective in producing accessible environments.

Are the requirements of the ADA clear? Although the preamble of the ADA was straightforward, Congress drafted the law imprecisely (Null and Cherry, 1996; Mazumdar and Geis, 2000, 2001b, in press b). The DOJ left regulatory requirements unclear. These resulted in court battles, expenditure of time and resources, and the assuming of adversarial positions (instead of cooperation) for persons with disabilities, designers, contractors, owners, and operators. Congress could have chosen to be clearer, to reframe or modify the current law, and regulating agencies could frame better regulations, guidelines, and standards. But lawmakers are not very prescient in anticipating all possible difficulties and misuses.

Advocates of universal design for private homes have deliberately avoided relying on federal law to achieve their goals, claiming that such a move might arouse strong opposition and envelope them in a quagmire of litigation. Instead, they have relied on moral persuasion and marketplace logic, such as pointing out that in time homeowners might themselves need universal design, and lobbying local lawmakers and builders to adopt universal design principles (Kaminski et al., 2006).

Are the ADA requirements adequate? Even with more detailed specification of final design outcomes, as in the Minnesota court order and the Rose Garden ruling, the needs of persons with disabilities may not be adequately addressed if their anthropometrics vary from those selected by the Department of Justice, or if the people standing in front are very tall (see also Salmen, 2001; Mazumdar and Geis, 2001b). The substantial compliance rule also can produce obstructed sightlines.

Is the law being applied properly? And what is being missed in the regulatory and judicial process? In court, judges chastised the law and rule makers for their failure to produce cogent and comprehensive standards. But neither did the judges always arrive at similar conclusions of law, nor did they clarify controversial issues, such as the meaning of *substantial compliance* and *design and construct.* Divergent interpretations by the courts may have been due to the use of differing philosophies of "parallel interpretation," which relies on textualism, and "significant degree of control" and places responsibility onto those who have considerable control or oversight over the outcome (Chatterjee, 2002, p. 317). In the above cases, the courts showed a proclivity toward concern for persons with disabilities, reflecting the emphasis of the ADA. In interpreting the ADA, judges have had to make decisions on matters such as technical architectural considerations about which they possessed little knowledge beyond partisan briefing by the litigating parties. Although they are not restricted in seeking expert opinion, they rarely do. Many questions related to accessible buildings remain uncertain and will continue to be unclear, unless the U.S. Supreme Court or Congress decides to clarify.

From a legal standpoint, federal court decisions were supposed to have relied heavily on matters of law and on *stare decisis* (the principle of following precedent), which is a key ingredient in Anglo-American law. In similar or equivalent fact situations, precedent requires judges to follow earlier rulings of the U.S. Supreme Court and higher courts in their own circuit. Although not required to do so, courts also give deference to equivalent or higher courts elsewhere. This suggests that courts are less concerned with matters of fact, and that decisions may turn on the way words are defined, known as *statutory interpretation*.

The legal liability of architects has received some attention from law reviewers (Chatterjee, 2002; Mazumdar and Geis, 2003; Circo, 2006). It seemed to have been clarified by the consent decree reached with the DOJ in 1997. But, the court decision in the Market Place Cinema case of 2001 reintroduces confusion.

Architects can and should be held responsible for their designs. But the matter is not simple. Designers are not solely responsible for accessibility. Inaccessible environments can result from nondesign factors, such as not constructing per the design and postdesign changes and actions, e.g., materials blocking a ramp. Lack of clarity in the law and in vacillating court rulings can be confusing to professional designers. Inconvenience and not knowing what to do and how can be reasons to ignore accessibility requirements. For example, should designs be based on published research information, on research conducted by the designers or their representatives, or on the demands of groups representing persons with disabilities? Loss of revenue and cost of compliance have been offered as reasons for noncompliance and for alternatives, such as in-fill seats. And, on occasion noncompliance is due to lack of caring (Mazumdar, 1998).

Nonetheless, designers will be required to know the law's original demands, court rulings, regulatory standards, and guidelines in order to make informed judgments. They must also consider professional, moral, and social responsibility. They are in the best position to design buildings to enable accessibility for persons with disabilities. Several judges surmised that architects adopted self-serving positions that disrespected the reasonable needs of persons with disabilities. The claim, supported by the AIA (AIA, 2000; AIArchitect, 1998), that architects bore no legal responsibility for adherence to ADA regulations was not an attractive position, from either a moral or a public relations viewpoint.

Where the law fails to provide clear guidance, designers can refer to research to understand the needs and rights of persons with disabilities (see, e.g., Zola 1982a, 1982b; Mazumdar and Geis, 2001a; Preiser and Ostroff, 2001; Imrie, 2001; Keats and Clarkson, 2003; Goltsman and Iacofano, 2007), anthropometrics and other requirements of persons with disabilities (see, e.g., Null and Cherry, 1996; Leibrock and Terry, 1999; Pheasant, 1996; Wilkoff and Abed, 1994).

Architects need not wait for laws to be enacted and litigation to be mounted to make buildings, arenas, theaters, and other spaces universally accessible and enjoyable. Rather than dispute the letter of the law, they can adopt as an imperative and professional duty the spirit of designing environments that serve the needs of all, including persons with disabilities. The stance that architects work primarily in a servant role seems demeaning for a profession that justifiably takes credit for some of the world's most remarkable buildings. Hopefully, the arena cases offer a lesson, one that will impel architects to harness their innovative spirit and take a leadership role in designing buildings for all to use and enjoy.

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CHAPTER 8
LIFE SAFETY STANDARDS AND GUIDELINES

Jake Pauls and Edwina Juillet

8.1 INTRODUCTION

Life safety in new larger buildings is undergoing what might, in some respects, be described as a paradigm shift, especially in greater reliance on elevators for evacuation. Such paradigm shifts are rare in the recent history of building design.

The first edition of the *Universal Design Handbook* included a chapter focused on stairway safety as one aspect of life safety, including the traditional use of stairways for evacuation; that chapter should be referred to for basic information on stairway design (Pauls, 2001). Many more details, along with recent stairway safety developments—most notably recent worsening safety of home stairways *and generally a failure of universal design*—can be accessed via a website established by Pauls: http://web.me.com/bldguse (accessed Sep. 30, 2009). The term *standards* is used here in a broad, umbrella fashion, covering legislation, regulations, and other sets of rules affecting life safety and usability of buildings.

8.2 LIFE SAFETY

Life safety is the term used to describe aspects of safety in buildings and other facilities that directly impact the well-being of occupants in emergencies. Of course, there is not a clear distinction between life safety as a goal and property or mission preservation as a goal. The latter goal must be achieved to a limited extent if the goal of life safety is to be achieved. A building or facility must remain habitable for whatever time is needed to conduct evacuation and critical, life-protective missions. For example, institutions such as hospitals must be operationally maintained as emergency conditions are mitigated, whether this involves evacuation or shelter-in-place options.

Stairways have long served as places of refuge and key means of egress. Elevators—generally a more universally designed means of access and egress—are out of service or have severely constrained use during emergencies in many countries, including the United States. With increased accessibility of facilities to persons with disabilities in recent decades has come increased awareness of the need to maintain life safety beyond the traditional reliance on exit stairs. This awareness dates back to the mid-1970s (Marchant, 1975). Efforts have focused on

1. Reducing the need for mass egress by mitigating the effects of fire, earthquake, or other danger.
2. Making the exit stairs work better, a more recent development driven by ergonomists and like-minded professionals (see Fig. 8.1).
3. Most recently, making the elevators more robust and more reliably usable in conditions that previously resulted in service shutdowns. Since 2004, this has been driven mostly by the professionals responsible for the combined U.S. and Canadian national elevator standard, ASME A17.1/CSA B44.

Literature on how to implement these approaches is most extensively and accessibly developed in the first listed effort (e.g., Cote, 2008) while the second has involved the smallest number of professionals (e.g., Pauls, 2007).

Following the September 11, 2001, ("9/11") World Trade Center (WTC) evacuations, there was a rekindling of interest in, and activity on, life safety for people with disabilities. However, with the exception of one brief article on the larger evacuation of the WTC Twin Towers in February 1993, there was no examination of how people with disabilities, and others assisting them, performed (Juillet, 1993). Among the well-disseminated, anecdotal accounts of experiences of individual evacuees with disabilities, that of John Abruzzo on the 69th floor of Tower 1 is remarkable and instructive. Fortunately in relation to his 9/11 experience, his experience was captured as an audio conversation recorded and archived by StoryCorps and otherwise, as in the instructive accounts (provided here in Box 8.1) of his experiences in both the 1993 and 2001 evacuations.

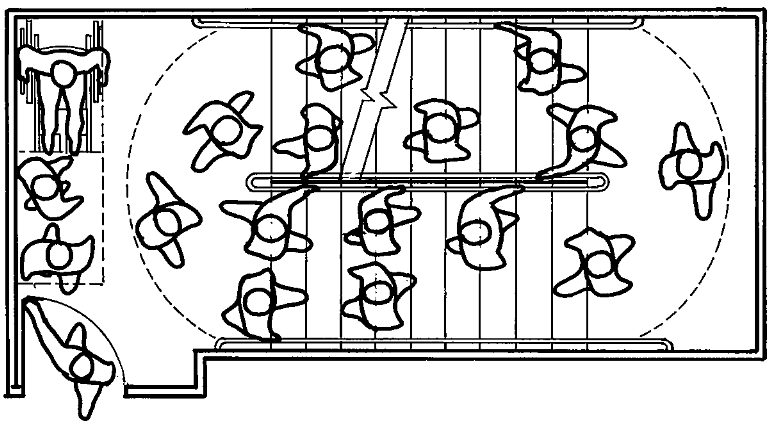

FIGURE 8.1 Plan of 56-inch (1420-millimeter) nominal width exit stairway providing an enlarged landing to serve as a refuge space for wheelchair users and others desiring to rest on a landing clear of the space needed for people traversing the stair flights. This stair width allows shoulder-to-shoulder coherent flow (depicted here), counterflow (such as by emergency responders), and overtaking movement as necessary.

Long description: Plan of 56-inch (1420-mm) nominal width, dogleg configuration exit stairway with two flights per story and two landings turning 180° each. The exit stairway provides an enlarged landing, at the entry door, to serve as a refuge space for a wheelchair user and a few standees needing to rest on a landing clear of the space needed for people traversing the stair flights. Plan views of evacuees on this stair depict how this stair width allows shoulder-to-shoulder coherent flow, i.e., with people moving unidirectionally as a group. The width also facilitates counterflow such as by emergency responders ascending against the predominant descent movement and overtaking movement where some people bypass others moving in the same direction.

Box 8.1 Wheelchair User Escapes World Trade Center Towers in 1993 and 2001

1993: February 13: A C 5-6 quadriplegic who relies on his electric wheelchair for mobility evacuated from his office on the 69th floor. He estimated his evacuation time at a little more than six hours and reported that "Everyone evacuated from the office except my manager and the fire warden. We went to an executive office where there was no smoke and waited for about 45 minutes. Then we went into the stairway, where I commandeered three men coming down the stairs who carried me and my wheelchair (combined weight, 350 pounds) to the 48th or 49th floor. The smoke got worse and the heat increased as we descended, and then the lights went out permanently. The stair landings were very narrow and seemed to switch from one stairwell to another. We got down to the 43rd floor, and I was transferred to a stretcher and carried the rest of the way out. It took approximately 15 people taking turns to carry me down. It was a very slow process. But I heard no one complain about the delay due to my evacuation."

Shortly after the 1993 bombing, a number of products and systems were purchased to aid in the evacuation and life safety of WTC occupants. These included portable, stair descent devices, specifically evacuation chairs that have two wheels for use on landings and two tracks, with special belts, for controlled descent on stair flights.

2001: On September 11, he, like others on the 69th floor, rushed to the stairwell when the plane hit the tower. The products and systems added since 1993 proved successful on 9/11. The lights stayed on while he—in an evacuation chair—and his friends evacuated with only several minutes to spare before the tower collapsed. Fortunately for him, unlike an undetermined number of people with mobility problems being held (in triage fashion) at the 20th floor, he and his colleagues chose to carry on to the ground. All those being held at that floor died in the collapse. (For an interview with details of his and a colleague's experience on 9/11, refer to the StoryCorps audio recording at www.storycorps.org/listen/stories/coworkers-michael-curci-and-john-abruzzo. Accessed Sep. 11, 2009.)

A troubling finding after the 2001 evacuation was that about 6 percent of the WTC Twin Tower occupants surveyed after 9/11 reported "having a limitation that constrained their ability to evacuate" (Averill et al., 2005); this was double the percentage reported in office building evacuation studies by Pauls around 1970 in Ottawa, Canada. The WTC finding is especially important as New Yorkers generally have relatively good physical fitness levels, compared to others in the United States. With physical fitness of the general population deteriorating almost everywhere around the world, there has been increased attention on the growing problems that a majority of the population—not only people with conventional disabilities—will have in evacuating large buildings by means of stairs (Pauls, 2008). While sometimes termed the *obesity epidemic*, the fitness deterioration is not simply a matter of excess weight or body mass index (BMI). Extremely overweight persons will have extra difficulty using stairs, especially in an evacuation situation, and these people pose additional safety problems directly and indirectly to themselves and to others. Generally, the incidence of overweight (BMI greater than or equal to 25) or obesity (BMI greater than or equal to 30) doubled between 1995 and 2005 in the United States (Centers for Disease Control, 2006).

Aside from the changing demographics in the population as a whole, those with conventional disabilities, chiefly the inability to use stairs independently, pose difficulties. Methods for mitigating the difficulties have been addressed in guides produced for the U.S. Fire Administration (USFA) by Juillet and others (USFA, 1995, 2002). These deal with disabilities more generally.

Since 9/11 and natural disasters such as Hurricane Katrina, there has been growing attention by government agencies and other organizations to the needs of people with disabilities in emergencies of all kinds. Examples of this attention, beyond the USFA guides noted above, include Government Horizons, 2006; Interagency Committee on Disability Research, 2004a, 2004b; Interagency Coordinating Council on Emergency Preparedness and Individuals with Disabilities, 2005; National Organization on Disability, 2002, 2004; Oklahoma State University, 2007; and U.S. Department of Homeland Security,

2005. Importance grew when the U.S. President issued Executive Order 13347 on July 26, 2004, "Individuals with Disabilities in Emergency Preparedness" (Federal Register, 2004).

8.3 USE OF ELEVATORS FOR OCCUPANT EVACUATION

In relation to universal design, the most significant development—even warranting the label of a *paradigm shift*—is the elevator industry and fire safety field embracing the concept of elevator use during fire by all building occupants, not only for firefighters, through an automated system protocol known as Elevator Evacuation Operation, or EEO. If implemented, this would be a radical departure from current practice enshrined on signs: "In case of fire, elevators are out of service. Use exit."

Among the early agreements is one that would require an exit stair to be directly accessed from the same protected lobby that serves the elevators counted on for use during fires. Also, although a bit less definitively decided, it is assumed that individual occupants can self-select whether to use an EEO elevator for egress or an exit stair. One does not need to have some recognized physical disability. For a listing of key building features needed to implement Elevator Evacuation Operation, see Box 8.2.

Box 8.2 Important Conditions for Implementing Elevator Evacuation Operation

- Building complies with ASME A17.1S-2005 and U.S. model building code 2006 or later.
- Elevators are accessed from a protected lobby that also has direct access to an exit stair.
- Building has total coverage smoke detection system complying with NFPA 72.
- Building has full automatic sprinkler protection complying with NFPA 13.
- Phase 1 recall of elevators is activated automatically by fire alarm initiating devices in elevator lobbies, machine rooms, and hoistways.
- An emergency voice communication system is installed for occupant notification.
- Corrective actions involving occupant behavior have been evaluated.
- Numerous generic "corrective actions," set out in ASME's Hazard Analysis, have been implemented, and other corrective actions have been developed for unique conditions.
- Generally there must be well-developed, effective coordination of actions by responding fire services, building management, and occupants.

In a universal design context, use of elevators for egress was addressed in a working meeting and workshop at the Include 2007 Conference held in London (Pauls et al., 2007). In this paper it was noted that "lifts (elevators) are designed to serve all occupants' upward and downward travel within the range of approximately 20 to 60 minutes." This performance is much better than what can be accomplished by stairs, even in the unrealistic case that everyone is able to use the stairs. The time required for stair-related, total evacuation increases with population, i.e., roughly the number of floors served, and can extend to a few hours, especially in tall or large buildings. The paper also sets out some key requirements:

> In terms of human factors or ergonomics challenges, there is good agreement that availability of relevant and accurate information is a key aspect of egress, especially if it entails use of lifts. Thus there should be increased discussion of "situation awareness" generally in our work on building design, operation and emergency response. Good situation awareness means having the information that gives one the best basis for determining current and future actions. Thus, aside from having effective means of communicating relevant information, we need to consider attitudinal factors that will influence interpretation of information. Here we face a basic problem with use of lifts for occupant evacuation in case of fire; we have been fairly effectively educated, trained or conditioned not to use lifts in case of fire. How will these attitudes,

> which have served well in the past, now be altered and how will they be selectively altered only for the appropriate buildings and lift systems? In part, this will require considerable intelligence in the design of interfaces between occupants and the lift system, including dynamic signage or visual displays generally. Thus, the paradigm shift to use of lifts, together with stairs, will demand more collaboration among design professionals and others.

An earlier paper, also presented in an international meeting, focused on critical human factors, especially information and communication (Pauls et al. 2006). This paper, as well as the Include 2007 paper (Pauls et al., 2007), cautioned that the paradigm shift is not straightforward. Consider the concluding comments of the 2007 paper, which apply more broadly to the implementation of universal design in life safety generally.

Generally, networking is needed in which various professions address problems in conjunction, individually and organizationally, with people with disabilities and other building users. Accomplishing a paradigm shift—through technological, regulatory, and social changes—will be difficult and, if not properly implemented, could lead to an even worse situation than we have currently. Confusion about appropriate emergency measures among ordinary building occupants as well as facility managers, emergency responders, and others must be effectively mitigated if not prevented during the transition to the new paradigm. The needs for the new paradigm are varied, the problems to be solved great, and the benefits real, and the downside risk is substantial.

8.4 CONCLUSIONS

There are mind-sets in the building industry and related fields that might delay, complicate, confuse, and jeopardize the implementation of universal design-based life safety systems such as elevators used in combination with exit stairs for occupant egress. One can only hope that the second, and possible third, edition of this handbook has some success to report in relation to improved life safety standards plus their widespread adoption, enforcement, and benefit to all building users.

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CHAPTER 9
THE UNIVERSAL DESIGN THESAURUS: CREATING A DESCRIPTIVE LANGUAGE FOR OUR FIELD

Richard Duncan, Barbara Brenny, and Hugh Kelsey

9.1 INTRODUCTION

Hold up a commonly recognized symbol of America, its "stars and stripes," before ten people. Distribute index cards to them, and ask that they describe the object in five words or fewer. It is likely that one will get many different answers for what is a familiar cultural icon—*American flag, U.S. flag, United States flag*, etc. That exercise, which one of the authors has employed as a teaching tool, shows that describing things adequately and consistently is less simple than may be initially understood. Classification of objects, events, etc. is, therefore, of more than mere academic interest. It has real-world implications for people seeking information in an increasingly interconnected world.

The field of universal design, little more than 20 years old, is newer and less iconic than our flag. It is challenged by misunderstandings and misperceptions about what it is and isn't. Arising in the 1980s from decades of work on accessibility and assistive technology, universal design has struggled to establish an identity separate from its origins. In particular, it is too often associated with narrowly targeted design features, useful only to those with significant disabilities, especially mobility impairments. In addition, universal design is burdened by perceptions that it is only concerned with functionality. The field needs to strongly communicate its emphasis on benefits for everyone and the importance of design integration and market appeal. In doing so, universal design can establish itself as a primary design paradigm of the twenty-first century. The creation of a distinct and well-articulated thesaurus will be a step in that direction.

The Universal Design Thesaurus (UDT) is a newly created vocabulary for describing, classifying, and organizing information for and about the field of universal design. This chapter explains the importance of classification, how the UDT was created, and how it can be used by theoreticians, strategists, and practitioners as a common descriptive language. In doing so, the chapter describes how a thesaurus of terms is derived from a taxonomical hierarchy, how the UDT can be reviewed and modified over time, and how early drafts of the taxonomy and thesaurus were reviewed by peers in the field.

9.2 THE NEED FOR A UNIVERSAL DESIGN THESAURUS

The Universal Design Thesaurus was the inspiration of universal design (UD) practitioner Richard Duncan, archivist/librarian Hugh Kelsey, and librarian Barbara Brenny. The development of the UDT emerged from a discourse of three separate but complementary disciplines: universal design, library science, and public health.

Under a 2005 contract with The National Center on Birth Defects and Developmental Disabilities (NCBDDD, 2009), Duncan provided 250 images from the Center for Universal Design (CUD) at North Carolina State University (NCSU) to the Public Health Image Library (PHIL, 2009) of the U.S. Centers for Disease Control and Prevention (CDC). Upon consideration of how to label the images for web storage and retrieval, preliminary research confirmed that, beyond the language and text of the UD principles (UDI, 2009) themselves, the field did not have an established body of terms (thesaurus) with which to label content. While the concept of universal design proximately emerged from the world of environmental accessibility, access code compliance, and the disability movement in general, its development, acceptance, and proliferation have been hampered, in part, by the dominant use of taxonomies from those other disciplines. As such, universal design has been too often misunderstood as a field that is concerned with "disability-only," with accessibility, and that it has an assistive technology focus. A vocabulary to suggest otherwise was lacking. The development and maturity of the field of universal design itself demanded its own taxonomy and thesaurus.

Kelsey suggested that if no established vocabulary existed to adequately describe the photographs, one should be created. Kelsey searched the field for an existing body of subject terms. Finding none, Duncan recruited Brenny in 2006, a visual resources cataloger specializing in thesaurus creation, to build a taxonomy and thesaurus. Its purpose was to provide access to knowledge through the standardization of descriptive terminology. The hope is that it will become a standard for managing information throughout the field.

9.3 THE IMPORTANCE OF CLASSIFICATION

Taxonomy is the area of scholarship that establishes the hierarchical relationship of objects or concepts that share similar characteristics. The goal in creating a taxonomy is to devise a classification system for naming and organizing things into groups. In the example below, the larger category *clothing* is composed of specific types of clothing, such as shirts, pants, etc., which can be treated even more specifically as blouses and polo shirts under the broader heading *shirts*.

- Clothing
  - Shirts
    - Blouses
    - Polo shirts
    - T-shirts
    - Tunics
  - Pants
    - Jeans
    - Dress slacks
    - Cargo pants
  - Dresses
    - Kaftans
    - Muumuus
    - Formal gowns

- Skirts
  - Mini skirts
  - Knee-length
  - Ankle-length

Taxonomies create categories that help the searcher identify and discover digital objects through a navigation scheme or search system. A thesaurus of terms based on a taxonomical hierarchy enhances the ability of practitioners within a given field to gain access to its body of knowledge. It does this because it defines and employs commonly understood terms and reflects decisions about how they will be used. It places them in a hierarchy and chooses between similar terms and concepts. The terms are then applied to content whether that consists of photographs, reports, or even three-dimensional objects.

A thesaurus contains a vocabulary of controlled indexing terms (subject headings), formally organized so relationships between terms are explicit. These relationships, as applied to the clothing example above, include the following:

BT = broader term—the term *clothing* is a BT for *pants*

NT = narrower term—the term *pants* is a NT for *clothing*

RT = related term—the term *zippers* is a RT for *pants*

UF = used for—indicates preferred term—the term *tunics* is UF *pullovers*

SN = scope note—description of term

USE = refers user to preferred term—for the term *pullovers* USE *tunics*

Common classification systems include the general collection Dewey Decimal System used in U.S. public libraries, the U.S. Library of Congress Subject Headings (LCSH, 2009) adopted by most U.S. university and college libraries, and the specialized collection thesauri of the Medical Subject Headings (MeSH, 2009) of the U.S. National Library of Medicine (NLM), the Art & Architecture Thesaurus (AAT, 2009) of the J. Paul Getty Trust, and the LC Thesaurus of Graphic Materials I & II (Library of Congress Thesaurus, 2009).

9.4 FROM TAXONOMY TO THESAURUS: APPLYING UD TERMINOLOGY

Consistent with professional library practice, Brenny created a four-tier taxonomy with the top levels being nonresidential, residential, product design, and transportation vehicles. Brenny made the taxonomy so it could be easily expanded to accommodate additional terms as needed. Much of the terminology, especially terminology related to the built environment, was borrowed from the AAT and LCSH. It was also modeled after other taxonomies including one that she had created to classify images of architecture, landscape architecture, urban design, industrial design, and graphic design. As it developed, the Universal Design Thesaurus was smaller in size and scope than the aforementioned thesauri, because the UDT focused on a single discipline rather than a multitude of print and visual materials.

In selecting terms for the taxonomy, the need arose to provide some flexibility for those instances when the precise type of building was unknown. An example of this is the employment of two generic entries under nonresidential: public entrances and public restrooms. There were multiple instances where the language of UD was chosen over something more closely related to AAT terminology. For instance, UD practitioners and other professionals categorize certain environments as either *improved* or *unimproved,* while the AAT does not subdivide terminology in this way. In the UDT, the objects *parks* and *rest stops* were allotted those terms as descriptors. *Service stations* were also conceived as either *self-serve* or *full-serve*, and those terms were used for that type of nonresidential establishment.

There were also several instances where UD practitioners felt certain AAT and LCSH terms seemed out of date. This was most noticeable in terms falling under the headings *medical spaces* and *welfare buildings*. The sections on product design and transportation vehicles were straightforward and presented few problems. The team originally put *transportation vehicles* under the heading of *product design,* but feedback from UD experts indicated that vehicles were important enough to warrant their own top-level heading.

All taxonomical hierarchies and thesauri are "living" entities and thus change with the introduction of new terms and concepts and the evolution of existing terminology. An example is the difficulty the team encountered when trying to differentiate all the various types of assisted-living facilities and housing for older people. UD practitioners use a variety of precise terms when describing these structures, which posed the problem of reaching consensus.

9.5 QUERYING THE FIELD

To make the thesaurus valuable to the universal design community, the project team understood that the community itself needed to evaluate it. When a draft version of the thesaurus and the taxonomy was finished, it was forwarded to selected practitioners in the field. It was explained that the purpose of the thesaurus was to facilitate the storage, labeling, description, and retrieval of UD information. Responses from practitioners with significant expertise have thus assisted with the development of the first universal design vocabulary, which included both a thesaurus and a taxonomy for description and classification. If the terms didn't make sense to UD practitioners, the terms wouldn't be used. It was offered to the community with the following questions to assist their review:

- Does it reflect contemporary terminology? Are these the terms you are likely to use? Example: *automobiles* instead of *cars* but *buses* instead of *autobuses*
- When a choice is made between using one term and another, will it make sense to someone in the UD field? Two examples are *elderly* instead of *aged* and *ambulation* instead of *walking.*
- Does it leave room for growth as more terms are added? This asked, in essence, if the upper-level headings were broad enough to encompass the field's main areas of endeavor and still allow new terms to be included when necessary. Example: *nonresidential* and *residential* likely cover all built structures at the highest description level.
- Does it allow for grouping of like images? When searching well-indexed information, is the retrieval consistent with the search terms employed?

Material that is cataloged using a well-constructed and managed thesaurus will likely be more consistently retrieved when a search is performed. A Google keyword search, by contrast, forces users to wade through many pages of results that are not systematically organized, sometimes making the searcher use multiple terms or perform multiple searches. Information that is consistently described according to a single set of rules, e.g., a thesaurus, will quickly give users the search results they need. Consistent metadata, such as titles and "alt text" for images, can assist in the efficient and accurate retrieval of items from millions of objects.

To assist their evaluation, UD practitioners were encouraged to ask librarians and other information professionals experienced in handling information for acquisition, cataloging, description, storage, and retrieval their opinions of the thesaurus and its potential value to the field of universal design. As a result, the thesaurus team received many terms not originally included, were advised of alternative language or phrasing for existing terms, and received recommendations to delete terms that did not apply or were inappropriate.

9.6 THE UNIVERSAL DESIGN THESAURUS

The Universal Design Thesaurus is organized, at its highest level, around four main categories of the built environment:

- Nonresidential
- Residential
- Product design
- Transportation vehicles

TABLE 9.1 The Four Main Categories of the Universal Design Thesaurus and Samples of Sub-Categories

Category (Level 1)	Subcategory (Level 2)	Subcategory (Level 3)	Subcategory (Level 4)
Nonresidential	Communication structures	Telephone booths	
Residential	Homes for the elderly	Assisted living facilities	
Product design	Containers	Containers for hygiene	Soap dispensers
Transportation vehicles	Automobiles		

Within the larger categories are subcategories going to no more than four, and usually three, levels of description. Examples include those shown in Table 9.1.

Subject headings serve to more specifically describe objects or concepts under broad categories. An example is *shirts* under the category *clothing*. The main subject areas in the thesaurus are building components, yard and landscape elements, age groups, physical movements, furniture components, impairments, disabilities, disorders, information technology, and other specific UD concepts such as social equity and inclusion. Below is an example of how an image is cataloged using the UDT. (See Fig. 9.1, Table 9.2.)

The thesaurus, taxonomy, and UD principles work together to describe an image fully using a threefold approach. The taxonomy or hierarchy serves the purpose of setting the stage or describing the UD product or environment. The thesaurus or *subject headings* are used to fill in other pertinent terminology and describe the images with greater precision. The assignment of a *title*, a *description*, and other metadata provides specific details that distinguish objects (in this case, an image) within the larger groupings created by *categories* and *subject headings*.

The UDT, however, only begins to set the context for describing and evaluating environments or other designed outcomes. The UD principles provide yet another standardized rubric to assign

FIGURE 9.1 Adjacent escalators and elevators in mall offer similar routes of travel for everyone.

Long Description: Locating the elevator and escalators together avoids segregating group members using different modes of mobility. The elevator is adjacent to and between up and down escalators in a shopping mall. Two women, one with a baby carriage, wait for the elevator. Another woman is about to ride the escalator with her walking child.

TABLE 9.2 Descriptive Elements of Figure 9.1

Title	Locating the elevator and escalators together avoids segregating group members who use different modes of mobility.
Description	The elevator is adjacent to up-and-down escalators in a shopping mall. Two women, one with a baby carriage, wait for the elevator. Another woman is about to ride the escalator with her walking child.
Category	Nonresidential, commercial spaces, shopping centers, shopping malls
Subject heading	Escalators, elevators, size differences, circumstantial disability, mobility impairment, families, children, toddlers, infants

TABLE 9.3 Universal Design Principles and Guidelines That Apply to Figure 9.1

Principle 1: Equitable use	1a. Provide the same means of use for all users: identical whenever possible; equivalent when not. 1b. Avoid segregating or stigmatizing any users. 1c. Provisions for privacy, security, and safety should be equally available to all users. 1d. Make the design appealing to all users.
Principle 2: Flexibility in use	2a. Provide choice in methods of use.
Principle 3: Simple and intuitive use	3a. Eliminate unnecessary complexity. 3b. Be consistent with user expectations and intuition. 3c. Accommodate a wide range of literacy and language skills.
Principle 6: Low physical effort	6b. Use reasonable operating forces. 6d. Minimize sustained physical effort.
Principle 7: Size and space for approach and use	7d. Provide adequate space for the use of assistive devices or personal assistance.

meaning to an image. For example, Fig. 9.1 could be described using five of the seven Principles of Universal Design, and several of the related guidelines as shown in Table 9.3.

9.7 ACQUIRING AND USING THE UNIVERSAL DESIGN THESAURUS

For easy access, and to encourage continual use and improvement, the UDT is available on the World Wide Web from the R. L. Mace Universal Design Institute web site at this address: www.udinstitute.org. Examples of its use can also be found on the site. The UDT is available for unconstrained use, royalty-free, and with the sole requirement of acknowledgment of the copyright holders.

- Download the thesaurus and guidelines from the Universal Design Institute web site: www.udinstitute.org
- Review the examples on the web site.
- Begin the cataloging process by assigning the material to the appropriate top-level category.
- Work through the hierarchy down to the lowest category and subject heading level necessary.
- Assign appropriate universal design principles.
- Distinguish between similar materials in the same category and with the same subject heading by assigning a *title* and *description* to the object.

9.8 THE FUTURE OF THE UNIVERSAL DESIGN THESAURUS

The UDT is being considered for inclusion in the CDC's Consolidated Health Thesaurus (CHT) to cover the universal design subject domain. It will be offered to the Library of Congress Cataloging Department as well as the NLM's MeSH Team for inclusion in those respected thesauri. Once it is established in the United States, it is hoped that the use of the UDT will be broadened to reflect the international character of UD as a discipline devoted as it is to research and design for full usability and safety of the built environment and designed objects across the full physical, cognitive, and cultural spectrum.

The hope of its creators, editors, and contributors is that it can usefully serve both UD practitioners and the public in accessing information about the UD field. The relevance of the UDT, however, will only be maintained if librarians, information specialists, and practitioners provide the feedback necessary to its growth and currency. It has been proposed that a UDT editorial board be established to solicit feedback and to review the thesaurus biennially.

9.9 METHODOLOGY

The creation of the UDT came about through the effort to strike a balance between how practitioners think and how librarians approach categorization and description. Its growth and refinement is, therefore, a collaborative effort reflective more of qualitative research methods in which the focus is on holistic and contextual understanding than of reductionist and isolationist viewpoints informing most quantitative research. Our qualitative research approach to data collection was a variant of grounded theory practice, which emphasizes the discovery of participants' main concerns in storing and retrieving documents, photographs, etc. related to the UD field and how they resolve them. In this case, UD practitioners responded to our questions about how they dealt with information categorization. It was from these data that we affirmed our hypothesis that a Universal Design Thesaurus would be useful to field practitioners. For this project, there were no "right" or "wrong" responses to our inquiries; what mattered was relevance, fit, workability, and modifiability consistent with grounded theory practice. Our data forms centered mainly on surveying and interviewing of subjects.

The methodology the authors used within grounded theory practice was participatory action research (PAR). A recognized form of experimental research, PAR focuses on the effects of the researchers' direct actions of practice within a participatory community to achieve the goal of improving the performance quality of the community as a whole or within a specific area of concern. The authors' goal was that of addressing, in this case, the difficulty of categorizing documents, images, etc. in the field of universal design, an identified problem common to the field. Participatory action research involves direct participation in a dynamic research process, while monitoring and evaluating the effects of the researcher's actions with the aim of improving UD practice, at least in regard to language standardization and information categorization. Action research is a way to increase understanding of how change in practitioners' actions or practices can mutually benefit the wider UD community of practitioners. Although it has been criticized for lacking adequate methodological rigor, a focus on the end result justifies taking the position that the sacrifice of some methodological and technical rigor is well worth the additional validity and practical significance gained through this research approach.

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INTERNATIONAL PERSPECTIVES

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CHAPTER 10
NORWAY'S PLANNING APPROACH TO IMPLEMENT UNIVERSAL DESIGN

Olav Rand Bringa, Einar Lund, and Kristi Ringard

10.1 INTRODUCTION

In 1997, the Norwegian government began an effort to develop more integrated and comprehensive planning for accessibility and universal design. This chapter describes the policies of the Norwegian government.

Every country chooses a way of conducting policy based on political priorities, political tradition, and the economic situation. When it comes to implementing the policy of accessibility for people with disabilities, there appeared to be some general characteristics shared worldwide 10 years ago:

- Focus on high-level national issues
- Lack of visible and effective objectives at other levels
- Concentration of responsibility in the social sector
- Lack of responsibility in other sectors

The Norwegian government started to look into this situation, trying to find a strategy that would accelerate the implementation and quality of accessibility in the built environment on a national basis. Interest now turned to the political and professional planning processes in counties and municipalities. The master plans for these administrative levels refer to the directions for how major political issues shall be implemented and financed in the coming years. These plans must include national objectives and local priorities, and they must comply with all legal and regulatory requirements. A survey conducted in 190 municipalities, out of a total of 431, showed that 17.2 percent had accessibility objectives for people with disabilities in their plans for the physical development of the municipality. Just over 3 percent had made these objectives binding by law (Hanssen and Stokke, 1999). This percentage is much lower than that for national objectives such as industrial development, general housing policy, and considerations for the living conditions of children.

10.2 PLANNING—NEW POSSIBILITIES

In searching for possible obstacles and ways to improve the results of the planning processes, community planners and advocacy organizations were both asked to give their opinions and to suggest solutions.

It became evident that planners were positive about including accessibility, but they considered accessibility to be a question of details, and not an issue for master plans, as well as local plans and development plans. When asked to define what they needed to incorporate universal design into master plans, the planners rather surprisingly rejected the idea of producing more guidelines (Høyland and Nistov, 1999). They argued that they already had too many manuals on accessibility and universal design from too many sources. They pointed out that their primary requirements for doing a better job with accessibility for people with disabilities were the upgrading of skills and better planning tools. They suggested that both planners and representatives of user organizations should be given the opportunity to improve their skills and qualifications locally through seminars, as well as at colleges and universities. Their preferred tools were concise information on planning and universal design, as well as references to the most important information. They emphasized that the authorities should be more precise in describing policy, guidelines, and solutions, and that examples of good practice were preferred and useful information was helpful.

A report developed by a research institute served as the basis for the strategic discussions with the organizations. It pointed out some important issues to be considered (Saglie, 1999). The responsibility of the local communities to take initiatives and marshal the user participation processes to suit all users was underlined, and the need for training and information was established. Based on the evaluation of previous pilot projects, the organizations were urged to give priority to subjects that they felt were important, and to choose to be represented in processes where their influence would be as effective as possible. It was evident that the planning arena, where strategic priorities are established and work is coordinated, did not recognize accessibility as an issue. At the same time improvements could obviously be achieved, and many parts of the strategies for obtaining better results were clear.

These aspects were carefully considered to make accessibility a key issue in planning in the 4-year program launched by the Norwegian government in 1998.

FIGURE 10.1 The Old City of Kongsvinger with buildings from the seventeenth and eighteenth centuries is situated on the hillside leading up to the Kongsvinger Fortress. The city of Kongsvinger included universal design in the development of the present city center by the foot of the fortress hill.

Long description: This photo shows the city of Kongsvinger with the old city with houses from the seventeenth and eighteenth centuries in the foreground. The landscape slopes down to the river where the present city center is located.

10.3 THE "PLANNING FOR ALL" PRIORITY AREA, 1998–2002

The Ministry of the Environment, which is the planning authority, was responsible for the program. The objective was to introduce accessibility as a high-level goal in plans and to integrate the issue in all the relevant parts of the plans. Using any means available, laws should be evaluated, directives issued to clarify national policy, research launched, development of methods carried out, pilot projects conducted, and a series of educational programs supported.

Accessibility-for-All Directive

Using the existing laws, relevant political resolutions, and available results from research and pilot projects, a directive was issued in late 1999. The directive "Accessibility for All," which is still effective, was based on universal design thinking and clarifies national policy in the field of planning for all. The main issues include the following: the objective of accessibility for all should be included in master plans and supportive plans; user participation should begin with dialogue in the early stages of the planning processes; and high-level authorities may stop plans that do not fulfill these requirements. In Norway, all municipalities are obligated to have an approved master plan covering priority activities for the coming 4-year period.

In addition to these formal and political instructions for the planning process, the directive defines *accessibility* in a broad context, covering national policies and regulations for land use, road building, city design, pollution, and noise control. The goal was to provide basic, easy-to-handle areas of concentration within the existing mainstream planning concerns. In all these aspects, accessibility in line with universal design was introduced with a focus on the technical requirements concerning people with disabilities.

Pilot Projects

Important information and knowledge on how the Ministry of the Environment should conduct the work and move forward was to be supplied by 20 pilot projects in counties and communities. The pilot projects all had the same objective: introduction of accessibility and universal design thinking in the actual planning. Various strategies were used to test the best practical way to achieve this in the pilot projects. The projects used, in general, one of two main approaches:

1. Universal design applied directly to the ordinary planning process
2. Universal design introduced in a special plan developed with a focus on accessibility for people with disabilities

It was important to establish knowledge on which of these approaches was more effective and reliable in view of the objectives to be achieved. In 1997, the latter approach was the one that had been used more, and many argued that a plan with a special focus was necessary to bring the issues of universal design onto the agenda. The pilot projects dealt with different types of plans and a variety of focused themes. Four projects involved county plans. Most of the projects dealt with community master plans, development plans, and thematic plans for recreation and historic areas.

Evaluation

An external evaluation of the priority area "Planning for All" was presented in 2002 (Hanssen and Stokke, 2002). The evaluation was carried out by the Norwegian Institute for Urban and Regional Research.

The main conclusion was that the program had had a positive effect on planning. The effect was most noticeable in relation to participation from people with disabilities. This was one of the main objectives of the priority area. In 1999, 37.3 percent of the municipalities answered that they had organized participation that included people with disabilities. This had increased to 45.2 percent in 2002.

The evaluation was also intended to reveal which means were the most effective. A representative selection of people, in more than 100 of the 431 municipalities, was asked to make an assessment of this. This selection included both municipal employees and representatives from organizations.

The representatives from the municipalities were of the opinion that the directive was definitely the most important means, followed by further training for planners. Representatives from organizations for people with disabilities also thought that the directive was the most important means. Conferences and the Internet course were ranked as the second and third most important means by the representatives from the organizations.

The pilot projects tended to be more successful if the responsibility for including accessibility was assigned to the community's planning department, not the social affairs department. It had also been observed that special plans developed with a focus on people with disabilities lose momentum and do not easily find their way into the mainstream political process and general plans.

10.4 GOVERNMENT ACTION PLAN FOR UNIVERSAL DESIGN IN KEY AREAS OF SOCIETY, 2005–2008

This action plan was designed to unify and strengthen efforts to increase accessibility to buildings, outdoor environments, products, and other important areas of society. It had been drawn up by the Ministry of the Environment and the Ministry of Labour and Social Affairs, in close cooperation with other relevant ministries. The Ministry of the Environment was responsible for coordinating activities relating to the action plan.

The goal of this action plan was to achieve satisfactory accessibility based on universal design principles on a permanent basis. More effective laws and focus on local initiatives were important features of the plan.

New Legislation That Incorporates Universal Design

In 2005 universal design had already been incorporated into the act relating to universities and colleges and the act relating to vocational school education. In the years that followed, provisions regarding universal design were incorporated into the regulations for public procurement, development agreements, consequence analyses, and various means of public transport.

A significant breakthrough for universal design took place in 2009. A new act regarding discrimination and accessibility was introduced. The act stipulates that all constructed, physical environments for the public shall be universally designed.

In 2009, a new planning and building act was adopted. Universal design has a central role in the preamble. As a consequence, universal design became a statutory requirement for both regional and municipal planning and for building. The statutory provision was followed up by a new technical regulation for buildings and installations, based on universal design.

Pilot Municipalities for Universal Design

A new pilot program directed toward the municipalities was given a central role in lending substance to the concept of universal design. The lessons learned from the priority area "Planning for All" and an intermediate "Programme of Action for Universal Design 2002–2004" formed the platform for the coming intensive and targeted efforts in the municipalities.

In March 2005, the Minister of the Environment and the Minister of Labour and Social Inclusion sent out a joint letter with an invitation to every municipality in the country which asked them to indicate their interest in becoming a pilot municipality for universal design. The application had to be processed by the municipal council, which is the highest political body in a municipality, in order to be considered. Thirty-six municipalities applied before the deadline expired, and 17 of these were selected

FIGURE 10.2 The main street in the city of Tromsø. Tromsø included universal design in the general plan for the city to ensure coordinated and comprehensive implementation.

Long description: The photo shows the main street in the city of Tromsø on a Saturday morning in June. The street is crowded with people. A wheelchair user and a man with a pram can be seen. The mountains in the background are covered with snow.

to become part of the program. Emphasis was placed on having a wide spectrum of municipalities both geographically and in terms of experience. For this reason, some municipalities with experience and others that had a desire to get started were selected. From 2006, the municipalities were given some financial support in order to run the development work. A vision and clear objectives for the work were also formulated in collaboration with the municipalities. With the vision "The pilot municipality programme for universal design creates local communities with good accessibility, equality, participation and freedom of choice for everybody," the following objectives were agreed upon:

1. Raise awareness and achieve results throughout the whole municipal organization—across subject areas and in all the municipality's activities.
2. Contribute to measures in the local community by means of cooperation with trade and industry, as well as with other participants, both private and public.

FIGURE 10.3 Chief planner Oivind Holand of the municipality of Verdal presents plans for universal design to government officials and representatives of other pilot municipalities.

Long description: This photo shows government officials and representatives of other pilot municipalities watching a presentation by chief planner Oivind Holand. Planner Holand shows pictures and plans to the group of professionals while standing on the pavement in a wintry Verdal community center.

3. Ensure that physical solutions take into consideration good accessibility, safety, environmental quality, and aesthetics.
4. Further develop goal-oriented cooperation with the municipal council for people with disabilities and relevant user groups.
5. Contribute to increasing the competence of all those who are responsible for planning, implementation, and operation.
6. Serve as a model and encourage other municipalities to increase their efforts toward universal design.
7. Offer suggestions and be a dialogue partner in the national effort for universal design.

The experiences from the 17 municipalities have been summarized in the T-1472 report "Universell utforming som kommunal strategi" ("Universal design as a municipal strategy"). The municipalities can refer to significant results regarding all seven objectives established for the work.

10.5 CONCLUSIONS

The two generations of pilot projects in municipalities and counties so far show that, through systematic planning, it is possible to place universal design higher up on the agenda.

Programs that aim to develop good practice in the municipalities and ensure that universal design is included in their planning and work must be complemented with clear national guidelines and laws. In addition, training and information are important aspects. This applies to politicians, municipal employees, and representatives from special interest groups for people with disabilities.

Since the second generation of the pilot program was concluded in 2008, new goals have emerged. A new Planning and Building Act, a new Discrimination and Accessibility Act, and a new

FIGURE 10.4 Assessment of walking routes in Jessheim, the community center of the Municipality of Ullensaker. Black lines show routes that are universally accessible. White lines show street crossings that are problematic for pedestrians with visual or mobility impairments. The map served as a basis for planning more continuous pedestrian movement, with links between parking and destination points via universally accessible sidewalks and street crossings.

Long description: This photo shows the community center of the municipality of Ullensaker as seen from the air with its business and living areas. A railway line passes through the center. Black lines show the good accessibility of pedestrian walking routes. White lines indicate limited accessibility at street crossings.

government action plan for universal design "Norway universally designed by 2025" are operational from 2009. This provides new opportunities and new challenges for the implementation of universal design as a national, regional, and local strategy and as a planning objective. New targets on main sectorial areas will be released. As one of these, the Ministry of the Environment is preparing a new generation of the pilot program. This is aimed at the regional level, i.e., the counties. Previous pilot municipalities will be involved as resource municipalities during this venture. It will be started up in 2009 and will be an important part of the work that aims to make Norway universally designed by 2025, which is the government's vision.

The universal design concept offers a framework for handling more accessibility features simultaneously, taking into account reduced mobility; hearing, vision, and learning abilities; as well as allergic reactions. These factors represent a challenging diversity of planning conditions. At the same time, these conditions fall in line with classical planning premises, such as high-quality pedestrian areas, noise control, design for human perception, the choice of plants and trees in parks and public outdoor areas, and pollution control.

The implementation of universal design in Norwegian legislation has revealed that some problem areas require caution when describing and using the concept. This became especially apparent in the development of the Planning Act, the Building Act, and the Discrimination and Accessibility Act. Planning requires normative objectives that can lead developments in a definite direction. Universal design provides such objectives. To a much larger extent, legislation relating to construction and discrimination needs to establish minimum requirements in order for authorities to be able to determine whether a law or a regulation has been observed. Furthermore, there may be a need for detailed standards. The same concept should be both normative and practical from a legal point of view. Opinions from different sources were obtained, e.g., from the Center for Universal Design in North Carolina (Duncan, 2007). The conclusion that emerged from this discussion was that universal design is used with two slightly different definitions: one is an open normative definition for planning, and the other is more limiting.

Based on the experiences so far, it is obvious that the fundamental ideas behind a strategy of universal design provide a better point of departure for discussing and explaining how people with disabilities can be taken into account within a broader and higher-quality framework. Experience has also shown that it is extremely important to underline that both the special and general aspects must be included in universal design.

To establish a common understanding of what universal design is, the Ministry of the Environment carried out debates with a number of special interest groups, government agencies, and public bodies. The result was published in the thematic report *Universal Design, Clarification of the Concept* (Ministry of the Environment, 2007).

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CHAPTER 11
THE IMPACT OF AGING ON JAPANESE ACCESSIBILITY STANDARDS

Satoshi Kose

11.1 INTRODUCTION

Within the context of the rapid aging of its population, this chapter discusses the implications for building accessibility in Japan. The introduction of the new Accessible Built Environment Law (2006) is described, as well as how dwelling design for an aging society has progressed in the last 20 years. Japan is among the first countries to succeed in persuading the general public to accept design-for-all concepts for dwellings. Japan may be the only nation that has used economic incentives at the federal level rather than legal enforcement. The lessons learned and possible future directions are also discussed.

11.2 AGING AND URBANISM IN JAPAN

The notion of the emergence of an aging society in Japan is relatively new, and its consequences have rarely been taken seriously, even by the government, until fairly recently. However, Japan is becoming a society with a rapidly growing population of elderly people (National Institute of Population Problems, 1986; National Institute of Population and Social Security Research, 1997). In 1970, just 7 percent of the population was of age 65 or older. In 1994, the figure had reached 14 percent. It took only 24 years—i.e., less than a generation—for Japan to double this percentage, a rate that has never been paralleled. In 2013, more than 25 percent of the Japanese population will be aged 65 or older, and the rate is expected to reach 40 percent in 2052.

It must be pointed out that in-family care has been implicitly integrated into the system of social welfare services in Japan. Moreover, the social assumption was that the eldest son's family would take care of the aging parents, preferably as an extended family. Unfortunately, the social context that supported this arrangement is becoming less prevalent, partly as a result of social change and the decreasing numbers of children.

Design requirements in dwellings for the aging population had never been properly met by designers, although the aging population was increasing (Kose and Nakaohji, 1991; Kose et al., 1992). The situation is similar in the larger community environment. It is true that barrier-free design has long been tried in larger buildings with the assistance of design guidelines, but this has only been on a voluntary and negotiated basis, because virtually nothing is required by the Building Standard Law of Japan.

11.3 INFLUENCE OF INTERNATIONAL ACTIONS ON JAPANESE ACCESSIBILITY LEGISLATION

It was not the United Nations International Year of Disabled Persons in 1982 or the International Decade of Disabled Persons between 1983 and 1992, but the enactment of the Americans with Disabilities Act (ADA) in July 1990 that prompted the Japanese government to introduce some accessibility measures at the national level.

In the past in Japan, the accessibility issue was mostly under the control of the Welfare Ministry and its departments. As early as 1974, Machida City, one of the local municipalities, issued "Design Guidelines of Buildings and Facilities toward Realizing a Welfare City," which aimed at creating an accessible environment for wheelchair users from the welfare perspective. Although it was not mandatory, the local government tried to influence building developers as much as it could to include barrier-free design for wheelchair users in larger buildings and facilities. Although they succeeded to some extent and other local governments followed, voluntary compliance was not as effective as desired, and the move toward realizing barrier-free environments was slow. Part of the problem could be attributed to insufficient coordination in the local governments between the Buildings Control Department and the Welfare Department.

To overcome this limitation, some local governments went one step further and introduced local building ordinances that incorporated mandatory accessibility requirements. Kanagawa Prefecture started the discussion in 1988, and after careful preparation the revised building ordinance was enforced in 1990.

11.4 OVERVIEW OF THE BUILDING STANDARD LAW

The most important point was that the Japanese Building Standard Law was established in 1950, and no revision had ever been made regarding the basic philosophy. Thus it became evident that the law is far removed from the current social context. In the early 1990s, with the impact of the ADA, the central government attempted to find ways to integrate new trends toward accessibility into its own policy initiatives. As a result, the new Japanese with Disabilities Act, which was handled mainly by the Ministry of Health and Welfare, was enacted in 1993. A completely updated version of the old Law on Measures for the Disabled, this revision appeared to have been accelerated by the ADA. In effect, it paved the way to establish a special law by the Ministry of Construction, the Accessible and Usable Buildings Law. This was the launch of a new era to ensure that environments would accommodate the aging society. Proposed in the spring of 1994, the new law passed the Diet on June 28, 1994 (Law 44, 1994). Government officials had feared there would be arguments against enacting the law, but the time was ripe and it passed without major opposition.

The new law, however, did not replace the Building Standard Law. Rather, it provided an alternative procedure to obtaining a building permit if the building incorporated accessible and usable design features.

11.5 NEW POLICIES AND INCENTIVES

The government also enacted preferential interest rate schemes and subsidies linked to the law at the same time, which were expected to work as incentives. Such measures were previously enacted by some local governments, e.g., for the installation of elevators in railway stations. New measures included tax exemptions for unavoidable floor area increase as well as other provisions. The difficulty was that the effort necessary to apply for such benefits did not always justify the extra work in terms of time and cost.

Policy measures by the Ministry of Construction were also issued in June 1994 as a move toward a barrier-free built environment, ranging from housing to urban infrastructure (Ministry of

Construction, 1994). When they were issued, public transportation was under the control of the Ministry of Transportation, and the issue could not be referred to by the Construction Ministry. However, with the buildings being made accessible, people realized that public transportation must be made accessible as well. This forced the Transportation Ministry to introduce Accessible Public Transportation Law, but people had to wait until 2000.

The inclusion of housing issues in the policy measures agenda was an attempt to integrate the whole problem of living environments. Previously, dwelling design solutions relied completely on efforts by the private sector and funding by individual residents, unless they were part of public rental housing schemes.

The attempt to solve the housing problems of the aging society originally occurred when the population forecast was announced by the National Institute of Population Problems in 1986 (Kose, 1987). The Ministry of Construction asked for research and development funds to tackle the emerging issues. Being responsible for promoting the five-year R&D project, the researchers with the Building Research Institute recognized the housing problems as more urgent than building design accessibility, and they continued efforts to make dwellings more suitable to the increasingly aging society.

As early as the mid-1980s, several housing manufacturers, and prefabricated housing manufacturers in particular, foresaw the aging of their clients as a business opportunity and began to showcase their design concepts for the aging society as strengths. During the research processes, the Building Research Institute collaborated with some of these housing manufacturers in order to integrate the revolutionary yet feasible housing design guidelines. Since most Japanese housing consisted of owner-occupied, detached houses, which were usually privately financed, it was crucial to obtain the support of such prospective buyers.

Through various surveys and experiments, these 5-year research efforts attempted to bring to fruition the Design Guidelines of Dwellings for the Aging Society (Kose, 1991, 1992b; Kose et al., 1992). The draft design guidelines were released in the spring of 1992 (Kose, 1994) and were finally issued in June 1995 by the Ministry of Construction. They required that three basic criteria be met: (1) floors without level changes, (2) handrail installation when keeping the body balance is crucial, and (3) corridors and door widths that permit assisted wheelchair passage (Kose, 1997). These were the problems commonly encountered in modifying existing dwellings (Nomura et al., 1990), and it was predicted that these requirements would change expectations for the future.

The guidelines were quickly incorporated into the government housing loan schemes by the Housing Loan Corporation of Japan (Kose, 1996) because they were considered essential for the realization of policy measures for housing for the aging society. They were not mandatory. However, coupled with the preferential loan schemes, they provided strong incentives. Design standards of major housing manufacturers were changed almost overnight when the Housing Loan Corporation decided to drastically change the system—in other words, to require energy-conscious design, highly durable design, or design for the aging society.

Around 20 years ago, even housing for senior citizens ignored the decreasing capabilities of the aging residents, and small floor-level changes constituted tripping hazards. Nowadays, most of these problems are nonexistent, not just in manufactured housing, but also in dwellings made by local builders. The most remarkable change is the introduction of the accessible bathroom unit that eliminated level changes between the dressing area and the wet area. Since this was realized without any cost increase, one can call this a true example of universal design (Kose, 1998). Figure 11.1 shows level changes in a dwelling unit for seniors, Fig. 11.2 is an early example of an accessible bathroom unit, and Fig. 11.3 is a more recent, more sophisticated design example.

11.6 THE NEED TO REVISE THE BUILDING STANDARD LAW TO INCORPORATE ACCESSIBILITY REQUIREMENTS

The problems designers and clients are faced with due to building control are probably not unique to Japan. However, it is true that there are several limitations of the present Building Standard Law in the Japanese system. The following issues need urgent solution:

FIGURE 11.1 Level changes to enter a bathroom. There exist two level changes, one between the wooden floor and clothing area, the other between the clothing area and the wet area of the bathroom. This is a bathroom in a dwelling unit for frail seniors built around the late 1980s.

Long description: This photo shows existing two-level differences, one between the wooden floor and the clothing area, the other between the clothing area and the wet area of the bathroom. This is a bathroom in a dwelling unit for frail seniors built in the Tokyo metropolitan region around the late 1980s.

1. The assumptions about building users, as far as their capabilities are concerned, are inadequate, as pointed out in part by the Accessible and Usable Building Law.
2. There is no explicitly stated established system for routine revisions.
3. There are no considerations for compromises when alterations to existing buildings are at stake.
4. While there is too much emphasis on specification requirements, the performance standards are too vague.
5. The delegation of authority to local ordinances is too restrictive.

FIGURE 11.2 The level change between clothing area and wet area is eliminated in the dwelling. To facilitate this, a wide water channel exists between the two spaces. This was designed and built between 1996 and 1997 as a standard design feature.

Long description: This photo shows a bathroom where the level difference between the clothing area and the wet area is eliminated in the dwelling. To facilitate this, a wide water channel exists between the two spaces. This was designed and built between 1996 and 1997 as a standard design feature for manufactured housing.

A major breakthrough came when the Accessible and Usable Building Law was amended in 2002. When the Building Standard Law was extensively revised in 1998, the Ministry of Construction did not include an accessibility clause. However, in 2000, the Accessible and Usable Public Transportation Law was introduced. It raised awareness of accessibility in public areas, i.e., through one's path of travel toward the destination, typically a public building. After discussion of the problems that still existed with the Accessible Building Law of 1994, the Ministry of Construction decided to upgrade the requirements. Some building types, such as educational facilities and offices, were covered. The most important change was that the requirements, if they were

FIGURE 11.3 The water channel is almost invisible in a newer design. The water channel at the bathroom door is almost eliminated in a more recent design, which was installed in 2007 as a bathroom unit for public rental housing. In repeated experiments and practical experiences regarding water overflow, problems were solved with more sophisticated designs.

Long description: This photo shows a bathroom where the water channel at the bathroom door is almost eliminated in a more recent design, which was installed in 2007 as a bathroom unit for public rental housing. In repeated experiments and practical experiences regarding water overflow, problems were solved with more sophisticated designs.

designated as mandatory, must be abided by; or otherwise, building permits would not be issued. The law also allowed individual local governments to introduce stricter requirements.

In 2006, the two laws, i.e., the Accessible and Usable Building Law and the Accessible Public Transportation Law, were combined to become the Accessible Built Environment Law. It now covers almost all public buildings and places.

11.7 HOUSING POLICY FOR A NEW ERA

In 1999, the Housing Quality Assurance Law was introduced that was intended to ensure that the quality of housing was reasonable enough for the dwellers. This also introduced a housing performance assessment system. Although to be included in the system was voluntary, many multifamily housing projects have been certified by the system partly due to the scandalous structural integrity fraud.

If the dwelling unit is to be certified, all 10 performance categories must be addressed, not just some of them. The categories are structural integrity, fire safety, durability, ease of maintenance, thermal performance, air quality, lighting and visual environment, sound insulation, design for aging, and crime prevention.

Since a recent survey on the effectiveness of the Dwelling Design Guidelines for the Aging Society suggested that they have been considered satisfactory by the residents (Kose and Tanaka, 1998; Kose et al., 1999), their inclusion has been highly appreciated.

The nonobligatory nature is likely to lead to a situation in which better-quality housing providers would apply for the performance rating, and the expectation is that the general quality of dwellings will be improved in due course.

A law on Securing Housing for Seniors was introduced in 2001. The primary goal was to invite the private rental sector into the housing market with economic incentives. The introduction of a new law for securing housing for seniors was necessary because it is now impossible to accommodate all the seniors who wish to rent a public sector housing unit. The Design Guidelines of Dwellings for the Aged, a revised version of the Design Guidelines of 1995, now became more formal than before. The law introduced several economic benefits for private rental housing, from subsidies for construction, to ensuring rents of seniors. This was a change of emphasis from direct housing provisions by the local governments to encouraging, through incentives, private sector development.

Regarding the official dwelling design guidelines for the aged, the content is quite similar to the previous design guidelines for the aging society, which means that the contents of the guidelines are acceptable as the basis for all dwellings.

Whether this works effectively or not is yet to be seen because constructing new higher-quality dwelling units targeted toward seniors could involve a large private sector investment. Existing dwelling units are generally of poor quality, and normally it would be very expensive to modify them. For private banks that provide housing mortgages, higher-quality dwellings are favored, which will help accelerate the trend toward design for aging.

11.8 THE GROWING NEED TO ADAPT EXISTING BUILDINGS

Among the aforementioned problems, the lack of distinction between new and existing buildings still seems to cause the most serious difficulties in real-world situations. The basic idea behind the Japanese Building Standard Law appears to assume a 30- to 60-year life span for buildings, depending on the type of construction. The Japanese assumed that timber structures would be replaced in 30 years and reinforced concrete or steel structures in 60 years. The thinking was that if change in society was slow, the country could perhaps wait until every building was replaced by a new one. However, as noted earlier, the growth of the aging population is much faster than had been anticipated. Japanese society cannot wait that long, nor can physical barriers be allowed to remain. It is preferable to improve existing buildings, even if more-demanding accessibility requirements cannot be met. To attain this intermediate goal, it is necessary to introduce a second, lower level of requirements applicable to alterations of existing buildings. The idea of two levels of requirements is common in countries where the expected life of buildings is long. Unfortunately, the concept is not part of the law yet. The new accessibility law asks that the buildings abide by the accessibility requirements if they undergo major remodeling equal to new construction. The government has insisted that the law define just the minimum level of requirements. In reality, however, not only clients but also architects and designers tend to think that current requirements are at an optimum level.

The need for adaptation to meet requirements of aging is common to dwellings (Lanspery and Hyde, 1996). The difficulty was more pronounced because of the mismatch between the capabilities of the residents and the design features of the dwellings. A solution that worked in one house would not necessarily be effective in another. There have been attempts by local governments to assist in modifying dwellings, but their effectiveness has been limited. Even the new Care for the Aged Insurance System does not appear to support home modification; the emphasis was more on providing services through human resources than on the initial improvement of the physical environment. This was not a fair policy measure, because it benefited only a small minority of the population, especially those who owned their own homes.

The most difficult part of the introduction of universal design concepts was how to persuade the general public to accept them. An examination of the Japanese accomplishments reveals that it is best when they are introduced into the market with economic incentives. Perhaps the best policy is to combine them with legal enforcement.

Kose (2000) stressed that good design is what is needed by the users, and that there are six essential requirements—safety, accessibility, usability, affordability, sustainability, and aesthetics—to "good design." Some of the requirements are enforceable, but not all. Kose stressed that the first four requirements must be met to qualify for being called *universal design*, but perhaps affordability is most crucial.

11.9 THE CURRENT SITUATION REGARDING DWELLING PROVISION

As stated earlier, the official design guidelines of dwellings for the aged and the Housing Loan Corporation (HLC) housing mortgage requirements emphasized three requirements: floor without unnecessary level change, support for handrail installation, and width of crucial space dimensions.

The Ministry of Construction wished to have 20 percent of all dwelling units in 2015 be newly built with at least such accessible and usable features and an extra 20 percent adapted to include these features. However, the most recent result of the Housing and Land Survey conducted in 2003 revealed the following picture: Among the entire housing stock, only 5.4 percent satisfy the three requirements, and even among those units where seniors reside, only 6.7 percent satisfy the same requirements. The situation is worse with rental units compared to owner-occupied units. More recent data, surveyed in autumn 2008, are to be released soon.

With an inclination toward laissez faire practices, the government diminished and changed the role of the Housing Loan Corporation, to be named the Japan Housing Finance Agency. With only a small role left as to housing mortgages, the primary role of the agency is to subsidize housing modifications for earthquake resistance and age-friendly design. Unfortunately, the number of dwellings that qualify is very small, far below government expectations.

11.10 CONCLUSIONS

There are several difficulties Japan faces in order to make dwellings accessible and usable during residents' later years. The Basic Act for Housing, enacted in 2006, lacks effective authority to enable the government to tackle and solve the problems. Generally, the act asks local governments to establish their own policy measures and priorities, yet under the current economic situation, implementation has come to a halt. It remains to be seen whether various tax incentives for new housing construction and adaptation can reverse the trend.

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CHAPTER 12
THE EVOLUTION OF DESIGN FOR ALL IN PUBLIC BUILDINGS AND TRANSPORTATION IN FRANCE

Louis-Pierre Grosbois

12.1 INTRODUCTION

The concept of universal design is, in fact, an extension of *commoditas*, Vitruvius' ancient concept of the importance of use. Vitruvius, an architect of Roman antiquity, specified that *commoditas* was the third element of architectural creation, along with beauty and firmness (or *voluptas* and *firmitas*). At the end of the second millennium, the objective Vitruvius defined 2000 years ago, "to lay out the building so ingeniously that nothing could hinder its use," was reinstated as consequence of a new concept: "Design for all."

Nowadays, to remain relevant, *commoditas* design must take into account the variety of physical, sensorial, and mental abilities of the population. It used to be that a large part of the population was excluded from design. These people were reintegrated into social life when the diversity of uses became one of the purposes of architectural design. This evolution has changed design attitudes and increased the role that diversity plays in aesthetic, technical, and economic choices. "Architecture is both an art and a science sustained by human necessities" (Grosbois, 2008).

The first French law concerning the accessibility of new construction was enacted in 1975. Thirty years later, in 2005, a new law came into effect, built upon the work of the World Health Organization to redefine disability. The new law included both new construction and existing structures, and it broadened the concept of disability beyond mobility. Moreover, the 2005 law was consistent with other European regulations in the setting of objectives, time frames, and scope. Described below is a process of evaluating how this change in mind-set is evident in French society. Two case studies, the Grenoble Tram System and the Grande Galérie of the Muséum d'Histoire Naturelle, are presented.

12.2 CRITERIA FOR ANALYSIS

In 1998, a research project entitled "Habiter une ville accessible—Des usages à la conception" was carried out on behalf of the Ministère de l'Equipement et du Logement by a multidisciplinary team comprised of architects and sociologist (Grobois et al., 1992). The study defined the nature of problems encountered in design for all and identified seven key points:

- *Language*. What are the attitudes in play, and how did they develop? What mental blocks can occur, and how can one remove them when carrying out a project? All the vocabularies in use must be analyzed, as they reveal attitudes.

- *Legal requirements*. To which legislative framework does each project belong, considering that projects are developed at different periods and that legislation evolves in time? Has the law been respected strictly?
- *Advocacy*. How can community associations defending people with disabilities influence decisions toward antisegregation policies during the course of urban planning? Different situations can be compared to see how groups can influence planning and how they evolve toward accessibility for all.
- *Planning*. This is the decisive phase when the criteria of accessibility for all are integrated into designers' specifications. How far can intentions and facts be extended, considering that specifications enable results to satisfy needs and assess the project manager's will?
- *Technical traditions*. Once the obstacles of attitudes have been overcome, obstacles raised by technical choices have to be dealt with. It is more pragmatic to use well-known techniques than to search for lesser-known alternatives.
- *Accessibility follow-through.* When strong intentions are expressed at the beginning of a project, it is necessary to ensure that a good accessibility level is realized and maintained.
- *Communications*. A breakthrough in design for all amounts to nothing if constituents do not know about it. Attitudes evolve mainly through examples. Broad communication and dissemination is essential.

These seven points were used to analyze the Grenoble tram system and the Grande Galérie of the Muséum d'Histoire Naturelle discussed below.

12.3 GRENOBLE TRAM SYSTEM, 1978–1988

Grenoble is a city of 400,000 inhabitants surrounded by mountains. The city spread considerably at the end of the 1970s. Car traffic then became saturated, and bus lines did not extend beyond the town center, so that a new mass transit network became necessary. Considering the nature of the subsoil, only tramways could be used. They were to be accessible to the entire population. Planned in 1983, after a popular referendum, the first Transport de l'Agglomération de Grenoble (TAG) line, which stretched nearly 9 kilometers (5.4 miles), opened in 1987. A second 6-kilometer (3.6-mile) line was completed in 1990, and a third one is now complete.

Language

In addition to the town's intentions to "question its development and the alterations to its infrastructure . . . symbols of massive changes," the language used in documents about the TAG consisted of mass transit terminology, i.e., passengers, clients, and users. *Accessibility* is the generic term used most frequently with regard to people with disabilities—"accessibility for travelers in wheelchairs, persons with reduced mobility, buggies, strollers, exceptional accessibility for all" (Document TAG, 1987).

Legal Requirements

In 1979, legal provisions governing the accessibility of buildings and mass transit systems were practically complete, with the 1975 law and two 1978 enforcement decrees. The law covered new buildings open to the public, while the decrees dealt with existing buildings that were not yet accessible, and with the adaptation of mass transit services. The distinction between new and existing buildings expressed the basic idea of implementing accessibility through adaptation, a process that was to be used for transportation systems. By implementing trams accessible to all and minibuses suitable for people with disabilities, the city of Grenoble applied the new legislation fully.

Buses and Regulations

When the tram project was planned, accessible buses had not yet been envisaged. Moreover, by limiting access to one person using a wheelchair, which has to be secured by means of a bar that can be pulled down, the French regulations for buses were an obstacle to accessibility. These regulations now have to be modified. In France, the carrier is responsible for the people carried, e.g., unlike in Germany.

Advocacy

The first demonstration by people with disabilities to be held in France took place in Grenoble in 1971. The same year also saw a person with a serious disability elected to the city council. These two events defined the context of the time, where the trend in opinion ran against all forms of social exclusion. "A handicap is not due to the chances of nature but to deficiencies in social legislation, to industrial injuries, to the welfare state. . . . Cities have to be changed" (Comité de lutte des handicapés, 1978). This trend of opinion, opposed to traditional associations, represented strong pressure for a better development of a city for all.

Among the pressure groups were several rehabilitation centers in that urban area. In one of them, the Centre Médico Universitaire D. Douady, classes and medical care are given along with primary and secondary education. It is also the only place where disabled people can receive a university education in France. Because they needed to break down their isolation, the centers acted to open up to the nearby town, and the new tram helped them. In 1983, after the positive referendum result in favor of the accessible tram, elected representatives reacted to pressure from these groups.

Planning

In 1976, Herbin, an architect and town planner, was given a consulting project to promote accessibility in the town's highway maintenance operations. The project first required a long process of technical research. The industries involved needed to follow a comprehensive plan, including issues of comfort, accessibility, security, and aesthetics. These constraints led research departments to rethink technical solutions.

Technical Traditions

Standard French tramways had been in use for a short time and exceeded the technical criteria, but failed to meet accessibility criteria. Electric motorization equipment in the bottom of the car required elevated floors that were incompatible with the level of the platforms at the tram stops (Fig. 12.1a). For a time, the possibility of overcoming this height difference by adding some structural modifications, such as elevator platforms or large ramps, was envisaged. The inadequacy of these solutions led to a rethinking of the design of the trams.

Tram associations were under pressure from engineers and managers, who argued that a great deal more money than usual would have to be spent. But a technical solution was finally found by reversing the usual logic: the electrical drive elements, such as shift batteries, were placed on the tram's roof (Fig. 12.1b), allowing for a lower floor in the tram. A retractable door step completed the leveling with the sidewalk (Fig. 12.2). This example is quite telling: from a very precise criterion of use, i.e., accessibility for the whole population, technical constraints described as obligatory were revised. According to Norman (1996), "People have to be the priority issue, before technology, in order to ensure that the final result will meet the needs of the persons who are expecting it."

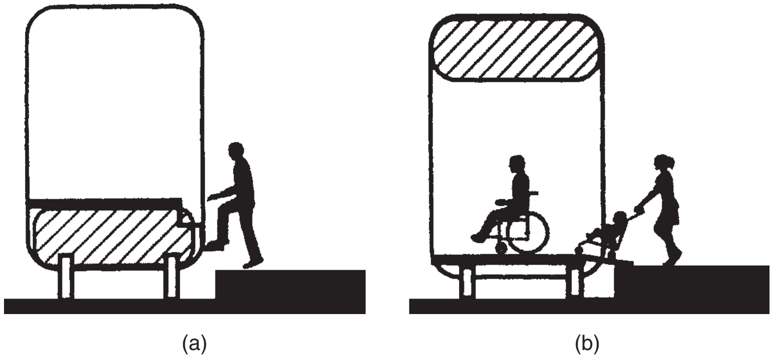

FIGURE 12.1 Principle of tram accessibility: battery location. In the classical tram (a), the electrical drive elements, such as shift batteries, were placed in the bottom of the car and required three steps up that were incompatible with accessibility. In the accessible tram (b), the electrical drive elements such as shift batteries are placed on the roof of the tram, allowing for a lower floor in the tram. (*Drawing by the author.*)

Long description: (a) The black-and-white drawing shows a tram in section with batteries placed in the bottom of the car. A user represented in the drawing must climb up the batteries with three steps to get to the tram. Technical criteria failed to meet accessibility criteria. (b) The black-and-white drawing shows a tram in section with batteries placed on the roof. Two users represented in the drawing, one in a wheelchair and another with baby stroller, get into a car on a lower floor.

FIGURE 12.2 Horizontal accessibility from the platform. A retractable door step facilitated the leveling with the sidewalk. (*Photo by the author.*)

Long description: This photo shows the retractable doorstep to facilitate the leveling with the sidewalk. The technical constraints permitted accessibility for everyone.

Buses

Would it be possible to improve buses as was done with tramways? Trams had introduced such an access quality to the town that equipment had to be faultless and highway maintenance had to be reorganized. Low floors had been chosen, together with heightened platforms (Fig. 12.3). The first accessible bus was bought in 1995. In the end, 20 bus lines and 3 trolley bus lines were accessible.

Accessibility Follow-Through

The first important action was undoubtedly the city of Grenoble's December 1976 decision to commission an accessibility consultant. This assignment contributed to the extension of the accessibility concept to the whole population.

Associations and Administrations

Associations have been playing a watching game. They were consulted and have been suggesting improvements. Whenever the tram's accessibility is not followed up, it is fair to say that associations and the entire public end up controlling the tram's use. However, good coordination is always difficult to establish between scattered administrative services and associations.

(a) (b)

FIGURE 12.3 Accessible bus station and entry ramp. Low floors and elevated platforms are used for buses and for tramways. (*Photo by the author.*)

Long description: Two photos show the accessible bus station with (a) heightened platform on the sidewalk and (b) a retractable ramp to get into the bus.

Communications

Communications worked quite well in this project, which was pioneering a new type of accessible mass transit. The TAG won the European Community Helios award for best transport achievements in 1989. The cities of Strasbourg and Bordeaux followed the example of Grenoble, and the Grenoble accessible tram model was then chosen abroad by the cities of Turin, Italy, and Brussels, Belgium.

Education

The accessible tram has increased the presence of persons with disabilities in the city, enabling greater access to both education and employment.

Signage and Signals

Recognizing accessibility signs does not seem to be a problem for users. Easily identifiable directions are indicated at both ends of each tram. The button to be pushed for the retractable doorstep opening is highly visible and accessible. Voice announcements are made at each station on the tramway and bus lines, and tactile signs are installed for users who are blind.

12.4 THE GRANDE GALÉRIE IN THE MUSÉUM D'HISTORIE NATURELLE, PARIS, 1989–1994

The building that houses the Muséum d'Histoire Naturelle was built in 1889. It is located in the Jardin des Plantes, between the Austerlitz Station and the Latin Quarter. Closed to the public in 1965, the Galérie engaged in information gathering and research, but remained rather secretive.

Refurbishment Project

An architectural competition organized in 1989 was won by Paul Chemetov and Borja Huidobro. Of all the building's functions (i.e., research and collection storage), only the exhibition function survived. But the architects had a double goal—to create a contemporary museum, to be visited by the general public, and to restore a nineteenth-century building. The public entrance was originally located on the facade that overlooks the garden, up an inaccessible monumental staircase (Figs. 12.4 and 12.5).

The architects decided to move the entrance to the side of the building, at street level, thus allowing easy access to the surrounding area. Panoramic glass elevators made the three gallery levels surrounding the central space accessible. As the space was not large enough to comply with the plan as envisaged, the basement was converted into exhibition space. This project actually involved redesigning a building, which was done by identifying the old and the new parts and by integrating accessibility into the new parts from the start.

Language

As defined by the consultants, Amplitude, the goal was to achieve complete accessibility. This was to "include reduced mobility and sensitivity in the definition of the criteria used to establish the conditions in which visitors might experience disability for themselves" (Amplitude, 1990). In addition, the public was "to be able to move through the gallery's entire exhibition space without having to be segregated through any specific route," because "comfort and social interaction have to

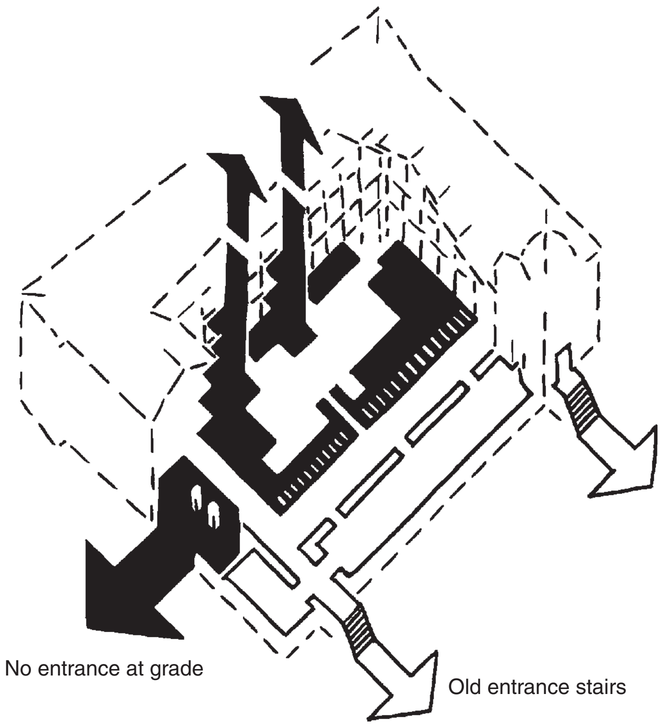

FIGURE 12.4 Grande Galérie du Muséum (Chemetov and Huidobro, architects): new accessible entrance after renovation. The old entrance was inaccessible because of staircases. (*Drawing by the author.*)

Long description: The axonometric drawing shows the old entrance with two inaccessible monumental staircases on the facade that overlooks the garden, an element of a nineteenth-century building preserved, and a new entrance created by the architects on the side of the building at street level that is easily accessible.

be sought" (Amplitude, 1990). Designed in the 1990s, this project illustrates how the vocabulary has evolved significantly as a consequence of the Cité des Sciences et de l'Industrie de Paris experience (Grosbois and Araneda, 1982).

Legal Requirements

The Grande Galérie was opened in 1994, the very year when the regulations became stricter. The project proved that regulations were only a minimum requirement that could be broadened by the architect, Paul Chemetov, who argued that "cities today attribute a dominant role to information and reception" and "locating the entrance on the side, i.e., the accessible facade, was thus a key option." Architecture critics perceive the concept of the free visitor flow as part of the concept of accessibility: "Nothing has changed but everything is different. A direct entrance at street level leads to the museum, since now the street and the side aisle are connected and are on the same…level" (Lamarre, 1994). This case shows that the concept of the free visitor flow went beyond the literal application of legal requirements.

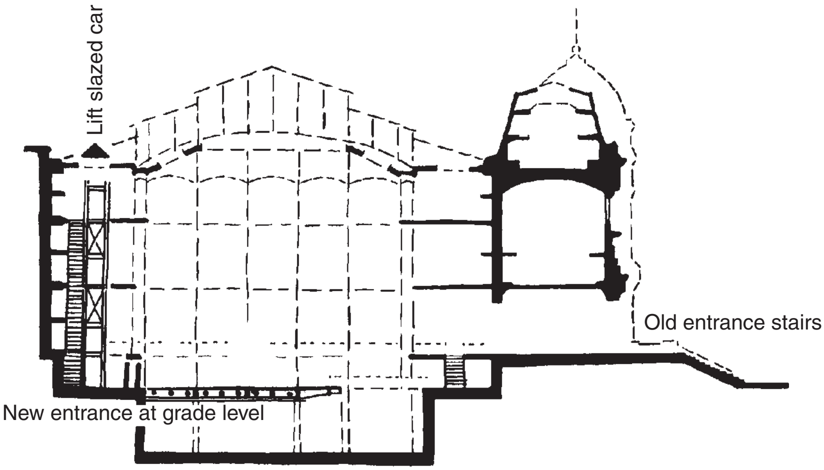

FIGURE 12.5 Grande Galérie du Muséum (Chemetov and Huidobro, architects): another view of the new accessible entrance. After renovation, the new entrance and the three gallery levels are accessible. (*Drawing by the author.*)

Long description: The section drawing of the building shows the old entrance inaccessible with monumental staircases and the new entrance accessible at the opposite part of the building at street level. This project redesigns the building, identifying the old and the new parts, and integrates accessibility into the new part from the street.

Advocacy

As part of the refurbishment project of the Grande Galérie, consulting accessibility for disabled people was commissioned by a design office. In this case, there was no advisory committee of associations.

Planning

The Laboratoire de Sociologie de l'Éducation had been developing a research program with the Québec University CREST (Évolution 93, 1993) since 1989, whose purpose was to study the Jardin des Plantes and the general public attending exhibitions in the museum. This program contained three parts: a sociodemographic survey, a survey of knowledge and competency, and a survey of visitors' needs and behaviors. Accessibility studies were subsequently integrated into the specifications to take the variety of the public's motor and sensory abilities into account. Several teams of contributors shared the work based on their professional skills: the team of architects worked on refurbishing the building, filmmaker René Allio designed visual and sound spaces, and the A.D. Sign Agency designed the exhibition spaces.

Technical Traditions

The A.D. Sign Agency was created by architects involved in the museum project, as an independent organization in charge of the museum spaces and the development of displays. The beautiful nineteenth-century industrial display cabinets were kept, but adapted to contemporary museum graphics requirements. The 3-meter- (10-foot-) high display cabinets provided all visitors, including children and wheelchair users, with excellent visual access.

This case shows that it is possible to combine traditions with technical evolution to preserve a building's identity. René Allio's (1994) stage-set approach combines sound and light, and he says that animals "will prompt visitors to complete the images they see with their feelings and sensitivity, so strong is the animals' evocative power." As the animals are set on the floor, persons with visual impairments can make tactile explorations. According to d'Eggis and Girault (1997), "the association of visual, sound and tactile possibilities provided by the scenography explains a great deal of the Grande Galérie's success."

Accessibility Follow-Through

One important factor was the education of museum staff regarding visitors' varying needs. Guided visits for the deaf are accompanied by deaf lecturers and actresses, who adapt their tours to the needs of their audiences. Workshops have been created to complete training for the blind, so that they can sense the exhibits better by touching them, e.g., forms, textures, animal furs, skeletons, and dimensions. This accessibility follow-up policy is essential to "attract an audience that does not always fit in cultural places" (d'Eggis and Girault, 1997).

Communications

The magazine *Musées et Collections Publiques de France* published an issue entitled "How to Receive People with Disabilities," showing that communications about all these new accessible places are developing ("Recevoir les handicapés," 1997). In addition, various associations were strongly involved in the development of a communications network.

12.5 CONCLUSIONS

The French examples of design for all reveal issues of compromise based on cultural, technical, and economic factors. This illustrates how accessibility may be developed by each country via social and technical considerations. This is a universal goal that deserves everyone's respect, and one that respects everyone's right to be part of social life through the use of buildings and transportation. It must not be confused with a policy of compromise to be defined according to each culture.

It now appears clear that law is only a tool, but political determination and democratic referenda set the various objectives and pursue their implementation. This reflects the evolution of the users' demands and the evolution of technical solutions. In Grenoble, this entailed the demand for accessibility and the definition of new transportation equipment, meaning an automatic metro and new, comfortable, safe, and elegant tramways. In public buildings, it entailed accessibility for all users, after their diverse abilities were defined. Humankind has to be considered as the focus, with technology playing the supporting role. Professional roles prove to be symbolic rather technical obstacles. The notion of the diversity of individuals is obvious, and the recommendation to designers is clear: Public spaces need to be designed for the public and all the diversity therein.

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Transport de l'Agglomération de Grenoble (TAG), www.semitag.com

CHAPTER 13
MANIFESTATIONS OF UNIVERSAL DESIGN IN GERMANY

Ingrid Krauss

13.1 INTRODUCTION

The concept of universal design (UD) is increasingly gaining a foothold in Germany, in architecture, planning, and design, as well as in politics and business, where it is seen as a possible answer to the challenges of demographic change. After a brief outline of the economic and social relevance of the concept, this chapter describes various initiatives and developments in this area.

13.2 SOCIAL AND ECONOMIC RELEVANCE OF UNIVERSAL DESIGN IN GERMANY

Like most other industrialized countries, Germany is faced with the consequences of an increasingly aging and simultaneously declining population. Whereas the proportion of those aged over 60 was only 5 percent in 1900, today this figure has risen to 25 percent and will reach almost 40 percent by 2050. Demographic change can have severe consequences on society and the economy. It affects planning and construction of buildings and infrastructures, product design, information and communication systems, and the design of services as well.

The 1970s already saw approaches similar to UD in the German-speaking region, such as "social design" for which the Institute for Social Design (ISD), founded in Vienna in 1975, among others, remains an advocate. The ISD's mission is the "improvement of people's living conditions through concrete changes in all areas of planning and design of products, objects, living and work spaces." At the heart of its efforts is "the person, who is entitled to expect that his/her wishes, needs and potential are taken into consideration." The ISD is predominantly involved in two areas: barrier-free design and the design of workplaces and equipment. Since 1975, numerous projects have been realized in these areas. The concept of social design was being implemented in Germany at the same time and was also represented in the 1970s at the International Design Center Berlin.

Due to the increasing aging of industrial societies, the social approach is accompanied by an economic one. Meanwhile, knowing the needs of older consumers and taking them into consideration in the development and design of products and services have become an important issue. In view of the size and purchasing power of this target group, it promises competitive advantages and market success. In addition, studies and tests, such as those carried out by the London-based Research Institute for Consumer Affairs, prove that products that have been developed with an eye to the needs of the older generation actually have cross-generational appeal. This is so because of their greater user-friendliness and better handling, and thus, they are appreciated by all age groups. One important criterion is, however, that such products should not look as if they have been made for "old people," i.e., they should not have a discriminating effect (Meyer-Hentschel and Meyer-Hentschel, 2004).

However, not only has demographic change resulted in an increased need for products and environments that are accessible and user-friendly. Also because of the increasing aging of employees and longer working lives, there is a great need for workplaces that meet UD criteria.

13.3 UNIVERSAL DESIGN VERSUS DESIGN FOR ALL (DfA)

Parallel to UD—both in terms of theoretical engagement and in practice—the concept of design for all (DfA) is also being applied in Germany and other European countries. Common to both concepts are the orientation toward people's diverse needs, wishes, and abilities and the aim of making the environment accessible to all. The underlying premise of both concepts is that all people, irrespective of their individual abilities, age, gender, or cultural background, should be enabled to participate equally in society.

The central goals of DfA state that products and services must be designed in such a way that they

1. Are demonstrably suitable for most of the potential users without any modifications
2. Are easily adaptable to different users (e.g., by incorporating adaptable or customizable user interfaces)
3. Are capable of being accessed by specialized user interaction devices (assistive technologies)
4. Involve potential users in all phases of their development

As with the explicitly stated seven Principles of Universal Design, the first three requirements relate to the result of the design process, while the fourth describes the process itself. This is where, along with the different historical and cultural contexts out of which they emerged, the main difference between the two concepts lies. While with UD the focus is on the end product, DfA is process-oriented and is less concerned with drawing up principles, standards, guidelines, and checklists. While checklists can be "ticked off" during the development and design process, DfA relies on the involvement of potential users, where this means not only the end users, but all those involved in the design, development, production, and marketing processes (Kercher, 2008).

While in terms of theoretical debate both UD and DfA represent known and much discussed concepts, the concept of accessibility (*Barrierefreiheit*) remains the approach most commonly used in Germany. This is most certainly due to the fact that the term *barrier-free* (*barrierefrei*) has already been used in the German-speaking region since the 1960s, and it is firmly embedded in legislation and standards, e.g., in the Disabled Persons' Equality Act (*Behindertengleichstellungsgesetz,* or *BGG*). The demand for accessibility is primarily implemented in the area of public planning and construction, as well as in the design of products and Internet services.

It has been codified, e.g., in national standards developed by DIN (Deutsches Institut für Normung), the German Institute for Standardization, such as DIN 18024 (DIN, 1996, 1998) which formulates requirements for the barrier-free construction of public thoroughfares and buildings, or DIN 18025 (DIN, 1992a, b) which outlines the requirements for constructing barrier-free housing. Furthermore, the standards committees have published various guidelines and recommendations for barrier-free design in specialized reports, e.g., DIN Technical Report 124 (DIN, 2002) or DIN Technical Report 131 (DIN, 2003). This is identical to the international ISO/IEC Guide 71 and the European CEN/CENELEC Guide 6, issued by the European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC).

In contrast to design that is oriented toward the concepts of UD and DfA, barrier-free design does not always mean design without stigmatization. Often function-oriented solutions are created which, because of a lack of alternative options, or because of their unappealing design, are felt to have a stigmatizing effect. Here, one can cite the example of the chair lift, with which the wheelchair user is heaved onto an ICE (Inter City Express) train, or the ramp, which is installed at a side or rear door, hidden well away from the main entrance.

Avoiding stigmatization and bearing human diversity in mind during the design process are the main aims of UD and DfA. It is not primarily a question of designing special solutions for older people or those with impairments which are attractive, such as walking aids, telephones with large keypads, grab bars, etc. The key issue is to reduce the complexity of everyday items, to design clearly structured user interfaces that can be operated intuitively, to produce packaging that anybody can open, to write operating instructions that everybody can understand, and to build housing suitable for all ages and abilities. In short, it is a question of designing in a people-friendly way.

13.4 POLITICAL INITIATIVES AND PROMOTIONAL MEASURES

Politicians such as the German Federal Minister of Family Affairs, Senior Citizens, Women and Youth, and the German Federal Minister of Economics and Technology, both recognized the potential of concepts such as UD and DfA, and they are encouraging the advancement of these design approaches through long-term promotional measures. As such, the Federal Ministry of Family Affairs, Senior Citizens, Women and Youth and the Federal Ministry of Economics and Technology jointly launched the "Age: An Economic Factor" (*Wirtschaftsfaktor Alter*) initiative in 2008. This initiative aims both at increasing older people's quality of life and at strengthening economic growth and creating jobs. As Federal Minister Ursula von der Leyen stated, "If we promote products and services today, which people of all ages use and like, Germany with its rapidly aging society has the great opportunity of setting standards and becoming a world market leader for generation-friendly products, before foreign competitors fill these gaps in the marketplace."

And indeed, the gaps in the market are still considerable, and the needs of older people are not being adequately taken into account by trade and industry. Although persons over age 60 already represent an important target group—both financially and in terms of numbers—and are responsible for a large share of consumer spending, they are still seen as a marginal social group with special needs. Products on the market aimed at older people are often stigmatizing. Additionally, people with limited capabilities are excluded from using certain areas, goods, and services.

Politicians have recognized the subsequent need for action, such that concepts like UD and DfA are now seen as worthy of promotion. On one hand, they can help to increase the social participation of older people and those with disabilities. On the other hand, companies that consistently apply these concepts when developing their products and services can realize lasting competitive advantages.

13.5 INFORMATION AND NETWORKING: THE UNIVERSAL DESIGN COMPETENCE NETWORK

Within the scope of the "Age: An Economic Factor" initiative, the Universal Design Competence Network is currently being built up at the International Design Center Berlin (IDZ). Bringing together information, ideas, skills, and knowledge on the subject of UD; promoting the exchange of experience; and helping to disseminate UD as a human-centered design approach are the central aims of the network. It is directed at designers, as well as at research institutions and companies.

In order to present this theme to a broad public, a traveling exhibition with accompanying publication was created in 2008. The exhibition "Universal Design: Designing Our Future" was opened at the IDZ in November 2008 and remained there until January 2009. By the end of 2010 it will have been shown across Germany in various places and contexts, e.g., at the leading consumer and trade fairs, as well as at Chambers of Commerce and Industry, Chambers of Skilled Crafts, and in a number of other design centers. The interactive exhibition displays over 50 everyday products, the user-friendliness of which enhances the quality of life for both old and young; visitors are encouraged to try out the products on display. The exhibition makes it clear that design must come to grips not only with new technological developments, but also with social change. The accompanying publication picks up on the theme, with contributions by eight leading authors from the areas of design, culture, and research, including Wolfgang F. E. Preiser, one of the editors of this book. Alongside well-known products such as the OXO Good Grips fruit and vegetable peelers, the exhibition shows products from German manufacturers, including household utensils and small kitchen appliances, furniture, sanitary products, products for public spaces, various electrical tools, and a hands-free phone system (see Figs.13.1 to 13.7).

In general, the field of sanitary products can be considered the one in which UD is most firmly established. HEWI Heinrich Wilke GmbH may be considered the first company in this area to have consistently applied UD or accessibility in developing and marketing its products. But most other manufacturers also have products that meet UD criteria. Added safety for all users is provided by bathroom systems, such as the Variogrip system by Erlau AG and slip-resistant flush-floor showers, such as those by Atlantis System GmbH (see Figs. 13.4 and 13.7).

FIGURE 13.1 Washing machine by BSH Bosch and Siemens Hausgeräte GmbH. The ergonomically designed control panel of this washing machine is on the front top of the machine, so that the drum door is higher and more accessible, which makes loading and unloading easier.

Long description: This picture shows a washing machine by BSH Bosch und Siemens Hausgeräte GmbH. Its ergonomically designed control panel is on the front top user-facing corner of the machine, allowing for a higher, and thus more accessible, placement of the drum door, which makes loading and unloading easier. The washing program is selected with a rotating dial on the right side of the panel, and there is a line of clearly marked buttons in the middle of the panel that access additional functions.

FIGURE 13.2 Easy Store Refrigerator by BSH Bosch and Siemens Hausgeräte GmbH. The Easy Store Refrigerator is equipped with pullout storage shelves, so that food stored at the back can be easily retrieved. This eases handling and accessibility.

Long description: This picture shows the front end of an open refrigerator, designed by BSH Bosch und Siemens Hausgeräte GmbH. Unlike common static refrigerator shelves, these shelves pull out so that the food at the back of each shelf can be easily accessed.

FIGURE 13.3 City Toilet Campo 2=1 by Wall AG. Wall AG's fully automated and self-cleaning City Toilet was awarded the "Barrier-free Berlin" designation in April 2008. The toilet is a good example of urban development in accordance with the ideas of universal design.

Long description: This picture shows the front of an automated, self-cleaning city toilet designed by Wall AG that is accessible by persons with disabilities, including those in wheelchairs and visually impaired people.

FIGURE 13.4 BFD Floor-Flush Shower by Atlantis System GmbH. The acrylic shower tub is flush with the tiles, making it easy for people of all ages to get in and out, since there is no lip to step over. The surfaces are equipped with slip-resistant strips.

Long description: This picture shows an acrylic shower tub, better described as a shower surface, since it is flush with the bathroom tile floor and has no lip to step over. This was designed by Atlantis System GmbH. The flush-floor design makes shower access easy for people of all ages. Additionally, the shower surface is equipped with slip-resistant strips, reducing the likelihood that users will lose their footing.

FIGURE 13.5 Hands-free Telephone by S. Siedle & Söhne Telefon- & Telegrafenwerke OHG. The receiverless intercom is part of a building entry door communication system. It allows communication with the entrance, opens the door, and switches the light on or off. Video surveillance shows who is at the door, without the person outside being able to see if someone is home or not. The ergonomic design of the controls permits easy and intuitive operation, so that it is not necessary to wade through a thick instruction manual.

Long description: This picture shows a person using a building entry door intercom system to check who is at the door of her house. The small screen on the system shows an image of who is standing in front of the door. The interface additionally allows communication with the entrance, opens the door, and switches the light on or off. The keypad on the system is simple and thus intuitive to use.

13.6 PRODUCT TESTING AND CERTIFICATION: THE UNIVERSAL DESIGN QUALITY MARK

To provide a greater incentive for companies to launch user-friendly products in the marketplace, on one hand, and to make it easier for consumers to select products, on the other hand, the IDZ, together with TÜV NORD, a German technical inspection association, developed the UD Quality

FIGURE 13.6 Coffee Machine by WMF AG. The small and handy coffee maker machine is suitable for prepackaged coffee pods. It is easy to clean and is operated by means of a large and highly visible button.

Long description: This picture shows the simple coffee-making machine, which is operated by loading a prepackaged coffee pod into it, placing the included coffee cup in its slot, followed by pressing the only button on the front of the machine and waiting for the operation to be finished. In this picture, the coffee cup is in front of the machine and has already been filled.

Mark. The development of the Quality Mark was sponsored by the Federal Ministry of Economics and Technology, and it was presented to the public in February 2008.

The Quality Mark is awarded only after a multiphase testing process to user-friendly products. This process involves expert testing and user tests, and it applies a comprehensive catalogue of criteria. The expert testing is undertaken by IDZ designers and technicians from TÜV NORD, while the user tests are carried out by a social research institute.

In terms of design testing, the product's suitability for use by people of varying abilities is a primary concern. In addition to the formal aesthetic quality, the functionality and material quality, haptic properties, and, where appropriate, designs of product labeling are assessed, as well as the arrangement of operating elements and menu. The quality of the packaging and operating instructions is also examined. For example, the main criteria in assessing operating instructions are good legibility, understandable wording and symbols, and a clearly organized, logical layout.

FIGURE 13.7 Variogrip System by Erlau AG. The Variogrip system from Erlau AG is a safety-optimized system for the bathroom. Depending on personal requirements, it can be expanded with various elements, such as a shower chair. The coated console can be used as a grab bar, and the towel rail can also be used as a support.

Long description: This picture shows a bathroom equipped with a range of equipment included in the Variogrip bathroom system by Erlau AG, consisting mostly of grab bars attached to walls doubling as towel holders or shelves, but that can be expanded to include shower steps or a shower seat.

Technical testing involves a conformance inspection based on accepted product standards, as well as on inspection decisions based on "GPSG" (Equipment and Product Safety Act), better known as the "GS" seal of approval. The second part includes the testing of the mechanical, electrical, functional, and safety aspects of the product, which are examined in the test lab. If the test process has already been carried out by a test lab on the basis of EN ISO/IEC 17025, the entire technical documentation, including measurement and test protocols, is subjected to verification.

A structured usability test is then methodically undertaken with users. Each product is evaluated by 12 users of different age groups. With the aid of observation protocols and semistructured interviews, i.e., thinking out loud, the individual steps taken while using the product are recorded in detail and summarized in test reports.

The Quality Mark is awarded using a point system, which weights the results on the basis of testing criteria. Weak points are also noted and suggestions for optimization are recorded.

Companies in many different areas, e.g., household appliances, computers, photographic, entertainment and communications technology, furniture, transport, or packaging, may all apply for certification. The first certified products include a coffee machine by Württembergische Metallwarenfabrik (WMF) AG, a hands-free intercom system by S. Siedle & Söhne Telefon- & Telegrafenwerke OHG, and the Variogrip bathroom system by Erlau AG.

13.7 COMPETITIONS AND AWARDS

Competitions and awards are a tried and trusted means of promoting engagement with certain themes by publicly recognizing good performance. In Germany, UD and DfA are not major elements of the designer's formal training. To bring these subjects closer to design students, and to sensitize them to the increasing aging of society, as well as the needs of older people, the Institute for Product and Process Design at Berlin University of the Arts has already held two competitions for students at German design schools and for young designers. The project is sponsored by the Federal Ministry of Family Affairs, Senior Citizens, Women and Youth, as part of its previously mentioned "Age: An Economic Factor" initiative.

The first competition aimed at encouraging young designers to develop "new packaging solutions for old and young." In all, 6 prizes and 10 commendations were awarded by an independent jury, based on a total of 161 entries. The second competition sought "daily companions for old and young," i.e., products that were attractive to people of all ages and would make everyday life easier for both old and young. Of the 117 entries submitted, three were awarded prizes, and two additional special awards were made. To date, along with other competitions and awards for students, the Universal Design Award has already been presented twice in Germany. This international competition is aimed at both designers and companies. The competition's premiere in 2008 saw a total of 131 entries from 18 countries. Of these, 32 entries were presented with the Universal Design Award 08 by the expert jury. The competition was repeated in 2009, with an equally good response. One special feature of the competition is that, along with the expert jury, around 100 test users evaluate the submissions, and the winner of this test process receives the Universal Design Consumer Favorite Award. As such, the public at large is both sensitized to this subject and actively involved in the decision-making process. However, UD is gaining ground at both the national and the state level as demonstrated, e.g., by the Designpreis NRW, which was awarded for UD by the federal state of North Rhine-Westphalia in 2009.

On one hand, competitions like those referred to above are perfect for capturing the attention of both the public and the media. On the other hand, they help to make trade and industry aware of new and innovative ideas.

13.8 CONCLUSION

In conclusion, it can be said that concepts such as UD and DfA have been recognized in Germany as important for social cohesion, and have high marketing potential. Likewise, this recognition is not restricted to the design disciplines. At a panel discussion held recently by the Federation of German Consumer Organizations and the DIN German Institute for Standardization, on the subject of "Design for All—beautiful dream or realistic prospect?" it did not feel overoptimistic to argue for the latter. As one would expect, doubts were expressed both by those debating and the audience. Such doubts will always exist. Readers will be familiar with the proverb "Rome wasn't built in a day." The fact that the *Universal Design Handbook* is already appearing in a second edition is a good omen, thus, offering a forum for voices from all over the world.

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CHAPTER 14
WRITING POETRY RATHER THAN STRUCTURING GRAMMAR: NOTES FOR THE DEVELOPMENT OF UNIVERSAL DESIGN IN BRAZIL

Marcelo Pinto Guimarães

14.1 INTRODUCTION

Since 2001, there has been slow progress in the development and application of the checklist criteria that verify universal design in built environments. For instance, the idea to promote universally designed architecture through the application of rating scales (Guimarães, 2001) has been ignored by officials who control construction activity in Brazil. Indeed, city administration experts seem to justify such inert resistance due to lack of logistics and financial resources. This hinders the implementation and control of data processing from project plans, through construction, and to the time of occupancy (Brasil/Ministério das.Cidades, 2004a). Before one regrets that the implementation of rating scales of accessibility is not possible in Brazilian cities, or elsewhere in industrializing countries, one must consider alternative ways to accommodate the holistic nature of universal design (Guimarães, 2008a).

This chapter addresses the current trend toward the international development of universal design, which could be in jeopardy through the application of a limited repertoire of design ideas that respect different world views, life experiences, and abilities. This discussion acknowledges the Brazilian initiatives of short-term public enhancement of accessibility, which have shown good results. However, the criticism is in regard to the limitations of such strategies in promoting better architectural environments. The goal is to emphasize the importance of interpreting universal design concepts in ways that go beyond minimal code compliance and flaws in legislation (Guimarães, 2008b). Metaphorically, this chapter reiterates the need for investments in cultural change through good practices that associate the concept of universal design with "writing poetry," rather than "correcting grammar," and to do so in an architectural language that is accessible to everyone.

14.2 McDONALDIZATION AND UNIVERSAL DESIGN

According to Ritzer (2000), who studied the success of McDonald's fast-food restaurants, the whole world is undergoing a process of implementing the four dimensions related to the needs of exponentially growing populations. These four principles of "McDonaldization" consist of

1. Efficiency: precise, simple, and small packages of solutions for complex problems
2. Predictability: clean, safe, and stable characteristics through repetition and uniformity of reliable features in every product
3. Calculability: time-saving and focus on quantity instead of quality-related outcomes
4. Behavioral control: particularly, nonhuman technology that reduces users' choices or decisions to a handful of patterns

It appears that universal design constitutes an ideology for user-centered solutions that focus too much on usability and that illustrate at least three of these four dimensions. However, the McDonaldization process, when applied to universally designed products and environments, can impact and distort concerns for user empowerment and social inclusion. In mass-market production, where industrialized components are assembled into buildings, user satisfaction appears to be predictable through the recognition of stylish and sophisticated brands and solutions. Thus, the success of universal design could be associated with marketing strategies that promote active lifestyles in sophisticated small packages for general application (Rains, 2008), although universal design is not necessarily limited to high-end technology.

Evidence of the effects of McDonaldization can easily be found in the scope of technical accessibility standards in Brazil: ready-made designs, which stem from strict requirements that refer to universal design, but do not produce compatible results. Initiatives for implementation of accessibility through technical standards and strong legislation will only replicate inadequate design solutions without addressing qualitative issues, such as social inclusion and other contextual or cultural considerations (Fernandino and Duarte, 2004).

14.3 POETRY ENRICHES SEMANTICS ABOUT ACCESSIBILITY FOR ALL

In essence, universal design simply refers to good design (Preiser and Ostroff, 2001; Goldsmith and Dezart, 2000). To be "good," a design idea must entail more than a complex collection of good design elements, such as the ones prescribed in the rating scale of accessibility, e.g., ramp slopes. If one can identify all possible design solutions that allow everyone to perform activities effectively without the need for adaptations, the long list of design alternatives cannot be applied perfectly and automatically to particular social and cultural contexts. The creation of innovative technologies or the selection of optimal solutions is dependent upon the ability to balance an array of considerations, some of which conflict with conventional patterns.

If one considers grammar as the simple structure of languages, then architectural design can be seen as a special kind of language expressed through built environments (Rapoport, 1982). In this sense, one can make the analogy that universal design is a new but unfamiliar dialect, and that it is easier for everyone to converse about these concepts than to read or write meaningfully. Unfortunately, it seems that legislation, codes, and ordinances, as well as official guidelines for development of accessible environments, focus too much on correcting grammar and spelling. As first lessons to beginners, such materials include a narrow range of articulated directives for instruction. The emphasis has been on transforming accessibility and universal design into guidelines. Due to normative thinking, that approach may be too limited with respect to the language of built environments. Consequently, that leads to a rather dull language of preconceived, repeated, and patterned solutions.

However, writing poetry enriches language development by challenging conventional grammar in order to better communicate meanings, feelings, and values. In this type of language, the built environment is the medium; subtle messages about usage and place making clarify semantics through the arrangement of physical spaces and materials, user movement, social interaction, etc. Creating poetry through built environments allows users to perceive psychological and social nuances by providing appropriate combinations of form and function.

Consider, e.g., the design of gently sloped ramps that appear to “float in the air” over gardens and clear running water falling in artificial ponds. Add to this scenery large resting areas with seats in the shade. That includes much more than the space typically provided by the landings between inclined paths. Artificial fountains can be installed at such landings, simulating small waterfalls at different levels, which produce distinct sounds of falling water at different heights (see Fig. 14.1).

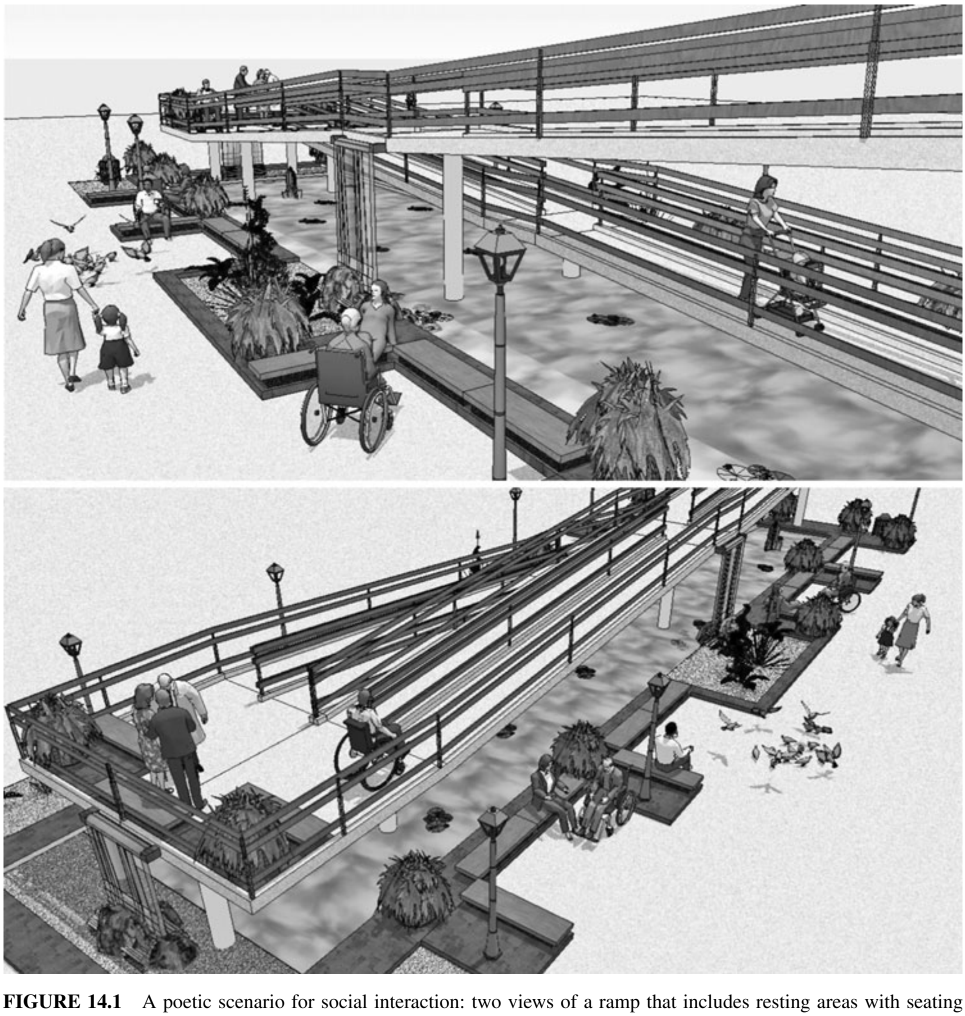

FIGURE 14.1 A poetic scenario for social interaction: two views of a ramp that includes resting areas with seating arrangements in intermediate landings and an artificial pond with waterfalls. (*Drawings by the author*.)

Long description: There are two pictures showing side views of the same “poetic” scenario. The scenario includes a slightly-sloped ramp that runs up above many seating areas around vegetation and an artificial pond. People standing on the ramp use the landings for conversation. There are U-shaped benches in such landings. Other people are seated on similar U-shaped benches in the resting areas below. They are also enjoying themselves next to the water that runs from artificial falls at each level of ramp landings. A mother takes the hand of a girl to show her pigeons that play on the ground next to the resting areas. There are people with different ages and abilities including wheelchair users and babies in strollers.

Thus, the ramp is no longer just a means for access to different levels, but has become a place of social interaction.

In envisioning how universal design can evoke new architectural forms, it is important to realize the need to shift the focus from correcting grammar. This can be done by structuring features of universal design toward making poetry through scenarios of social inclusion, with the intent of expanding the vocabulary and experience of accessibility for everyone.

It can be said that the conceptual model of universal design includes an interwoven mesh of visual references, words, ideas, allegories, and legitimating symbols. All those factors can help shape the consistent expression of social inclusion into contemporary forms. Starting from isolated discourses about accessibility for minority groups, this conceptual level of accessibility is expanded to address sustainable development of urban ecosystems through user-centered and participatory design, as well as user-friendly interfaces in information design.

14.4 STRUCTURALISM IN TECHNICAL ACCESSIBILITY LITERATURE

Structuralism encompasses a variety of interpretations across different fields. Initially developed in linguistics and anthropology, it is a theoretical paradigm that explores tacit ideas, processes, or structures that underlie events, and it is an attempt to understand such events. Although structuralism recognizes that meaning is achieved through subjective, interpretive processes, it values deep, subtle structures over surface phenomena and is concerned with underlying social forces. Considering typological studies (e.g., Colquhoun, 1981; Rowe, 1987; Tesar, 1991), structuralism appears at the core of architectural tradition through the development of an inventory of geometrical forms, conceptual tools, formalistic expressions, and organizational strategies.

Structuralism tends to view culture as a communication system and often reduces cultural manifestations into constituent units as a means to understand the principles of their operation. Using both the analytical and global frameworks of structuralism (Lawrence, 1989), one can study existing universal design applications worldwide. That way, one can consider use and behavior patterns in particular cultural settings to explain the common needs of people of different ages and abilities. Unobservable logic mathematical models that establish wholeness and transformation through self-regulatory processes provide the framework to test reciprocal relationships of variables in a database system of observable, successful results.

Code requirements and checklists need to be commensurate with cultural frameworks. Otherwise, checklists simply reduce individuals to impersonal entities. According to the structuralist framework, a single element in systems of different societies has meaning when it is an integral part of a set of permanent structural connections in the organizational categories of experience. Therefore, in successful universal design applications, individuals generate or control the effectiveness of codes and regulations in regard to their social existence, well-being, or interpersonal exchanges.

A database of universal design solutions organized around a structuralist framework could be useful for both expert practitioners and novices. Although structuralism does not consider the historical background of research topics, the outcomes of good design practices could serve as a basis for future projects as well as foster the evolution of universal design.

14.5 ACCESSIBILITY CODES: THE LANGUAGE OF POORLY ADAPTED ENVIRONMENTS

For an increasingly diverse population, universal design addresses the fit between environmental design and human abilities. Unfortunately, at this juncture, Brazilian experts have not reached consensus regarding the recognition and assessment of the quality of universally designed projects in Brazil.

Brazilian federal laws and ordinances (Brasil, 2004) consist of a comprehensive approach to accessibility issues. Based on that fact, the roles of experts, building officials, city administrators, public attorneys, and professionals have changed, and people have become more responsive to concerns about the range of needs of the population. In fact, one positive outcome is the attempt to present universal design as a holistic perspective, synthesizing a wide range of initiatives: transportation, e.g., buses, train systems, ships, and airlines; communication, e.g., the Internet, television, telephone, etc.; and other public services.

Although Brazil continues significant initiatives to create accessible environments and social inclusion, those efforts remain ineffective. Brazil invests a large amount of social resources to improve the built environment through law enforcement as a means to address the needs of a growing population of people with disabilities, people older than 65 years, pregnant women, and other people with temporary impairments (Brasil/Ministerio das. Cidades, 2004b).

However, legislation and technical standards primarily focus on design ideas for specific problems. Anecdotal observation and academic research (Fernandino and Duarte, 2004) reveal that many of these resources do not result in the creation of universally designed environments. Compliance with legislation has been inconsistent thus far, and there is no single architectural design project that strictly follows all requirements contained in the national standards of the Associação Brasileira de Normas Técnicas (ABNT). Product design, automotive manufacturing, and urban interventions also appear to lack conceptual consistency with both universal design concepts and accessibility requirements.

At Brazilian universities, formal design education still focuses on understanding the basic criteria for accessibility of "people with reduced mobility." In practice, however, there is concern for the development of accessible buildings only with regard to special groups of people. This is a problematic fallacy, because, in the context of Brazilian laws, the concept of universal design has been partially misunderstood (Guimarães, 2010). Thus, major elements of accessibility, such as larger restrooms, wider doors, platform lifts, or ramps, have been slowly incorporated as special features in new buildings. Despite the growing number of buildings, urban settings, and products that attempt to follow the guidelines and standards, the overall scope of design ideas seems shallow (Cambiaghi, 2007). This reveals that, despite all the efforts, the practice of universal design is not a significant part of Brazilian design culture.

A common design solution for public buildings, e.g., is to place a code-compliant vertical platform lift outside, typically beside a flight of stairs with handrails and landings protruding into the main entry area. Such clutter of elements distorts the message of "everybody is welcome" (see Fig. 14.2) and implies that accessibility creates unattractive results. Proper consideration of site planning at the early stages of project development can eliminate unnecessary level changes and will provide equal access to building for everyone (see Fig. 14.3).

As a consequence of "grammar structuring" through code compliance, the above example shows a combination of accessible features of building elements, which can diminish the quality of the architectural experience. Conversely, one can "write poetry" by adopting a truly inclusive approach in preliminary stages of design, and by focusing on quality experiences for all users.

Adopting technical standards for accessibility (ABNT, 2004) in order to create better environments constitutes one of the general guides for development of more user-responsive design solutions. Its well-known format with sketched illustrations helps novices working on solutions to architectural barriers. The technical standards booklet appears to provide all the needed information related to dimensions and the required minimum number of accessible fixtures or installations. Thus, the prevailing message to students and professionals is to treat unfamiliar situations by utilizing technical rules-of-thumb as shortcuts. Unfortunately, as a consequence, they are avoiding direct contact with building users and their diverse needs.

Since the development of universal design depends on increasing diversity in the built environment, it is important that the design literature present clear explanations, such as connections among problems; prescribed solutions; users'/clients' various perspectives; and, finally, postoccupancy evaluations of successes and failures. For example, illustrated how-to booklets in a variety of formats are dominant in the Brazilian literature, rather than technical books or magazines that describe novel and successful universal design solutions. This again reinforces the "grammatical," and not the "poetic," practice of the concept of universal design.

Both legislation (Brasil, 2001a, 2001b, 2004) and technical standards (ABNT, 2004) in Brazil contain information that is based on foreign scientific research. However, as the knowledge base for

FIGURE 14.2 By grammar structuring, a clutter of code-compliant accessibility elements is located outside the entrance of a building. (*Photograph digitally manipulated by the author.*)

Long description: This is a view of a building entry area that includes the sidewalk, the vehicle driveway, and pedestrian doors. At the sidewalk level, there is a contrasting colored strip that leads users to handrails of the four-step stairs of the pedestrian entrance. The handrails are double height with 1-ft extensions at each side. The main glazed pedestrian door provides horizontal handrails as well. On the left side of the stairs, there is a vertical platform lift that takes pedestrians to a parallel glazed door at the same entrance, but that is separated from the stair landing outside by a small garden. The lift contains a sign with the international symbol of accessibility. On the right side of stairs, there is a vase with tall ornamental vegetation.

accessibility expands to the more holistic aspects of users' life experiences, more qualitative studies become necessary. The priority of research funding agencies in Brazil is directed at quantitative rather than qualitative investigations. Culturally based research on autonomy, personal space, territoriality, and user preferences is more prevalent in the foreign literature.

The consequence is that foreign design concepts are assimilated as ready-made solutions without further analysis and contextualization. Furthermore, the concept of universal design has been applied only to places where older adults and persons with mobility problems are prevalent. Designers, who attempt to explore innovative and aesthetically pleasing ideas, often disregard important aspects of design, such as personal safety and security. This implies that design practitioners tend to place too much emphasis on the technical standards, codes, and legislation, rather than develop more innovative—poetic—design solutions. Subsequently, their misconceptions about design for people with disabilities are perpetuated.

14.6 CONCLUSION

The advancements of accessibility in Brazil are concentrated in major urban areas at this time. In public buildings, street design, or large real estate developments, it is easy to detect design elements that reflect the formal and material specifications of technical standards. From banks to churches to

FIGURE 14.3 By writing poetry, the entrance becomes universally attractive and socially inclusive. (*Photograph digitally manipulated by the author.*)

Long description: This is a night view of a similar building entry area that includes the sidewalk, the vehicle driveway, and pedestrian doors. At the sidewalk, there is also a contrasting colored strip, but it leads straight to the glazed doors of the pedestrian entrance. This pedestrian entrance is at the same level as the sidewalk. On each side of the walkway toward the entrance, there are vases with tall ornamental vegetation, which mark the edge of this walkway with the sidewalk. In the darkness, the overhead lighting of the doorway creates a bright area around the landing of this entrance.

convention centers, from gas stations to clubs to residential complexes, from schools to shopping malls, code-compliant accessibility features exhibit the same characteristics.

In summary, the prevailing notion of accessible environments in Brazil is that a limited repertoire of design features is sufficient. The national standards for accessibility act as a basic catalogue for acceptable solutions. However, the small number of examples, as well as rare reference to exemplary works in specific cultural contexts, causes novices to repeat conventional approaches over and over, without exploring more-diverse and better design methods and solutions. System-oriented scenarios of social inclusion should result in value-based solutions for user-centered design. That way, best practices will be based on knowledge about a number of person-environment fit issues and will help to establish new exemplars of universal design.

A dramatic cultural revolution remains necessary. As a means to promote universality, sustainability, and social justice, professionals, clients, and users alike need to create poetry out of architectural accessibility, rather than persist on a dull monologue with few alternatives.

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CHAPTER 15
ACCESSIBLE DESIGN IN ITALY

Assunta D'Innocenzo and Annalisa Morini

15.1 INTRODUCTION

Because of the lack of public space that is required for new development, and the desire to retain many of the cultural and historical sites that still exist, Italy is currently focusing on the renovation of existing buildings. The inclusion of accessibility in the planning stages of renovation is the challenge.

The primary aim of this chapter is to describe how accessibility is studied, regulated, and applied in Italy, emphasizing work on residential buildings and outdoor environments. This chapter focuses on accessibility in renovation, and because of the inherent complexity involved, the chapter will cover

1. Laws and technical requirements, showing the evolution of the accessibility concept
2. Renewal programs for residential buildings
3. Outdoor environments and mobility

The evolving concept of "integration" has led to a substantial change in the definition of *accessibility* in Italy, as in many other industrialized countries. Today in Italy, *accessibility* (*accessibilità*) means design for all or universal design, but unlike in the United States, it is applied to the built environment, and not to products.*

15.2 LAWS AND TECHNICAL REQUIREMENTS

Italian laws on accessibility were first initiated at the end of the 1960s, but applied to only specific structures rather than in general. Revisions to the initial laws that enhanced implementation occurred over 25 years later with the introduction of Law 13 (1989), regulating the accessibility and adaptability of private and public housing, including exterior environments. It was applied to both new construction and renovation and was followed by DPR 503.1996, which revised all the previous regulations on the removal of architectural barriers in buildings, open spaces, and public services.

Since 1997, administrative procedures concerning renovation of existing buildings have been simplified, and they included specifications for installing lifts and lift platforms, as well as an increase in the width of main entrances and hallways. Law 449/1997, Article 1, (in force until 2010) introduced tax incentives for work that eliminated architectural barriers and replaced outdated heating and electrical systems. Regions integrated these national laws at the same time, thus broadening support for increased accessibility. Law 328 (2000) improved the accessibility and safety conditions

*Note that while *design for all* is the term currently used in Europe and *universal design* is more commonly used in the United States, currently in Italy, as well as in parts of Europe, the term *accessibility* is frequently used.

of homes for people with disabilities, and it created the framework for an integrated system of social services.

Three levels of accessibility were introduced in 1989 and then reinforced in 1996:

1. *Total accessibility*: People with reduced motor or sensory abilities shall have an accessible route leading to and into a building, shall have equal access within a building including access to all common areas, and shall be able to safely use spaces and equipment as independently as possible, and to the best of their ability.
2. *Visitability, or partial accessibility:* People with reduced abilities shall have access to the primary spaces in a building, and they shall include no less than one accessible toilet.
3. *Adaptability, or deferred accessibility*: The built environment can be easily modified, so that it could become usable by people with reduced abilities.

In addition, the design of new and renovated buildings must include technical drawings that show the potential levels of accessibility related to the structures of buildings, heating and electrical systems, common spaces, fittings, and finishes. Designers and architects can suggest alternative solutions that meet or exceed existing specifications. If approved by a specific commission, designs can be used not only in a particular project, but also in other future projects, thereby updating and improving the codified legal requirements.

15.3 CASE STUDIES: REHABILITATING RESIDENTIAL BUILDINGS

The design and construction of new housing or the renovation of any house, building, or entire residential area must follow the same established laws and technical requirements. The Bagnacavallo Housing Project and the Pinerolo Project are the selected case studies presented in this chapter. The success and failure of each will be discussed.

Bagnacavallo, "Il Giardino dei Semplici" Housing Project

Located in the historical center of Bagnacavallo, a small municipality in northern Italy, the complex "Il Giardino dei Semplici" consists of four deteriorated buildings. One building dates back to the eighteenth century, and it is considered a noble and valuable building that features vaulted fresco wooden ceilings, stucco, and furniture of exquisite workmanship. It is located in a green area of the Botanical Gardens (Missiroli, 2004). The project consists of 27 dwellings, including 22 fully accessible units for older adults and people with disabilities and 5 conventional units for unemployed workers.

The housing cooperative supervised the project, the region financed both the construction and necessary equipment, and the municipality arranged communication among the different participants. The project players included a team of doctors who provided health services as well as the social cooperative that supervised the management of public spaces and assistance services (see Figs. 15.1 and 15.2).

The housing complex includes a security room equipped with a tele-aid station, meeting rooms, therapeutic rooms, and health services. A botanical garden completes the complex. All the services offered are available to both residents and the neighborhood. Special services such as laundry or personal care are available on demand and at an additional cost. Dwellings are equipped with smart systems, such as intercoms, gas and smoke alarms, automatic power shutoff, and emergency lighting. In addition, all dwellings have preset automated systems that control windows, shutters and curtains, internal doors, antitheft devices, and air conditioning systems (see Fig. 15.3). To meet the requirements of people with visual impairments, special attention was paid to the selection of floor and color finishes in all rooms as well as to internal and exterior lighting.

FIGURE 15.1 The recent renovation of a residential complex in the small city of Bagnacavallo, northern Italy, was focused on the improvement of accessibility and energy efficiency. The project included the main historical building and two new buildings.

Long description: This is the façade with the accessible entrance of the main renovated three-story residential building. The accessible entrance is made possible by a continuous and slightly sloped ramp, even though it is not equipped with handrails.

FIGURE 15.2 The apartments in the two-story residential building renovation project in Bagnacavallo, Italy, face an inner courtyard.

Long description: The two-story residential building faces a courtyard, which is partly covered by a wooden roof. On the ground floor, windows are equipped with sliding shutters, which ensure easier access to the outdoor environment.

FIGURE 15.3 The renovation project in Bagnacavallo included the removal of old windows, which were replaced by motorized windows and shutters, to be easily operated by the residents.

Long description: The figure shows the detail of one of the new windows of the renovation, which is equipped with motorized shutters. Motorized controls were chosen to maintain the dimensions and character of the original windows, while enabling easy operation of the large, heavy windows.

The Pinerolo Project

Pinerolo is a small municipality close to Turin. This project included a complex of completely deteriorated residential buildings of the late 1950, and a former slaughterhouse. The residential buildings that were occupied almost entirely by older people had no heating system or elevators, and there were accessibility barriers throughout. The goal of the renovation was to improve the quality of the existing buildings and meet the requirements for accessibility, comfort, and safety. New dwellings were added to improve social integration and enhance amenities.

The major renovation of 68 existing dwellings included the removal of architectural barriers, the addition of elevators, and the installation of heating and ventilation (see Fig. 15.4).

A new residential area consisting of two buildings around a central square was constructed. The first building consisted of 34 dwellings—with units on the ground floor for the elderly and dwellings on the upper floor for young couples (see Fig. 15.5).

The new dwellings for older people included smart technologies for gas, water, fire alarms, and telecommunication systems and were linked to an internal control center. Common rooms and outdoor spaces were designed to encourage the formation of new friendships (see Fig. 15.6).

The second building was designed for mixed use, including a communal space for the elderly, commercial spaces and studios, and 25 private dwellings. The environmental quality of the pedestrian routes, gardens, and access from the neighborhood to the city was improved through modifications to accessibility, usability, safety, and security.

The project was completed in 2006. Unfortunately, not all the initial goals were realized, because of the limitations of the existing buildings as well as the fact that renovations occurred while inhabitants

FIGURE 15.4 The renovation project of a deteriorated neighborhood of the 1960s in the small city of Pinerolo, northern Italy, provided for better energy efficiency and accessibility in the four-story buildings with a large number of older adults. Further, a stair lift was installed near the entrance to allow accessibility to and usability of the first-floor apartments.

Long description: The image shows the addition of a lift as part of the renovation project of a deteriorated public housing neighborhood that was built in the late 1960s. Many older people live there. The lift was attached to the façade, and it stops between floors. The project was carried out while residents continued to live there.

remained in their homes.* The floors of the apartment entries were not wide enough to access the lift, so the new lifts stop at the wider midlevels of each floor. This requires that the user take the stairs to go up or down a half flight.

*In Italy, interventions on existing buildings must be carried out with the constraint of residents remaining inside their homes. This is due both to the attachment of residents to their homes and to the difficulty of finding satisfactory temporary accommodations.

FIGURE 15.5 The Pinerolo renovation project focused on public housing buildings on the site of the old municipal slaughterhouse close to the city center.

Long description: The image shows the new two-story residential building for older people and young couples. On the ground floor there are smaller apartments for single persons, while on the first floor there are bigger ones for couples. On the first floor a small living room faces the courtyard and the park, where residents can socialize and converse during the winter months.

FIGURE 15.6 The service center is devoted to older people, located close to the new residential building.

Long description: The image shows the community meeting room in the service center, which is devoted to older residents of the building, but is also open to older residents of the neighborhood. The room is located on the first floor of the building and has wooden walls, a chimney, and a cooking area in order to convey the concept of a homelike environment.

15.4 OUTDOOR ENVIRONMENTS AND MOBILITY

In the early 1990s, new regulations were introduced to try to improve the usability, comfort, and safety of outdoor public spaces that included pedestrian pathways, squares, parking, urban parks, and natural and archaeological sites. Public spaces, including new construction, rehabilitated areas, and those areas intended for temporary use, had to comply with these new regulations.*

Accessible Venice

Venice is seen as one great architectural barrier with 100 islands connected by about 420 bridges. Thanks to public waterborne transport and the other initiatives implemented by the Venice City Council, almost 70 percent of the city center is accessible to people with impaired mobility. The Agency for Promoting Tourism in Venice distributes maps of the city showing the most accessible pathways. Yellow map areas are reachable by persons with disabilities by crossing only bridges with platform stair lifts. Different areas of the city can be visited by using accessible boats, which have at least one place for a person using a wheelchair. Ferry stops are accessible, but some of the ramps are quite steep.

In 2008, during the Biennale Exhibition, a provisional ramp was installed at the bridge "Ponte Della Veneto Marina," linking the "Gardens" with the "Arsenal," where the Biennale was held. Twelve ramps were installed on the bridges along the Venice Marathon route. The project exemplified that "In Venice, barriers are overcome by running" (see Fig. 15.7).

FIGURE 15.7 In recent years the municipality of Venice, Italy, has been engaged in an initiative to install mobile ramps on existing bridges.

Long description: The image shows one solution to making accessible one of the bridges in the historical center. The solution consists of a movable ramp with several smaller segments, which are placed on the steps and are located next to one side of the bridge. Accessibility is improved not only for wheelchair users but also for people who are carrying heavy loads, such as luggage, as well as parents with strollers.

*The regulations cover the following elements: pathways and pedestrian areas; bus stops; public parking; green spaces and recreational areas; street furniture; and streets with limited circulation.

The Constitution Bridge

The Costituzione Bridge opened in September 2008. It deserves more coverage than a chapter, because of the length of time it took to complete and the debates that started during its design. They continued throughout construction and are still going on today. It is the fourth bridge that crosses the Canale Grande, linking the railway station, car parking, and bus stations on one side and the historical and pedestrian center on the other side. Spanish architect Santiago Calatrava completed the preliminary design in 1997, and the final design was completed in 2001. Construction began the following year.

As the project plans started to circulate among architects, engineers, and associations of persons with disabilities, the design analysis immediately showed the lack of attention that was paid to Italian accessibility laws. A petition started, but authorities ignored it. International dissent resulted in a project review meeting of the mayor and a group of representative architects, engineers, and persons with disabilities.[*] This meeting resulted in commissioning another firm to design an attached mobility system that would be able to transport people with reduced mobility across the bridge. This mobility system is a cable car, called Ovovia, and it is designed to run on one side of the bridge. The time for the Ovovia to cross the span of the bridge is longer than if one were to use a boat. As of this writing, the bridge is open, but the Ovovia has not been installed. Poor communication has created many versions of the design and installation. Each player of this complex project has his or her own version of the story, some of which have appeared in newspapers, resulting in more than 1000 articles published so far. The bridge and Ovovia construction elicit at least three different responses from

- Those who think that the bridge is not fully accessible, but at the same time feel that complaints are excessive
- Those who think that the bridge is not accessible and that authorities are guilty of having opened it before the installation of the Ovovia
- Those who think that Ovovia installation is not very useful, because it takes too much time to cross the bridge

There are also many opinions that overlap these three groups. Surely, after the Ovovia opening other comments and complaints will be made. The total cost of construction was around 12.3 million euros, including 1 million euros for the Ovovia. Opinions about the design of the bridge also vary. Almost all people visiting it have stated that its shape is breathtaking, but that it is overwhelming in scale. Many complaints are made about its difficulty and hazardous glass steps, the variability in height and depth, and the slippery surfaces.[†] Thus, despite the laws regarding accessibility, aesthetics sometimes play a more important role in the design decision-making process, thereby creating situations that may have no practical solutions.

15.5 DESIGN GUIDELINES FOR INFRASTRUCTURE AND TRANSPORT

Like other European countries, Italy has developed design principles based on those established in 1997 by the European Commission for safe and sustainable mobility. Local public administrations must aim their plans and programs at achieving infrastructure and transport goals, while attending to the safe and sustainable standards set by the commission.

Public rail transport, rather than the air transport, was selected for this discussion for two reasons. First, in Italy, trains are used more frequently than airlines for domestic travel. Second, airports and air networks are generally more accessible than railways.

In railway stations across Italy, information and assistance for people with disabilities are provided by Assistance Centers that are located in each station in Sale Blu (Blue Rooms). Some services include

[*]Among them, Shirley Confino Rehder, AIA, United States, also wrote about it as a case study (Confino Rehder, 2004).

[†]For further information, see the newsletter of the municipality of Venice on the website www2.comune.venezia.it/letturagevolata/newsletter and see Russo's paper (Russo, 2007).

train information, seat booking, wheelchairs, escort from/to the station entrances/exits to the train, to other railway connections, or to lifts with platform elevators and porter service. By calling in advance, the traveler with a disability can have services arranged to meet the individual requirements. On each of the 260 major trains, there are cars with facilities for two passengers using wheelchairs, plus two companions. These cars are equipped with an accessible toilet, a seat with a large window, a table, a grab bar, and a call button. With the new organization of the railway system, two efforts were undertaken to properly renovate major stations: Grandi Stazioni, which is aimed at improving railway stations in major cities,[*] and Cento Stazioni, which is devoted to the renewal of stations in medium-sized cities.[†]

In addition to the 2150 Italian medium- and smaller-sized railway stations, such as the Cento Stazioni office, the Italian Railway built additional amenities for accessibility, allocating a budget of 15 million euros per year.[‡] The projects that are built follow the guidelines prepared by the Italian railways company RFI (RFI, 2002), which cover

1. The square outside the station, included parking areas, bus and taxi stops, as well as pedestrian pathways
2. The railway station, its entrances and main lobby and services, such as ticket offices, luggage storage, information centers, waiting rooms, and toilets
3. The vertical connectors, such as moving and fixed stairs, ramps, lifts, and lift platforms
4. The gates, platforms, pathways, waiting areas, and elevators to enter trains
5. The specifications of signage, public telephones, and ticket machines
6. The finishes of surfaces, detailing, and plants installed in the stations

Roma Termini Station opened before World War II (1939), and was later renovated and enlarged. Updating the ticket offices and information systems, the provision of automated ticketing, the inclusion of luggage delivery, and the renovation of restrooms enhanced the quality of traveler services.

The underground level, quite deteriorated, was replaced with a new service center consisting of a wide variety of commercial stores,[§] attracting both travelers and nontravelers. The Roma Termini area is currently a multipurpose center with public services as well as cultural and fitness centers, shopping, and bars. This station, like others, features tactile guides to assist people with visual impairments.

15.6 FUTURE TRENDS

The main goal is the acceptance and inclusion of design-for-all principles within urban and building policies throughout Italy, whether it is for new or renovation programs. This will address the increasing number of older people,[¶] the growing general demand for more appealing living environments, and the need for more accessible, safe, comfortable, attractive, and functional cities.

The quality of life has improved in the last century, permitting better social services, including an increase of cultural activities, free time, and recreational travel. Persons with disabilities should be included. Today, people with visual or motor impairments can participate in any sport or activity once believed to be beyond reach, such as skiing or horseback riding. To reinforce the goals of accessibility and inclusive design, new technologies are commonly used in the European Union, particularly the installation of "smart" technologies in dwellings for the elderly and persons with disabilities. These technologies, known as *domotics*, are used to support daily activities and can provide social and health assistance. The inclusion of domotics and assistive technologies adds to a safer and

[*]For further information see www.grandistazioni.it.

[†]For further information see www.centostazioni.it.

[‡]For further information see www.rfi.it.

[§]For further information, see the newsletter of the municipality of Venice on the website www2.comune.venezia.it/lettura-gevolata/newsletter, and see Russo's paper (Russo, 2007).

[¶]Italy leads all European countries in the percentage of persons aged 65 and over—20.5 percent in 2006—according to National Statistic Institute ISTAT.

more secure home environment. Good design specifications can prevent accidents within the home environment, which very often prove to be debilitating or fatal. These expectations can be achieved through more conscientiousness design and with the support of politicians and advocates.

Italian policies are now written to work within the guidelines of inclusive design, and they are intended to meet the growing needs and demands. This approach still requires acceptance at all European and international levels. ISO's approach to accessibility (ISO/ TC59/SC16) and CEN-CENELEC Guide 6 (CEN-CENELEC, 2002) make an important contribution toward its ultimate acceptance.

It is recognized that the integration of inclusive design/universal design within the built environment may require investments that could strain the different and changing economies of Europe. The work that needs to be done remains a major undertaking.* But it is also an investment in people, their independence, and their ability to participate in society. It is an investment for the future. Italy recognizes this and is working hard to create places in which all people can fully participate and enjoy their lives.

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Railway station renovation in medium-sized cities: www.centostazioni.it

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CHAPTER 16
PLANNING ACCESSIBILITY IN THE OLD CITY OF JERUSALEM

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16.1 INTRODUCTION

The Old City of Jerusalem has been settled continuously for more than 3000 years. The current structure including the Old City walls and location of its gates has existed since the early medieval era (Prawer, 1972; Rubin, 1999). The Old City contains a mixture of old and new construction, archaeology, history, people of many different religions, and holy sites. Each of the main monotheist religions and their denominations has its own holy sites within the Old City walls. The area is characterized by very dense population, about 35,000 residents (*Jerusalem Statistical Yearbook*, 2005); in addition there are about 10 million visitors per year. This chapter discusses the tools and planning processes of accessibility in the unique and complicated nature of the Old City of Jerusalem, a model for other historic cities (see Fig. 16.1).

16.2 STRUCTURE AND TOPOGRAPHY

The Old City extends for 871 square meters (*Jerusalem Statistical Yearbook*, 2005), and is built on two hills separated by a valley. The Old City was built in a medieval Mediterranean scheme, based on a former Roman city, not necessarily in accordance with the topography. Two main streets, the north-south Cardo Maximus and the east-west Decomanus Maximus, divide the Old City into four quarters, each containing residential block areas, schools, prayer places, etc. (Bahat and Rubinstein, 1990).

The present design resembles other eastern cities. It is based on residential enclosures, connected by major streets allowing for free passage among the different parts of the Old City. Dead-end streets and alleys lead to the residences. The main streets contain the main trade markets, which overflow to the nearby streets, as well as most of the municipal and religious public buildings. Many of the residential homes are located on top of the commercial areas. They can be reached only by staircases, starting from internal dead-end alleys. Therefore, there are no direct passages among residential areas.

Because the streets are hundreds of years old and surrounded by very high density construction, their width in general is, at its maximum, 3 m, and often the space available for pedestrians does not exceed 1.50 m.

Some of the streets are sloped very steeply due to the natural topography. Many of the sloped streets were built with stairs to accommodate the pedestrians, while minimizing the slope between

FIGURE 16.1 Muristan Square, located next to the church of the Holy Sepulcher. The accessible gate to Muristan Square, a busy street of shopping and restaurants, is where merchandise is displayed on the street outside the shops, as is typical in the Old City.

Long description: This photo shows a semicircular triple-arched gate built of masonry in a neoclassic style. The threshold is lifted from the street limestone pavement by a 12-cm step (made to block out vehicles). The entrance was modified to accommodate wheelchair users by the insertion of a concrete ramp. Beyond the gate, there is a commercial street about 8 m wide, where a significant amount of merchandise is displayed outdoors. The shops are tourist-oriented, offering ethnic clothing hanging down from shop marquees, baskets, and artisan work displayed on the street pavement, and local restaurants with outdoor seating.

the staircases. The buildings were built along the streets; therefore the level of the entrances to the shops or houses correlates to the slope and subdivisions created by the steps.

The seven well-preserved city gates are the only way to connect this area to the New City, outside the Old City walls. A green area around the walls helps isolate the Old City from the new construction outside the walls. The decision to have this separation was made in the nineteenth century, and it is maintained to this day.

16.3 MOBILITY INFRASTRUCTURES

Three mobility systems are currently interconnected.

- The most common is for pedestrians who can use all streets, as long as their physical fitness permits them to use the stairs (see Fig.16.2).
- Carts and cars, built specially to suit the crowded streets, are used for transporting merchandise. For that purpose, narrow stone ramps were added to enable pushing the carts. These ramps are fitted to meet the distance between cart wheels (see Fig. 16.3).
- Cars and narrow tractors are relatively new to the Old City. These can be used only in a limited number of streets. There is no room for a sidewalk in these streets, which are more or less suitable for the use of cars (see Fig. 16.4).

FIGURE 16.2 Residential stairway street in the Moslem Quarter. Narrow municipal service wagons, specially adapted for the narrow stairway streets, are an effective way to provide the Old City with routine municipal sanitation and maintenance services.

Long description: This photo shows a residential stairway street climbing up the hill. Most of the rises are up to 14 cm, while the treads differ from 30 to 60 cm. The stairs are grouped by two to three steps, with landings of about 180 cm in between. The average width of the street is about 3 m and is paved with limestone tiles. On the rear, the street is blocked by a residential building, allowing the public an arched path 180 cm wide and 270 cm high. The photo shows a narrow (100-cm or less) municipal service wagon, which is pulled by a modified small tractor, driving on the stairway with a man passing by the side of the vehicle.

16.4 THE PROBLEM OF PLANNING UPGRADING

For many years there were no significant renovations done in the Old City. With the urgent need to improve the quality of life and upgrade the infrastructure for the increasing number of residents and tourists, a major comprehensive planning project was initiated. This project was designed to address general concerns, with particular attention to accessibility. A multidisciplinary team was set up for this purpose and was coordinated by the Jerusalem Development Authority. The team was composed of representatives of the following concerns, services, and entities: architecture, civil engineering, electricity, sewage, water, tourism, archaeology, preservation, heritage, emergency services, religions, community organizations, and accessibility. Priorities were proposed for each street. Integration of proposals was the responsibility of the coordinator. The accessibility planning team was faced with two major dilemmas:

- How to implement the official national guidelines for accessibility in the complex context of the Old City
- Where to start, since no criteria to prioritize the overall accessibility needs were available

It is important to note that in many countries, including Israel, laws, regulations, and guidelines for barrier-free design exist in many places. These guidelines, although often similar in nature, vary from country to country. In many countries, including Israel (Standards Institution of Israel, 1998;

FIGURE 16.3 Semicommercial street in the Christian Quarter. A street constructed as a stairway is paved by limestone tiles, and a handrail is mounted on the left façade wall. Narrow stone ramps are anchored into the stairway for scooter and wheelchair users as well as pushers of carts and wagons.

Long description: This photo shows a steep street that is approximately 3 m wide, with shops on the right and a continuous stone wall on the left. Typical to the Old City of Jerusalem, the street is paved with limestone tiles and is made as a stairway, which is constructed of wide treads (60 to 100 cm) with short risers (10 to 14 cm). Larger treads allow entrances to shops. Steep and narrow stone ramps are anchored into the stairway on a line. These ramps serve wheelchair or scooter users as well as carts and wagons. A handrail fixed to the wall assists the pedestrians who prefer to use the stairway beside the ramps.

State of Israel, 2008) and the United States (*ADA Accessibility Guidelines*, 2002), the standards refer to minimum requirements. There are many cases in which enforcement of the guidelines is problematic. As a result, there are buildings and environments that do not comply with the requirements.

In Israel, as in the United States, full compliance with the standards is required only for construction of new buildings as well as alteration of existing buildings. Structural barriers must be removed from the latter on the condition that this can be easily accomplished. If complying with the standards is not readily achievable, modification that does not fully comply may be approved on the condition that it poses no health or safety risk. The regulations do not define what changes would be accomplished easily, and what expense is required for a facility to meet its obligation to remove barriers. The judgment is made on a case-by-case basis by the planner, architect, or engineer of the facility (*ADA Compliance Materials,* 1995).

Old cities throughout the world are the ultimate environments for facing difficulties with enforcement of the guidelines. Adaptation of environments and facilities must be undertaken in accordance with standards required by law, as well as with the goal of meeting the needs of the consumer. At the same time, access needs and universal design must also relate to heritage; historic and archaeology needs; preservation as opposed to modernization and progress; tourism; and local citizens' welfare, different religions' needs, etc.

There are guidelines, but no official audit tools to assess compliance. The first step in addressing the demand to provide accessibility is to share consistent, reliable, and objective access information.

FIGURE 16.4 New Gate streets in the Christian Quarter. A street leading to the "New Gate" is one of very few where private cars can enter the area within the walls of the Old City. Cars are parked very close to the building walls between low stone car barriers.

Long description: This photo shows a level street, about 500 cm wide, paved with limestone tiles. The left façade is occupied by small shops, and the right façade is a mixture of buildings and a wall of a public yard. Low stone car barriers define a one-way dual-purpose driving and walking route 320 cm wide. The distance from one barrier to the next is not constant. In front of shop entrances, the barriers are grouped to block car parking, while next to blank walls the distance between the stone barriers accommodates car parking.

To provide such information, there is need for a valid and reliable accessibility evaluation tool (Dijkers, 2003).

The existing data collection tools are not official audit tools to assess compliance and are not supported by data analysis tools. Several authors focused on identifying instruments that measure the built environment. For example, The Enabler (Steinfeld and Danford, 1997) assesses private homes. The basic premise of the work is that accessibility problems arise in the relationship between the individual and the environment. Scoring is dependent on judgments and, therefore, training in administering the tool is recommended to ensure interrater reliability (The Enabler, 2005).

Other tools attempt to assess hazards that persons with physical or cognitive deficits face in their homes, with the ultimate purpose of predicting and preventing falls and other injuries. Most of these tools develop a set of items each of which constitutes a risk, e.g., loose rugs, dangling power cords, lack of grab bars, etc.; assign points for presence or absence; and add up to obtain a residence hazard score (Clemson et al., 1999). A decision support system tool for evaluating accessibility of various facilities was created in Israel using mathematical equations based on the specifications of the official guideline requirements (Bendel, 2006).

Accessibility checklists are most commonly used to assess the degree to which both existing and new buildings satisfy legal criteria for access. The purpose of the Americans with Disabilities Act (ADA) checklist for Readily Achievable Barrier Removal (*ADA Compliance Materials,* 1995), e.g., is to "help you identify accessibility problems and solutions in existing facilities, in order to meet your obligations under the ADA" (*ADA Compliance Materials,* 1995, p. 2). This tool checks for compliance with the *ADA Accessibility Guidelines* (2002) and has been widely used in the United States since the passage of the ADA.

Most of the evaluations or audits were done regarding accessibility in existing buildings, public transportation, or tourist sites. Emerson (2008) in Ottawa and tourist sites in Chicago (Open Doors Organization, 2010) are examples. As for old cities, work was done on renovation and upgrading, e.g., Athens, Greece, and Ávila, Spain. *A Management Guide of Historic Cities* was published by the Organization of World Heritage Cities (1991), but accessibility was not addressed intensively. Specifically, not much work was reported on audit tools and criteria to evaluate old cities.

In regard to accessibility in the Old City of Jerusalem, the planning unit was required to make decisions and prioritize the required work. The work in planning accessibility resulted in an attempt to create such an evaluation tool, as well as a model for decision making. The pilot decision support system focused on the interplay between people and the built city environment. The results of the audit highlighted items in the Old City that required adaptation or upgrading to better meet users' needs, and it prioritized items for implementation.

16.5 DECISION SUPPORT AND EVALUATION SYSTEM

The decision support and evaluation system is a unique and bias-free tool. Criteria were defined to grade accessibility of specific elements and spaces separately, e.g., route width and slope. At this stage, weighted criteria were defined specifically for people with mobility impairments, including persons using wheelchairs, crutches, or other assistive devices.

Since the official guidelines do not take into consideration the unique situation in old cites, the criteria were defined with the official standards in mind. Deviations from these standards were allowed for reasonable accessibility within the complex layout of the Old City. Grades were given on a scale from 1 to 5, as follows:

1 = inaccessible, no simple solution is apparent

2 = requires major renovations

3 = requires some renovations

4 = requires some superficial improvements of surfaces

5 = accessible according to national standards, no renovations required

16.6 AUDIT OF ACCESSIBILITY IN THE OLD CITY

The audit of accessibility in the Old City was the first step taken to study and highlight the problems to be addressed in the planning process.

Methodology

Information was collected regarding the streets' suitability for either individuals using wheelchairs, crutches, or walkers or individuals with walking difficulties without aid devices. The audit took place in all streets and alleys of the Old City, regardless of the size, popularity, or population. The audit included public open spaces only. No buildings were evaluated.

The topics studied were as follows:

- *Width:* When the width of the street was not uniform along its entire length, an approximate average width of the street was established.
- *Height:* Some streets were covered, and the ceilings were low. In other streets there were other obstacles, such as old logs sticking out of the walls and protruding into pedestrian paths.

- *Slope:* Besides the steepness of slopes, the availability and standard of handrails were evaluated.
- *Stairs:* Size, height, surface, and distance between steps and groups of steps were measured. Here again the availability and standard of handrails were assessed.
- *Surface:* Roughness of the surface, bumps, holes, and missing, uneven, or broken tiles were noted.
- *Obstacles:* In addition to surface problems, poles, roadblocks, electricity, telephone, other distribution boxes, and other permanent obstacles to travel were noted.
- *Signage:* For the purpose of general orientation, the location and design of signage were studied, and the accessibility of signage according to the guidelines was not addressed.

Two sets of criteria were defined to analyze the data. The criteria were defined by a multidisciplinary team of experts (rehabilitation and accessibility experts, plus an architect).

The first set of criteria consisted of each specific element audited, such as slope. In other words, if the specific element in the street complied with all requirements for mobility-impaired users according to the defined standards and behaviors (as defined in the questionnaire), the element received a score of 5. However, elements received a score of 4 if some of the components did not fully comply with the standard but enabled some access. For example, the slope received a score of 4 if all components complied with the standards except, e.g., the width of the slope being less than required. This approach considered the interaction between the individual and the environment as well as possible combinations and variations between the different elements of the design.

The second set of criteria defined the overall accessibility of the street. The overall weighted grade was computed based on all the different elements, using the grades of each element determined by the first set of criteria. The relative importance of each element and the connection between elements were considered in the definition of the criteria. If all the elements at the street complied with all defined requirements, the street received a score of 5. However, if most of the relevant elements received a score of 5 or 4, but one element scored 3, then the total score was 3. As such, the system is flexible, and the criteria can be further developed and refined.

Results

Once the two sets of criteria were defined, all streets and alleys of the Old City of Jerusalem were graded accordingly. A decision was made to start work on the streets that graded at least 3 on the surface criterion (see Fig. 16.5).

Yet, in addition to decisions based on the use of the grading system, some other components had to be considered and dealt with before any recommendations or upgrading could be implemented, such as public versus private land ownership. The assumption is incorrect that all public areas, such as streets, alleys, and squares, are public properties and everything beyond the entrance gate or door is private property in the Old City of Jerusalem. Inner dead-end alleys are semiprivate property, welcoming only local community members. In other cases, streets are owned by the church (see Fig. 16.6).

Among the 10 million visitors per year there are people who attend the Old City daily for work, trade, or school. These people can be considered residents, even if they do not live in the Old City physically. However, a great number of visitors are tourists. Therefore, to some extent, the 35,000 residents can be imagined as living in an open museum. This can create tension for the residents who wish to live a quiet and peaceful life and who view curious tourists as intruders.

The main decision to be made was whether to give higher priority to the residents' needs or to those of the visitors, as these two do not always coincide. The main reasons to give priority to the residents' needs were to

- Improve quality of life
- Advance social justice

FIGURE 16.5 Via Dolorosa, with original Roman pavement in situ. A section of the Via Dolorosa is paved with original large Roman stone tiles and is combined with much smaller stone tiles of the twentieth century. Pedestrians, carts, and wagons use the pavement intensively on a daily basis.

Long description: This photo shows pedestrians walking in a market street about 300 cm wide. The street is paved with large original Roman limestone tiles, uneven but smooth. The impressive original Roman pavement (measured as 300/200 cm) serves as an integral part of the twentieth-century limestone pavement. This section of the market street is challenging for pedestrians with mobility disabilities, who find it hard to cope with the uneven surface. On the right, dresses hang for sale in front of a shop, with an open kiosk and two customers seated at an outdoor table. On the left, a cart is being pushed.

- Involve residents in planning and implementation
- Influence political positions and enhance dialogue between hostile parties

Favoring the visitors, on the other hand,

- Increases the possibility for people from all religions to visit the holy sites
- Increases income and encourages the residents to develop new tourism-related businesses
- Improves the image of the Old City and public relations in the world

After much struggle with the problem, the planning team, with the input of policy makers, concluded that each priority area has some balance between the needs of the residents and those of the tourists, with emphasis placed on residents' welfare. Priorities were based on

- Access leading to schools, especially special education schools
- Access leading to local public services
- Access leading to meaningful Islamic, Christian, and Judaic religious sites

This decision created momentum for resident participation, despite density, distrust, costs, and other factors.

FIGURE 16.6 Semiprivate residential dead-end alley. A typical inner residential alley demonstrates different styles, sizes, angles, and directions of staircases in one street, all serving private residential compounds.

Long description: This photo shows a dead-end residential alley meandering up the hill. In front, the alley is evenly paved by stone tiles. From that point onward, a main wide, curved staircase leads the way. A secondary, much steeper staircase attached to the left façade, constructed of 12 steps with a handrail on one side, leads to the door of a residence. A secondary staircase of five steps with no handrail leads to another door in the same façade. On the right façade, a door opens to the alley. The semipublic stairway ends with an arched entrance to a private residence.

16.7 IMPLEMENTATION

A feasibility study for the upgrading of the old city, including the accessibility for people with mobility impairments, was the next step. Four different areas meeting the aforementioned criteria were chosen for the pilot phase of the project. At present, the actual implementation is being planned by the designers.

The first step will be to improve the existing amenities for pedestrians in the streets within the chosen areas, which scored at least 3 on the surface item. This includes repairing stairs, adding handrails, adding signage, and providing resting places. The goal was to make a strong impact with as little disruption to residents' daily lives as possible (see Fig. 16.7).

FIGURE 16.7 Renovated, noncommercial public street. One of the accessible streets transitions into a modified stair. Most accessible streets are not connected to one another in an accessible way.

Long description: This photo shows a clean, recently renovated noncommercial street. In the photo the street is level, 240 cm wide, paved with limestone tiles. The left façade combines old stone walls with newer ones, behind which is a monastery. The right stone façade belongs to a private community compound. The street is divided in two parts by a neoclassical arch. Behind the arch, the street ends with stairs going down the hill. This street is very usable, but is isolated due to the stair at the end.

16.8 PUBLIC TRANSPORTATION

As an element of upgrading mobility, public transportation was also considered. As of 1931 there was only one minibus line, which enters the Old City and runs on a relatively short route along the southern wall. The goal was to develop effective public transportation that connects to the main attractions. That way, transportation can increase the accessibility of the Old City for all, including users of personal mobility devices. Although other transportation ideas were suggested, the feasibility of internal public transportation has yet to be examined.

16.9 CONCLUSIONS AND RECOMMENDATIONS

This chapter clarified the need for an audit tool and data analysis criteria to provide consistent, reliable, and objective information when planning according to universal design principles in old cities and heritage sites. The criteria used to assess accessibility were defined based on the interaction between disability and environment, as well as on possible variations of accessible design. The data analysis tool provided reliable, unbiased results.

The described pilot decision support system is based on universal values. It is expected that the tool can be adapted to audit old cities anywhere, in preparation for upgrading accessibility. Research is recommended to test the system's usefulness in countries other than Israel and to refine the criteria used for purposes of future evaluations.

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PUBLIC SPACES, PRIVATE SPACES, PRODUCTS, AND TECHNOLOGIES

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SECTION 1

PUBLIC SPACES

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CHAPTER 17
CREATING AN ACCESSIBLE PUBLIC REALM

Sandra Manley

17.1 INTRODUCTION

A young woman with a baby stroller walks along slowly. The small child accompanying her makes some of his first exploratory journeys away from his mother in a game of hide and seek. An elderly woman, after admiring the baby, walks slowly with the aid of a stick toward her garden to tend to her plants. Two boys whiz past on their bikes while two people chatting look on benignly. Is the scene described taking place in a safe public park or in a private space? The answer is that it is a public highway in a city in the southwest of England, in a street that is also used by vehicles. This is only possible because people take precedence over vehicles in this historic street; the car is tamed. Why is it that this simple scene where people can walk, play, and socialize in the public street is not an everyday experience in many urban realms?

The answer is that streets are not for people but for traffic. Surely everyone deserves safe, accessible, and pleasant streets as a basic human right. Indeed such streets are essential for a healthy society and the freedom of all citizens.

Everyone's freedom is limited by poor street environments, but disabled people are particularly disadvantaged. An individual's chance to participate in mainstream community life may be severely reduced. There has been some excellent progress in the United States, United Kingdom, and many other countries in legislating for improved human rights for disabled people, but reducing environment-related discrimination is centered on buildings and not streets. Any disabled person, or indeed any parent who has tried to make a crosstown journey with a baby stroller, will testify to the truth of this statement and explain that inaccessible streets lead to inaccessible buildings and thus to associated inequalities (Goldsmith, 1963; Goldman, 1983; Manley, 1996). One possible reason for this emphasis is that to right this wrong, public money would have to be spent. Inaccessible streets are perceived to be a minority issue, so the political will to make changes is normally in short supply and even more constrained by the current economic situation and global recession. It is surely time to abandon the idea that issues associated with good accessibility are only a minority interest. Everyone is affected.

17.2 DISABLING STREETS—DISABLING SOCIETY

The automobile is the main reason for the disabling nature of the public realm. The car brought freedom to travel for many people, but at the tremendous cost of restricting other freedoms. It has been allowed to dominate public space to such an extent that safety measures channel the pedestrian into

FIGURE 17.1 Too many bollards and street furniture in this secondary street are aesthetically displeasing, but they also restrict movement and create irritating or even dangerous obstructions for parents with strollers and for disabled people.

Long description: This photograph shows a secondary shopping street in southwest England where people are walking, carrying shopping bags, or strolling along the street. Shops front the highway, which is a shared street for pedestrians, cyclists, and traffic. Various types of street furniture can be seen in the photograph, including lamp columns, traffic lights, and metal seating. The most significant aspect of the scene portrayed is the large number of cast iron bollards in the photograph. It is possible to count about 35 bollards in the scene, and even more disappear into the distance. Individually the bollards, which are of a traditional design, are quite acceptable, but there are so many of them that they make the street look cluttered; they are also a potential hazard for people with visual impairments who may walk into the bollards accidentally. The spacing of the bollards makes it difficult for people with wheelchairs, baby strollers, or large shopping bags to cross the street without encountering obstructions.

enclosures that restrict freedom of movement and effectively deny access for those who cannot keep up the pace. Pedestrians often require the ability to sprint across traffic lanes and negotiate high curbs or obstructions caused by traffic-related paraphernalia, which is described, rather inappropriately, as “street furniture” by highway engineers (see Fig. 17.1).

Furthermore, the layout of streets in many cities and neighborhoods has been planned for the motor vehicle. As such, pedestrian routes are circuitous and illegible and ignore the routes that people on foot want to take. The lack of permeability that results from the proliferation of culs-de-sac in residential areas is a typical example of a situation where the pedestrian’s needs are low priority.

Poor-quality street environments have contributed to the increased use of motor vehicles for short journeys with the associated environmental consequences of air pollution and global warming. Driving, instead of walking, for local journeys may even affect people’s physical and mental health. Increased levels of obesity, not just in adults, but among children, is a particular concern (Ogden et al., 2008; Department of Health, 2008), but the diminution of the scope to socialize, particularly in aging societies, where increasing numbers of people live alone, is a worrying development and may even be a contributory factor to rising levels of mental health problems amongst the population of countries such as the United States and United Kingdom.

Children are particularly affected by poor street environments through the reduction in opportunity for exploration and play well outside the direct control of adults. The behavior change for children may be an adult-imposed limitation of opportunities so that children only experience the organized play scheme or orchestrated adult-centered social interaction. This takes the place of unrestricted play and more adventurous situations that mold character and develop intelligence as well as enhance enjoyment. Furthermore, if fewer people use the street because of its inaccessible or undesirable nature, the scope for antisocial behavior and fear for the personal safety of children become an even greater issue, and the problems of alienation outlined in Jane Jacobs' seminal work on the city multiply (Jacobs, 1961).

The car is not the only culprit in the proliferation of barriers to public access to the street. The rise in crime and, perhaps more important, the rise in the fear of crime means that many people are afraid to use streets, particularly in town centers and after dark (Lee and Farrall, 2009). The increasing attractiveness of the sanitized shopping mall, which appears to be a safer and more acceptable place to be than the traditional street, is not unrelated to the fact that the street is perceived as dangerous. The exclusion of "undesirable" people and the removal of risks associated with traffic conflicts make the shopping mall appear to be a safer and more pleasing experience. This sense of security may well be false, and there are obvious concerns that the screening out of "undesirable" people by security guards has worrying connotations about the rights of individuals and the moral implications of making judgments about a person's acceptability to the rest of society.

Fear of danger is particularly apparent after dark, when many women, and an increasing number of older men, simply decide to stay at home rather than risk encountering antisocial behavior. People's fears and worries in public places have been exacerbated through the threat of terrorism following the September 11, 2001, attack in New York and more recent atrocities. This adds yet another dimension to the scope to reduce the accessibility of the public realm, particularly in crowded places as designers, encouraged by governments (West, 2007), seek ways of limiting access for would-be terrorists. Attempts to prevent vehicles loaded with bombs from entering public spaces may unwittingly have the result of restricting public access even more. In the worst-case scenario the development of a fortress mentality could be the outcome. This seems to go against the idea that terrorist activity by a few should not destroy the way of life of law-abiding people everywhere.

17.3 ACCESS FOR ALL: MOVING TOWARD A UNIVERSAL APPROACH

The rather bleak picture of the disabling built environment described implies that there is an urgent need for a more proactive stance to bring about change. To achieve change, it is necessary to recognize that society has a responsibility to remove barriers; it requires a paradigm shift (Goldsmith, 1997). This shift will only be achieved if it is recognized that disabled people are not the only ones who are disadvantaged by disabling environments.

The seven Principles of Universal Design can be applied at the scale of the street—or indeed the city as a whole—as well as to the scale of buildings and products (Manley, 2001). Indeed, this is essential if equality of opportunity for everyone is to be achieved. People need to be able to travel unhindered to their intended destination. To achieve this, the journey needs to be considered as a series of links—each one of which must be accessible. In Chap. 19, "Universal Design in Mass Transportation," Steinfeld details the concept of the *travel chain.*

Creating seamless journeys from people's homes to accessible transport facilities via barrier-free pedestrian routes and on to the final destination needs to be considered strategically in order to create a more accessible urban realm. Improving the accessibility of existing streets is crucial to this process but is often ignored, possibly because of lack of concrete evidence of the problems.

One method of raising awareness of the sheer number of barriers in public spaces is to carry out systematic street audits to measure the extent to which the public spaces of cities meet the criteria for a good street, as shown in Fig. 17.2. This method has proved useful in towns and cities in the west of England as it provides some quantifiable evidence of the existence of the problem.

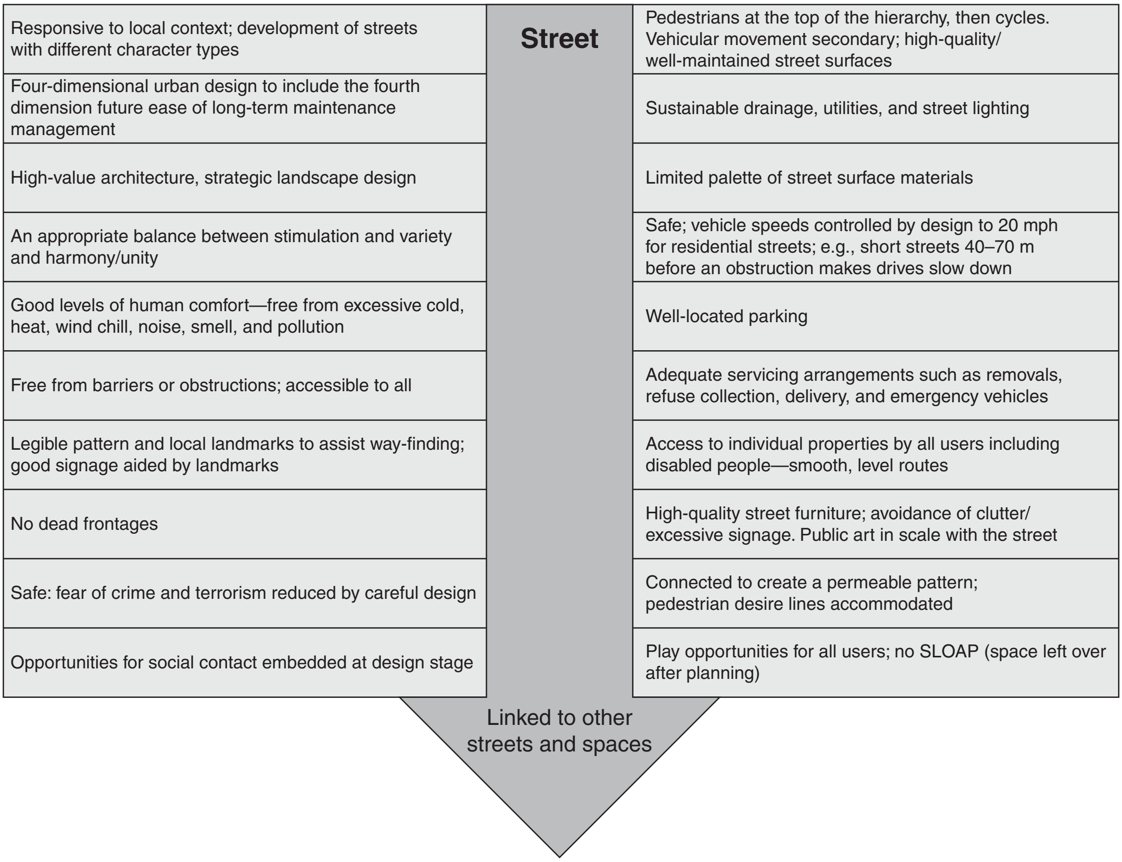

FIGURE 17.2 What makes a good street?

Long description: A large arrow is flanked by a column on both sides. The arrow represents a street. At the head of the arrow the text indicates that an important aspect of street design is that streets should be linked together to create a network of streets and spaces that enable easy movement for pedestrians, and following the routes that pedestrians want to take.

17.4 STREET AUDITS: THE TAUNTON CASE STUDY

A street audit is a systematic survey of an area, designed to record all the barriers to access and use. This means recording all the physical obstructions to free movement, but also noting the less obvious barriers that limit access to the street—barriers created by the fear of crime or isolation, alienating surroundings, and areas that are simply unpleasant.

The Taunton street audit involved a comprehensive study of the key pedestrian routes in the town to identify problems. Following attendance at training sessions, the auditors, who were made up of mixed teams of students and disabled people, surveyed the routes allocated to them and noted every barrier to pedestrian movement. A simplified version of the matters that auditors noted is given in Table 17.1.

A cycling audit and street interviews were also carried out. Discussions, which focused on matters that were more difficult to quantify than the more obvious physical obstructions, were held with the members of local groups, such as a cycling club, the visitors to an elderly persons' drop-in center, and town center visitors. It was considered essential to obtain the views of as many people as possible to ensure that people of different genders, ages, races, and cultural perceptions and abilities

TABLE 17.1 Access Audit Checklist*

Physical (Quantitative) Indicators Qualitative Indicators	Qualitative Indicators
Curb barrier	Lighting
No dropped curb/curb cut	Insufficient after-dark lighting
Poorly aligned dropped curb/curb cut	Lighting targeted to road users
Steps barrier	Disorientation
No alternative route via ramp	Paths not following desired lines
Steps poorly constructed	Lack of clear structure to route—illegible
Insufficient demarcation of steps	Signage confusion
Inadequate handrail	
Slopes or ramps	Threatening area
Too steep	Fringe area—potential for ambush
Adverse camber	Potential threats from certain groups
Surface conditions	Blank alienating walls/no active frontage
Poorly maintained—damaged	Dead ends—no perceived escape route
Slippery—at all times or in certain weather conditions	Dangerous corners
	Overgrown vegetation
Narrow pavement or sidewalk	
Insufficient width for traffic volume	
Insufficient width for wheelchairs, etc.	
Danger from vehicles	Uncomfortable area
No safe crossing places	Exposed/cold
Crossing places inadequate	Excessive heat and lack of shade
No tactile warnings	
Lack of safety barrier or other hazard	No activities/stimulation
Doors, gates, or other boundaries	Boring environment
Difficult to close/open	No sensory or visual delight
Too narrow to negotiate	Lack of color/interest
Eye-level hazard	
Overhanging vegetation/building, etc.	Public perception of the quality and value of a place affected by multiple factors associated with standards of maintenance/street cleaning, littering, and general ambience
Street furniture	
Inadequate size, location, or design	
Insufficient or poorly designed (e.g., seating)	
Poorly sited, causing obstruction	
Excessive use	
Incidence of litter	
Excessive litter	
Excessive fouling by dogs	
Streets not cleared of leaves, snow, or standing surface water	

were taken into account. The results of this process were finally presented to the local authority, and they were used to frame the work for public realm improvements. Not surprisingly, numerous problems were noted, and the attitude survey revealed widespread dissatisfaction with street quality.

An audit cannot solve the problems in the public realm, but it can have a number of benefits. First, it can raise public awareness of the problem of the inaccessible nature of streets. Second, it can draw the attention of local government organizations to the fact that the rights of disabled people must be considered at the scale of the street, neighborhood, and city, as well as individual buildings or service provision and thus contribute to policy formulation. Third, it can draw attention to the way in which different groups of people are affected by barriers, e.g., people with different types of impairment, women, children, and elderly people. Fourth, it can provide quantifiable evidence that can be compared from area to area and over time to determine whether improvement has taken place. Fifth, it can cross professional boundaries by addressing the street in a holistic way and drawing the attention of a wide range of professionals whose work impinges on the accessibility of the public realm to access issues. Sixth, it can draw attention to the scope for improvements to streets that can be carried out on an incremental basis, e.g., minor changes that can be undertaken for minimal cost when business premises are refurbished or street works undertaken. Seventh, it can provide a basis for the production of a prioritized action plan to remove barriers based on a rolling program of works. Eighth, it can provide a basis for bids for funding from a variety of sources. Ninth, it can enable the publication of access maps to indicate accessible routes and premises. Tenth, it can be of educational value and empower people to take responsibility for making changes.

Although audits are not a panacea for solving the inaccessible nature of streets, they can reinforce the importance of inclusive access as a central part of the design process, and they have particular value as a pedagogic process both for students at the beginning of their training and for midcareer professionals, and even business owners who may not realize the impact of inaccessible streets on economic viability.

17.5 CONCLUSIONS

There are some major challenges associated with changing attitudes toward the design and management of the public realm to achieve accessible streets. Fundamentally, the professional bodies that accredit the educational programs for built environment professionals need to ensure that the curriculum for courses embeds universal design as a mainstream consideration, as advocated by Lifchez, (1987), Welch (1995), and others. The Royal Institute of British Architects (RIBA) has taken some steps in this direction by appointing an Inclusive Design Committee to raise awareness and produce educational materials (RIBA, 2009), and it has recently launched research designed to find ways of supporting disabled architects and students.

There are several key challenges. The first is that the Principles of Universal Design need to be embraced by urban design and planning policies for new development. To achieve this, it would be necessary for governments to reconsider the way in which new neighborhood planning is undertaken, possibly by rethinking the nature of the process of achieving permission for new development schemes to secure greater public involvement. Perhaps the message for governments and the development industry is that when a new area is developed, and before the plan is allowed to proceed, developers should be required to demonstrate how the scheme enhances quality of life and both social as well as environmental sustainability. The new interest in streets for people that is central to the U.K. publication *Manual for Streets* (Department for Transport, 2007) is a welcome advance. This is supplemented by a new provision that requires developers to submit a design and access statement as part of planning applications for new development (Department of Communities and Local Government, 2006). This requirement has the potential to be a useful tool as the designer must explain his or her philosophical standpoint in relation to design and accessibility. Sadly, this measure may be treated as just another box to check off unless local authorities know the right questions to ask and are adequately trained to understand the nature of the statement.

The second significant point is that when existing streets are redesigned to reduce traffic speeds and achieve more livable environments (see Fig. 17.3), the need to secure good access for everyone

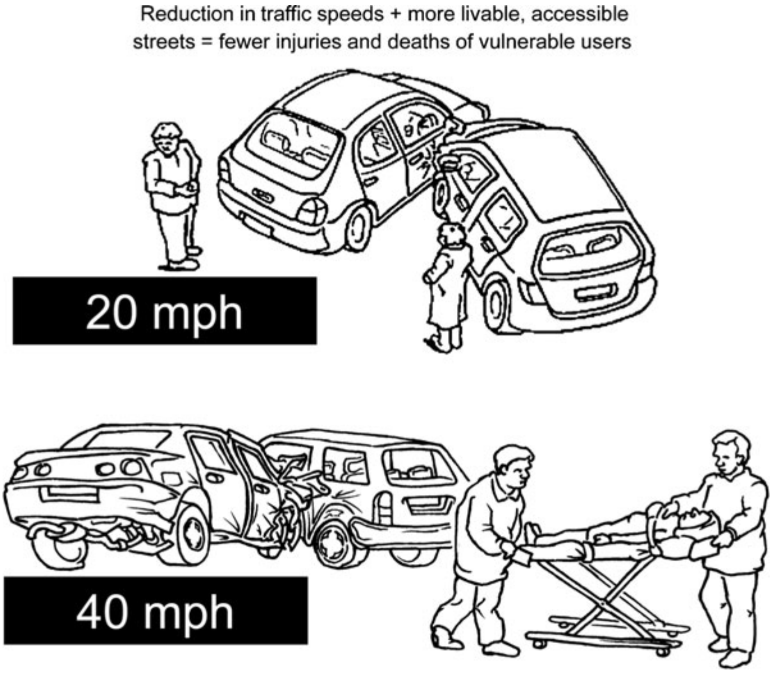

FIGURE 17.3 Create livable streets.

Long description: In this illustration there are two cartoons. The first shows an accident that has taken place at vehicle speeds of 20 mph. The drivers are standing by their crumpled cars looking cross, but nobody is hurt. In the second cartoon the accident has taken place with vehicle speeds of 40 mph. Again the cars are crumpled, but this time medical workers are wheeling the accident victim off to a hospital. The cartoon makes the point that reducing traffic speeds and making more livable streets would be beneficial for everyone by reducing accidents and even deaths.

must be at the heart of the design process. The interest in retrofitting to create livable streets is to be welcomed, but the pursuit of shared surfaces, where pedestrians, motorists, and cyclists make eye contact to establish who has priority, must be viewed with caution. The traditional vocabulary of the street with clear demarcation between people and vehicles is universally understood. Departing from this can place blind and partially sighted people at risk; and children, people with learning difficulties, and others who find it hard to communicate or make judgments may be frightened by the streets (Commission for Architecture and the Built Environment, 2008; Guide Dogs for the Blind Association, 2006). In the United Kingdom, home zones or the DIY (do-it-yourself) streets introduced by Sustrans (2009), which encourage local people to take up the challenge to improve streets themselves, are interesting initiatives, but in most examples of innovative street design, universal principles are not at the heart of the design process.

Finally, the management of existing streets and public spaces needs to be reconsidered. The fact that in many countries the responsibility for streets and public spaces is fragmented and no one body has a sense of ownership of the street exacerbates the problem. The task may appear so overwhelming that it is constantly sidelined. In consequence, the limitation on movement for disabled people caused by the inaccessible nature of streets is a daily frustration and may even prevent some people from leaving their homes altogether. Meanwhile, everyone suffers from the fact that the street environment is not working.

However, it is important to recognize that in the 1970s the battle to improve access to individual buildings seemed to be an overwhelming task. Although this battle is far from over, it is evident that great strides have been made.

The next major task for universal design is to take up the challenge of the inaccessible nature of the street environment and focus attention on the need to ensure that everyone has access to the streets, spaces, parks, and sidewalks that make up the public realm.

Worldwide concern about the increased use of motor vehicles and the undesirable environmental and health effects makes this an opportune moment to try to reclaim the streets for people and encourage walking by creating good-quality street environments that everyone can enjoy. Without this, individual freedom becomes meaningless for many people.

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CHAPTER 18
A CAPITAL PLANNING APPROACH TO ADA IMPLEMENTATION IN PUBLIC EDUCATIONAL INSTITUTIONS

John P. Petronis and Robert W. Robie

18.1 INTRODUCTION

The United States has been gradually moving toward integrating everyone, regardless of physical ability, into all aspects of the built environment, including education. As a result, public educational institutions—elementary, secondary, and higher education—are challenged with making learning environments supportive for all students, regardless of their learning or physical abilities. Meeting this challenge in the real world is often burdened with confusion about regulations, threats of litigation, and the need to balance accessibility funding with other capital needs. This chapter describes a proactive process for a state university in the United States to identify and correct accessibility obstacles for all university users.

18.2 BACKGROUND: REGULATORY CONTEXT

In 1973, the federal government passed Section 504 of the Rehabilitation Act which prohibited discrimination in programs that received federal funding. Since most educational institutions receive federal funding, they were, and still are, subject to this law. Federal guidelines for accessibility in schools were promulgated in 1977, and this law was a major impetus for creating design guidelines and modifications to local building codes to accommodate the needs of people with disabilities.

Since 1977, Section 502 of the law initially adopted the American National Standards Institute (ANSI) Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People (A117.1-1980). In 1984, the Architectural and Transportation Barriers Compliance Board (ATBCB) adopted the Uniform Federal Accessibility Standards (UFAS) to be used in all federally funded construction projects. The standards were amended several times; also new elements relating to accessibility for children and for play areas were added in 1998 and 2000, respectively. The Americans with Disabilities Act (ADA) of 1990 laid the groundwork for the current group of regulations. In addition to UFAS and ANSI, the Americans with Disabilities Act Accessibility Guidelines (ADAAG) were created by the U.S. Department of Justice and revised in 2004. Under the ADA, state and local governments could choose which standard or combinations of standards to use.

In addition to the ADA Standards for Accessible Design, state and local governments could use the UFAS, ADAAG, or the modified ICC/ANSI A117.1-2003. Many state and local governments adopted regulations based on federal standards. For example, New Mexico adopted parts of the ADAAG, ANSI A117.1 (2003), and the UFAS to clarify design issues relating to needs of young students with profound disabilities, funding sources, and the status of private versus public ownership.*

Meeting the access requirements of students, staff, and visitors with disabilities presents planning challenges to educational institutions that ultimately result in making a variety of physical improvements. Most educational institutions have more capital needs than can be funded from available revenue. Allocating large sums to accessibility issues may prevent funding for other projects. Failure to comply with federal and local accessibility regulations, however, can expose the institution to litigation, accreditation issues, and compliance problems with state and local building codes.

18.3 ACCESSIBILITY ISSUES FACING EDUCATIONAL INSTITUTIONS

Educational institutions face many issues when seeking to comply with accessibility requirements. Issues include the following:

- *Status of the existing facility inventory*. Educational institutions generally manage a range of facilities. Many institutions built new facilities in the 1960s and 1970s to accommodate the baby boomer generation. These facilities were constructed prior to the general integration of accessibility requirements into local building codes. While some of these sites and facilities may be relatively easy to modify, most require extensive and costly changes.
- *Balancing capital needs.* Educational institutions must keep investing in their facilities to accommodate growing enrollments, meet evolving educational requirements, respond to changing codes, and renew building systems and sites as they age. There are always more improvements to be made in educational facilities than funding can match. Since the ADA is a federal mandate that establishes requirements but provides no money to implement these requirements, accessibility projects must compete for funding with other capital needs (e.g., new science buildings, roofing, and renovation of older schools). (See Fig. 18.1.)
- *Transition planning.* If educational institutions accept federal funding, they are required to develop a transition plan that identifies how they will comply with federal accessibility laws. The transition plan identifies program and facility deficiencies and how the institution will rectify the deficiencies. While institutions face liability risks if they do not comply with the law, the transition plan also provides the opportunity for an institution to think comprehensively about accessibility requirements and how they integrate with both long-range educational program and facility needs.

In summary, the questions facing public educational institutions include these:

- What architectural barriers do staff, students, and visitors with disabilities confront while at the institution?
- Are there means to meet the accessibility intent of the law without physical modifications to facilities, programs, or staffing?
- How can the institution best develop an implementation strategy that balances the capital funding needs of accessibility compliance and general facility improvement?

*There is a new body of regulations in review currently from the United States Access Board that will replace UFAS entitled Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines draft 2004 (or ABA regulations) for federally funded projects. In addition, the Individuals with Disabilities Education Act (IDEA) is a U.S. federal law significantly updated in 2004 that governs how states and public agencies provide early intervention, special education, and related services to children with disabilities. It addresses the educational needs of children with disabilities from birth to the age of 21.

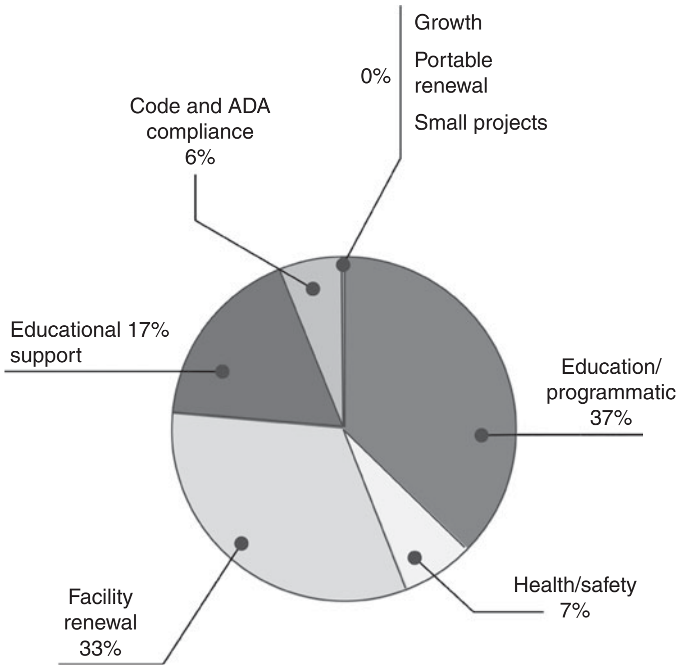

FIGURE 18.1 This chart shows that addressing accessibility requirements (building code and ADA) is a relatively small part of a total capital improvement program of a typical educational institution.

Long description: This pie chart shows that code and ADA compliance represents 6 percent of the total capital budget of the 90,000-student Albuquerque Public Schools District in Albuquerque, New Mexico. Other categories are education/programmatic, 37 percent; health and safety, 7 percent; facility renewal, 33 percent; and educational support, 17 percent.

18.4 COMPLIANCE PLANNING PROCESS

The authors have assisted a number of school districts and institutions of higher education in accessibility compliance planning, using a five-step process. A representative committee made up of educators, administrators, public representatives, and design professionals generally helps to guide the process for the client. (See Fig. 18.2.)

Step 1. *Organize for planning.* During this step, existing data are collected and assessed, questionnaires are distributed, information about the facilities and sites is collected, and schedules are established. A kickoff meeting is held to introduce all participants, clarify deliverable services, and discuss the goals, schedule, security requirements, and expectations for the project.

Step 2. *Identify target budget for compliance*. During this step, the client establishes a target budget for compliance based on an assessment of the scope of work and availability of funds. For example, a school district may limit the number of sites for comprehensive modifications to locations where they provide centralized services for students with disabilities. On the other hand, a university with open enrollment may choose to make accessible all buildings serving students, staff, or visitors (educational or administrative).

Step 3. *Assess the sites and facilities for needs*. A detailed evaluation of each site and facility is performed during this step. An elementary school usually takes one day, and a secondary school

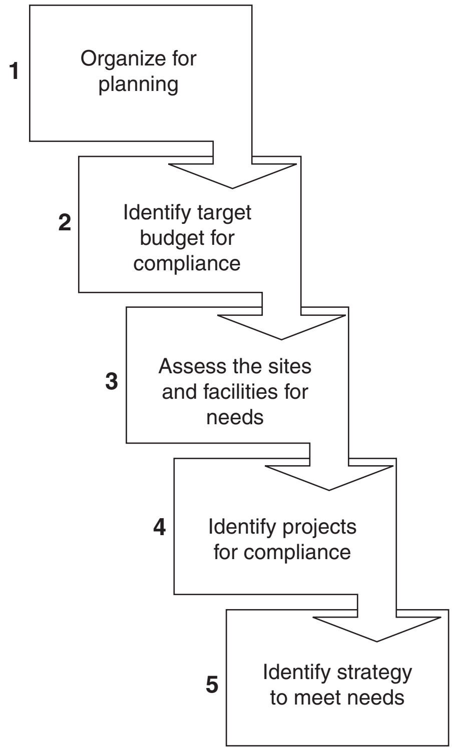

FIGURE 18.2 Five-step compliance planning process diagram.

Long description: This diagram shows that planning for compliance is a five-step, sequential process that progresses through planning organization, compliance budgeting, site and facilities needs assessment, action identification, and implementation strategy development.

may require two to four days to evaluate. The time required to evaluate a higher education institution depends on the number and size of the buildings on campus. Large structures can take up to three days to assess. Residential structures add another level of complexity, due to issues of access availability and privacy.

Step 4. *Identify projects for compliance.* This step identifies specific projects and associated costs to rectify any accessibility deficiencies. Often, further discussion with district educators is required to understand the spatial requirements of the educational programs that need to be met by the proposed solution.

Step 5. *Identify strategy to meet needs.* During this step, specific guidelines for each aspect of the project (step 4) are described. Timing of need, ability to accomplish, and potential funding sources are determined in this step.

18.5 CASE STUDY: NEW MEXICO STATE UNIVERSITY ACCESSIBILITY SURVEY, 2004

Planning Context

An illustrative example of the five-step process described above is the New Mexico State University accessibility survey. New Mexico State University (NMSU) is a medium-sized state university located in Las Cruces, New Mexico, with an enrollment of about 17,000 students. The accessibility survey was limited to its main campus, excluding the surrounding student residence areas and remote branch campuses. The campus comprised about 88 acres with 156 buildings (average age of

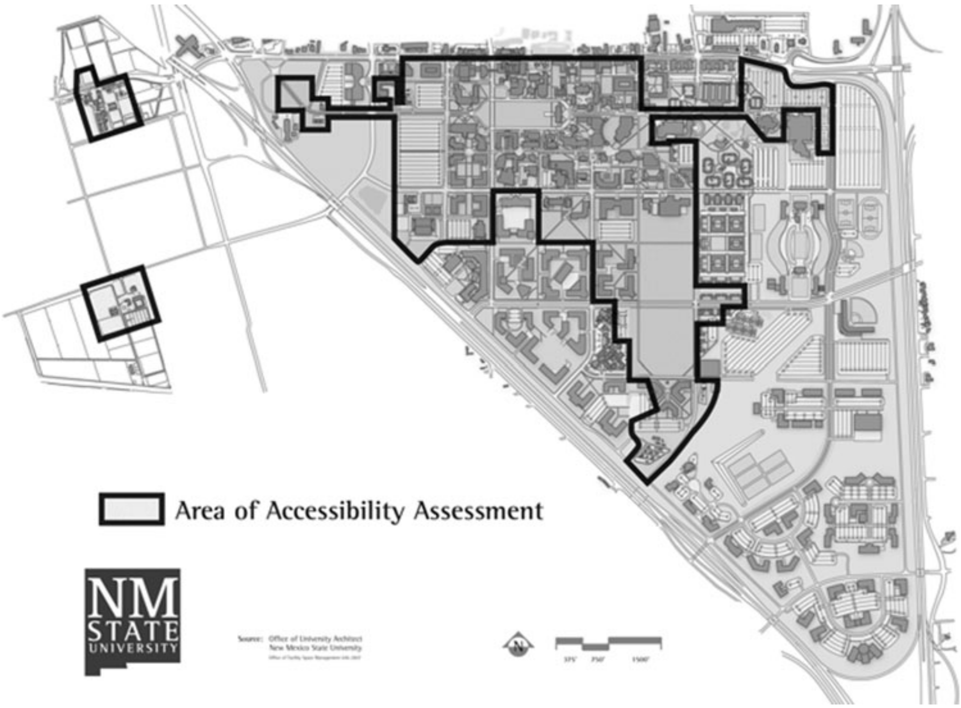

FIGURE 18.3 Map of New Mexico State University main campus. The area surveyed for accessibility is outlined in gray.

Long description: This map shows the area of the main New Mexico State University campus that was surveyed for accessibility (outlined in gray). Within the area, 156 buildings and all the pedestrian pathways were assessed.

36 years) totaling 2.9 million square feet (see Fig. 18.3). The university desired to update its transition plan and provide a proactive means to address accessibility obstacles for all university users.

Planning Steps

Step 1. *Organize for planning*. The university contracted with Architectural Research Consultants, Inc. (ARC) to conduct a campuswide accessibility survey. The goal was to characterize and estimate the cost to correct all physical accessibility issues for campus buildings and public walks that can be feasibly addressed. Specific objectives were to

- Identify the noncompliant accessibility features of buildings and site routes.
- Revise the map of existing accessibility pathways.
- Identify, categorize, and prioritize corrections of the noncompliant features.
- Provide a means to track the status of projects or their completion as funding becomes available.

The university architect and an accessibility oversight committee would use the survey information.

ARC employed upper-level students from the university's College of Engineering to conduct fieldwork. ARC architects provided training, supervision, and quality control. ARC also hired three students with disabilities (two mobility-impaired and a blind student) to assist in the training, answer questions, and provide advice on how to correct difficult accessibility issues. The participation of the students proved to be invaluable in securing funding for the study and for its implementation.

Step 2. *Identify target budget for compliance.* The university determined that all buildings with public access, including the exterior pathways between buildings, were to be surveyed for accessibility. This compliance target required identifying all accessibility obstructions that a student, staff member, or visitor might encounter while entering campus by foot, car, or bus and then traveling to any office or classroom destination.

Step 3. *Assess the sites and facilities for needs.* Detailed training materials were prepared, including an eight-page ADA checklist modified for a universal design emphasis (see Fig. 18.4). Part of the student evaluator training incorporated wheelchair "tours" and shadowing wheelchair and blind students as they moved about the campus. The evaluators assessed each building, taking extensive field notes and photographs to document problem areas. All accessible routes and the potential for new pathways were identified. Evaluators used survey equipment to map elevation changes along exterior pathways to verify acceptable slopes.

Building (As Needed) | YES | N/A | NO | NUMBER OF: | Notes or quantity to estimate

1.0 TRAFFIC DIRECTIONAL SIGNS (Section 703, pp 56)

a Are there site signs at all entrances to parking areas with ADA parking?
Or are the ADA parking signs easily visible from the traffic areas?
b How many site signs are needed to direct one to ADA parking?
c Is the building easily identified from the traffic ways?
Where is the sign located?
d Are there signs that provide information about and direction to buildings, e.g. does the general area have a Site Map with building list?

2.0 PARKING: (Chapter 5, pp 33-38)

a Number of parking choices for this building? (Street, Lot, Drive, Garage, etc)
b How many ADA spaces exist? Lot #/Street Total Spaces Total ADA Spaces
Parking lot?
See NMAC pp 62 for chart. Does # WC spaces in lots comply?
Parking lot?
See NMAC pp 62 for chart. Does # WC spaces in lots comply?
Curb side on traffic way?

2.1 PARKING SPACES:

a Do existing handicap spaces meet requirements (minimum of 96" wide with a 60" access aisle)? (pp 33 & 34)
b Are there any van accessible spaces with 96" side aisle? (pp 34)
c Do the parking spaces have appropriate signage with pictograph?
Number missing?
Are the spaces painted to standards? Note number of any not painted.
Are there van space signs below the normal pictograph sign?

2.2 PASSENGER LOADING ZONE: (Figure 503.3, pp 34)

a If passenger loading zone exists does it have an access aisle adjacent on the same level and parallel to the vehicle pull up space that is at least 20' x 60"?
b Does the accessible space provide a minimum vertical clearance of 114"?
c Do vehicle parking spaces and access aisle have slopes of 1:50 (2%) or less in all directions?
d If there is a curb between the access aisle and the vehicle pull-up space, are there curb ramps with slopes that comply?
e Are there changes in level greater than 1/2"?
f Are there signs designating the accessible loading zone?

NOTES: Some notes are best on the site or accessibility plans.

FIGURE 18.4 An example of a section of the accessibility evaluation checklists used at NMSU to identify capital improvement needs.

Long description: This exhibit shows part of the first page of an eight-page checklist form for assessing accessibility needs. The form includes detailed questions about elements and spaces, and areas to record answers to yes/no questions, quantity if applicable, and notes.

Step 4. *Identify projects for compliance.* Based on the field evaluation, about $16 million of capital improvement projects (CIPs) were identified and entered into a web-based computer database. The CIPs were recommendations for correcting deficiencies as well as for adding accessibility features to sites and buildings to comply with ADA requirements. Some of projects resulting from surveying the exterior pathways involved

- Replacing damaged walks
- Replacing walkways with excessive slopes
- Installing new walks, curbs, and gutters where none existed previously
- Installing shoreline strips as required for guiding canes
- Removing and relocating protruding objects and architectural barriers including parking meters, landscaping and light poles, and installation of wheel bumpers for car overhangs

Projects resulting from the assessment of interiors included modifying restrooms, door clearances, hardware, ramps, counters, signage, etc. (see Fig. 18.5).

Each CIP was coded to identify the category and type of work. Site and floor plans were marked to locate noncompliant features and were then drafted into AutoCad for ongoing reference. In addition, accessibility capital improvement projects were coded for three different accessibility factors: priority of building use, level of demand for action by students with disabilities, and level of difficulty to achieve accessibility objectives (see Fig. 18.6).

Priority of Building Use. This accessibility factor considers the intensity and type of use of the building.

- Priority1 buildings have intense use and significant student occupancy. Barrier issues include resolving access into the building, to specific programs or services offered, and to restrooms or other building services.
- Priority 2 buildings have lower use and occupancy, but exhibit a major concern for research and specific service.
- Priority 3 buildings are newer or recently remodeled; they comply with ADA regulations and need few modifications.
- Priority 4 buildings may be replaced within the next five-year period. Buildings used largely for storage or service activities are included in this priority level.

Demand for Action Level. This accessibility factor considers the urgency of the improvement based on the following criteria:

- Low: projects with no immediate demand or need and where alternatives to improvements may exist (e.g., providing a second entry into a building with an easily accessed primary entry)
- Medium: projects with a moderate demand or need (e.g., ramps that do not have proper slopes or have handrails only on one side)
- High: projects with some degree of health or safety issue with the highest degree of demand (e.g., difficult-to-use elevators, lack of areas of refuge, or lack of accessible restrooms)

Level of Difficulty to Achieve Accessibility Objectives. This accessibility factor considers the cost of achieving the accessibility objective and distinguishes between those projects that are readily affordable and those that entail great difficulty and substantial costs (see Fig. 18.7).

- Difficulty level 1: Work is readily achievable and is easy to accomplish under normal construction conditions and costs.
- Difficulty level 2: Work is more difficult to achieve and has a higher cost, often requiring special equipment or major structural or HVAC changes.
- Difficulty level 3: Work is difficult to achieve and has a high cost.

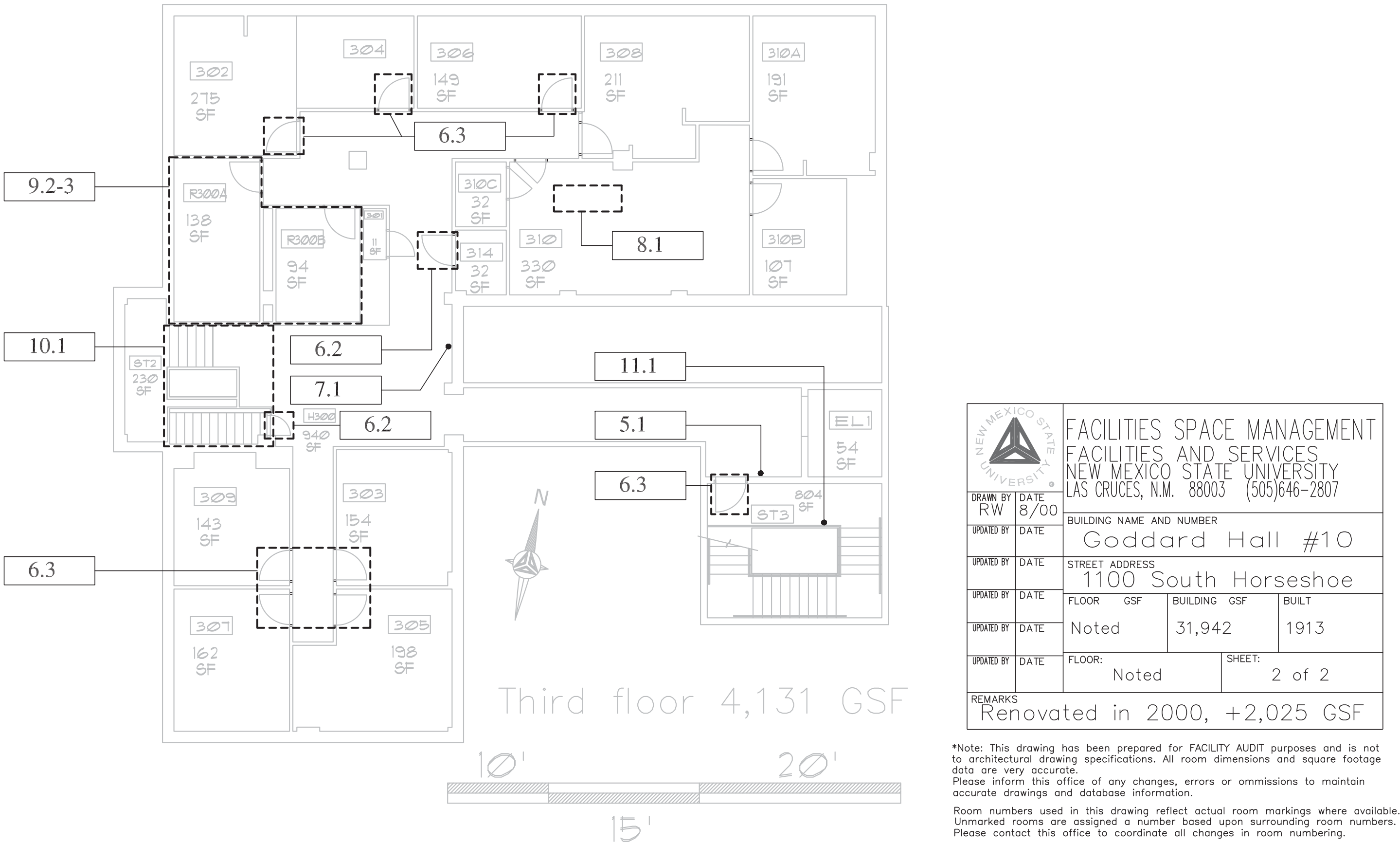

FIGURE 18.5 Example of floor plan identifying the location of noncompliant features and their project numbers.

Long description: This floor plan identifies accessibility needs in Goddard Hall, one of the main office buildings at New Mexico State University. The locations of specific projects such as doorway modifications are outlined and labeled with capital improvement project numbers. Descriptions of the project needs and costs are discussed elsewhere.

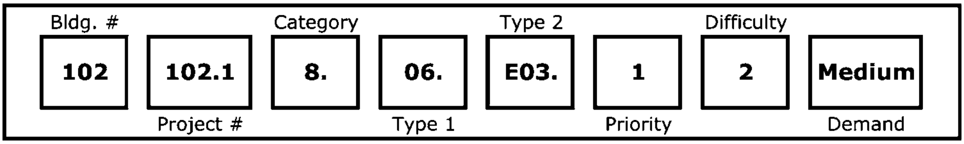

FIGURE 18.6 Capital improvement project coding scheme.

Long description: This illustration shows the project coding scheme where each accessibility deficiency is coded with a unique number comprised of its building ID number, project number, category, type of project (type 1: interior or exterior; type 2: building system that the project impacts), priority, difficulty, and level of demand for action.

Step 5. *Identify strategy to meet needs.* The university oversight committee reviewed the compliance needs and adopted a strategy that incrementally makes accessibility improvements to target buildings and establishes a process by which all users of the university community can petition to resolve immediate accessibility obstacles.

NMSU's accessibility capital plan was developed considering priority of building use, demand for action, and level of difficulty. This strategy created a list of most needed projects with the greatest student impact and completed all but the most difficult and costly.

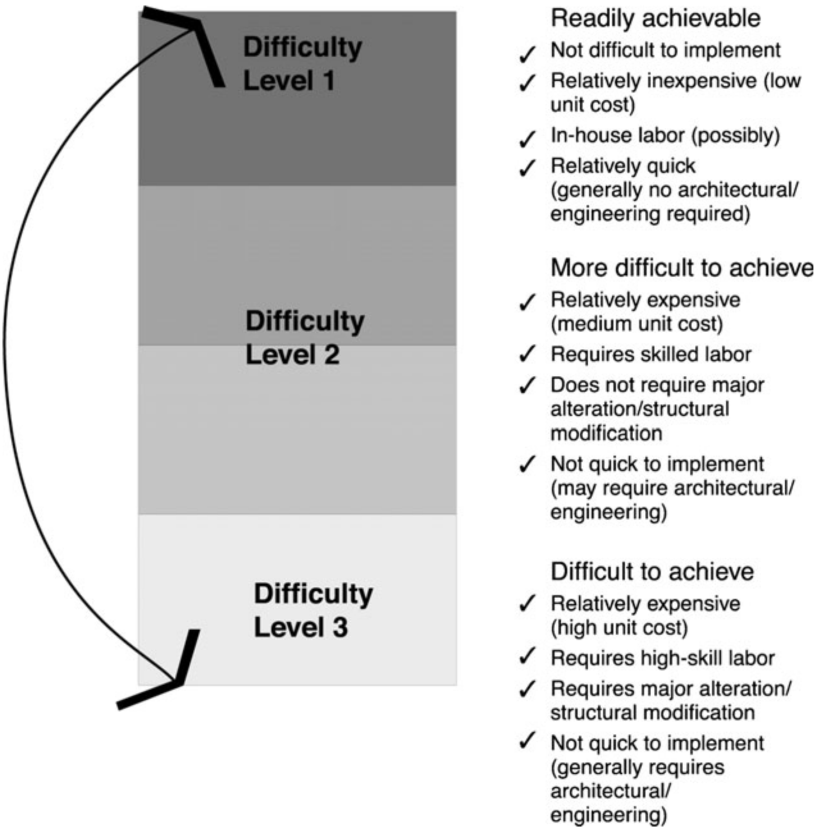

FIGURE 18.7 Illustration of three levels of project difficulty to correct an accessibility problem.

Long description: This diagram illustrates and lists three levels of difficulty for a project, from readily achievable (not difficult to implement, low-cost, in-house labor and relatively quick), to more difficult to achieve (medium cost, skilled labor, no major alterations, not quick), to difficult to achieve (high cost, highly skilled labor, major alterations, not quick).

- Fifty-four percent of the projects are related to priority 1 buildings, or buildings that have high use and occupancy by students.
- Fifty-nine percent of the projects are classified as high demand; i.e., they pose health or safety concerns to persons with disabilities, especially those in wheelchairs.
- Of the projects 26 percent are readily achievable (level 1), 33 percent are more difficult to achieve (level 2), and 41 percent will require some structural or significant site alteration (level 3).

The information collected was documented and made accessible via a web-based computer application, spreadsheet, and two-volume written document. The university plans to incorporate accessibility survey results into its ongoing capital program, making improvements as campus buildings and sites are modernized.

In addition to an accessibility capital plan, the Office of the University Architect established a flexible process whereby all members of the educational community—students, parents, staff, and visitors—can petition the committee with any accessibility issue that they believe exists. The staff investigates all petitions on a case-by-case basis. The investigation considers all potential physical and nonphysical solutions to the issue at hand and makes a final recommendation to the full committee for action.

18.6 CONCLUSION

The planning process described in this chapter serves to inform participants of the need for universal design and how the built environment can be a positive force to integrate all members of the community. Universal design principles seek optimal solutions for all users.

The authors believe that universal design is taking a more central role in accessibility compliance planning among educational institutions. As universal design solutions are implemented, educational institutions will serve to change the perceptions and expectations of what is good design for the next generation.

Accessibility compliance requires careful planning, with active communication between district or university staff and the building users, to ensure accurate data are presented. The authors' experiences show that accessibility planning can be integrated with other capital planning activities in a systematic and equitable way. By establishing priorities and targeting achievable goals, educational institutions can transition toward compliance, stay within their capital improvement budget, and make the most effective use of resources. Through establishment of a systematic planning process, accessibility compliance considerations become a fundamental element in facility programming. Furthermore, evaluation activities of the district become a driving force toward universal design awareness, acceptance, and implementation.

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CHAPTER 19
UNIVERSAL DESIGN IN MASS TRANSPORTATION

Edward Steinfeld

19.1 INTRODUCTION

Everyone who uses a mass transportation system stands to benefit from universal design. Thus, everyone shares in the investment, not just people with disabilities. This chapter describes how mass transportation can facilitate convenience and safety for all, including people with disabilities, elderly people, and many others who are often "handicapped" by conventional design. In today's global economy, a convenient, safe, and effective mass transportation system is an essential aspect of social sustainability. This chapter focuses on a few key topics regarding mass transportation, including: terminal design, information resources, loading vehicles, and vehicle design.

19.2 TERMINAL DESIGN

Way-finding in large, complex terminals, such as central bus and train stations, multimodal stations, multilevel transit stations, and large airports, can be difficult. Linear, ring, or island plans introduce fewer decision points, make it easier for a passenger to find his or her destination, and reduce the impact of making a wrong decision when compared to complex treelike or mazelike plans. Terminal halls with good visibility of all destinations, as in traditional train stations, and designs that break up large terminals into several smaller terminals linked together by a major pathway,are also easier to navigate.

Travel distance within terminals can be a barrier for use by all passengers. Some prototypical terminal designs are more compact than others, e.g., those with clusters of gates compared to those that spread the gates out in long fingers. Mechanical transportation is often needed within terminals. These systems need to be designed for universal access. Rapid transit links should provide some seating for people who have limitations in balance or low stamina; the use of the links has to be easily understood by people with sensory limitations and those who do not speak the local language; and the links need markings to ensure priority access for people with disabilities and elderly people. Moving walkways should be wide enough to safely accommodate a wheelchair or walking aid user; and walkways should provide a safe transition at each end to accommodate people with walking difficulties or people with visual impairments.

Although electric courtesy carts and trams are beneficial for many people with disabilities, they can also cause hazards to pedestrians sharing the same path. Equally, crowds of pedestrians can thwart the efficiency of carts. People with hearing impairments are not able to hear them, even when they have annoying warning signals. Moreover, there are many wheelchair users who cannot stand and

FIGURE 19.1 The Detroit Metro Airport has three methods of circulation: a wide pedestrian promenade, sliding walkways located in the middle of the promenade, and an elevated electric train link.

Long description: This photo shows an overhead view of the interior of the main terminal space in the Detroit Metro Airport. It illustrates the three methods of circulation: a wide pedestrian promenade, a sliding walkway located in the middle of the promenade, and an elevated electric train link. The promenade is about 16 ft (5 m) wide on both sides of the moving walkway. The moving walkways go in opposite directions and are divided into segments about 200 ft long. The photo shows overhead signage prominently using white characters on black backgrounds. Many people are included in the photo both walking and waiting.

climb into the carts. Clearly, the use of shuttles is a provisional solution used to overcome poor design. As the population ages, one can expect that demand for such assistance will increase. Thus, creative solutions to terminal design should be developed to integrate such vehicles into the overall circulation scheme or, better yet, provide a more universal transit system for all passengers (see Fig. 19.1).

Level changes within transportation terminals are accommodated the same way they would be in any multilevel structure—with elevators, stairs, and ramps. In terminals where access to some zones is restricted, however, providing an accessible path of travel is complicated by the need to provide accommodations in the areas on either side of security barriers or fare collection gates. One of the most serious problems faced by people with mobility impairments is being forced to rely on assistance to negotiate changes in level or to get through security checkpoints and fare gates. This often results in inconvenience, embarrassment, frustration, and exposure to injury by poorly trained attendants (Kawauchi, 1999). Careful design can reduce the need for duplicate elevators or ramps, e.g., a system that keeps all passengers at the same level from the time they enter the terminal until they depart. Universal design reduces the need for special training for staff, reduces the potential for accidents, and improves productivity, as workers do not have to leave their posts as often to assist individual travelers.

Recommendations for Terminal Design

- Make all services and destinations as visible as possible.
- Plan terminals to minimize the distance of trips within the terminal.
- Integrate transit systems into large terminal design.
- Provide automated walkways wherever there are long pedestrian paths in terminals.
- Plan terminals to separate courtesy carts from pedestrian traffic.
- Plan terminals to reduce level changes, checkpoints, and fare collection to a minimum.
- Provide wheelchair accessibility to all loading areas.
- Maintain a continuous accessible circulation path in front of, through, and beyond security checkpoints and fare collection gates.

19.3 INFORMATION RESOURCES

All transportation terminals must include information resources to make travelers aware of schedules, routes, boarding locations, amenities (e.g., restrooms and food services), late-breaking news on schedule changes, and other announcements. The ability to use these resources effectively is critical for the traveler.

Sign systems should be easy to read, with fonts that are large enough to be seen at a distance and contrasting text and background. Signs should be located in the most visible position, which is usually overhead for signs directing people to key destinations. In general, most contemporary sign systems used in large intercity terminals fulfill all these criteria, although in intracity systems there is less emphasis on the usability of signs. The use of international symbols for common destinations is a major aid to the traveler who has sight but cannot read the languages available. The trend toward the use of dynamic signs implies that additional criteria should be identified that would ensure that the rate of information presented is within the abilities of people with sensory and cognitive limitations to perceive. One of the benefits of dynamic signs is that it costs no more to provide information in different languages with cycling messages.

Real-time information on delays, gate and route changes, and arrival times is a particularly important concern of travelers. Message boards and video/computer monitors are replacing many public address announcements in terminals. They are also being used at transportation stops to inform riders of the estimated arrival times of vehicles en route. But message boards do not always have the same late-breaking information that is provided by public address systems, such as the reasons for delays, and they may not update fast enough to keep up with recent announcements. Moreover, they are limited to strategic locations.

The Internet can be used to provide real-time information in both audible and visual modes anywhere in a terminal via Wi-Fi enabled devices. Some transportation agencies have implemented web-based sites where travelers can download trip planning information. The most sophisticated sites also provide alternatives to inaccessible routes and even adjust the routes when elevators are not in service. However, these services have not yet been extended to real-time information accessible at terminals and stops and on vehicles.

Tactile maps and tactile guide strips are useful in helping people with visual impairments find important destinations (see Chap. 42). These devices could be designed to benefit all travelers. For example, a tactile map provides more information than a two-dimensional map and can include color-coding and other visual features to make it useful for everyone.

A promising technology for helping people with visual impairments find their way in transportation systems is the *talking sign* (see Fig. 19.2) (Golledge et al., 1998; Crandall et al., 1999). Talking signs require a handheld receiver and a clear and uninterrupted line of sight between receiver and transmitter, and the receiver must be pointed roughly in the direction of the transmitter to pick up the signal. However, experience with the technology has identified solutions to most problems. GPS navigation is not yet available inside buildings, but there are R&D efforts underway to provide localization information where GPS

FIGURE 19.2 The CALTRANS commuter train station in downtown San Francisco is equipped with remote infrared signs or "talking signs." They are installed above doors to key spaces such as entry doors and entries to public bathrooms.

Long description: These two photos of the CALTRANS commuter train station in downtown San Francisco show installations of remote infrared signs or "talking signs." One shows the sign installed above an entry door and the other above the entries to public bathrooms. The signs are small black squares and identified by black arrows at a 45° angle. In the first photo, the doors and frame are painted bright red. In the second photo, a man and a woman dressed in black are entering the respective restrooms. The woman is wearing a long coat and has long dark hair. The man is wearing a short jacket and black jeans. The restrooms are marked with two sets of signs, both a set required by the ADA to the side of the door and another set required by California accessibility code on the door. The California signs have a triangle shape for the men's room and a circle shape for the ladies room. The hung ceiling has recessed circular light fixtures.

signals are not available. Research is also underway on the use of camera phones to help people with visual impairments find and read visual signage.

Recommendations for Information Resource Design

- Text on signs should be in a large, easy-to-read font and should contrast with its background.
- Directional signs should be overhead and should be directly related to the location described or the path to it.
- Use international symbols wherever possible.
- Use multiple languages.
- Provide information kiosks or human information clerks.
- Provide text-based information for public address announcements.
- Provide navigational aids that are usable by people with visual impairments.

19.4 LOADING VEHICLES

One of the most difficult issues in universal design of transportation systems is accommodating level changes to board and exit vehicles. There are two basic accommodation strategies that can be used separately or in tandem. The first focuses on design of the transit stop and the second on design of the vehicle.

In new systems for rail and bus transit, loading platforms should be at the same level as the vehicle floor. The gap between the platform and the vehicle must be narrow to prevent wheelchairs and walking aids from getting caught in the gap and to reduce tripping and falling hazards for people who are ambulatory. To ensure continuity of access, consistency in platform height across a system and over time is important, so standards have to be established for both rolling stock and terminal construction. In existing systems where there are small inconsistencies in the gap or a generally large gap between vehicle floor and boarding platform, vehicles will have to be fitted with small ramps called *bridge plates*. Where there are great differences in levels, lifts, or folding ramps provided on vehicles may be needed.

There are several technologies available to reduce or compensate for the level change between buses and streetcars and the loading surface. The best practice today is the *low-floor* vehicle that is within one step of the ground (see Fig. 19.3). This benefits children, parents with children, older people, and people with limitations of mobility. It also helps people with visual impairments, because it reduces the complexity of entering and exiting a strange vehicle. By loading directly onto sidewalks or raised platforms from a low-floor vehicle, the difference between vehicle and landing levels can be almost eliminated. Where loading takes place to the roadway level, a short ramp can be used with the low-floor bus that folds out or telescopes. Several types of wheelchair lifts are available for high-floor transit buses. They include lifts that slide out from under the bus floor and lifts that are integrated into the stairs of the bus and fold out when needed.

FIGURE 19.3 Low-floor buses have ramps to bridge the horizontal and vertical gaps from the boarding platform, sidewalk, or street. The two photographs show a folding ramp in the stowed position and a wheelchair user descending a deployed ramp.

Long description: This figure has two photos of a ramp at the entry to a low-floor bus. One photo shows the folding ramp in the stowed position. The other shows a middle-aged male wheelchair user descending a deployed ramp. The ramp perimeter is colored bright yellow, and the surface is black. The bus is white with a blue horizontal accent stripe. (Colors not shown in this black and white photo.)

Avoiding falls off loading platforms is a major safety issue for all transportation riders but particularly for individuals with visual impairments. Several methods can be used to protect the traveler from falling. Visible, audible, and tactile signals should all be used at once to provide redundant modes of information. Warning signals provide advance notification that vehicles are about to arrive at the platform. Lights and announcements can notify passengers of arriving vehicles. Platform edges can be marked with textures such as rough concrete or stone, applied resilient plastic materials, and contrasting paving materials such as concrete against brick. There is great concern as to whether any of these methods are effective in warning pedestrians, particularly people with visual impairments (Richmond and Steinfeld, 1999). Several materials have been developed to provide an effective tactile warning. Tactile tiles are manufactured as a modular plastic or composite tile with a pattern of small raised domes or ridges, usually with a bright yellow color. This material has been used extensively, particularly in Japan. Kanbayashi (1999) reported that people with visual impairments still fall onto the track despite the presence of these tiles at the edge of the platform.

The most secure system for protecting waiting passengers at the platform edge is a physical barrier along the entire platform. In new subway stations, guardrails and even complete glazed enclosures with automated sliding doors have been introduced (see Fig. 19.4). Not only do such

FIGURE 19.4 Safety barrier at station in Copenhagen Metro. The station is a good example of universal design features that enhance usability and safety for all, including full-height glass safety barriers with sliding doors along the platform edge, real-time arrival information on an electronic overhead sign, and well-marked route information with high-contrast fonts and directional arrows. Boarding locations are marked on the platform with tactile guide strips and is lit with natural light from a skylight above. Both seating and leaning bars are provided.

Long description: This photo of the interior of a station in the Copenhagen subway shows an underground loading platform with full-height glass safety barriers with sliding doors along the platform edge, real-time arrival information on an electronic overhead sign, and well-marked route information with high-contrast fonts and directional arrows. Boarding locations are marked on the platform with tactile guide strips. The station is lighted with natural light from a skylight above. A stairway can be seen in the distance, but an elevator is also provided in the station although it is not visible in the photo. Both seating and leaning bars are provided. Several people are shown in the photo waiting for trains to arrive. They are standing, sitting, and leaning against the leaning bar. The waiting passengers are all young adults, one woman and five men, dressed casually. Two of them are reading. The station surfaces are different shades of gray. A ticket machine is seen in the foreground with instructions in Danish.

barriers protect people with visual impairments, but also they protect the general population from falling or being pushed off the platform and prevent attempts of suicide. Whatever the method used to protect passengers from falling off the platform edge, a uniform design approach throughout a system eliminates surprises for travelers, especially travelers who have visual impairments.

Recommendations for Design of Vehicle Loading Areas

- Eliminate the change in level between vehicle floor and loading surface wherever possible.
- Provide mechanical loading systems when level changes cannot be eliminated.
- Eliminate the gap between platform and vehicle either by initial design or through mechanical means when a vehicle stops.
- Protect people from accidents at loading platforms by means of barriers or warning devices.
- Warn passengers on the platform of arriving vehicles, using both visual and audible means.

19.5 VEHICLE DESIGN

Wheelchairs are often wider than the aisles in buses, trains, and airplanes; and if not positioned out of the way, they can create an impassible aisle for other passengers. Perimeter benches, rather than seating in rows, can provide enough space to accommodate wheelchairs. Removing seats to provide a designated wheelchair area and the use of folding seats are two other solutions. All these strategies also provide more space for standing passengers during rush hours, thus increasing overall system capacity. The extra spaces can also be used for storing luggage, carriages, or bicycles (see Fig. 19.5).

On buses, wheelchair securement devices are needed to prevent injury to both the wheelchair users and other passengers if an emergency stop is necessary. Two basic approaches are in use. The first, which is deemed safe for vehicles that travel at low speed in dense urban areas, is a three-sided compartment with padding around it like that on a car dashboard. Buses in the United Kingdom are equipped with such systems. In the United States, however, where design speeds are double those in the United Kingdom, devices that mechanically secure the wheelchair and passenger are used. New research indicates that many common wheelchair designs are not safe in a crash, even when fastened to a tie-down device. Standards have been developed for "transport" wheelchairs that are designed for compatibility with mechanical securement devices and are certified to withstand a crash at a specified speed. Currently there are no mechanical wheelchair securement devices on the market that accommodate all wheelchair designs and are easy to use without assistance. Clearly, this design issue requires much more research and product innovation.

The most difficult problem in passenger seating is on airplanes, where a variety of cost, space, and safety issues come into play. Currently, most airplane aisles are too narrow for wheelchair users. Presently, the best strategy is to provide independent wheelchair access at least to the entry of the plane, where a passenger is then assisted to his or her seat (often with a transport chair), and the wheelchair is stowed in the baggage compartment. This strategy, however, separates the passenger from his or her wheelchair and creates dependency on airline staff members that have many other duties. Wheelchairs are often damaged or lost, leaving individuals stranded without mobility far from home. Innovative design solutions are needed to develop a system that can accommodate wheelchair users more effectively.

On long-distance vehicles—trains, intercity buses, and aircraft—people with disabilities, like everyone, need access to toilet facilities. On many trains and widebody airplanes, access has been successfully achieved. To conserve space, such facilities are designed so that a wheelchair user can back in or enter forward, reach all the fixtures and equipment, and open and close the door without turning around. Automated sliding doors facilitate access significantly.

FIGURE 19.5 This low-floor light-rail transit vehicle has wheelchair seating marked by the international symbol of accessibility (ISA). A large button, also marked by the ISA, is provided to request help from the train operator when the passenger wishes to have the ramp deployed. A two-way intercom is also provided.

Long description: This photo shows a wheelchair seating location on a light rail vehicle. The location is marked by the international symbol of accessibility (ISA). A large button, also marked by the ISA, is provided at the side of the location that can be used to request help from the train operator when the passenger wishes to leave the car and have the ramp deployed. A two-way intercom is provided so that the operator can talk to the passenger. The button and intercom are mounted on a stainless steel horizontal bar installed in front of a window. There is a vertical stanchion and partial partition separating the wheelchair location from the car entry. An advertising poster can be seen on the wall of the train, but it is unreadable in the photo except for the word *change*. The walls of the vehicle are very light blue, and there is a radiator along the wall under the window covered by a stainless steel grill. The radiator has toe space underneath.

Recommendations for Vehicle Design

- Provide space for wheelchair users in the vehicle with safe securement systems.
- Develop universal securement devices that can be used independently.
- Provide priority seating for people who have difficulty standing during a trip.
- Include accessible toilet compartments on long-distance transport.

19.6 CONCLUSIONS

While many of the lessons learned in the design of accessible buildings are applicable to transportation systems, there are many concerns not addressed by existing guidelines and standards, such as dynamic scheduling information. Additionally, many universal design concerns go beyond issues of minimal accommodation for disabilities, such as the inability to read the local language. Moreover, high-technology applications are emerging that could increase the options available for universal design.

In the field of human factors in transportation, there is a developing body of research and information on the physical design of vehicles and information systems. However, there is clearly a need for more research and development. Some specific design issues still have not been resolved adequately, such as loading vehicles, vehicle interior design, safety systems, and information for people with sensory impairments. As the demand for mass transportation continues to increase, these issues are likely to become more important.

The challenge of universal design in transportation is not only to eliminate discrimination in access but also to ensure social integration. Thus, the perceived value of including universal design features in transportation systems will be increased if research can demonstrate a value to all travelers, not just for people with disabilities and the elderly.

While the existing mass transport infrastructure is difficult to change, there are many opportunities for practicing universal design in developing countries and the rapidly growing suburbs of major cities. Economic development, reducing environmental pollution, and reducing energy consumption are the driving goals of contemporary mass transportation initiatives. While these goals may drive infrastructure improvements, designers, developers, and government officials should not lose sight of demographic shifts and issues of social justice that can be incorporated at the same time.

19.7 ACKNOWLEDGMENT

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19.9 RESOURCES

The following resources can be helpful in learning more about universal design in transportation systems:

Access Exchange International. Publishes a newsletter, *Accessible Transportation Around the World,* with updates on international efforts to make transportation systems accessible, including developing economies. Address: 112 San Pablo Ave., San Francisco, CA 94127-1536. Web site: http://www.globalride-sf.org.

International Centre for Accessible Transportation. Supports the development of new technologies and other methods to make transportation more accessible to all travelers. Address: World Trade Centre, 380 Saint-Antoine St. West, Suite 3200, Montreal, PQ, Canada H2Y 3X7. Web site: www.jcat-ciat.org.

The Rehabilitation Engineering Research Center on Accessible Public Transportation. Focuses on improving transportation for people with disabilities by using universal design strategies. Robotics Institute, Carnegie Mellon University, and the IDEA Center at the University at Buffalo. Web site: www.rercapt.org.

TELSCAN. European commission research project that develops resource information on all aspects of travel for people with disabilities. Web site: http://hermes.civil.auth.gr/ telscan/telsc.htm.

CHAPTER 20
UNIVERSAL DESIGN AT THE URBAN SCALE

Wolfgang F. E. Preiser and Korydon H. Smith

20.1 INTRODUCTION

Throughout the past century, the design of urban environments has relied on codified health, safety, and security regulations; zoning codes and covenants; and best-practice researches in the realms of sociology and psychology. Nevertheless, universal design concepts have gained momentum in urban environments throughout the world in recent decades. Multiple examples of applying universal design principles at the urban scale can be found in the first edition of the *Universal Design Handbook* (Preiser and Ostroff, 2001), such as Weisman's work "Creating the Universally Designed City: Prospects for the New Century." What has remained lacking, however, is the use of explicitly defined universal design criteria in the design and evaluation of urban environments. As such, this chapter utilizes the seven Principles of Universal Design, developed by the Center for Universal Design at North Carolina State University (Story, 2001), to examine the design of urban environments. For each principle, performance criteria are defined and used to scrutinize a sample of case studies, and implications for control mechanisms, such as zoning and other regulations, are outlined.

20.2 PRINCIPLE 1: EQUITABLE USE

"The design is useful and marketable to people with diverse abilities."

Definition

This idea speaks to the democratic principle of equality, meaning that everybody should have equal access to built and urban environments. "Provide the same means of use for all users, identical whenever possible, equivalent when not" (Story 2001) promotes equal access to streets and side-walks, public (and privately owned) buildings, community centers, hospitals, schools and colleges, transportation facilities, urban and national parks, and so on.

System Performance Criteria

Provide horizontal pathway systems that separate travel paths and surfaces from vehicular traffic, thus easing pedestrian and wheelchair movement, at ground level, aboveground, or underground.

For example, street-level crossings of vehicular roadways and pedestrian sidewalks present a complex situation, especially when visually impaired travelers are involved. Drivers do not obey traffic lights in some cultures. For example, in Brazil the authors found drivers racing through red lights at night, while drivers with green lights cautiously approached the intersections and then checked cross traffic before proceeding.

The National Federation of the Blind and the American Council of the Blind have engaged in considerable debate as to whether sound signals at pedestrian street crossings (e.g., buzzers, chirping bird sounds) are effective. The National Federation of the Blind rejects them and maintains that sound traffic signals are bad, since they can only be found in relatively few locations. They say that what is needed is for the visually impaired to use white canes and seeing-eye dogs. In Japan the approach has been for communities to install both yellow rubberized tiles in subway station platforms and the pavement of sidewalks and sound signals at street crossings.

Different issues arise with skywalk systems. In Minneapolis, where the severe climate forces people inside for much of the winter, the city created an extensive skywalk system that is heavily utilized. On the other hand, in Cincinnati and other U.S. cities with much milder climates, the skywalk systems have been all but abandoned and/or disrupted in various places, thus making them dysfunctional. One reason for this is that skywalk systems can suck pedestrian life out of sidewalks at street level, while at the same time presenting passersby with empty storefronts at the skywalk level. Similarly, the underground passage and mall system works well for Montreal, but in balmy Albuquerque, New Mexico, the underground shopping center next to Fountain Square sits mostly empty.

In general, private shopping centers are by definition discriminatory: the owners often use security to remove "undesirables" such as teenagers or other persons just hanging out. This has included our students who were doing observational studies or were trying to conduct surveys of shoppers.

An anecdote about an accessibility paradox: With tourism being a major driver of the economy in Edinburgh, Scotland, the cathedral dedicated to the Patron Saint of the Disabled, St. Giles, is a curious example of inaccessibility. Located on the Golden Mile, and converted into a tourist information center, the cathedral belies its name because its main entrance is not accessible to people with disabilities.

When dealing with an historic structure such as St. Giles Cathedral, one cannot cover the steps with a ramp as was done in the TWA Terminal building at JFK International Airport. One will have to figure out equal access, perhaps with clear signage pointing to a side entrance where there is an elevator that can reach all critical levels of the building.

20.3 PRINCIPLE 2: FLEXIBILITY IN USE

"The design accommodates a wide range of individual preferences and abilities."

Definition

This concept provides for adaptive reuse of existing facilities, such as converting lofts into housing or turning hardware stores into churches. At the community scale, it also aims at the creation of a variety of mixed, complementary uses, such as retail and recreation and entertainment in connection with housing (i.e., so-called lifestyle centers) or even more advanced and increasingly popular mixed-use suburban town centers. In "Creating the Missing Hub," Langdon (2006) characterized these as follows: "The ingredient missing from many suburbs is a 'town center,' a place people head to for many different purposes—to shop, dine, visit a library, deliver a package to the post office, take in a movie or a concert, or just to enjoy being in an animated public place."

System Performance Criteria

One criterion is to better meet increasing demand among people wishing to reside in downtowns and/or within walking or biking distance from their employment locations. Similarly, recognize the growing trend to develop so-called lifestyle communities, with high-density housing in walking distance from shopping and services, as well as entertainment and recreation. According to the new urbanists, an acceptable walking distance range is from 600 ft to about ¼ mi.

Over the years, there have been many attempts at traffic calming in Europe and elsewhere, especially in older cities. Design solutions included roundabouts at street intersections, single-lane automobile traffic with on-street parking, planters, places to sit, and so on. The Village at the Streets of West Chester (Ohio) is a new town center currently under construction. One of its designers, Raser (2006), characterizes this project as pedestrian-friendly: "for all pedestrians, whether able bodied, wheelchair bound, on crutches, in strollers, elderly or youthful."

According to Raser, wheelchair ramps and handrails are not enough. A universally designed neighborhood should have narrow streets, easy to cross, bump-outs for "safe harbor for pedestrians to stand on when awaiting their chance to cross," sidewalk ramps to crosswalks that are "well defined with a rectangle of contrastingly colored truncated domes along the back rail of the curb," and "crosswalks well-marked with texture in the street, like stamped concrete or asphalt."

An example of a "beyond the beltway community" on the Minneapolis border is Burnsville, Minnesota, with its Excelsior & Grand town center. Ben Gavin of *The New York Times* (2006) noted:

> The latest thing in suburban development is something very old: city living . . . . A handful of suburban areas around Minneapolis-St. Paul have begun ambitious plans to create town centers, with pedestrian friendly sidewalks, condos, restaurants and shops. If it looks like a city, well, it is supposed to.

Another example of planning for choice and adaptation is sports arenas and stadiums. In recent years there have been federal lawsuits against some major sports arena and stadium design firms, who basically designed according to code. However, they didn't understand that sight lines can be disrupted when spectators get excited and stand up, blocking the view of a person in a wheelchair. The spirit of universal design is exemplified by arrangements providing for flexible seating and choices in different locations and price categories.

A good example of flexible arena design for spectators with disabilities may be the Nationwide Arena in downtown Columbus, Ohio, in which hockey is played. It provides for choices in seating. It has fixed seating and mobile seating, next to which a wheelchair can be pulled up, in various price ranges and seating locations. Meanwhile, in the Schottenstein Arena on the campus at The Ohio State University, and despite the good intentions of the arena planners, sight lines are still disrupted because spectators climb on top of their seats when the action gets wild.

20.4 PRINCIPLE 3: SIMPLE AND INTUITIVE USE

"Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level."

Definition

This principle is based on the assumption that for intuitive use to be successful, the design has to be simple and easily understood, and it has to function flawlessly for persons with a wide range of literacy and language skills, including cultural conventions and differentiations.

System Performance Criteria

Provide accurate and intuitively understandable directional guidance or markers for planned and designed environments, which in themselves need to be legible with a minimum of confusion at both pedestrian and automobile speeds. Furthermore, devise criteria that apply to persons with different sensory disabilities.

The qualities inherent in good urban design were defined by Kevin Lynch (1960) as focal points for orientation, edges or barriers, places of congregation, and so on. These were visual means to describe and define markers, boundaries, and other spatial features of the urban environment, primarily seen from the perspective of pedestrians. At the speed of automobiles, different mechanisms are at work, such as highly visible destinations like the Transamerica Tower and Golden Gate Bridge in San Francisco; the Opera House or Harbor Bridge in Sydney, Australia; the Wasatch Mountains in Salt Lake City; or the hugely successful harbor front in Baltimore.

Making public parks, playgrounds, and spaces accessible is just as important as the free use of public facilities such as toilets that serve everybody, including the disabled and tourists. For example, in Paris, 400 new and latest-model automatic conveniences will be installed, including an exterior tap for drinking water.

20.5 PRINCIPLE 4: PERCEPTIBLE INFORMATION

"The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities."

Definition

This principle refers to the concept of presenting information in sometimes redundant fashion so that it is grasped intuitively by the user. This may involve pictorial, verbal, and tactile modes, hierarchies, and ways to differentiate essential information as well as legibility of forms and passage systems.

System Performance Criteria

Provide for some degree of redundancy among the different senses, especially when one is dealing with emergency egress: signage and signals using sound, light, or even strobe lights. Employ different media, such as pictograms, touch, or other means of presenting stimuli or information. Enhance the legibility of essential information by using hierarchies of letter sizes, different fonts, colors, and graphic systems.

An example is tactile and visual clues on sidewalks and subway station platforms, as in the case of Japan. These aforementioned tiles are yellow, rubbery, and with raised straight lines, which mean "proceed," or dots, which indicate "stop and reorient."

Another example is the use of distance markers and maps with the purpose of creating mental maps in drivers. This is in anticipation of what to expect in making driving decisions, such as turning off of a freeway. One could argue that amber alert signs are true universal design, since they are intended to alert all drivers to traffic conditions that lie ahead, or vehicle information on missing persons' kidnappers.

In transportation facilities such as airports, clarity in signage systems and communication of information essential to the traveler's direction finding is of utmost importance. For example, when the Dallas–Fort Worth Airport first opened, it was thought that automated trains and video displays of gate information could replace a lot of ground personnel. In reality, once passengers boarded a train, no more feedback on the train's location in relationship to one's destination was provided. The loop routes of the trains meant that with no reference to the outside, many passengers were disoriented, traveled in circles, were very distressed, and ultimately had to ask for assistance. In recently traveling through that airport, it was surprising to find personnel at every corner asking, "Do you have a question?" In other words, overkill in technology can result in poor performance and experiences. Similarly, at the Atlanta airport, the Metropolitan Atlanta Rapid Transit Authority (MARTA) changed the toll system to tickets that are dispensed from a machine. This was so confusing that MARTA had to post a person at each machine to explain how to use it. This is self-defeating: can you imagine a person standing at every machine once it goes systemwide?

Large hospitals, frequently accretions of building phases and additions over time, are notorious for confusion and stressful way-finding experiences. One such case is Children's Hospital in Cincinnati, which covers a huge area with no clear indication of where to enter, park, and proceed from there. Consequently, the hospital installed a color-coded building directory and synchronized signage system.

20.6 PRINCIPLE 5: TOLERANCE FOR ERROR

"The design minimizes hazards and the adverse consequences of accidental or unintended actions."

Definition

This principle is aimed at making features of products and environments fail-safe, both by reducing distractions and the need for vigilance and by providing warnings of hazards and potential errors.

System Performance Criteria

"Make environments secure and safe to use by all" (Story, 2001).

In her article "Making Sidewalks Accessible Is the Decent Thing to Do," Kendrick (2003), who is blind, described that accessible sidewalks are her most important criterion when selecting a place to live. They allow her to access any service, program, or product everybody else uses. Of course, many suburban communities have abandoned the idea (and cost) of building and maintaining sidewalks. Where they do exist in urban areas, they need to be free of obstructions, cracked concrete, and other obstacles that might cause a visually impaired person to fall and be injured. Kendrick stated that sidewalks are "ribbons of concrete that, when smooth and unobstructed by tree roots and utility lines, bring all citizens, with and without disabilities, into the same employment, education and recreational activities our communities offer."

Special elevators for emergency evacuations from high-rise buildings are an example of progress being made. "Panel May Recommend Firefighter Elevators," an article in *The Wall Street Journal* (Frangos, 2005), discussed elevator safety for all building users, including rescue personnel. The article reflects on the commission that is investigating 9/11 and the fall of the twin World Trade Center towers. Why is it that other countries' building codes in Europe and most of Asia require these lifts, although the rules differ? In the United States, people are forbidden to go down in elevators, but firefighters cannot use elevators to go up and help people to evacuate. In 1993 they had to walk up the World Trade Center stairs, which was utterly ineffective. In countries such as Malaysia, with the Petronas Tower in Kuala Lumpur designed by Cesar Pelli, such elevators are common. The new Freedom Tower in New York City, designed by SOM, will have such an elevator. To quote June Kailes, a Los Angeles–based disability consultant:

> Disability rights activists are strong supporters of the elevators. What we learned from 9/11 and many events before 9/11 is the ability to evacuate multi-story buildings is an issue for a broad spectrum of people who would never identify themselves as disabled, but who couldn't negotiate so many steps.

This is true because there are many people who are not necessarily using wheelchairs but have all kinds of mobility problems, and who would find themselves stranded on the 100th floor where they would probably all perish. A lot needs to be improved in the area of fire egress from tall buildings.

Remembering the disastrous evacuation of New Orleans in the aftermath of Hurricane Katrina, one could argue for universally designed disaster evacuation plans for cities and regions that are vulnerable and experience disasters on a recurring basis.

20.7 PRINCIPLE 6: LOW PHYSICAL EFFORT

"The design can be used efficiently and comfortably, and with a minimum of fatigue."

Definition

This principle is aimed at reducing the expenditure of sustained physical effort and repetitive action when negotiating an environment by requiring reasonable operating forces and maintaining neutral body positions.

System Performance Criteria

"Find ways to reduce the expenditure of effort and to minimize repetitive actions at all scales of the environment" (Story, 2001).

An example of affordable and accessible mass transportation is a rapid transit system that has been developed and that uses dedicated high-speed lanes in Ecuador and Brazil. Bus stations have ramps on either side. After entering and paying, one is level with the floor of the buses—meaning that they can be emptied and filled up rapidly. There is no delay for paying or being in a wheelchair. This is a universally designed rapid transport system that is appropriate for those countries that cannot afford subways.

When it comes to individualized public transportation (i.e., taxis), London is considered the most accessible city in the world. All new taxis have to have foldout ramps, which take a few seconds to put in place. All older-model taxis have to have one of these ramps in the trunk. In addition, the taxis are very comfortable, with high ceilings and multiple seat configurations. For example, one can put a seatbelt around one's wheelchair in order to secure it. On the other hand, the subways (called "the tube") are not accessible at all except for the recently built Jubilee Line.

At the building scale Zipf's famous *Human Behavior and the Principle of Least Effort* (Zipf, 1949) clearly applies. Festinger's (1950) classic sociometric study *Social Pressures in Informal Groups* explored how post-World War II GI Bill Massachusetts Institute of Technology student housing demonstrated how the amount of effort implied in overcoming distance and height (number of floors) proved critical in the establishment of acquaintance and friendship patterns among residents. Another multistairway investigation (Hanyu and Itsukushima, 2000) found that increased expenditure of effort resulted in reduced use.

Finally, as was pointed out in connection with evacuation elevators above, residential elevators are essential for a variety of groups with disabilities, whether wheelchair-bound or not. A new generation of more affordable elevators, by Daytona Elevators, using the suction principle that can accommodate wheelchairs has come on the market.

20.8 PRINCIPLE 7: SIZE AND SHAPE FOR APPROACH AND USE

"Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility."

Definition

This principle and category clearly does not apply to the urban and planning scale when interpreted in its original meaning: the limits that the human body and dimensions place on the accessibility of counters, shelving, appliances, dispensers, controls, electrical outlets, door handles, and other critical items. Therefore, in considering the goal of "access for all" at the urban scale, different concepts come into play.

System Performance Criteria

The elements that are critical for a city to be livable refer to *accessibility* from the perspective of pedestrian distances in neighborhoods in high-density cities such as New York. In Manhattan most necessary daily services—shopping, the library, churches, and entertainment—are within a mile's walking distance from one's apartment. Lewis Mumford (1991) attested to this in his film classic "Toward a Humane Architecture." In short, in this type of community the operating principle is integration, not separation of uses, and, implicitly, mixed-use zoning approaches. Building "livable communities" in the interest of maintaining independence for seniors is also strongly advocated by the American Association of Retired Persons (AARP). The common elements of this include "affordable and appropriate housing, public transportation, community services, nearby shopping and medical services, job opportunities, and recreation" (Novell, 2006).

An example of this is current inner-urban redevelopment schemes in the United States in which mixed-use zoning calls for high-rise buildings with residential floors at the top, a hotel underneath, office uses below that, retail at the street level, and finally parking underground.

A number of precedents exist in Japan, e.g., at both Tokyo and Nagoya Stations. Mixed-use towers have been built with office zones, hotel zones, and restaurant zones, as well as retail shopping centers, and parking.

1. The Marunouchi Building in Tokyo connects to the Japan Rail Station and the city blocks being redeveloped around it via a system of underground shopping arcades and tunnels, which are fed by the traffic generated by hundreds of thousands of passengers passing through the station every day. Two remarkable features distinguish this building, which was fully leased only months after its opening in 2003 while there was a glut of office space in Tokyo. First, it has a huge atrium space, open to the public, that is used for exhibits and public gatherings. It is, in fact, a window to the community, welcoming the public for lunchtime concerts and other events. Second, at the top level of the tower a viewing floor is open to the public at no charge. In short, the building has become a destination in Tokyo—a public place in private property.
2. The JR (Japan Rail) Tower in Nagoya utilizes the air rights above Nagoya Station and contains a mix of uses that is similar to that of the Marunouchi Building in Tokyo, plus a Marriott Hotel. What is most unusual is a buzzing Sky Mall 13 to 15 floors above street level, a concept that would never work in the United States.

At a smaller scale, and in the suburban context of the United States, many of the continuously growing communities outside the beltway are playing catch-up with the increasing need for community infrastructure and support facilities, such as community centers. An example is the Lakota Schools in West Chester, Ohio. Recent high schools were planned with the "Main Street" concept in mind—a large, long space primarily used as student break areas, but also for community events such as public fairs and gatherings.

20.9 CONCLUSION

Future research will need to clarify advantages, disadvantages, and cost implications of a number of factors. First, proximity and relationships between various types of inhabitants need to be considered. This includes differences in traffic patterns, differences in building usages, and differences in age and ability. Second, investigating alternative systems for street crossings is necessary. This includes explorations of a variety of level, underground, and aboveground options. Third, the adaptability of the built fabric of urban environments needs to be addressed. This includes issues regarding mixed-use zoning, adaptive reuse, and gentrification as cities evolve over time. Fourth, alternative means of urban way-finding need to be explored. This includes both macro-scale planning and organizational decisions as well as issues regarding smaller-scale elements, such as signage, for vehicular and pedestrian traffic with a variety of mobility and sensory needs. Last, with natural and human-made disasters becoming more common in urban environments, urban designers need to consider how to make environments not only more resistant but also more responsive to catastrophes of various kinds.

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20.11 RESOURCES

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CHAPTER 21
DESIGNING INCLUSIVE EXPERIENCES

Roger Coleman

21.1 INTRODUCTION

In 1991, an action research program exploring “the design implications of ageing populations” was launched at the Royal College of Art (RCA) in London under the name of DesignAge. Importantly, the program encouraged young students to work with older persons on developing new concepts for products and services that could break with the then-current and patronizing norm of “design for the elderly and disabled.” By contrast, DesignAge advocated an inclusive and holistic approach to design whereby a better understanding of the needs and also the aspirations and lifestyles of groups hitherto excluded from mainstream design considerations might become the springboard for innovation and better design for the whole population.

This thinking found a resonance among influential members of the design community and progressive thinkers in industry. However, for it to be adopted widely, best-practice exemplars were needed that could demonstrate a genuine benefit to both business and the consumer. This requirement triggered design research, collaborations with industry, and a series of groundbreaking seminars and events at the RCA, focusing on inclusive design in transportation, fashion and textiles, product development, and retailing. These activities culminated in an international conference entitled “Designing for Our Future Selves” in November 1993, European Year of Older People and Solidarity between Generations (Coleman, 1993), which led directly to the founding of a European Design for Ageing Network.

The impact of this approach became the inspiration for a broader program of research around social change issues at the RCA, and design for an aging population is now a core theme of the Helen Hamlyn Centre (HHC), a permanently endowed research center at the RCA. Launched in January 1999, the HHC has built up a powerful set of user-centered design exemplars through two key mechanisms. First, its Research Associate (RA) program offers some of the best RCA graduates the opportunity to work for an additional year developing new designs, scenarios, and thinking for industry and voluntary sector partners. Since its inception in 2000, the RA program has worked with more than 70 organizations worldwide on over 100 inclusive design exemplars, details of which can be found on the HHC web site.

Second, an Inclusive Design Challenge program teams up groups of professional designers with persons with disabilities and asks them to develop new designs and concepts informed by the lifestyles of their users and the challenges they face in everyday life. The Inclusive Design Challenge began in 2000 as a collaboration between the HHC and the Design Business Association (DBA), the trade association for the U.K. design industry. Since then it has been taken up by some of the United Kingdom’s leading designers and consultancies and delivered over 40 innovative and inspirational designs, details of which can be found on the DBA web site and the HHC web site. It has also spawned other variants in the form of 24- and 48-hour national and international challenges and industry workshops, all with the same basic format, that are proving to be a powerful method for knowledge and skills transfer.

The central thrust of this inclusive design approach has been a focus on the user experience rather than on functionality per se, and on understanding users within the context of their daily lives and aspirations. In the case of older and disabled people, this meant looking beyond the aids and adaptations of the past to a mesh of new products, services, environments, and information that could support lifestyles of choice, delivering real life-quality improvements and pleasure in use.

21.2 IMPROVING THE SHOPPING EXPERIENCE

An example of this approach in action is the first practical project undertaken on the DesignAge program, which remains relevant and insightful some 17 years later. It began in 1992, when the design team of Safeway Stores (in the United Kingdom) worked closely with RCA tutors and students over a 12-month period, to develop a range of innovations offering benefits to customers of all ages and abilities by extrapolating from the particular needs of older consumers. In parallel with this, a Safeway "Young Managers Group"—a mechanism employed by the company to initiate change—investigated older consumer issues from a retail perspective. The combined results were presented to the Safeway board of directors, and many of the lessons learned were transformed into improvements in store design, packaging, customer service, and other aspects of the company's business.

Central to this process were in-store observational studies of older consumers and an investigation into the sensory and experiential factors that play an important role in determining the quality of the consumer experience. The use of scenarios was another key aspect of the project. This technique proved a powerful way of demonstrating how a range of design issues can be addressed in a holistic manner to deliver a substantially improved experience, and that a better understanding of older consumers can drive design innovations that deliver benefits for consumers of all ages (Coleman 1994a). This holistic or "inclusive" design approach has since become an integral element in the range of design disciplines taught at postgraduate level at the RCA.

The first stage of the collaboration identified many features that create problems for older customers, from bending and stretching associated with high and low shelves to information design, signage, labeling, lighting, and glare (see Fig. 21.1). This initial audit resulted in design guidelines and a store checklist highlighting the needs of older and less able users. However, since shopping is a social experience as well as a practical necessity, a group of RCA industrial design engineering students undertook a further, more general study of the sensory quality of the environment as it might affect the older shopper. Information was gathered on shop organization, layout, and user behavior by a variety of methods. These included photography and video recording, discussions with managers and customers, and a work-study analysis of the supermarket environment in action.

The team identified a range of sensory factors of particular importance to older people. Since older people experience changes in the way they see, hear, and move, the students argued that an environment that set out to enhance sensory feedback and pleasure would be especially attractive to older people. By integrating changes in layout with new and emerging technology, they developed scenarios of shopping in the future (projecting forward 10 to 15 years from 1992) to demonstrate how considering the needs of older people could lead to new concepts in store design. An important consideration was how to make the change from a retailing space—where efficiencies of stocking, turnover, throughput of customers, and minimal staffing take precedence—to something more akin to a social space, where people gather and meet out of choice rather than necessity.

These scenarios were illustrated with collages and picture stories, in which human-centered technology was combined with spatial and organizational changes. The question addressed in each case was, How can superstores be brought back into the town center where most older people live, and still offer choice within a smaller space, while making it attractive and convenient for everybody (Coleman, 1994b)?

FIGURE 21.1 Bending and peering, Safeway Stores, United Kingdom.

Long description: This composite black-and-white image shows three older (70+) women struggling to access goods in a Safeway supermarket. One is trying to pick up a pack of tissues she has dislodged, and the pain in her back is evident. Another, who is short, is staring at goods on an upper shelf that is inaccessible to her. The third is peering at wine bottle labels and having difficulty getting them into the stronger area of her bifocal glasses.

21.3 SHOPPING IN THE TWENTY-FIRST CENTURY

The year is 2005. Alice and her young grandson Henry are going on a shopping expedition—it is more fun than staying in and shopping by TV, and the exercise will do them good—but it looks as if it might rain, so Alice calls up a local "European rickshaw." Soon the doorbell rings and the driver is waiting for them. The rickshaw is a small, lightweight taxi that will take a wheelchair or two passengers plus luggage or store purchases. It costs one-quarter of the price of a London black cab and runs on environment-friendly electricity. Because of its low capital cost and fuel economy the fares are cheap. Alice uses it frequently as it saves having a car and as she no longer enjoys driving.

The rickshaw avoids the worst of the traffic in the bus lane, and it is allowed into the pollution-free central area of the city. Soon they arrive at Alice and Henry's favorite shop, which looks more like a street market or arcade than an old-fashioned supermarket. The designers have discovered ways of breaking out of the gridlock of shelving and checkouts that made shopping such a bore in the last century, and they have opened up the shop frontage with an "active facade" of movable panels incorporating information, advertising, and large-scale visual elements (see Fig. 21.2). They have also used the latest scanning and electronic warehousing technology to do away with checkouts and high-density shelving.

Changes like these have made it possible to humanize the environment by reorganizing it around social focus points such as the café, newsstand, and bakery. Alice likes it because it is busy and sociable, as shops used to be! She can choose her vegetables and cheese personally, while the boring staple items can be ordered and paid for with a handheld "ticker" and collected separately or delivered. In a clever way this has brought back the intimacy and conviviality of the traditional market, while combining it with the modern benefits of convenience, choice, and value.

As they enter the shop, Alice takes a "ticker," an electronic shopping list (see Fig. 21.3), which she uses to order all the items she wants parceled up for her. The list tells her what she has ordered and what it all costs. She can "tick" individual items by scanning the bar codes on the product, or at the shelf edge, or from a catalogue in the café area, and add or subtract goods until she has ordered everything she wants and can afford. There are also in-store displays that will read the bar code on a product, tell her all about what's in it and where it comes from, and give her recipes, tips, and

FIGURE 21.2 Royal College of Art Industrial Design Engineering students' scenario for Safeway stores—shopping in the twenty-first century, an active facade.

Long description: This black-and-white collaged image shows an older man (70+) standing in front of an "active" Safeway supermarket facade, consisting of static images and moving images screened on sliding panels, and in this case showing the news and weather in real time.

more. Henry loves finding out where everything comes from and seeing the people who produce it and how they live.

The shelving is curved so that Alice can easily reach a large area from one point, and there is none of the bending and stretching that there used to be. There is also far less shelving, with goods displayed in small quantities, and less confusion, all of which makes the routine side of shopping quick, simple, and convenient. Once she is sure she has everything she wants, Alice pays off her ticker with her debit card. While her goods are being collected and packed in the electronic warehouse

FIGURE 21.3 Shopping in the twenty-first century, scanning technologies.

Long description: This black-and-white collaged image shows a young female shopper using a ticker and enhanced bar-code scanner that is circular and shaped like a quoit, which makes it easy to hold. The scanning region is illuminated to make it easy to orient, and scanned items appear as a shopping list with price against them on the face of the ticker, making it easy to check what has been ordered. In the first image she ticks a shelf-edge bar code, in the second she ticks the bar code on a pack, and in the third image she swipes her ticker past a checkout point.

downstairs, she and Henry buy fresh pasta in the delicatessen and a cake from the bakery, and they pick up Alice's prescription refill at the pharmacy, which has a direct link to her doctor's office.

This human-centered approach is carried through into the detail of fixtures, fittings, and products, with fiber-optic display lighting to reduce glare and improve presentation, glass jars and lids that are easy to handle and open, and attractive chairs that are surprisingly easy to get into and out of. Even the crockery in the café works well for older people such as Alice, who often find cups, plates, and saucers difficult to grip and carry. There are shopping trolleys that combine functionality with convenience and ergonomic fit, and they even offer a perch seat for a short rest.

After visiting the newsstand for Henry's favorite old-fashioned comic book, they decide they are ready to go back. Alice stops to check the electronic classifieds on her way out—she is looking for a garden shed—and, seeing two that might do, enters her phone number so she can be called later by the sellers. By now the sun is shining, and Alice and her grandson decide to walk back home via the park. They take the cake and comic book with them, leaving all the bulky goods to be delivered later.

In reality, shopping is not like that at all, but why? The problem is, very few people can imagine such things are possible, and this is where creative designers can help, by offering new visions of a people-friendly future.

21.4 GENERAL LESSONS LEARNED FOR UNIVERSAL DESIGN

The key lesson from the DesignAge program and subsequent work at the Royal College of Art is that there is an important choice to make regarding design for the future, especially regarding older adults and consumer activities. It seems that this represents a significant fork in the road for universal design (UD). Designers can work hard at patching up what is clearly wrong in the way products, services, and the built environment are designed, and this is an important endeavor, but designers also have the choice to radically rethink the status quo. This is a sort of Microsoft versus Macintosh choice. As constant patches have been added to the Microsoft operating system, it has become clumsy and not nearly as user-friendly as its lighter-footed competitor that has given us more recently the iPod, the iPhone, and the iPad, all of which provide a convenient and user-friendly e-shopping experience. And even Macintosh may soon find itself ousted by yet more radical forms of technology that are under development by Google and other innovative companies.

Another way of looking at this is to think in terms of the time lag between idea and implementation. A good example of this is the shopping in the twenty-first century scenario featured in this chapter. That scenario was written a full 17 years ago, yet one of the editors of this book singled it out as a unique contribution to UD pointing the way to a future that has yet to be realized. In 1992, almost all the elements of Alice's shopping trip were achievable. Many were prototyped and could have gone into production immediately. In other words, the design disciplines could have moved forward in a far more people-friendly way than they have, and one has to ask why that proved not to be the case.

At the RCA, researchers and designers developed similarly radical ideas about the future of transportation, taking into account environmental and amenity issues along with population aging and disability issues, and they came up with an all-encompassing vision of mobility for all rather than ideas about adapting existing vehicles. The European rickshaw that Alice ordered up was part of that vision, which was one of joined-up micro and macro services, not a monolithic state-controlled system of public transport, but a network of services delivered by public, private, and voluntary sectors that together were capable of meeting complex individual needs in a seamless way (Coleman and Harrow 1997, 2000).

Achieving this requires two things. First, a new generation of designers committed to a human-centered future and sufficiently educated to envisage and invent what is needed. RCA faculty members have been working hard to nurture those young designers with insight and ability and to place them in industry and research and development. Second, a new type of consumer, who is actively involved in the design and development process, is required. All this points to a form of participatory codesign that is not about fixing what already exists, but about mapping out a more human-centered future along the lines of the above scenario.

21.5 STUDENT DESIGN COMPETITION

In an attempt to bring about these conditions, an annual competition "Design for Our Future Selves" was established as part of the DesignAge program and continued under the aegis of the HHC. Open to final-year Master's students in all the design disciplines taught at the RCA, a condition of entry was evidence of research and design development undertaken with older people. This was facilitated by a collaboration with the U.K. University of the Third Age (U3A), an educational and social program organized by and for retired people. The judging panel consisted of leading designers, U3A members, and representatives of appropriate nongovernment organizations (NGOs). Entries were exhibited and judged at the RCA annual summer show, giving a high profile to the project as the show has thousands of visitors.

The competition began in 1994, and over the years the variety of entries has served to establish a body of work, give substance to the concept of age-friendly inclusive design, and bolster the idea that today's designers should actively seek to design a world in which they will enjoy living when older. The competition entries demonstrate that by including the needs of older people it is possible to design better solutions for all ages and abilities. The diversity of the competition projects supports this concept by demonstrating how traditional objects can be redesigned and new concepts developed. Some of the designs represent a sense of freedom and escape, such as yachts or cars or flotation platforms from which to view the underwater world; others home in on the practicalities of restricted lives, with ideas to support household chores, reading, sitting, standing, and staying warm, and extending into humanizing hospitals and residential care. (For examples of winning designs, see Figs. 21.4 and 21.5.)

FIGURE 21.4 DesignAge competition winner in 1999: "Pull the plug" by Martin Bloomfield (*RCA Industrial Design Engineering*).

Long description: This black-and-white image shows an older person's hand pulling a U.K. three-pin electric plug from a socket—a difficult operation for anyone with arthritis or a weak grip—by using a colored plastic "pull the plug" strap. The strap wraps around the plug, using the pins to secure it and creating an easily accessible and low-cost handgrip, thus converting a standard plug to a more expensive, accessible plug without the need for replacement.

FIGURE 21.5 DesignAge competition winner in 1998: the "Tate Stool," a lightweight, portable seat for museum visitors by Olof Kolte, RCA Furniture Design.

Long description: This black-and-white composite image shows a nesting stack of lightweight Tate Stools and two older (70+) people sitting on them and conversing. The stools are ultra-lightweight and constructed of thin, slotted plywood and plastic-coated tubing. They are gently saddle-shaped and have a small handle at the back for carrying. They were designed for galleries and similar situations and named after the Tate Gallery in London. They are intended to be carried around from room to room and used for temporary sitting.

Personal alarms, steps, and purses that cannot be snatched are small advances that could make life worth living for many older people. These designs offer greater self-determination, mobility, and choice for a section of the community that has been overlooked until recently. By no means are all the projects aimed directly at the older adult market, but in tackling such issues as living alone, they bring the age issue into focus. Most importantly, they engage a young generation of designers with crucial issues of inclusion and the goal of designing for the whole population rather than for just their own peer group. For many students this is a life- and career-changing experience that refocuses their thinking and helps them discover a new purpose and source of inspiration. By applying their creativity and inventiveness to these issues they deliver the exemplars that can carry the universal design message out into the wider community and help change thinking in a most positive way.

21.6 CONCLUSION

An important task and challenge for universal design in all its local incarnations as it spreads successfully around the globe is to map out an inclusive future vision that can be achieved through good design that is relevant to local communities. Design exemplars help nondesigners "see" how things could be different and give them new goals and objectives. The more flesh that can be put on that vision the better, which requires that bridges be built and collaborations be made with progressive thinkers in industry, government, and the voluntary sector. In short, universal design needs to reposition and promote itself as *better* design and not as a "fix" for poor design.

21.7 POSTSCRIPT

The RCA was awarded a Queen's Anniversary Prize for the DesignAge initiative in 1994, which the author received personally from Her Majesty Queen Elizabeth. He retired in 2008 but has a continuing involvement with the RCA as Professor Emeritus in Inclusive Design.

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21.9 RESOURCES

Helen Hamlyn Centre web site: http://www.hhc.rca.ac.uk/208/all/1/research_associates.aspx.

Inclusive Design Challenge web site: http://www.dba.org.uk/awards/challenge.asp.

CHAPTER 22
OUTDOOR PLAY SETTINGS: AN INCLUSIVE APPROACH

Susan Goltsman

22.1 INTRODUCTION

A quality play and learning environment is more than just a collection of play equipment. The entire site, with all its elements—from vegetation to storage—can become a play and learning resource for children with and without disabilities. This chapter discusses how to create an inclusive play area that integrates the needs and abilities of all children into the design.

22.2 BACKGROUND

Play is fun and joyful, but play is much more than amusement. For centuries, thoughtful observers have recognized play as integral to childhood life. Play shapes our brains, opening us to new possibilities and making us more adaptable to new situations. Like nutrition and sleep, play is a central element in determining our health, well-being, creativity, and intelligence. Through play, children learn to interpret and interact with the world around them. It can be solitary or cooperative, active or contemplative. It is flexible and changeable according to one's mood, the time of day, or the season of the year.

It is a process through which children develop their physical, mental, and social skills. It is value-laden and culturally based. In the past, most play experiences occurred in unstructured, child-chosen places around the neighborhood. However, children with disabilities, depending on the type and severity of the disability and the attitudes of their parents, generally have less access to these neighborhood free-range play settings. They also have limited choices within most structured play settings. It is possible, however, to create well-designed and developmentally appropriate play areas that successfully integrate the needs of *all* children. The key is to provide diverse physical and social environments, so that children with disabilities are a part of the overall play experience.

Designing an Integrated Play Area

While most forms of play are essential for healthy development, spontaneous "free play"—the kind that occurs in play areas—is the most beneficial type. Play scholars define *free play* as an activity that contains six key dispositional factors. Play is

- Voluntary, allowing players to enter or leave play at will
- Spontaneous, facilitating play that can be changed by the players

- Unique, different from everyday experiences because it involves a pretend element
- Engaging, as players are involved in the activity
- Autonomous, separated from all surrounding activities
- Fun, pleasurable, and enjoyed by the players

Outdoor free play allows children to do what their bodies need to do—move. Development depends upon movement. A well-designed, well-managed play environment should provide children with developmental opportunities for

1. Physical activity and motor skill development
2. Decision making
3. Learning
4. Dramatic play
5. Social development
6. Fun

A good play area that is designed to integrate children of all abilities consists of a range of settings carefully layered onto a site. It contains one or more of the following elements: entrances, pathways, fences and enclosures, signage, play equipment, game areas, landforms and topography, trees and vegetation, gardens, animal habitats, water play, sand play, loose parts, gathering places, stage areas, storage, and ground covering and safety surfacing. In any play area design, each play element varies in importance, depending on community values, site constraints, and location. The way these elements are used will also determine the degree of accessibility and integration that is possible in that environment.

To be developmental, play must present a challenge as part of its value. Therefore, physical challenge within the play area must be part of a progression of challenges that promote an individual's skill. Not every part of the environment should be physically accessible to every user; a play area must support a range of challenges, both mental and physical.

However, the social integration experience *must* be accessible to all. Social diversity is very much linked to physical diversity. Contact between children of different abilities will naturally increase in play areas that are open to a wider spectrum of users. This interaction is particularly critical for children with functional limitations, who so often are denied these social experiences. If the play area truly serves the range of children who use it, then it is considered to meet the definition of universal design. Such an environment will allow more children to participate, make choices, take on challenges, develop skills, and most importantly play together (see Fig. 22.1).

Elements of an Integrated Play Area

- Consider the many ways in which children with disabilities can interact. When arranging the play area, integrate accessible play equipment with the rest of the play setting. Placing less challenging activities directly next to those requiring greater physical ability will encourage interaction across all ability levels.
- Provide an accessible route that connects every activity area and every accessible play component in the play setting. A *play component* is defined as an item that provides an opportunity for play; it can be a single piece of equipment or part of a larger composite structure. Even though not every play component will be physically accessible to everyone, simply enabling all children to be "near the action" provides opportunity and choice and promotes the possibility of communication with others. This is a major step toward integration.
- Ensure that at least one of each kind of play component on the ground is accessible and usable by children with mobility impairments. Likewise, at least one-half of the play components elevated aboveground should be accessible. Access onto and off equipment can be provided with landforms,

FIGURE 22.1 Universally designed play areas provide diverse activities.

Long description: This illustration shows the universally designed Always Dream Play Park in Fremont, California. Funded by Olympic Champion Kristi Yamaguchi's Always Dream Foundation, this play area was designed for movement for children of all abilities. The design includes curving pathways that encourage running and playing with wheeled toys, circular play mounds in bright colors for climbing and rolling, spinning net equipment for group play, a slide, and swings. The play area also contains a dramatic play area, sand and water play, and a family gathering area in the center of the space.

ramps, transfer platforms, or other appropriate methods of access. Remember that ramps and transfer systems can also serve as physical challenges and should be designed so that they add to the diversity of the environment.

- Make portions of gathering places accessible to promote social interaction. These are important areas of interaction and allow groups of people to play, eat, watch, socialize, and congregate. Include accessible seating, such as benches without backrests and arm supports, so people of varying abilities can sit together.
- Don't forget safety guidelines, which outline important parameters such as head entrapments, safety surfacing, and use zones. At times, however, provisions for safety and accessibility can conflict. For example, a raised sand shelf could be considered hazardous because the shelf is more than 20 in. off the ground. If one strictly followed the safety requirements, the edge of the shelf would require a nonclimbable enclosure, which would defeat the whole purpose of the design. In such cases, seek solutions that provide other means of access or that mitigate the safety hazard, such as installing rubber safety surfacing on the ground below the shelf.

22.3 PERFORMANCE CRITERIA FOR INCLUSIVE PLAY SETTINGS

A universally designed play setting is not high tech; it is design tech. To accommodate the needs of children with varied abilities, the overall design or individual components should be designed as an inclusive system. The focus needs to be on good anthropometric data as well as user-based design guidelines and performance criteria. The accessible components that are created, such as transfer systems for manufactured equipment, should not themselves be stigmatizing by their appearance.

The options available for creating a universally designed play area are based on innovative thinking and problem solving. The following section presents performance criteria for creating accessibility and integration in play areas.

Pathways and Circulation within a Play Setting

Because play is primarily a social experience, accessible routes through a play setting must connect all types of activities. Without this connection, children with disabilities can too easily find themselves isolated from their friends without disabilities. Accessible routes within play settings avoid problems caused by circulation design flaws, and they satisfactorily promote social interaction.

A good play setting has many routes through the space; a route itself may be the play experience. Pathways can be a play element in themselves, supporting wheeled toys, running games, and exploration. Most exercise that takes place on a play area happens on the circulation system. To be accessible, pathways require firm and stable surfaces and correct grades (1 up to 20) and cross slopes (2 percent or less). The quality of the pathway system sets the tone for the environment. Pathways can be wide with small branches, long and straight, or circuitous and meandering. Each creates different play behaviors and experiences. To promote the range of challenges necessary for a variety of developmentally appropriate play experiences, minimum routes or auxiliary pathways through a play experience are exempt from the strict requirements of the primary accessible route of travel. The following criteria for accessible route design apply:

- An accessible route to and for the intended use of the different activities within the play area setting must be provided.
- The accessible route should ideally be a minimum of 72 in. wide but can be adjusted down to 36 in. if it is in conjunction with a bench or play activity.
- The cross slope of the accessible route of travel shall not exceed 1:50.
- The slope of the accessible route of travel should not exceed 1:20.
- If a slope exceeds 1:20, it is considered a ramp. A ramp on the accessible route of travel on the ground plane should not exceed a slope of 1:16.
- If the accessible route of travel is adjacent to loose-fill material or there is a drop-off, the edge of the pathway should be designed to protect a person using a wheelchair from falling off the route and into the loose-fill material. This is done by beveling the edge with a slope that does not exceed 30 percent. A raised edge will create a trip hazard for walking children. If this route is within the use zone of the play equipment, the path and the edge treatment should be made of safety surfacing.
- Changes in level along the path should not exceed ½ in.
- Where egress from an accessible play activity occurs in loose-fill surface that is not firm, stable, and slip-resistant, a means of returning to the point of access for that play activity should be provided, and the surfacing material should not splinter, scrape, puncture, or abrade the skin when being crawled upon.

Manufactured Play Equipment

Most equipment settings stimulate large-muscle activity and kinesthetic experience, but they can also support nonphysical aspects of child development. Equipment can provide opportunities to experience height, and it can serve as a landmark to assist orientation and way-finding. These settings may also become rendezvous spots, stimulate social interaction, and provide hideaways in hiding and chasing games. Small, semienclosed spaces support dramatic play, while seating, shelves, and tables

FIGURE 22.2 A play village that provides access through and around makes the dramatic play social experience available to all.

Long description: This photo shows a child and adult caregiver in the play village in Chase Palm Park in Santa Barbara, California. A play village is a child-sized setting for dramatic play. This play village consists of three thick concrete and plaster walls that evoke the Spanish-style buildings of Santa Barbara. The walls are offset from one another to create hiding places, social nooks, and spaces for dramatic play.

encourage social play. Access up to, onto, through, and off equipment should also provide a variety of challenge levels appropriate to the age of the intended users (see Fig. 22.2).

In addition to the standard requirements for siting and safety, consider the following:

- Properly selected equipment can support the development of creativity and cooperation, especially structures that incorporate sand and water play. Play structures can be converted to other temporary uses, such as stage settings, and loose parts can be strung from and attached to the equipment, such as backdrops or banners for special events. Equipment settings must be designed as part of a comprehensive multipurpose play environment. Isolated pieces of equipment are ineffective on their own.
- Equipment should be accessible, but must be designed primarily for children, not wheelchairs. Transfer points should provide both visual and tactile cues. The most significant aspect of making a piece of equipment accessible is to understand that children with disabilities need many of the same challenges as children without disabilities. Using synthetic surfacing can provide access to, under, and through the equipment for children who use wheelchairs. For these children, getting into the center of action may be as important as climbing to the highest point for other children.
- Play equipment provides opportunities for integration, especially when programmed with other activities. Play settings should be exciting and attractive for parents as well as children, as adults accompany children to the park or playground more often today than in the past. It is equally important to design for parents using wheelchairs who accompany their able-bodied children.

Water-Play Areas

Water in all its forms is a universal play material, because it can be manipulated in so many ways. Permanent or temporary, the multisensory qualities of water-play areas make a substantial contribution to child development. Water settings include a hose in the sandpit, puddles, ponds, drinking fountains, bubblers, sprinklers, sprays, cascades, pools, and dew-covered leaves (see Fig. 22.3).

FIGURE 22.3 Water sprays installed below a rubber surface provide water play for everyone.

Long description: This photo shows the water-play area at the Jacksonville Children's Zoo in Jacksonville, Florida. In the photo children play in water sprays placed at ground level as well as within large whale sculptures and other sea creatures found in the ocean near Jacksonville. Rubber safety surfacing covers the ground plane, and planting surrounds the water-play area.

If water play is provided, a part of the surface area must be wheelchair accessible. If the water source is manipulated by children, it must be usable by all children. If loose parts such as buckets are provided and children have access to the equipment storage, the storage must be usable by all children. When water is provided for play, the following dimensions apply:

- Forward reach: 36 to 20 in.
- Side reach: 36 to 20 in.
- Clear space: 36 × 55 in. The clear space should be located at the part of the water-play area where the most water play will occur. If the water source is part of the active play area and children turn the water on and off, it must be accessible. If the water source is part of a spray pool, the area under the spray should be accessible. Accessibility should involve the dimensions for both clear space and reach.
- Clearance ranges: top height to access water, 30 in. maximum; under clearance, 27 in. minimum.

Sand-Play Areas

Children will play in dirt wherever they find it. Using props such as a few twigs, a small plastic toy, or a few stones, children can create an imaginary world in the dirt, around the roots of a tree, or in a raised planter. The sandbox is a refined and sanitized version of dirt play. It works best if it retains dirt play qualities. The sand area should be large with small, intimate spaces designed into it, with access to water and small play props (see Fig. 22.4).

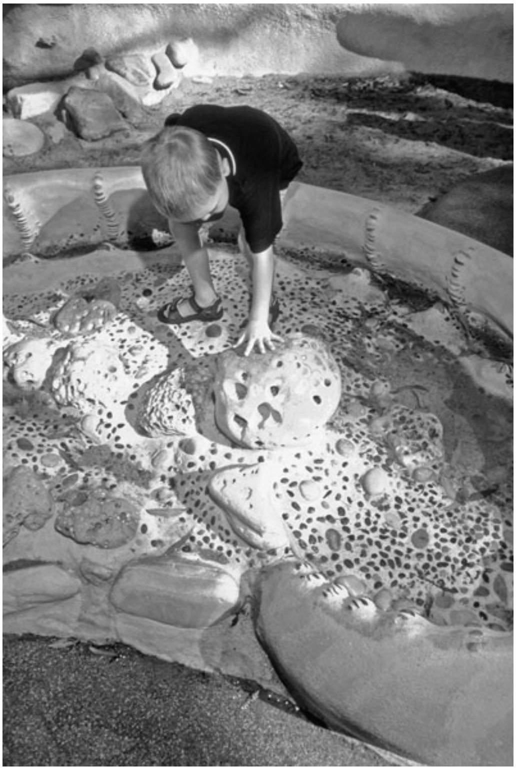

FIGURE 22.4 Giant nautilus water-play element.

Long description: This photo shows a child touching a nautilus-shaped play element with water running through it at Chase Palm Park in Santa Barbara, California. The nautilus is part of the sand- and water-play area in the park and is made from concrete with inlaid stones and pebbles.

If a sand-play area is provided, part of it must be accessible. Important elements are clear floor space, maneuvering room, reach and clearance ranges, and operating mechanisms for control of sand flow. When products such as buckets and shovels will likely be used in the sand-play area, storage places should be at accessible reach range.

Raised sand play is a very limiting play experience because of the way a raised area must be constructed. To provide a place for the wheelchair user under the sand shelf, there is very little depth of sand available for play. Therefore, a raised sand area by itself is not a substitute for full-body sand play.

If the sand area is designed to allow children to play inside the area, a place should be provided where a participant can rest or lean against a firm, stationary back support in close proximity to the main activity area. Back support can be provided by any vertical surface that has a minimum height of 12 in. and a minimum width of 6 in., depending on the size of the child. Back support can be a boulder, a log, or a post that is holding up a shade structure. A transfer system into a sand area may also be necessary if the area is large and contains a variety of sand activities. A transfer system is appropriate if there are no areas of raised sand play in the primary activity area, or if the sand area is over 100 ft^2 and the raised sand area would tend to isolate accessible sand-play activities.

When raised sand is provided, the following clearance ranges apply:

- Top height to sand: 30 to 34 in. maximum
- Under clearance: 27 in. minimum
- Side reach: 36 to 20 in.
- Forward reach: 36 to 20 in.
- Clear space for wheelchair: 36 × 55 in.

Depending on the site conditions and the amount of sand play, shade may be required. It may be provided through a variety of means, such as trees, tents, umbrellas, structures, and so forth. This advisory requirement for shade is based on the site context, program, and users. Some shade in or around sand is usually desirable, but sand needs sunlight to dry out and keep clean.

Gathering Places

To support social development and cooperation, children need comfortable gathering places. Parents and play leaders need comfortable places for washing up, sitting, socializing, and supervising (see Fig. 22.5). If gathering places are provided, a portion of them should be accessible and serve people of all ages. A gathering place contains fixed elements to support playing, eating, watching, talking, or assembling for a programmed activity:

- *Seating.* At least 50 percent of fixed benches should have no backs and arms so they can be used for a variety of activities, not just sitting.
- *Tables.* Provide a variety of sizes and seating arrangements.
- *Game tables*. Game tables provide a place for two to four people to play board games. If fewer than five game tables are provided, a minimum of one four-sided game table should include an accessible space on one side.

FIGURE 22.5 Accessible washup sink serves people of all ages and abilities.

Long description: This photo shows an adult sitting in a wheelchair washing his hands at an accessible sink in Flood Park, located in Menlo Park, California. The sink is made of concrete and can be used sitting down or standing up.

- *Storage*. If storage is supplied and a part of the gathering area and the storage are used by children, accessible shelves and hooks should be a maximum of 36 in. above the ground. The amount of storage is dependent upon program requirements.
- *Shade.* Shade may be desirable for gathering areas where people will be participating in activities over a long time. Shade can be provided by a variety of means such as trees, canopies, or trellises, depending on site context.

Garden Settings

Gardening, a powerful play-and-learn activity, allows children to interact with nature and one another. Gardens in play areas primarily provide activities of planting, tending, studying, and harvesting vegetation. Depending on the type and height of plantings, planter boxes may require a raised area for access or transfer. A garden must provide a minimum of one accessible garden plot.

If a raised garden area is provided, it should have the following features:

- The raised area should be located as part of the main garden area. The amount of raised area is determined by the program, but a minimum of 10 percent of the garden should be raised.
- The edge should be raised above the ground surface to a minimum of 20 in. and a maximum of 30 in.

The garden growing area should allow access either by side or by forward reach 12 to 36 in. above the ground.

- *Transfer systems*. If children are required to sit in the dirt to garden, a transfer point should be provided that enables a participant to transfer into the garden.
- *Potting and maintenance areas*. Potting and preparation areas should allow access by either forward or side reach. The amount of area to be made accessible depends on the program. At least one workstation for potting should be made accessible.
- *Storage*. Storage areas for the garden should provide access for children who use wheelchairs. Hooks and shelves should be a maximum of 36 in. off the ground.
- *Circulation*. Aisles around the garden (36 to 44 in.) should be provided on a main aisle so a child using a wheelchair or walker can get to the garden. This larger aisle (48 to 60 in.) should also provide access to the accessible gardening spaces.

Landforms, Vegetation, and Trees

Landforms, vegetation, and trees should be integrated into the flow of play activities and spaces, and they can be play features in themselves.

Landforms help children explore movement through space and provide for varied circulation. Topographic variety stimulates fantasy play, orientation skills, hide-and-seek games, viewing, rolling, climbing, sliding, and jumping. “Summit” points must accommodate wheelchairs and provide support for children with other disabling conditions.

Trees and vegetation comprise one of the *most* ignored topics in the design of play environments. They are two of the most important elements for social integration because everyone can enjoy and share them. Vegetation stimulates exploratory behavior, fantasy, and imagination. It is a major source of play props, including leaves, flowers, fruits, nuts, seeds, and sticks. It allows children to learn about the environment through direct experience.

Designers and program providers should emphasize integrating plants into play settings rather than creating separate “nature areas.” For children with physical disabilities, the experience of being in trees can be replicated by providing trees that a wheelchair user can roll under. An accessible mini-forest can be created by planting small trees or large branching bushes.

If vegetation, trees, or landforms are used, access also needs to be provided. Tree grates and other site furniture that support or protect the feature must be selected so as not to entrap wheels, canes, crutch tips, etc.

Entrances and Signage

Entrances are transition zones that help orient and inform users and introduce them to the site. They are places for congregating and for displaying information. Not all play areas, though, have defined entrances. Sometimes entry to a play area can be provided from all directions.

Expressive and informative displays use walls, floors, ground surfaces, structures, ceilings, sky wires, and roof lines on or near a play area to hang, suspend, and fly materials for art and education. Signage is a visual, tactile, or auditory means of conveying information, and it must communicate a message of "All Users Welcome."

22.4 CONCLUSION

Play is learning. Play helps children to express, apply, and assimilate knowledge and experiences. A rich play environment encourages all children to grow and develop into healthy adults. Most children today have very sanitized, "packaged" play experiences. Many urban children have never built a fort or "claimed" a piece of an outdoor environment as their own private adventure area.

One day the author was walking through a housing development that was under construction. There were piles of dirt and boards around—great fort-building materials! On top of one dirt pile was a 5-year-old boy, and at the bottom of the pile was his grandfather watching him play.

The construction foreman soon came over to the grandfather and told him that the boy must get off the dirt because his liability insurance would not cover it. The grandfather told the boy what the foreman said. The child looked around and just could not understand why he could not play there. He knew he was doing nothing wrong. The grandfather tried to explain to the child. Finally the boy got up off the pile of dirt, looked around, and said to the grandfather, "A kid's gotta do what a kid's gotta do." It is the responsibility of every adult and every institution that serves children to create places so that a kid—any kid—can do what a kid's gotta do.

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CHAPTER 23
OFFICE AND WORKPLACE DESIGN

James L. Mueller

23.1 INTRODUCTION

The unemployment rate among Americans with disabilities remains well above that of nondisabled Americans (Bureau of Labor Statistics, 2009) despite passage of the Americans with Disabilities Act (ADA) of 1990 and the American with Disabilities Act Amendments Act of 2008 (ADAAA), which ensured the rights of individuals with disabilities in the workplace and in the community. The Ticket to Work and Self-Sufficiency Act was passed in 1999 to remove financial disincentives to work for people with disabilities. As the workforce ages and the cost of work disability rises, demographic and economic trends have combined with legislation regarding employment of people with disabilities to make universal design in the workplace a powerful issue. Workplace design that considers age-related changes in vision, hearing, posture, and mobility will be critical to an aging workforce expected to work even further into their senior years than previous generations (Taylor et al., 2009).

This chapter discusses how these trends impact designers and manufacturers of furniture, equipment, materials, and other workplace products. This chapter also presents specific examples of how designers, employers, and manufacturers have responded by implementing the concept of universal design.

23.2 ECONOMIC BACKGROUND

"What do you do for a living?" is one of the first questions posed when people meet. Especially in the United States, one's personal identity depends heavily on what he or she does for a living. But approximately two-thirds of Americans with disabilities are unemployed. This is an enormous burden on them and on their families. Hundreds of thousands of employees become disabled each year and leave the workplace permanently. Their former employers must bear the burden of replacing them as well as paying disability benefits, and taxpayers must help fund public benefit programs for them such as Social Security Disability Income (SSDI).

The SSDI program is the primary source of income for millions of Americans considered too disabled to work. Between 1985 and 1994, SSDI payments doubled from $19 billion to $38 billion (U.S. General Accounting Office, 1995). By 2003, this total had reached $70 billion (U.S. Government Accountability Office, 2004). Realizing that continuing increases like these could destroy the national budget, Congress passed the Ticket to Work and Self-Sufficiency Act of 1999 to provide greater vocational rehabilitation services and financial incentives to enable more Americans with disabilities to work (Social Security Administration, 2000). Fostering work among SSDI recipients continues to be an important priority in the government's agenda regarding disability policy (Benitez-Silva et al., 2006). Workplace design that considers the needs of workers with disabilities in both the public and private sectors promises to continue to be important to the national economy.

The workplace is the site of millions of injuries per year. A permanently disabled employee can cost his or her employer thousands of dollars in benefits, insurance costs, and lost productivity. Thirty percent of current American workers will become disabled before retirement. Twenty percent will experience an accident or illness that will keep them out of work for at least a year (National Safety Council, 2008). But not all disabilities are caused at work.

Seventy percent of all people with disabilities are not born with them, but develop them during the course of their lives (Louis Harris and Associates, 1994). As more people live longer lives, the likelihood of experiencing a disability during one's lifetime increases. Medical progress has had a profound effect on treatment of illness and accidents that a short time ago might have been fatal (Lew, 2005).

Historically, both government and business have been more willing to pay cash benefits than to provide assistance to help disabled workers return to productive employment. Consequently, federal work incentive programs for people with disabilities have struggled to gain traction (Ticket to Work and Work Incentives Advisory Panel, 2007). Among private businesses, costs of insurance, employee replacement, and workers' compensation and other disability benefits have prompted long-term disability insurers to institute comprehensive rehabilitation and return-to-work programs. These programs have been shown to yield excellent returns on investment (Beal, 2007).

Both the ADA and ADAA, as well as their predecessor, the Rehabilitation Act of 1973, prohibit employers from discriminating against individuals with disabilities who are qualified and able to perform the essential duties of an available job, with or without reasonable accommodation. Although these laws have boosted the employment rights of people with disabilities, they have had little effect on the level of unemployment among people with disabilities.

Occupational injuries and the steadily aging workforce ensure that disability will continue to be a common concern among American workers and their employers. Compared with the enormous cost of paying disabled employees not to work, making accommodations to bring them back to the job is cheap. According to ongoing studies by the Job Accommodation Network (JAN), 56 percent of accommodations cost absolutely nothing to make, while the rest typically cost only $600 (Job Accommodation Network, 2009).

23.3 JOB ACCOMMODATIONS FOR EVERYONE EQUAL UNIVERSAL DESIGN IN THE WORKPLACE

Job accommodations usually benefit coworkers without disabilities as well as the worker requesting accommodation. It is rare that on-site job accommodation needs analysis fails to reveal risks of reinjury to the returning disabled worker that are also hazards to other employees. Accommodations developed with this in mind bring employers the double benefit of accommodating as well as preventing disability.

At the very least, job accommodations for workers with disabilities should be "transparent" or have no effect at all on coworkers or customers. This is not as difficult as it may sound. For employers with little experience with disabilities, it can be very difficult to imagine how an employee with very different abilities from his or her coworkers might share similar needs. But the same barriers to productive and safe work faced by an employee with a significant disability are usually barriers to nondisabled coworkers as well, although perhaps to a lesser degree.

For example, an individual with limited manual strength and coordination was hired by a window manufacturer to insert weather strip into 12-ft sections of window frame channel. Previous workers had used a pair of pliers to tightly grasp the end of the weather strip in order to pull it the length of the channel. Even for workers with a very strong grip, this was a tiring job that often caused considerable hand pain by the end of a workday.

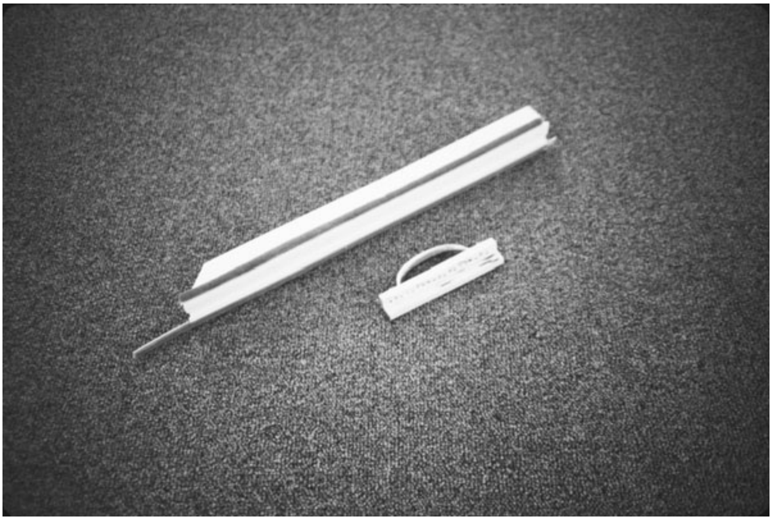


FIGURE 23.1 Simple tool for gripping weather strip.

Long description: This photo shows an 18-in. section of plastic window frame with weather strip inserted. Below is a 6-in. tool with handle and protruding points for gripping weather strip.

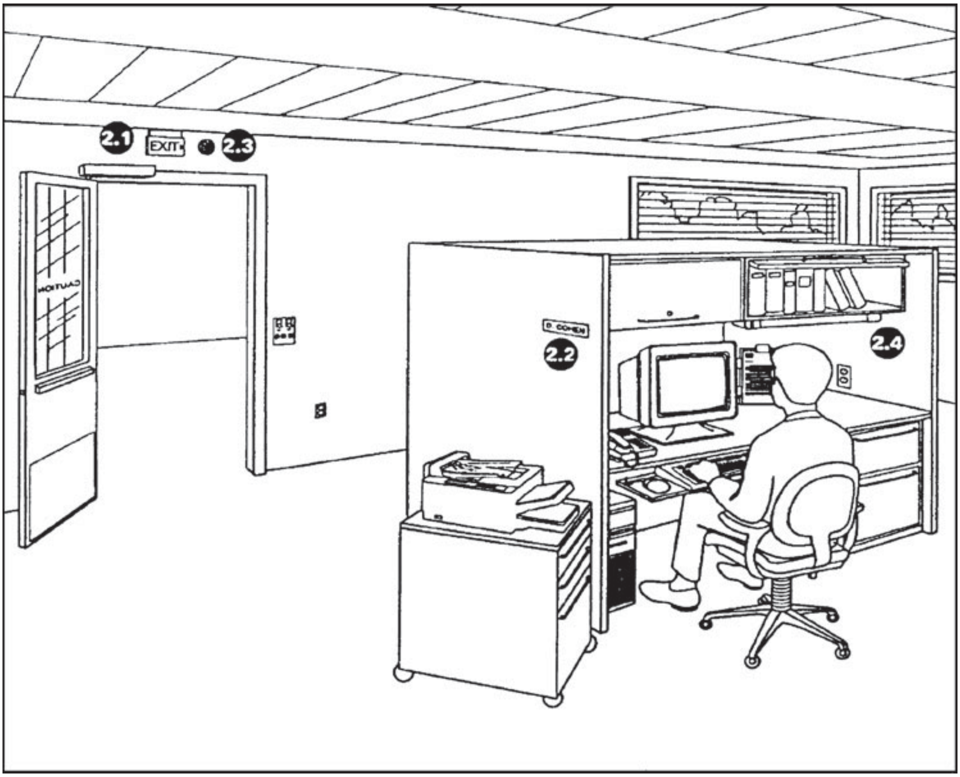
The newly hired individual with manual limitations was unable to exert adequate grip on the pliers to pull the weather strip through the channel without slipping. To accommodate this limitation, the author designed a simple tool, shown in Fig. 23.1, shaped to fit the channel, with a large hand loop and a toothed gripping surface for the weather strip. The worker was then able to hold the tool without gripping tightly and was able to use his body weight on the tool to supply adequate pressure on the toothed gripping surface. The rest of the task simply required him to walk the length of the channel. Both his coworkers and his supervisor were surprised at the ease with which he was now able to perform a task that had been difficult for even the strongest employees. Not surprising, the supervisor suggested that all workers use this tool.

There are many examples like this of successful job accommodation benefiting all workers. Employers in these situations commonly ask, “Why didn’t we do this in the first place?” With growing emphasis on reducing risk of cumulative and repetitive-stress injuries, the supervisor in the aforementioned example might well have asked this very question. He realized the importance of the simple tool in preventing injuries to other employees as well as in accommodating the worker with the disability. In situations like these, employees formerly seen as “different” due to their disabilities helped to identify job and workplace design problems affecting all workers. Their ergonomic needs become effective templates for improvements in job and workplace design for all.

23.4 WORKING TOWARD A UNIVERSAL WORKPLACE

Working with the Computer/Electronic Accommodations Program (CAP) of the U.S. Department of Defense, the author applied this principle to the development of a workbook for workers and supervisors to assess the fit between the employee and his or her workplace. The intent of this effort was to identify workplace design factors that might be barriers to workers with disabilities as well as risks to workers not yet experiencing a disability. The result was CAP’s *Workplace Ergonomics Reference Guide.* Two illustrations from this guide are shown in Figs. 23.2 and 23.3.

Ergonomic Needs Assessment — Visual and Auditory Information



2. Is all visual and auditory information clear and easy to understand?

2.1 Can see and hear important information from anywhere in your work area? ___Yes ___No

2.2 Can see important information in very bright or very dim light? ___Yes ___No

2.3 Can you hear important information above the noise? ___Yes ___No

2.4 Is your work area quiet enough for conversations and telephone use? ___Yes ___No

FIGURE 23.2 Illustration from the *Workplace Ergonomics Reference Guide.*

Long description: This line drawing shows a woman seated in a wheelchair facing a computer monitor, telephone, lamp, and document stand on a table. She is wearing a cordless headset. Her hands are positioned on a keyboard mounted on a slide-out tray, which also holds a computer mouse. Beneath the table is the computer CPU. In the background is a window with blinds and a view of trees beyond.

2. Is all visual and auditory information clear and easy to understand?

2.1 To make vital information seen and heard throughout the work area...

Locate visual information according to its importance-direct line of sight from workstation to emergency signs, less important signs away from center of vision

Ensure adequate lighting on all visual information; lighting should strike signs at an angle of about 45 degrees

Wherever possible, communicate information through sight, sound, and touch (example: vibrating pager with visual display)

2.2 To make visual information understandable in very bright or very dim light...

Use matte, non-glare surfaces on signs; clearly contrast color, brightness, and texture of lettering with background

Use sharp san-serif typestyle with clear distinction between similar shapes (0 and O, A and 4, 1 and I, I and l); for large bodies of text, use serif typestyle, such as Times Roman

Use caps and lower case, except for tactile signs, which should be all UPPER CASE, 5/8" - 2" high, with extended letter, spacing and accompanied by Braille

For numbers, use arabic (1, 2, 3, 4) rather than Roman (I, II, III, IV) numerals

Tactile lettering should be located 60" above floor; raised 1/32" where dirt may fill recessed lettering, recessed where raised lettering might cause confusing shadows on raised lettering

Avoid underlining and borders around lettering, and avoid tight spacing between letters, words, and lines

Reinforce text message with familiar symbols wherever possible

2.3 To make auditory information heard above noise...

Avoid very high or very low tones

If work area is noisy, amplify loudness to exceed usual noise level

Minimize or isolate noise from air conditioning and other equipment with isolation mounts or enclosures; locate copiers, printers, etc. in sound-proof area near work station

Reinforce auditory information with visual signals

2.4 To make the work area quiet enough for conversations and telephone use...

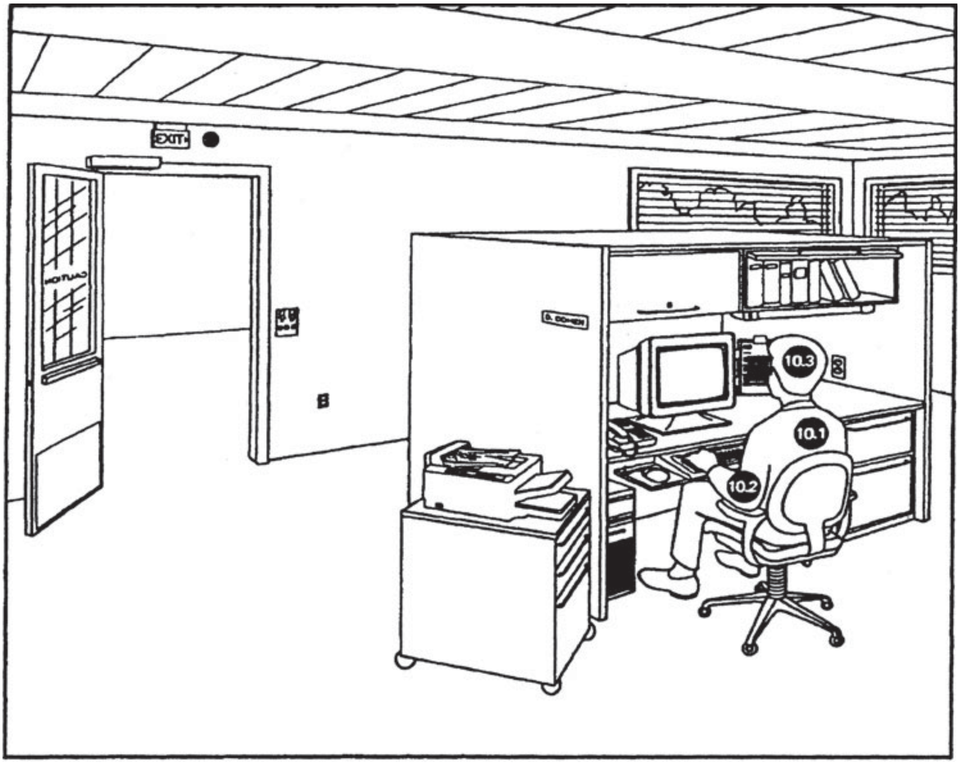
Use sound-absorbing ceiling tile, wall coverings, and carpeting to minimize reflected sound

Install sound absorbing panels at work stations to minimize distractions or provide privacy: 29–41" for modesty screens, 41–69" for seated privacy, 70–73" for standing visual and acoustical privacy

Add volume control or headset to telephone, use e-mail, or set aside “quiet area” for meetings

FIGURE 23.2 (*Continued*)

Ergonomic Needs Assessment — Work Practices



10. Are you free of excessive fatigue and pain at the end of your work shift?

10.1 Do you maintain as neutral a work posture as possible? ___Yes ___No

10.2 Do you avoid repetitive and cumulative stresses? ___Yes ___No

10.3 Do you take care of your health? ___Yes ___No

FIGURE 23.3 Illustration from the *Workplace Ergonomics Reference Guide.*

Long description: This line drawing shows a man seated in an ergonomic chair, facing a computer monitor, telephone, lamp, and document stand on a table. His hands are positioned on a keyboard mounted on a slide-out tray, which also holds a computer mouse. Beneath the table is the computer CPU. Over this drawing have been added dimensions of proper desk height (25 to 34 in.) and depth (19 in. minimum), as well as proper angles for elbow, back, and knees (all at least 90°), and angle of vision to the monitor (35 percent).

10. Are you free of excessive fatigue and pain at the end of your work shift?

10.1 To maintain as neutral a posture as possible...

Sit in a comfortable upright position with feet flat on the floor, thighs fully supported by the chair seat, with no pressure on back of knee area

Adjust the chair armrests so that your upper arms are parallel with your upper body, your lower arms are level, your shoulders neither slumped nor hunched, and your elbows are close to your sides

Adjust the chair backrest so that the lumbar support contacts with hollow of your back, and you can lean forward or backward with moderate resistance

Check the knee clearance: If too low, raise the work surface or remove center drawer; if too high, modify work the surface supports or raise your chair and add a footrest equal to the additional height; remove any obstructions to free movement of your legs

Check the work surface height: Your hands should rest on the keyboard or work surface with your forearms on armrests and your wrists in a neutral (relaxed, not bent) posture

Locate the monitor directly behind the keyboard and mouse, with the top of the monitor at your eye level about arm's length away; to adjust the angle, place a small mirror on the center of the screen and tilt the monitor until you can see your eyes

Position your work, equipment and materials directly in front of you; locate the keyboard and mouse close together on same surface, which should not move when the keyboard is used; use a light touch on keyboard

10.2 To minimize repetitive and cumulative stresses...

Readjust your chair to suit your individual tasks and to give muscle groups a break

Alternate tasks throughout the work shift (example: stop using keyboard, lean back and proofread your work, retrieve work from printer, messages from fax machine, etc.)

Wherever possible distribute or alternate tasks between right and left hands; alternate between use of keyboard and mouse (use keystroke equivalents to mouse)

Avoid prolonged use of a "notebook" computer; minimize "recreational" computer use

Take regular breaks for simple, brief exercises (examples; shoulder shrugs, neck rolls, ankle rotations, leg extensions, overhead stretches, hand shakes, finger spreads)

Every 20 minutes, refocus your eyes from the computer screen to an outside window or other object at least 25 feet away

10.3 To maintain your health...

Have regular general medical and eye examinations as recommended by a physician

Get adequate rest, regular exercise and maintain a healthy diet

FIGURE 23.3 (*Continued*)

This guide includes a simple checklist about common workplace features and provides ergonomic guidance based on a broad compilation of ergonomic resources addressing the following:

1. Workplace accessibility
   - Accessible routes of travel
   - Accessible doorways and door hardware
   - Changes in level
   - Flooring
   - Navigation
   - Emergency evacuation
2. Visual and auditory information
   - Positioning and lighting
   - Typeface selection
   - Ambient noise and auditory signals
   - Sound attenuation
3. Lighting
   - Illumination without glare
   - Materials and positioning to reduce glare
   - Orientation to natural and artificial light
   - Personal measures for reducing eye fatigue
4. Storage
   - Easy access at the workstation
   - Appropriate containers
   - Identification of materials
   - Safe handling and transport
5. Seating
   - Adequate support and stability
   - Adjustability features
   - How to adjust seat, back, and arm support
6. Work space layout
   - Adequate space
   - Work surface materials and adjustments
   - Air quality
7. Computer displays
   - Monitor placement
   - Minimizing glare
   - Locating source documents
8. Computer inputs
   - Keyboard and mouse positioning
   - Hand and wrist support
   - Software options
9. Telephones and other office equipment
   - Electrical supply
   - Equipment controls
   - Telephone location
   - Telephone peripheral options
10. Work practices
    - Maintaining a neutral posture
    - Minimizing repetitive and cumulative stresses
    - Maintaining general health and productivity

Significantly, CAP's *Workplace Ergonomics Reference Guide* offers not only suggestions the employer can apply to improve workplace ergonomics, but also guidance for workers to minimize their risk of workplace-related injury by adopting healthy work habits.

23.5 ENABLING UNIVERSAL DESIGN

The Enabler system was developed in the 1970s (Steinfeld et al., 1979) to aid designers of products and environments in integrating the needs of elderly people and people with disabilities with the rest of the population. This approach points out a number of human functional characteristics that are important to consider in design for human use. The Enabler, as seen in Fig. 23.4, offers a way of dealing with the functional effects of disabilities without getting tangled in medical jargon or compromising confidential medical information.

It is important to keep in mind that the impact of each of these functional characteristics is determined as much by the demands of the environment as by the level of functional ability. For example, limitation of balance is far more significant for a high-rise building construction worker than for a data entry operator, even though their levels of limitation may be very similar.

Since its development in the 1970s, the Enabler system has been widely adapted, including its use in *The Workplace Workbook 2.0* (Mueller, 1992), an illustrated guide to reasonable accommodation and assistive technology for employers. As seen in Fig. 23.5, the explanatory text clarifies each functional limitation.

This approach has also been used by office furniture system manufacturer Herman Miller, Inc., in helping its customers comply with the ADA and gain control of disability management. Herman Miller, Inc., based in Zeeland, Michigan, and second in size only to Steelcase among office furniture manufacturers, had a strong reputation among its customers and wanted to maintain it (Mueller, 1997).

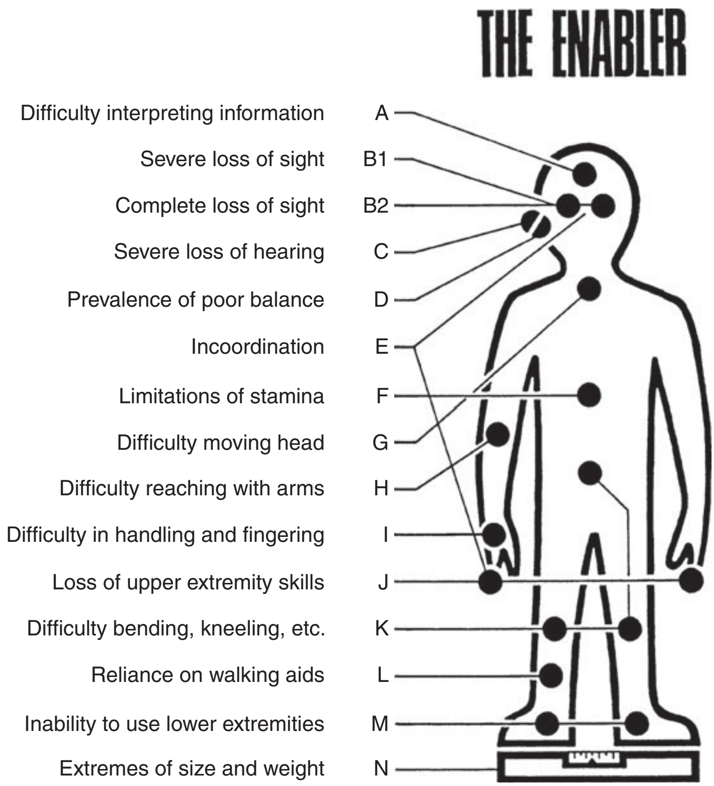


FIGURE 23.4 The Enabler.

Long description: This line drawing shows the outline of a human figure standing on a scale. Along the body are dots connected by lines to corresponding functional limitations listed to the left of the figure.

Difficulty in Processing Information

This characteristic is defined as an impaired ability to receive, interpret, remember, or act on information. Among Americans experiencing this characteristic are approximately 614,000 workers ages 18-69 with learning disabilities, mental retardation, or senility.

Limitation of Sight

This characteristic is defined as a difficulty in reading newsprint-size copy, with or without corrective lenses, and extends to "legal blindness" (but not TOTAL blindness). Among Americans experiencing this characteristic are approximately 829,000 workers ages 18-69 with glaucoma, cataracts, or other eye disorders.

Total Blindness

Total blindness is the complete inability to receive visual signals. It is experienced by approximately 164,000 American workers ages 18-69.

Limitation of Hearing

Limitation of hearing is defined as a difficulty in understanding normal speech (but not TOTAL deafness). It is experienced by approximately 320,000 American workers ages 18-69.

Total Deafness

Total deafness is the complete inability to receive auditory signals. It is experienced by approximately 78,000 American workers ages 18-69.

Limitation of Stamina

Limitation of stamina is defined as fatigue, shortness of breath and/or abnormal elevation of blood pressure due to mild exercise or sensitivity to chemicals. Among Americans experiencing this characteristic are approximately 6,935,000 workers ages 18-69 with heart disease, emphysema, or other respiratory or circulatory conditions.

Difficulty in Lifting, Reaching, Carrying

This characteristic is defined as impaired mobility, range of motion, and/or strength of one's upper extremities. Among Americans experiencing this characteristic are approximately 9,522,000 workers ages 18-69 with arthritis, bursitis, tendonitis, loss/paralysis/deformity of extremities, back impairment, hernia, or quadriplegia, paraplegia, or hemiplegia.

Difficulty in Manipulating

Difficulty in manipulating means impaired hand or finger mobility, range of motion, and/or strength. Among Americans experiencing this characteristic are approximately 2,833,000 workers ages 18-69 with arthritis, carpal tunnel syndrome, cerebral palsy, or multiple sclerosis.

Inability to Use Upper Extremities

This characteristic is defined as complete paralysis, severe incoordination, or bilateral absence of upper extremities. Though not specifically itemized in the National Health Interview Survey data, this characteristic is experienced by Americans ages 18-69 with severe cases of conditions such as multiple sclerosis, spinal cord injury, or cerebral palsy, as well as by those without arms as a result of amputation or congenital loss.

Limitation of Speech

This characteristic is defined as a capability of only slow or indistinct speech, or non-verbal communication. Among Americans experiencing this characteristic are approximately 280,000 workers ages 18-69 with cerebral palsy, a distinct speech impairment, or total deafness.

Susceptibility to Fainting, Dizziness, Seizures

This characteristic may be spontaneous or inducible by environmental factors such as sudden sounds or flashing lights, resulting in loss of consciousness, balance, or voluntary muscle control. Among Americans experiencing this characteristic are approximately 2,094,000 workers ages 18-69 with epilepsy, diabetes, or cerebrovascular disease.

Incoordination

Incoordination is defined as limited control in placing or directing extremities, including spasticity. Among Americans experiencing this characteristic are approximately 442,000 workers ages 18-69 with multiple sclerosis, cerebral palsy, Parkinson's Disease, quadriplegia, paraplegia, or hemiplegia.

Limitation of Head Movement

This characteristic is defined as a difficulty in looking up, down, and/or to the side. Among Americans experiencing this characteristic are approximately 1,732,000 workers ages 18-69 with curvature of the spine or intervertebral disc disorders.

Limitation of Sensation

Limitation of sensation means an impaired ability to detect heat, pain, and/or pressure. Among Americans experiencing this characteristic are approximately 1,789,000 workers ages 18-69 with diabetes, multiple sclerosis, or full or partial paralysis.

Difficulty in Sitting

Difficulty in sitting is defined as excessive pain, limited strength, range of motion, and/or control in turning, bending, or balance while seated. Among Americans experiencing this characteristic are approximately 4,367,000 workers ages 18-69 with curvature of the spine, deformity or impairment of the back, intervertebral disc disorders, complete or partial paralysis, or quadriplegia, paraplegia, or hemiplegia.

Difficulty in Using Lower Extremities

This characteristic is defined as slowness of gait, difficulty in kneeling, sitting down, rising, standing, walking, and/or climbing stairs or ladders. Among Americans experiencing this characteristic are approximately 1,915,000 workers ages 18-69 with cerebral palsy, multiple sclerosis, deformity/absence/impairment of one or both lower extremities, or quadriplegia, paraplegia, or hemiplegia.

Limitation of Balance

Limitation of balance means a difficulty in maintaining balance while standing or moving. Among Americans experiencing this characteristic are approximately 939,000 workers ages 18-69 with cerebral palsy, cerebrovascular disease, complete or partial paralysis, or Parkinson's Disease.

* LaPlante, M.P. (1988). Data on Disability from the National Health Interview Survey, 1983-85. Washington, D.C.: National Institute on Disability and Rehabilitation Research. Data for 1990 are unpublished tabulations provided by the Disability Statistics Program, Institute for Health & Aging, School of Nursing, University of California, San Francisco.

FIGURE 23.5 Definitions of functional characteristics of disabilities from *The Workplace Workbook 2.0.*

Long description: Definitions of each of the 17 functional characteristics of disabilities used in *The Workplace Workbook 2.0* are presented, along with selected data from the 1990 National Health Interview Survey (NHIS).* These data relate to the 16,904,000 Americans ages 18 to 69 who report a "work limitation" due to a chronic condition covered by the NHIS, such as "deformity/impairment of lower extremities." For example, 1990 NHIS data indicate that more than 23 million Americans of all ages, both working and nonworking, report having some hearing impairment, while 398,000 report a work limitation due to a hearing impairment. Many people with disabilities do not report a work limitation, because they do not require accommodation, do not wish to self-identify, or are not in the workforce. Some disabilities result in more than one functional characteristic, so they are listed more than once. It should be kept in mind that individuals having temporary or minor conditions such as flu or a broken leg, as well as those who live long enough to experience the natural effects of aging, will also experience some of these characteristics.

In response to their customers' concerns, Herman Miller, Inc. produced a videotape and an illustrated guide to office planning and design entitled *Designing for Accessibility* (Herman Miller, Inc., 1995). These materials include recommendations for creating a workplace that was as usable for workers with disabilities as for those without disabilities. This workplace also includes flexibility for making specific accommodations for employees who need reasonable accommodation.

In the early 1990s, Herman Miller's customers felt the impact of the ADA in several ways. Public businesses and state and local government facilities were required to ensure that their facilities were accessible to people with disabilities. This meant that interiors, office systems, and furniture designed and supplied by Herman Miller to these customers had to comply with the accessibility guidelines of the new law. Furthermore, the ADA required that employers make "reasonable accommodation" for employees with disabilities. This meant that a Herman Miller workstation might have to accommodate an employee who could be blind, deaf, a wheelchair user, or limited in a variety of other ways.

At the same time, a recession was causing American businesses to postpone investments in new facilities and equipment. Seeking to make the most of their investments, Herman Miller's customers began to preface their contacts with sales representatives with the question "How do your products comply with the ADA?" Since the ADA does not include standards for products such as office furniture, Herman Miller products by themselves could not comply with this law. Instead, the law was written for compliance by organizations. Herman Miller set out to address its customers' question by developing a program to communicate its philosophy of complying with the ADA through workplace design that eliminates barriers that all workers face.

For example, a worker using a wheelchair might have difficulty retrieving a thick file folder from the top drawer of a four-drawer file cabinet. But a coworker with short stature might have similar difficulties, as would a worker with wrist fatigue after long hours of keyboard work. The philosophy also included the capability to make "reasonable accommodation" for disabled employees without undue effort or expense.

The company also developed an *Applications Guide* to help customers understand the requirements of the ADA, the incentives for returning employees with disabilities to the job, and the features of office furniture products that made reasonable accommodation possible (Herman Miller Inc., 1995). The drawing shown in Fig. 23.6 is keyed to a list of features. Both the video and the *Applications Guide* were made available on request through Herman Miller's sales network.

23.6 EFFECTIVE JOB ACCOMMODATION

Through Herman Miller's efforts, customers learned the best approach to effective job accommodation. When approaches such as that suggested by Herman Miller are applied to the overall design of workplaces, most job accommodations are very simple and involve minimal cost. But this doesn't mean that inexpensive accommodations are reasonable and expensive accommodations are not. The most successful accommodations are those that are

1. *Effective.* The solution enables the individual with the disability to do her or his job productively and safely. An effective accommodation does not substitute for the individual but enables the individual to use his or her own abilities.
2. *Transparent.* The solution either has no effect on coworkers, customers, and other aspects of the business or has a positive effect in improving productivity and/or safety.
3. *Timely.* The solution can be implemented within a reasonable time frame.
4. *Durable.* The solution is useful and flexible enough to remain effective throughout the employee's service. Maintenance, as well as modifications necessary due to business or technology changes, can be readily accomplished.

Reasonable workplace accommodations are likely to be a compromise among these criteria. For example, it may be less expensive for a business to relocate an employee who uses a wheelchair to

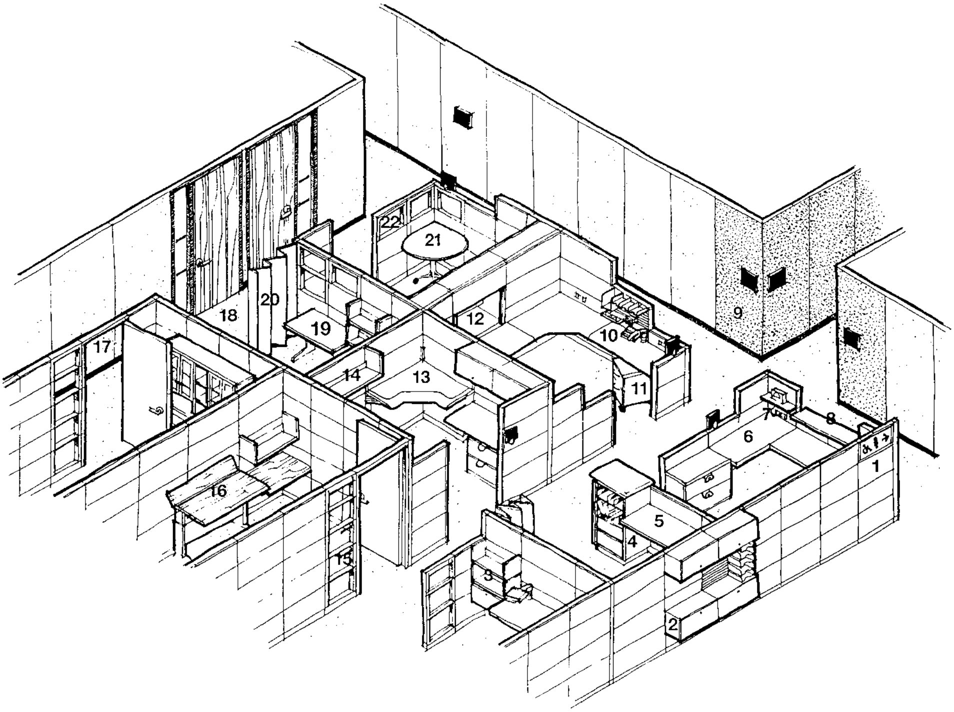


FIGURE 23.6 Illustration from *Designing for Accessibility.*

Long description: Black-and-white architectural line drawing showing overhead view of an office workplace divided into eight individual workstations, including hallways, signage, partitions, doors, shelves, desks, cabinets, and tables.

a ground-floor office than to invest in an elevator to the usual workplace. Similarly, it may be less disruptive for coworkers to invest in a document scanner than to restructure jobs, so that a coworker can read documents to a blind employee. Each employer must select, from a number of alternatives, the solution that best suits the needs of the individual and the business.

23.7 GOOD DESIGN IS JUST GOOD BUSINESS SENSE

Thorough analysis of Herman Miller products and their usefulness to workers with disabilities was needed for production of the *Applications Guide*. This effort revealed that Herman Miller's traditional strong attention to established ergonomic principles was a good beginning. The flexibility of its products in meeting a variety of needs also helped customers to meet unique ergonomic needs of workers with disabilities.

Significantly, Herman Miller's competitors also realized the importance of providing guidance to their customers regarding workers with disabilities. Haworth, Inc. developed an *ADA Handbook* (referenced in Mueller, 2002), which described the requirements of the law and, like Herman Miller, illustrated ways in which Haworth products could be used effectively to comply with these requirements. The Knoll Group produced a guidebook entitled *Workplace Issues: Universal Design and the ADA* (also referenced in Mueller, 2002). Steelcase, in its award-winning design for a self-contained workspace called "Personal Harbor," incorporated accessibility guidelines into the parameters of the project (Mueller, 2002).

23.8 LESSONS LEARNED FOR UNIVERSAL DESIGN

Given the ever-increasing rate of technological advances, it seems that just about anything that can be imagined may very well be technologically possible. Among these advances, broadband and wireless technologies greatly enhance opportunities for employers to accommodate flexible work styles, schedules, and workplaces for workers with and without disabilities. The Rehabilitation Engineering Research Center for Wireless Technologies (Wireless RERC) in Atlanta, Georgia, focuses on ensuring that people with and without disabilities have equitable access and use of wireless products and services. Through its Survey of User Needs (SUN) and Consumer Advisory Network (CAN), RERC conducts user research and shares its findings to increase awareness among consumers and the wireless industry. As technology evolves, this awareness must be constantly reinforced and expanded to other fields of workplace access and technology, including landscape and building architects, facility managers, interior designers, product designers, and graphic designers.

Through participation of citizens with disabilities in research such as that conducted at Wireless RERC, other groups—including Congress, rehabilitation technologists, major manufacturers of telecommunications, and computer software and hardware developers—have gotten the message that people with disabilities are a major portion of the workforce and are likely to remain so. It has become clear that "disabled" no longer means "unable to work." This attitude has been rendered obsolete by law as well as by population demographics and the economic realities of disability in business.

Accommodation of workers with disabilities through job and workplace design is here to stay. By instilling a universal design approach among those responsible for the development of work environments and products, the incidence of work disabilities can be reduced. And those accommodations that are required for workers with disabilities will be much more likely to be reasonable accommodations.

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SECTION 2

PRIVATE SPACES

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CHAPTER 24
UNIVERSAL HOUSING: A CRITICAL COMPONENT OF A SUSTAINABLE COMMUNITY

Leslie C. Young

24.1 INTRODUCTION

In the first edition of the *Universal Design Handbook*, a chapter entitled "Next Generation Universal Home" was discussed primarily in the context of a single-family house. In this edition some of the same concepts are reintroduced because they still are not embraced by the design and construction industries. Other dwelling unit types are considered, and a connection is made between housing characteristics, neighborhood "walkability," transportation choices, and community health. Providing a wide range of universally designed housing types is perhaps the most overlooked factor in guaranteeing a successful, more stable, and less transient community (National Council on Disability, 2004).

Livable homes and communities, to be sustainable, must address the different needs and requirements of all users regardless of size, age, or conditions affecting sight, hearing, cognition, or physical ability. This design approach, known as *universal design*, strives to make possible and safer for a global population the practical day-to-day tasks involved in living.

The next-generation universal home is an example of how housing may evolve over the next several decades in response to demographic and marketing trends. The innovative ideas incorporated in this conceptual illustration focus on human interaction with the environment. These innovations are based less on "high-tech" advances in technology and manufacturing and more on a knowledge of how people function at different stages of life and what features best support independent self-care and interdependent connection with family and friends.

24.2 PROMOTING INDIVIDUAL AND COMMUNITY HEALTH

Community and human health are inextricably tied together. "Lack of physical access in a community becomes a factor leading to illness and even death" (Gilderbloom and Markham, 1998). It is physically and emotionally unsafe to be imprisoned in one's home because there are steps at the door, the sidewalk is too narrow and steep, or street crossings are too hazardous to use.

Many components must be combined to ensure a healthy sustainable community. Several of the most critical are neighborhood walkability, opportunities for safe recreation, transportation choices, and a variety of housing types.

Walkable neighborhoods provide opportunities for impromptu socializing and exercising integrated into daily life. Streets and communities are safer when it is easy for people to be in community settings and share in public activities. The most challenging part of urban design is to create spaces where people want to congregate. If there are no people around, the space has most likely failed (Harmon, 2002).

Intersection and street crossing design is critical. A level intersection makes street crossing safer, and “bulb outs” at corners narrow the street, slow traffic, and shorten the crosswalk. Crossings that emphasize traffic speed reduction allow older adults and anyone with compromised gait to safely negotiate the crossing (see Fig. 24.1). Extreme roadway slope combined with excessive curb ramp cross slope prevents safe crossing if one is pushing a stroller, in a scooter, or with balance limitations.

Crosswalk markings and new in-pavement flashing lights allow drivers and pedestrians to better establish visual contact (Boyce and Van Derlofske, 2002). Signaling devices added at crosswalks alert people who are conversing and may be inattentive to their surroundings, while providing necessary information for someone with vision loss.

A clearly defined and consistent way-finding system is necessary. Strategies include locating rectilinear spaces in open areas to facilitate route identification and should include changes in contrast and surface texture as well as auditory and visual landmarks. Signage should be tactile, visual, high-contrast, and audible.

Improved planning of medians and street green areas ensures a person with limited stamina the use of shaded resting areas in a pleasant microclimate, as well as contributing to lowered pavement and building surface temperatures and a potential reduction in air conditioning loads on nearby buildings (Maryland Department of the Environment, 2008). Canopies create weather protection so pedestrians may be in public settings whenever desired, e.g., in a spring rain. Where extremes of climate are experienced, some of these informal activities may occur indoors, making it even more critical that all facilities incorporate universal design features.

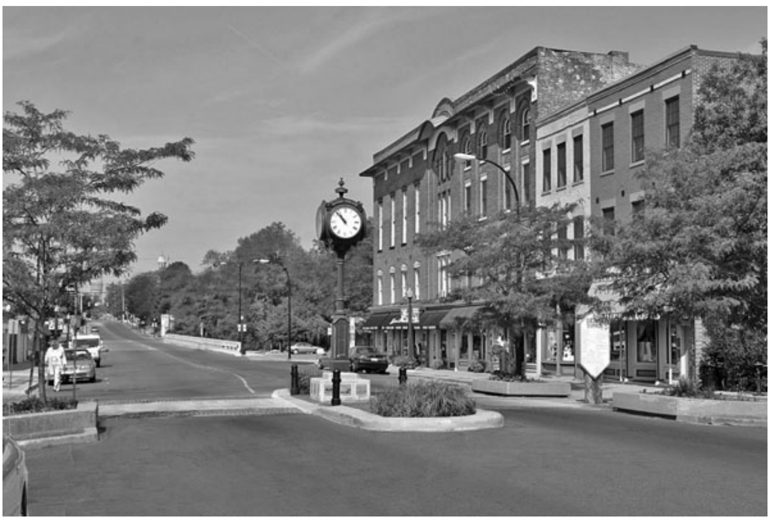

FIGURE 24.1 The street crossing has been modified to slow traffic and reduce the amount of time a pedestrian is exposed to oncoming cars. (*www.pedbikeimages.org/Dan Burden.*)

Long description: Photograph of a small downtown street crossing in Ypsilanti, Michigan. By adding concrete planters at the crosswalk, four lanes of traffic were reduced to two with parallel parking on both sides A traffic island with level resting area at least 48 in. long by 48 in. wide accommodates pedestrians who may need to wait to cross. Four low decorative iron bollards, an elevated “town clock,” and planting provide a buffer from vehicular traffic without obstructing the view. Plant containers and the clock base provide an area on which to perch while waiting to cross the street.

Transportation alternatives reduce fuel consumption and automobile emissions and encourage people to stay engaged in community life even if they are not able to drive. Universally usable bus and rail transportation allows people to be less automobile-dependent and people with disabilities less dependent on para-transit services.

Communities must offer a variety of housing choices in a range of prices, including apartments and condominiums, single-family homes (affordable and market rate), cohousing, live-work units, and accessory apartments, the majority of which with at least one stepless entrance. Cohousing with an emphasis on shared community spaces, such as a common vegetable garden, reduces the demand on costs for transporting produce long distances and promotes community interaction among children and adults of all ages. Those who need a little extra help in managing daily activities may, because of close dwelling unit proximity, be able to combine resources and hire a single shared personal assistant.

24.3 DEMOGRAPHIC AND HOUSING TRENDS

As people go through life, some acquire a change in abilities as a result of an accident or illness, while others experience changes as part of the aging process. Globally, the vast numbers of people reaching retirement age, people remaining in the workforce longer, and people with and without disabilities now living well into their seventies and beyond make the demand for universally usable environments even more pressing.

In 2008, there were 129 million residential units in the United States, with over 1.1 million new that year, and very few with UD features. Just over 6.8 million community-resident Americans use assistive devices to help them with mobility (U.S. Census Bureau, 2005–2007). These numbers will continue to grow. So little accessible housing is available that almost one-half of wheelchair users and many people who do walk, but with difficulty, must use steps to enter or exit their homes (Kaye et al., 2000).

Public policy research indicates that governments, to reduce spending on hospital and nursing home care, are beginning to implement policies that support the delivery of health care in community settings. As most people prefer to avoid institutional living, there is an increasing demand for in-home services. When housing is universally designed, such services will be less stressful on the individual and will reduce work-related injuries for the provider.

With the exception of better insulation, tighter windows, and more electronic devices, housing in the United States continues to be built much as it was 50 years ago. The country is experiencing an affordable housing crisis that has led to the widespread construction of the two-story townhouse, generally with a multistep entrance and an interior layout that is difficult to navigate by a person using a mobility device.

Architect and New Urbanist Andres Duany is concerned that universal design may eliminate the four- to eight-unit apartment building "considered crucial when *affordable* housing is built." Competent forward-looking design embraces the challenge of generating new housing types. We cannot "replicate the discriminatory and isolating building types of the past . . . if we want the diverse, intergenerational communities" (Smith, 2002) that are socially and environmentally sustainable.

24.4 UNIVERSAL HOUSING

The next-generation universal home (NGUH), one of the last projects in which Ronald Mace (1991) actively participated, identifies specific universal design features and elements that can be incorporated into most single- and multifamily housing. Figure 24.2 shows how housing could evolve to satisfy the needs of a changing market, yet retain features that many residents request.

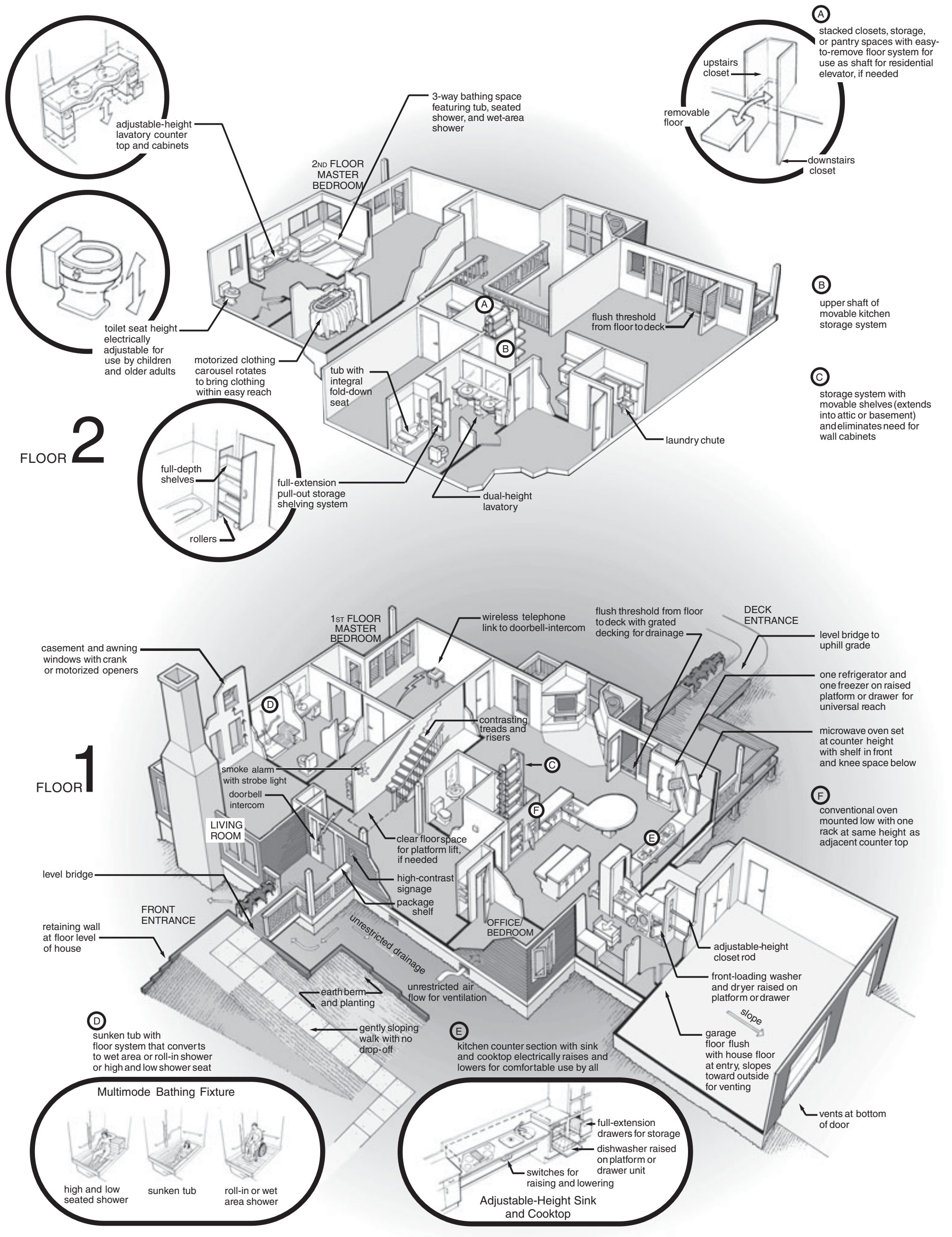

FIGURE 24.2 The next-generation universal home shows three different approaches to creating stepless entrances as well as numerous conceptual and concrete universal features in housing. (*Illustration by Ron Mace and Rex Pace, Center for Universal Design.*)

Long description: A detailed illustration of the two-story next-generation universal home drawn as an aerial perspective with the two floors separated for better examination of features. "Bubbles" show an adjustable-height lavatory countertop, stacked closets for future elevator, adjustable-height toilet, full extension pullout storage system, multimode bathing fixture, and adjustable-height sink and cooktop. The majority of the features in the home are discussed in the chapter narrative.

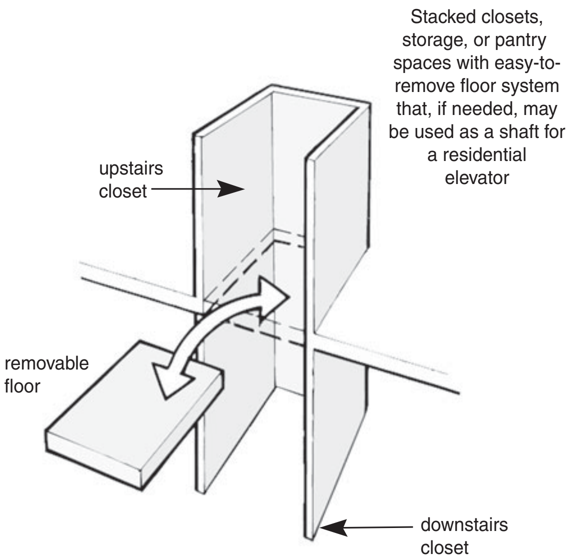

FIGURE 24.2 (*Continued*)

Overview of Key Features in the Next-Generation Universal Home

Not all possible universal features are included here, and many others will be developed over time. These are the key features in the NGUH:

- All entrances are stepless with flush thresholds.
- Future access to second floor is provided.
- Some elements and features are located contrary to traditional building norms.
- Adjustable features adapt to the individual.
- Bathing fixtures allow multiple bathing options.
- Features are included to enhance warning and orientation.

The open layout facilitates good sight lines and, for people with hearing loss, makes communication with others easier. Not incorporated in the illustration but worthy of consideration, the house could be engineered so the number of interior "load-bearing" walls is minimized, to meet residents' current needs, providing the "flexibility" can be adjusted later if needs change.

A first-floor master bedroom and bath can be converted into a suite for an older parent, someone transitioning from college to employment, or a relative unable to climb stairs. The additional first-floor bedroom doubles as either a guest room or home office, especially as the largest growing segment of the workforce is employees who work from home.

Unlike fixed features of the past, multifunctional pieces that offer dual use, adjustability, or hidden storage accommodate the widest range of users. All the features illustrated are technically possible now, although some are not widely available.

One seemingly incongruous element of the NGUH is the upper floor. Several options to gain access to the second floor can be built in at the time of initial construction. The straight-run stairway with adequately sized landings at the top and bottom can accommodate either a chair or platform lift.

At the center of the house is a set of stacking storage closets with an independent removable floor. A residential elevator can be installed at a significant cost savings.

Entrances

Critical to a sustainable community is the ability of residents and guests to enter and exit their own residence and those of friends and neighbors. A few changes in design and construction significantly expand housing options, perhaps the most important being the stepless entrance. A gently sloping walk leading to a flush threshold entrance keeps children with overstuffed book bags from tripping and makes life easier for anyone with rolling luggage, bags of groceries, pushing a stroller, transporting sports equipment, or moving heavy appliances or furniture. This is the same entrance used by a friend who is unsteady on his or her feet or family member who relies on a mobility device.

Raised porches overlooking the surrounding neighborhood are often considered a primary mechanism for creating a successful community. In smaller multifamily housing developments, several design options allow raised porches and stepless entrances. Presented here in Fig. 24.3 is one example with a shared elevated walkway separated from the public sidewalk. The units are staggered and angled to the roadway, forming individual entrance niches and a transition between the shared walk and each unit.

Returning to the NGUH, three different universal entrances are shown. Although not difficult, some unconventional construction details may be necessary. At the front entrance, excavation for the foundation provides the soil for an "earth berm" and bridge. Soil is pushed up to a new retaining wall, leaving a "dry moat" in front of the foundation for drainage and air circulation. A bridge spans from the gradually sloping walk to the entrance.

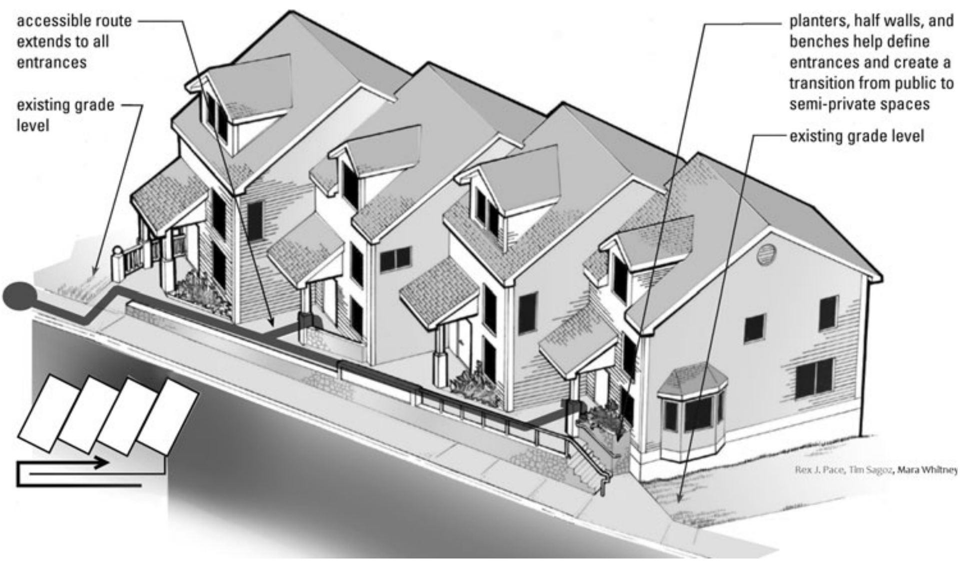

FIGURE 24.3 The elevated semiprivate walkway, physically separated from the public walk, allows a stepless entrance into each dwelling unit. Because the walk slope is less than 1:20 handrails are not required on the low end of the walk, but would be important where the walk is at its highest elevation. (*Conceptual design by Rex J. Pace.*)

Long description: A line drawing shows four two-story townhouses, connected in a single building. Each unit is set back from its neighbor on the left, creating a staggered pattern. The units each have a covered stepless entrance and a greater degree of privacy than if the units were in line with one another. The gently sloping walk starts on the left and terminates in a set of steps on the far right of the last unit.

At the back of the house, a bridge extends from the deck to an uphill point. The deck, set at the same level as the interior floor, is slotted at the entry door to provide drainage. The garage entrance is also set at the same level as the house floor. However, to prevent fumes from seeping into the house, the entire garage floor gently slopes away from the house door, and vents are installed at the bottom of the garage doors. Other strategies may be used such as a level connector between the house and the garage.

Kitchen

In the varied living arrangements of today, food preparation and cleanup may be conducted by several people, each with unique ergonomic requirements. Work surfaces that move from 28 to 42 in. are ideal and may be accomplished by an electrical or manually adjustable-height countertop (see Fig. 24.4). Fixed dual-height work surfaces provide less utility.

Retractable doors cover storage/knee space, helping to maintain a conventional appearance. Carts can be rolled under the cooktop when knee space is not needed. The dishwasher is elevated to reduce bending and stooping and to facilitate reach by a seated person or someone of short stature. The front-loading washer and dryer are also raised. Careful attention must be paid to space planning so elevated appliances do not interrupt the work flow.

For someone with vision loss to more quickly identify the counter boundary, the top and edge contrast. Contrasting strips can be used to demarcate the sink basin or the basin color selected to

FIGURE 24.4 Easy-to-operate countertop adjusts in height from 28 to 42 in. (*Wendi Fitzgerald, photographer for Starkloff Disability Institute.*)

Long description: Photograph of a kitchen in a small apartment at 6-North, a universally designed 80-unit apartment building in St. Louis, Missouri. The cabinets are light-colored wood with contrasting dark countertops. In the foreground is an adjustable-height countertop (radiused to minimize injuries from sharp corners) adjacent to a work surface set at a conventional 36-in. height. The height is movable via pneumatics in the columnar base. A long lever handle set under the counter and close to the sidewall of the adjacent base cabinet projects almost to the edge of the top for easy reach.

contrast with the countertop. To minimize lifting heavy and/or hot dishes, the wall-mounted oven is positioned so one rack is at the same height as the adjacent work surface. The microwave oven, with a pullout shelf below, is set at counter height.

Cold-food storage is provided with an elevated side-by-side refrigerator and freezer. Undercounter drawers with separate compartments for fresh and frozen food have recently become available. Conserving floor area, dry goods are stored vertically in a mechanized rotating shelf system running between floors.

Bathrooms

All bathrooms incorporate universal fixtures and features to ensure that friends may visit and family members may safely remain in their home indefinitely. Broad expanses of reinforcements are included in the walls around the toilet and bathing fixtures so wall-hung shower seats and grab bars can be installed when and where needed.

Included are additional common universal design features such as lever-handle faucets and offset tub/shower controls. Toilets and lavatories are adjustable in height, and each bathing area allows multiple bathing options. The first-floor bathroom suite contains a conceptual bathing fixture with a movable floor that can be reconfigured so the bather can be submerged, can be seated on a bench, can stand, or can use a shower wheelchair. In the upstairs master bedroom bathing area, fixed features are combined to create a universal or three-way bathing area (see Fig. 24.5). The floor space devoted to the approach to the bathtub doubles as a curbless shower, and a bench runs along the back of the shower and extends behind the head of the tub.

Controls, Alarms, and Home Automation

Environmental controls, alarms, and home automation systems benefit everyone, but allow people with variable perception modalities or sensory loss to independently control the environment. Thermostats, smoke alarms, and fire detectors provide audible and visual feedback or signals.

Home automation reduces daily and often frequent stress for people with mobility loss. A doorbell intercom linked to a wireless telephone or a video intercom system allows someone in the house to communicate with visitors from a remote location. A centrally located computer can provide access to door locks, appliances, lighting, windows, and mechanical systems. “Zoned” heating and cooling, with separate thermostats for different regions of the house, conserves energy and allows occupied rooms to be set at the temperature most comfortable for someone sensitive to temperature shifts.

24.5 CONCLUSION

Residential and community design can have a significant impact on the physical and emotional lives of all people. One couple living in a universally designed area reports that the real “payback is being able to live the lifestyle we want.”

Several new housing developments in the St. Louis, Missouri, area are testing the viability of incorporating universal features. The first, 6-North, is an 80-unit fully universal apartment building developed as mixed-income property. All 80 apartments were leased within eight months of completion to people with and without mobility loss, to older adults, to students, and to families. The second development, Renaissance at Grand, has 400+ garden-style units and townhomes. All 400 units, including the townhomes, incorporate a stepless entrance and universal features. Here, too, units were occupied almost immediately.

The current national trend to legislatively support increased usability of the built environment through “visitability” ordinances, fair housing, and the yet to be adopted “Inclusive Home Design

FIGURE 24.5 Universal wet area combines fixed features in a small space to offer users a variety of bathing choices. (*Roger Winstead, photographer, NC State University Communications.*)

Long description: Photograph of a rectangular bathing area. A soaking tub runs parallel to the long wall, and a 32-in.-wide wet area bench extends from the head of the tub and narrows to approximately 20 in. for a length of 48 in., terminating at the back wall. The wall opposite the tub side has a showerhead for a standing user, and the wall perpendicular to the bench has a handheld shower within easy reach of a person seated on the shower bench, in a shower wheelchair, or even in a "garden" chair.

Act" is a positive step forward; however, it is insufficient to meet the growing need. A much broader application of universal design is necessary.

It is critical that all new housing incorporate universal design features within the next housing construction cycle. It is taken for granted that basic safety and energy efficiency features will be included in all new housing. Now is the time for universal "usability" to take its place beside safety and energy efficiency and to become the norm rather than the exception.

Land planners, architects, designers, and builders must work more closely together. Policy makers must consider universal usability and remove constraints on housing choices and allow closer

FIGURE 24.6 A universally usable elevated sand table facilitates the park's use by all children and adults, promoting social integration and psychological inclusion. (*Kids Together Playground, Raleigh, N.C., Leslie Young, photographer*.)

Long description: Photograph of a man seated in a power wheelchair pulled up under a cantilevered sand table in a public park. With him are two young boys. The sand table is created by a series of retaining walls, and at its highest point, the wheelchair user can pull into kneespace to play with the two children, everyone at the same eye level. The sand table slopes to grade, allowing children of all ages to walk or crawl and play in the sand. The lower retaining wall provides seating for a parent or other supervisor.

proximity to work, school, shopping, all with a greater reliance on public transportation. To be sustainable, a community must support the integration, participation, and enhancement of the independence of all people throughout the course of their daily lives (see Fig. 24.6).

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CHAPTER 25
THE EVOLUTION OF UNIVERSAL DESIGN IN HOUSING IN THE UNITED STATES: TOWARD VISITABILITY AND PATTERN BOOKS

Jordana L. Maisel

25.1 INTRODUCTION

The disability rights movement in the United States has been successful in achieving legislation that guarantees people with disabilities the right of free and equal access to the physical environment. Despite these successes, a critical accessibility problem still exists; physical barriers in almost all single-family housing prevent many people with disabilities from enjoying the benefits of a home of their own or require them to pay a premium to modify homes to their needs. The lack of accessibility also creates barriers for older people seeking to age in place in their own home. This chapter examines the current housing situation with respect to our aging population and an overview of housing policy and legislation targeted toward seniors and people with disabilities. It also explores more-recent innovative approaches to housing, including visitability and universal design, as well as tools to assist in their implementation.

25.2 THE CURRENT HOUSING PROBLEM

The current housing stock fails to meet the needs and preferences of older adults and people with disabilities, forcing many to unwillingly leave their homes and prematurely move to institutional settings or to live with their families. Researchers and policy makers expect the need for accessible housing to increase in the next few decades as the country's population ages. The U.S. Census Bureau estimates that the number of persons age 65 and older will grow to almost 40 million by the year 2010 and 70 million by 2030 (U.S. Census Bureau, 2004). Compounding this is the fact that approximately 70 percent of Americans live in single-family homes (U.S. Census Bureau, 2001), and the overwhelming majority of these housing units have barriers that make it difficult or impossible for someone with physical disabilities to enter and exit.

These barriers often have significant consequences. In addition to social isolation, many people with severe mobility impairments may be unable to exit their homes independently in an emergency, and these individuals risk injury from falling while being carried in and out of the home. Barriers within a home can also increase the work and stress of the caretakers who assist older adults and people with disabilities. Many family caregivers report that they suffer physical injuries as a result of lifting and handling their relatives, as well as psychological health problems such as fatigue, anxiety, and depression (Brown and Mulley, 1997).

Although a majority of older Americans prefer to stay in their homes, barriers can make it difficult for older adults to remain in their homes as they age. According to a 2004 survey conducted for the American Association of Retired Persons (AARP), more than four in five (84 percent) persons age 50 and older strongly or somewhat agree that they would like to remain in their current residence for as long as possible (AARP/Roper Public Affairs and Media Group, 2005). Aging in place offers numerous social and financial benefits. Research shows that independent living promotes life satisfaction, health, and self-esteem, three keys to successful aging. Furthermore, older adults get a sense of familiarity, comfort, and meaning from their own home (Herzog and House, 1991).

25.3 OVERVIEW OF HOUSING POLICIES AND PRACTICES*

As a response to this need for more accessible homes, changes in public policy and new design practices have emerged in the United States. While tremendous strides in accessibility legislation have taken place over the past few decades, there is still much room for improvement.

While antisegregation laws have been advanced in education, employment, and health care, housing has seen few gains in both the federal courts and everyday practice (Lamb, 2005). The Fair Housing Amendments Act of 1988 expanded the scope of housing covered by accessibility laws to all new multifamily housing, both *public* and *private*. The act required every unit in all newly constructed, multifamily, elevator-equipped housing with four or more units and all ground-floor units of multifamily residences to be accessible.

Fair Housing, however, is merely one piece of legislation in the more than four decades-old legislative history of disability rights in housing, which includes the *Civil Rights Act* (1964), *Fair Housing Act* (1968), the *Rehabilitation Act* (1973), the *Americans with Disabilities Act* (1990), *Individuals with Disabilities Education Act* (IDEA, 1997 and 2004), and many others. Some legislation, e.g., Fair Housing, centers on housing, while other legislation, e.g., IDEA, invokes housing more indirectly, as location and quality of housing affect access to and effectiveness of education.

Three significant themes should be noted from an analysis of the most significant pieces of legislation that influence housing for people with disabilities. First, the bulk of federal housing legislation and programs focus on economic issues (i.e., income) and to a much lesser degree on disability-only programs. Second, there is a trend away from the construction of federally owned/managed housing (i.e., public housing). Presumably, this results from the negative criticisms (e.g., ghettoizing) that public housing projects, such as Chicago's infamous Cabrini-Green, have faced. Finally, the U.S. Department of Housing and Urban Development (HUD) maintains the greatest number of housing-related programs, but only a very small percentage focus on age- and disability-related housing.

Housing legislation, policy, and programs have transformed considerably since the inception of Fair Housing in 1968. An overarching transformation can be conceptualized in terms of the transformation from federal to local oversight which began in the early 1970s (Shlay, 2006). While legislation, policy, and programs at the federal level have primarily focused on antidiscrimination and the distribution of federal funds, the state and local municipalities have concentrated more on accessibility policies. A second trend toward privatization of housing programs and funds further reinforces the localized and individualistic concepts that make single-family housing so prevalent in the United States, and underscores both the need for and growing interest in visitability.

*This text is adapted from Chap. 8, "Redefining Policy and Practice" (Brent Williams, Korydon Smith, and Jennifer Webb), in the forthcoming book *Just Below the Line: Disability, Housing, Equity in the South* (Korydon Smith, Jennifer Webb, and Brent Williams, eds.), to be published by the University of Arkansas Press.

25.4 VISITABILITY AS AN ALTERNATIVE HOUSING POLICY*

Visitability represents a highly focused strategy in the continuing evolution of accessible housing policy and practice in the United States. Visitability is an affordable, sustainable, and inclusive design approach for integrating basic accessibility features as a routine construction practice into all newly built homes. Visitability provides a foundation for improving the home with additional universal design features, thereby lowering the cost of achieving higher levels of usability. Started in the United States by Eleanor Smith and her group Concrete Change in 1987, visitability proponents seek to make homes more accessible by having them meet only three conditions: (1) one zero-step entrance at the front, side, or rear of the home; (2) 32-in.-wide clearances at doorways and hallways with at least 36 in. of clear width; and (3) at least a half bath on the main floor (see Fig. 25.1).

Visitability provides benefits to a wide range of users, including those with disabilities, their nuclear family, friends, and other relatives who may, from time to time, need to use wheelchairs or other assistive equipment. Consequently, as a result of visitability, individuals with a variety of abilities can interact with one another and participate in community activities outside of their homes.

As of January 2008, some 57 state and local initiatives had been adopted in the United States, of which 33 (58 percent) are mandatory and the other 24 are voluntary. Local government officials report that about 30,000 visitable homes have been built as a result of these efforts. Current visitability initiatives vary significantly. For example, some visitability programs cover housing within an entire state, whereas others affect only cities or counties. Another difference is that some programs strictly

FIGURE 25.1 In 2003, Mayor Roger Claar signed a mandatory visitability ordinance in Bolingbrook, Illinois. Since then, the more than 3500 new homes demonstrate that zero-step entrances are practical even in cold-weather climates, are cost-effective even with basements, and can be aesthetically pleasing, as evidenced by the home shown above. (*Photograph courtesy of Edward Steinfeld, IDeA Center.*)

Long description: This photo shows a single-family home on a traditional, suburban residential street in Bolingbrook, Illinois. The home has an asphalt driveway that leads to a concrete pathway to the home's front door. The pathway is slightly sloped and leads to a zero-step entrance.

*This text is adapted from "Increasing Home Access: Designing for Visitability" (Jordana L. Maisel, Eleanor Smith, and Edward Steinfeld), published by the AARP Public Policy Institute, August 2008.

adhere to the three basic accessible features, whereas others include a few additional architectural elements such as lever handles, blocking for grab bars in bathroom walls, and accessible environmental controls. Visitability programs also vary in how they are implemented. Some are mandatory, with a law or an ordinance requiring builders to include the visitable features during new construction. Others are voluntary. With regard to scope, some ordinances cover only houses constructed with some form of government assistance, whereas a few ordinances cover every new house built (i.e., Pima County, Arizona; Bolingbrook, Illinois; and Tucson, Arizona).

Several foreign countries have national policies that require all new housing to include accessibility features. In the United Kingdom, Part M of the national building code requires basic access features for any new dwelling unit, whether it is a single-family or multifamily unit. Sweden, Denmark, and the Netherlands also require basic access features in all dwelling units. Other highly developed countries such as Canada and Australia have movements to expand accessible housing policies to universal coverage of single-family homes. A new effort underway in the United States could lead to enactment of a national policy. The ICC/ANSI A117.1 Standard for accessible design is the national consensus standard referenced by most building codes in the country. The committee that promulgates the standard recently developed a new section, Type C Dwelling Units, with technical design criteria for visitability. Developing consensus-based technical standards for visitability features will reduce confusion about exactly how to design a zero-step entry, an accessible bathroom, and accessible doorways. The Type C technical information will be in the 2009 ICC/A117.1 Standard for jurisdictions to reference in their ordinances if they so desire, thus promoting uniformity in applications and aiding in their interpretation.

25.5 UNIVERSAL DESIGN IN HOUSING AND THE ROLE OF PATTERN BOOKS*

Moving beyond visitability, universal design provides an even wider array of features that improve usability, safety, and health for a more diverse group of people and abilities. In many countries, new housing designed for older people is being produced with a high accessibility standard to reduce the need for relocation and supportive services over time. This type of housing, sometimes called *aging-in-place* or *life span housing*, has many universal design features and represents a noteworthy development in the field of housing.

Design for aging in place should include a broader range of features than accessible and visitable housing. In particular, design for sensory limitations, security, and the prevention of falls is a key goal. Moreover, community context is also important. Aging in place, with any decent level of quality of life, requires livable neighborhoods that have conveniently located community services, opportunities for recreation and work nearby, a vibrant street life, and informal gathering places through which neighbors can more easily get to know one another.

Although the features of other types of accessible housing have been codified by various laws and the ICC/ANSI A117.1 Standard, there has not been a codification of life span design housing in the United States. A U.K. standard, Lifetime Homes, does identify 16 specific design features that together create more accessible and adaptable housing.

The Lifetime Home Standard (LTH) criteria (Habinteg Housing Association. n.d.) include

1. Car parking width
2. Access from car parking
3. Approach gradients
4. Entrances
5. Communal stairs and lifts
6. Doorways and hallways

*This text is adapted from *Inclusive Housing: A Pattern Book* (Edward Steinfeld and Jonathan White), published by W.W. Norton & Company.

7. Wheelchair accessibility
8. Living room
9. Entrance level bedspace
10. Entrance level WC and shower drainage
11. Bathroom and WC walls
12. Stair lift/through-floor lift
13. Tracking hoist route
14. Bathroom layout
15. Window specification
16. Controls, fixtures, and fittings

In *Inclusive Housing: A Pattern Book*, the authors go beyond the criteria outlined in the LTH to include more features related to the senses and cognition. Their interpretation of the concept includes both "essential" and "optional" features.

Essential life span housing design features:

- One no-step path to a no-step entry that can be at the front, side, or rear or through a garage
- No-step access to patios, balconies, and terraces
- Doorways that have at least a 32-in.- (815-mm-) wide, clear opening
- Hallways and passageways that have 42-in. (1065-mm) clearance minimum
- Basic access to at least one full bath on the main floor
- Reinforced walls at toilets and tubs for future installation of grab bars
- Cabinetry in kitchen that allows a resident to work in a seated position
- Light switches and electrical outlets between 15 and 48 in. (380 and 1220 mm) from finished floor
- Stairways with tread widths at least 11 in. (280 mm) deep and risers no greater than 7 in. (180 mm) high
- Good lighting throughout the house including task lighting in critical locations (e.g., under kitchen cabinets)
- Nonglare surfaces
- Contrasting colors to promote good perception of edges and boundaries
- Clear floor space of at least 30 in. × 48 in. (760 mm × 1220 mm) in front of all appliances and fixtures and cabinetry
- Front-loading laundry equipment
- Ample kitchen storage within 24 to 48 in. (610 to 1220 mm)
- Comfortable reach zone

Optional life span housing design features (partial list):

- No steps on paths and at all entries
- One-story plan, or residential elevator, or stacked closets and framed out ceiling/floor to allow future installation of a residential elevator
- Adjustable-height kitchen sink
- Cabinets with built-in convenience features, e.g., full-extension sliding drawers and shelves
- Smart house system

One of the most promising areas for application of universal design is the introduction of information technology in the home. Most appliance companies and other product manufacturers are engaged in research to develop "smart products." Technologies already available or under

FIGURE 25.2 This three-bedroom, two-bathroom American Craftsman Bungalow single-family house, while initially inaccessible due to the front porch, was redesigned to include a cross-sloping lot with an on-grade front entry. The space-efficient plan contains generous circulation clearances, an L-shaped kitchen, one visitable full bathroom, and two accessible bedrooms. (*Image courtesy of Steinfeld and White, 2010.*)

Long description: This image shows a single-family, two-story home designed in the American Craftsman Bungalow style. The home has four steps leading to a front porch. There is a central wooden door flanked by two windows on either side. From the front elevation of the image there does not appear to be an accessible entrance; however, an accessible, no-step entrance is created from the cross-sloping of the lot (which is not seen in the image).

development include devices that provide more powerful remote control functions, home monitoring systems that can notify service providers of the need for assistance, and smart tags that will help to maintain an inventory of food and other supplies. It is essential that the new generation of products be universally designed to accommodate disability and be made truly usable for the older population (see Norman, 2007).

Pattern books serve as a valuable tool to help professionals practice good design. They provide detailed drawings and descriptions that assist designers and home builders through the design and construction process. For example, *Inclusive Housing: A Pattern Book* presents common prototype block, lot, and house plans and evaluates the accessibility of each. It describes the components that support inclusive design within a home and provides examples to illustrate applications of these strategies. While recommendations are provided for other features, this book focuses on the most critical issues of space planning for wheeled mobility. Designing access for wheeled mobility affords generous space clearances for all users, makes a house feel more spacious and comfortable, and provides a foundation for future upgrades toward life span design (see Figs. 25.2 and 25.3).

25.6 MOVING FORWARD

Housing policies, once effective, no longer match the current demographic makeup or cultural predilections of today's society (Williams et al., forthcoming). As the demographic shift compounds the current lack of accessible housing and neighborhoods, a growing segment of the population will confront challenges in the usability of their dwellings.

FIGURE 25.3 This image shows the stepless entrance that is created by cross-sloping a lot. The driveway is slightly sloped to create a stepless transition from the driveway to the front porch to the front door. (*Image courtesy of Steinfeld and White, 2010.*)

Long description: This black-and-white image shows a drawing of a single-family, two-story house, with a minivan in the driveway. The image is taken from the perspective of a person looking at the front porch and front entrance from the driveway. There is a porch that extends along the entire length of the house and has a wooden banister. The image clearly shows how the front porch opens up to the asphalt driveway along the right side without any changes in elevation. Therefore, a stepless entrance is created from the driveway to the front entrance.

Whether through visitability, universal design, or other innovative approaches, producing an environment that is more inclusive will reduce the need for specific accommodations for people with disabilities. Moreover, the benefits for all will generate a larger constituency to support the provision of increased usability.

Incorporating more innovative and cost-effective design practices into the new housing stock, with assistance from model standards, commitment programs such as Lifetime Homes, and pattern books, will help create a larger supply of homes that support seniors' housing preferences. Facilitating seniors' ability to age in place, rather than in expensive assisted living and nursing homes, will help save taxpayer money as well as foster seniors' autonomy and dignity. To accomplish this incredible feat, designers, builders, planners, and policy makers must become more aggressive in their efforts. They need to utilize more-proactive strategies to ensure tomorrow's housing supply meets the needs of today.

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25.8 RESOURCES

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Concrete Change: http://www.concretechange.org

IDEA Center: http://www.ap.buffalo.edu/idea

CHAPTER 26

A HOME FOR THE NEXT 50 YEARS: REMODELING FOR AGING BABY BOOMERS DEMONSTRATES UNIVERSAL DESIGN IN ARTS AND CRAFTS DETAILING

John P. S. Salmen

26.1 INTRODUCTION

Nearly empty-nesters and approaching age 50 with the rest of the baby boomers, John Salmen and his wife Ann Scher designed and built the "Home for the Next 50 Years." They chose to renovate a Craftsman Bungalow in an historic district, turning it into a universally designed home that preserves its historic context. They carefully considered the universal design implications of every element and space while keeping in mind the actual users—their family and friends.

Salmen has spent a lot of time, professionally and personally, thinking about homes and how they can meet the needs of their residents, as well as his own needs and the needs of his family as they age. One of the keys to designing homes that meet the needs of people with a variety of abilities is to design things so that they are flexible. This can mean everything from selecting cabinets with adjustable-height shelves to designing rooms that can be easily converted to different uses over the years as needs and families change, for instance, a bedroom that can change into a studio or a living space.

26.2 AGING IN PLACE

They wanted a house where they could live comfortably and safely now and in the future, but they also wanted to have it as a place where family and friends could comfortably visit and/or stay. Over the years they have seen friends and neighbors "age out" of their houses—sometimes it is the overwhelming yard work, sometimes it is the stairs. Salmen and Scher wanted to control their destinies. They wanted to have the option of staying in their home and "age in place."

26.3 A LIVABLE COMMUNITY

As with any real estate–related decision, location was the first and one of the most important considerations. They wanted a house in an established neighborhood, close to community and commercial services. For them, a neighborhood that supports aging in place includes

- Proximity to critical services, i.e., grocery stores, pharmacy, post office, and bank
- Access to public transportation
- Neighbors who are a “shout away,” who can watch the house while you’re on vacation; who might check on you when you’re sick; and who might help to shovel the snow off your driveway
- Proximity to amenities such as parks and recreation facilities; safe, walkable, rollable paths and sidewalks; community and social organizations; churches, temples, and synagogues; and restaurants
- A small lot and house in poor condition that would justify a major renovation

After more than two years of searching in Montgomery County, they found a circa 1910 “bungalow wannabe” in the heart of historic Takoma Park, Maryland. The location was perfect: a cozy neighborhood within walking distance of work, stores, services, and the Washington, D.C., Metro. And the house was in dismal shape, warranting the planned overhaul.

26.4 THE FEATURES

They were determined to make the home functional for a lifetime, and committed to having it remain true to its original design so as to fit in with the “historic district” neighborhood. To achieve this, they wove updated arts and crafts details into their adaptable house.

When the project began, the house was a three-bedroom, one-bath, two-story square with a wet basement that boasted barely 6 ft of headroom. After the reconstruction, the basement had been reclaimed, and a wing was added on the rear of the house. The historic main entry via two sets of steps and a front porch were maintained; however, a new main entrance to the house was created via a new doorway at the corner of the first floor nearest to the driveway and public sidewalk (see Figs. 26.1 and 26.2).

Fundamental to the design was a front entry that had no stairs or level changes. A no-step 36-in.-wide entry allows a parent pushing a stroller to wheel a sleeping child into the home without waking him or her up; it allows furniture and large appliances to be more easily moved in and out; and it allows someone who uses a wheelchair to enter the home independently. The front door opens into a spacious foyer that allows maneuvering space for strollers, wheelchairs, and walkers and plenty of room to put on coats and change into boots.

The entry is situated less than 2 ft above the grade of the public sidewalk, allowing an accessible route from the sidewalk. The entry is covered and lit by motion-activated lights. There is an intercom system that allows for the doorbell to be answered and the front door to be unlocked from any phone in the house.

A raised-bed garden along the entry drive/walk provides an accessible height garden that both masks and maintains the grade-level change necessitated by the new accessible entry. A GrassPave driveway provides automobile and rolling access to the rear garage while allowing groundwater to nourish the property’s trees and plants. The rear entry to the second floor, the main living level, is directly accessible from the new garage.

Because bathrooms and kitchens have many built-in features and see the highest level of activity in any house, those rooms pose the biggest design challenges. As people come in all shapes and sizes, one size does not fill all when it comes to work surfaces and sinks. To accommodate a variety of users, counters at several heights were included (see Fig. 26.3).

In the kitchen, designed by Jane Langmuir, a Sub-Zero top/bottom refrigerator freezer, in addition to refrigerator drawers below the counter, was selected instead of a narrow side-by-side refrigerator. That way, everyone has frozen and cold storage at a height she or he can reach. A wall-mounted oven was specified, rather than a traditional oven/range, because the side-swing door allows close approach and is easier on the back of a tall person, while still within the reach of a short or seated person.

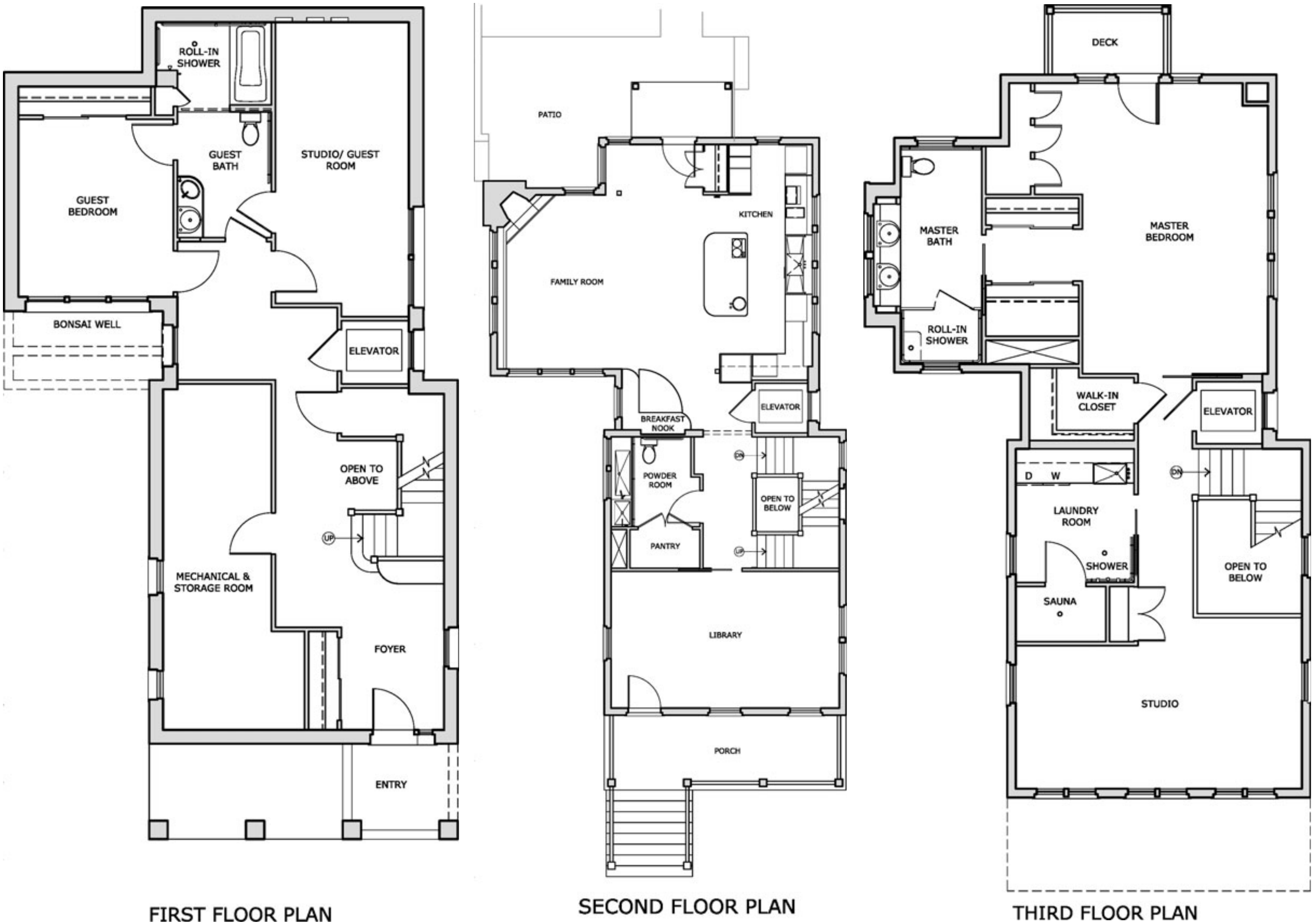

FIGURE 26.1 Floor plans of the three levels of the Home for the Next 50 Years show the wing added to the rear of the house and generous circulation spaces throughout.

Long description: The floor plans for the three levels of the Home for the Next 50 Years appear side by side. The first-floor plan shows the reclaimed basement with a two-room attendant suite, a roll-in shower, and the accessible front door entrance. The second-floor plan shows the historic front porch, an office space in the front room, a bathroom with ample maneuvering space, a stairwell and adjacent elevator shaft, and a large kitchen and family room at the rear. The third-floor plan includes a fiber studio in the front of the house, an accessible sauna and laundry with a shower area, and a master bedroom with exterior deck and master bath with roll-in shower.

FIGURE 26.2 A new main entrance to the house was created via a new doorway below the front porch at the corner of the first floor nearest to the driveway and public sidewalk.

Long description: This photo shows a wheelchair traversing the covered 36-in.-wide doorway entrance into the house. The entrance features an exterior covered paver landing, a zero-step entrance, and a top-lit large character raised house number, a full-height viewing window along side the door, a mailbox, intercom doorbell, and weatherproof convenience electrical outlet to the right of the door, within reach of short statured or standing persons.

Storage space is at a variety of heights as well. Pullout pantries, shelves and a dishwasher drawer were selected for their accessibility and versatility. The cabinetry and drawers have “D” wire pulls and cup pulls, as they are historically accurate and easy to use for aging hands. The drawers and pullout shelves are on ball bearing suspension arms that are easily opened and closed. Under-counter rolling carts can move to provide knee and toe space for frontal approach to counters at a variety of heights. One includes a toaster oven, and it can be moved to be near the eating nook or taken up the elevator for breakfast in bed (see Fig. 26.4).

The guest bedroom/suite on the first floor of the house has a fully accessible bath connected to both it and a second guest-bedroom/studio/living area. The suite can accommodate two kids, a visiting family, an aging parent, or a personal assistant’s apartment. The bathroom’s dual-height lavatory provides accessible options for standing and seated users, as well as little kids brushing their teeth (see Fig. 26.5).

The open-area shower and adjacent tub with continuous grab bars and movable seat provide alternative bathing choices for everyone. The dramatic cherry stairwell with craftsman details in the handrails on both sides, newels, and columns provides grippable surfaces while the adjacent elevator provides comparable access to all floors for convenience or for those who cannot use stairs or don’t want to carry groceries up the stairs (see Fig. 26.6).

At the front of the house, on the second floor, is the library/home office which can do double duty as a dining room. The fully accessible powder room on this floor features a dual-height concrete

FIGURE 26.3 Jane Langmuir–designed kitchen offers counters and sinks at a variety of heights, which can accommodate standing children and adults of different heights as well as seated people.

Long description: This photo shows the kitchen island in the Home for the Next 50 Years. Behind the island are multiheight counters with open shelves and base cabinets with oversized toe space, all within reach of a sitting person.

FIGURE 26.4 This versatile tea/toaster cart on wheels can be rolled to the breakfast nook for additional serving space, or it can be taken upstairs via the elevator for breakfast in bed. The removable cherry top becomes a serving tray.

Long description: Photo of a table height cart on wheels that features a shelf with a toaster oven above two pullout drawers. The cart is stored neatly under a space below the kitchen counter.

FIGURE 26.5 The guest bathroom features dual-height accessible lavatories that can accommodate sitting or standing people or children.

Long description: This photo features side-by-side white porcelain lavatories, one mounted on top of the counter and one undermounted, with single lever handle faucets.

FIGURE 26.6 The cherry stairwell includes craftsman details in the handrails located on both sides. The newels and columns create a forest of grippable surfaces while the adjacent elevator with exterior windows and glass doors provides comparable access to all floors.

Long description: This photo shows the home's craftsman detailed interior stairs which are made of cherry and have grippable grooves along the handrails on both sides. Immediately adjacent to the stair is the elevator with its contrasting white door with windows.

lavatory/sink with clear floor space for wheelchair frontal approach. The front porch was rebuilt to eliminate the original 4-in. step at the door to the library.

The third floor has a laundry room with an accessible shower and sauna. A "fiber studio" is in the front of the house, and the master bedroom and bath, with a roll-in shower with stained concrete floor and Corian walls that virtually eliminate mold and mildew (see Fig. 26.7). A small accessible outside balcony provides rain and snow protection for the kitchen entry below, as well as a private outdoor space and escape in case of fire from the master bedroom.

26.5 CONCLUSION

The number one safety hazard for older people is negotiating level changes within the home—steps at the entry, stairs between floors, and curbs to step over into the bath or shower. Eliminating level changes is very difficult in existing homes and almost impossible to do beautifully and without major compromises, unless there is a major renovation. The result is that most homeowners decide to sell the house rather than make the changes. One of the most stressful aspects of aging is the need to relocate because a home is no longer safe or easy to use. When universal design is incorporated into their design, homes can accommodate the needs of their owners as those needs change over time.

FIGURE 26.7 The curbless master shower features a stained concrete slab floor that allows a roll-in entry, a handheld shower, and horizontal white grab bars.

Long description: This photo shows the glass-enclosed roll-in shower with horizontal white grab bars along three sides and a handheld showerhead. The floor is a leather-color stained nonslip concrete.

26.1: UNIVERSAL DESIGN

Universal design is "the process of embedding choice for all people in the things we design" (Salmen, 2006).

- Choice involves flexibility and multiple alternative means of use and/or interface.
- People include the full range of people regardless of age, ability, sex, economic status, etc.
- Things include spaces, products, information systems, and any of the other stuff that humans manipulate or create.

For instance, a no-threshold, roll-in shower works not only for someone who uses a wheelchair, but also for a walking person, especially one who is stumbling around late at night or early in the morning. By the same token, the multiheight kitchen counter system provides a variety of counter heights to match different people's preferences as well as different types of kitchen tasks. For example, kneading bread is easier at the lower counters, while decorating a cake is easier at one of the higher counters.

26.2: FEATURES OF THE HOME FOR THE NEXT 50 YEARS

Exterior

- Slope of the drive entry is 1:20 (5 percent).
- Flowerbeds along drive are raised for easy maintenance.
- The covered main entry provides ample maneuvering space and a bench.
- The driveway incorporates a rollable, driveable porous subsurface known as GrassPave.
- The outside water faucets are submetered to reduce sewage costs and monitor conservation efforts.
- There is an accessible path between garage and house via wide gradually sloped bridge.

First-Floor
Entry

- The front door features a full-length entry door view window.
- Doorbell includes a built-in speaker phone and security camera to provide visual and audible surveillance of the entry.
- There is a no-step entry threshold at the front door.
- The automatic door lock is releasable from any of the house phones.

Hallway

- Concrete floors are low maintenance and feature easy rollability.
- The elevator is in a public area serving all three levels and includes an emergency phone.
- All the doors feature lever hardware.
- There are grippable handrails on both sides of staircase.
- The stair tread-to-riser ratio is designed for easy stepping.
- The stair runners create beveled tread nosings, reducing tripping hazard.
- The dimmable, programmable stairwell lights turn on automatically as a user approaches.

Guest Bath

- There is a roll-in, no-threshold shower.
- Dual-height lavatories with single lever faucets are provided.
- The tub/shower features grab bars and an adjustable seat.
- There is a side grab bar at the toilet.
- There is side access to the toilet.
- There is a full-length mirror in the guest bedroom.
- The faucet, shower, sink, and tub hardware can be operated with a “closed fist.”
- The cabinet and door hardware is also easy to use with a closed fist.
- The handheld shower has an adjustable rod and pin system so users can choose the optimum location for standing or seated showers.
- The soaking tub is recessed into floor slab to provide an easy wheelchair transfer height.
- There is clear floor space for side access to the tub.
- There is an automatic motion-sensing night light.
- There is a time-delayed automatic shutoff for the exhaust fan.

Guest Bedroom

- There are dual-height closet rods.
- There are accessible routes to both sides of the bed.

- There is direct access to the guest bathroom.
- The room features southern light orientation and a view of a year-round bonsai garden.
- The drapery controls are within children's reach.
- There is a remote-controlled overhead fan.
- The TV features a remote control.
- Simplified lighting controls can be operated from multiple locations in the room including from the bed.

Sound Studio/Second Guest Bedroom

- There is direct access to guest bathroom.
- Mechanical stub-ins have been installed for future kitchenette.
- There is an integrated whole-house audio/video/data system with accessible hub in this room with controls in accessible locations throughout the house.

Second Floor
General

- There is a no-step threshold from the interior of the house to the front porch.
- There is a no-step threshold to the rear patio.
- Quarter sawn red oak hardwood floors are found throughout the house for easy maintenance, rollability, and visual contrast.
- Solid hardwood cherry columns, pilasters, and trim in craftsman detailing offer finger grip fluting and create a forest of vertical elements that darken with age to increase visual contrast with the floors and walls, establishing a clear sense of up and down for aging eyes.

Powder Room

- The bilevel, multipurpose concrete sinks include wheelchair clearance below.
- The modular/removable base cabinets feature oversized toe space.
- The faucet and cabinet hardware are accessible.
- There is an automatic light in the pantry.
- The storage shelves are height-adjustable.
- There is side access to the toilet.
- A stained hardwood towel rail doubles as a grab bar.

Kitchen

- There is a solid hardwood cherry, accessible pedestal-mounted corner nook dining table and island lunch counter.
- The modular/removable base cabinets feature oversized toe space.
- The solid hardwood cherry grab bar doubles as a towel rail.
- The soapstone counters enhance the visual contrast with utensils and dishes.
- The multiheight countertops offer comfortable heights for different tasks and people, and they are created by inserting differing height plinths below the counter surface on top of 32-in.-high base cabinets.
- All appliances and controls are within reach range: dishwasher with dish drawers; refrigerator drawers and low freezer; wall oven and warming drawer; electric grill with front control burners; and a front control exhaust fan switch.
- The oversized push-button disposal controls are on the cabinet front.
- Trash/recycle/compost drawers are in a pullout cart that provides seated knee and toe space at the island.
- Tea/toaster cart has a removable solid hardwood cherry tray top.
- The HVAC and security controls are mounted at a height that allows hand-eye coordination from a seated position.

- The family room bench/hearth is at an accessible height.
- There is a handheld remote control unit for lights and all audio/video equipment.

Library

- The accessible workstations have adjustable keyboards at positions that allow frontal-approach knee and toe clearance.
- The cabinet hardware is accessible.
- The lateral file drawers are within easy reach of seated people.
- The meeting table is easily moved and provides wheelchair-accessible knee and toe clearance.

Third Floor
Laundry

- The floors are nonslip waterproof stained concrete.
- The roll-in shower features a hand held shower, grab bars,and shower seat.
- The shower curtain hangs on a hinged bar.
- The sauna controls are accessible.
- The sauna door and bench are accessible.
- The clothes washer and dryer are front-loading.
- The sink features a front-mounted lever faucet.
- The grab bar doubles as a towel rail.
- The towel rods and clothes pegs are mounted at an accessible height.
- The base cabinet features an oversized toe space and accessible drying rack.

Master Bedroom

- There is a 3-ft-wide space on both sides of the bed.
- There is a no-threshold accessible door that leads to the accessible rear deck/emergency exit.
- The height of the clothes storage is adjustable.

Master Bath

- The floor is made of waterproof nonskid concrete.
- The shower features a no-threshold entry at wheelchair width with a self-closing, double-swinging glass door.
- The heights of the handheld showerheads and deluge shower are adjustable.
- The shower and sink faucet hardware are accessible.
- The cabinet hardware is accessible.
- The side-access toilet and bidet are integrated into one unit.
- The accessible-height refrigerator drawers can store fresh fruit, cold water, and medications.
- There are full-height mirrors on the pocket doors.

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CHAPTER 27
THE SENSORY HOUSE

Beth Tauke and David Schoell

Architecture is the art of reconciliation between ourselves and the world, and this mediation takes place through the senses.

Juhani Pallasmaa (2005)

27.1 INTRODUCTION

Given that senses change significantly throughout people's lives, it follows that carefully balanced, multisensory home environments might increase both physical and psychological well-being. Architects are beginning to focus on new sensory strategies that establish greater reciprocity between the home and its occupants.

Attention to multisensorial experience parallels the introduction of inclusive design paradigms to the broader architectural discourse. While inclusive practices have generated tremendous benefits in terms of facilitating physical access, still underrecognized is the potential benefit of expanding universal design to more fully engage sensory issues.

27.2 SENSE SYSTEMS

Traditional sensory classification has five commonly referenced modalities: vision, hearing, smell, taste, and touch. Although medical fields still adhere to this system, a model presented by Gibson (1966) has proved more conducive to design applications: (1) visual system, (2) auditory system, (3) taste-smell system, (4) basic orienting system, and (5) haptic system. This model considers space as a more integral component of sensory perception. Each system has its own spatial component as well as a spatial relation to the other sense systems. While Gibson's model includes the traditional senses, it introduces an expanded categorization of sensory perception, a foundation upon which new design strategies may be discovered, tested, evaluated, and employed.

27.3 THE VISUAL SYSTEM

The visual system typically is regarded as the primary means to acquire information about an environment. Vision works using a refractory system (the eye) that focuses light waves onto nerve endings, which communicate with the brain for interpretation.

Visual processing is not just a simple translation; instead, the image that is transferred to the retina requires complex interpretation to result in what one "sees." Because eyes see forms in light, Gibson (1966) asserts that "vision is useful for (1) detecting the layout of the surrounding, (2) detecting

FIGURE 27.1 While most homes have two to three lighting sources per habitable space, the LIFEhouse, an inclusively designed home in the outskirts of Chicago, provides a minimum of five lighting conditions in each room. Kitchen lighting includes daylighting, overhead, under-cabinet, over-cabinet, shelf illumination, and task lighting in the appliances. Controls are on dimmers, allowing the resident maximum control of the ways that the space is lit. (*Photograph © 2009 Susanne Tauke*.)

Long description: This photo of the LIFEhouse interior by New American Homes shows a kitchen area with multiple modes of lighting: daylighting, overhead, under-cabinet, over-cabinet, shelf illumination, and task lighting in the appliances. Those working in the kitchen area are able to choose between a variety of lighting options to meet specific needs.

changes, and (3) detecting and controlling locomotion." Vision is considered to have the greatest precision for perceiving space and the environment at a distance. As such, it plays a primary role in basic human survival.

Despite the current overuse of and dependence on the visual realm, attention to its application in the home offers advantages that both improve function and enhance pleasure. For example, various lighting types and levels provide enriched visual access. (see Fig. 27.1).

Clearly differentiating edges using lighting and color contrast helps those with low vision or those operating in low lighting conditions to better understand their environment. Light also has the potential to prompt directional cues. Illuminating the end of a hallway can have a leading or pulling effect.

Light affects physical and psychological senses of well-being. Several studies have demonstrated that a shortage of exposure to daylight or artificial bright light has been linked to the occurrence of mood and behavior shifts. Indoor illumination that compensates for seasonal low light levels is beneficial to a sizable portion of the population (Grimaldi et al., 2008). Therefore, consideration of lighting levels and timing helps to balance these shifts.

As a component of both light and material, color also affects the understanding of and response to domestic space. Used sensitively, color can enhance safety (i.e., contrasting colors on stair tread edges), increase attention span, stimulate appetite, influence emotion, and change perception of spatial form (see Fig. 27.2).

The interaction of light and material is a source of aesthetic pleasure. People "find beauty not only in the thing itself but in the pattern of the shadows, the light and dark which that thing provides" (Tanizaki, 1991). It is this relationship that moves the visual out of its culturally commodified role and into one where humans become participants in this interplay.

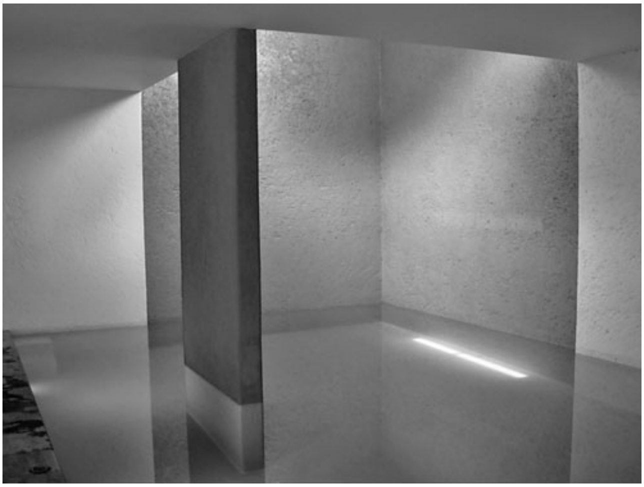

FIGURE 27.2 In Louis Barragan's Casa Gilardi in Mexico City, brilliant red and blue pigments on vertical surfaces were used to invoke a simultaneous sense of "presence" and immateriality in the indoor pool area to prepare residents for the act of swimming. (*Photograph © 2007 Adolfo Peña-Iguarán.*)

Long description: The photo shows an indoor pool area at Louis Barragan's Casa Gilardi in Mexico City. A square skylight illuminating one area of the pool suggests a cubic volume. Two joining walls of the skylit area are painted a brilliant blue. A third separated, bright red wall connects the skylight and the pool.

27.4 THE AUDITORY SYSTEM

The auditory system responds to vibrations and is mechanical in nature. "The ears receive sounds and send them to the auditory cortex, near the back of the brain, for processing" (Anissimov, n.d.).

Hearing is an active process. While humans cannot physically shut out sound, they do have the ability to focus on what they want to hear. Therefore, the basic purpose of hearing is not merely to detect sound, but instead to "pick up the direction of an event, permitting orientation to it, and the nature of the event, permitting identification of it. Its proprioceptive function is to register the sounds made by the individual, especially in vocalizing" (Gibson, 1966). These basic survival tasks involve distance, orientation, spatial understanding; the relation between the self and the world (physiologically and psychologically); and social interaction.

As such, the auditory system has remarkable potential for spatial definition. The reverberation of sound describes the confines, expanses, and materials in space. Apart from helping to cognitively sculpt the spatial confines of a volume, sound also can assist navigation. Humans have the ability to "transform the acoustic attributes of objects and geometries into a useful three-dimensional internal image of an external space. . . . Listeners who must move around in places without light are likely to . . . recognize open doors, nearby walls, and local obstacles" (Blesser and Salter, 2007).

Typically, aural architects and sound engineers focus on the design of concert halls, restaurants, and other public spaces in which sound is a primary programmatic component. No less important is the design of sound in the home, which can (1) provide escape from sound pollution, (2) establish zones of privacy and socialization, (3) give warnings, and (4) enhance sound pleasure.

Designing spaces in the home where people can experience quiet is becoming more important as noise levels from the outside world increase. There are well-established techniques for noise-abating designs that include reducing sound reverberation time, limiting airborne noise, reducing impact noise, and minimizing background noise (Gatland, n.d.). Architects can employ sound-absorbing surfaces, such as fabrics, carpeting, acoustical materials, and natural vegetation; add sound-absorbing insulation to wall and ceiling cavities; and install solid wood or mineral core doors with threshold closures in spaces designed for quietness.

Most homes have places for socialization as well as privacy that require attention to acoustic design. Places of socialization are first and foremost places of listening, and they require high levels of sound absorption. High reverberation in these areas does not invite relaxed conversation, and it is particularly frustrating to those with hearing difficulties. Essential considerations for effective sound design include room dimensions and shape, position of furniture in relation to the shape of the space, placement and types of openings, and construction techniques. Adding conversation niches or spaces in overly large social spaces provides hearing-friendly areas that allow greater participation and thus more inclusion.

Warning and alert systems such as smoke alarms, burglar alarms, and stove timers are typically sound-based. Of primary importance is the sound range of these devices. The human ear is most sensitive to frequencies around 1,000 to 3,000 Hz (Cutnell and Johnson, 1998). As a result, it is critical that all alarms cover this frequency range. In addition, alarms that are sound-based should offer other sensory prompts such as light, color, smell, and/or movement shifts.

When considering the aural palettes of homes, designers might move beyond sound reduction, isolation, and absorption and into positive acoustic design as well (Schafer, 1977). Designers might not only consider the physical and spatial support system to ensure sound quality, but also consult with occupants to ensure choices and levels that are both stimulating and enjoyable.

27.5 THE TASTE-SMELL SYSTEM

Given that taste and smell operate together, they often are regarded as "alternative ways to experience similar phenomena" (Molnar and Vodvarka, 2004). Approximately 75 percent of what is perceived as taste is derived from the sense of smell. Taste-smell is a chemical sensing system and is activated when "molecules released by the substances around us stimulate nerve cells in the nose, mouth, or throat" (American Academy of Otolaryngology, n.d.).

As survival mechanisms, taste and smell stimulate the desire to eat and warn of various dangers in the environment such as fire, poisonous fumes, and spoiled food (American Academy of Otolaryngology, n.d.). In addition, the taste-smell system affects preferences and aversions and, as such, influences emotion and behavior. Strong correlations have been found between smell and attention, reaction times, mood, and emotional state. Taste-smell can stimulate the memorization of concepts or experiences, and acts as a contextual retrieval cue not only for autobiographic memories but also for other types of memory, including visual-spatial memories (Gutierrez et al., 2008).

Taste-smell as a spatial definer is often neglected by designers. "Odors lend character to objects and places, making them distinctive, easier to identify and remember" (Tuan, 1977). Each home, like each person, garners an individual scent. Materials such as wood and masonry characterize space with their odors. Others, such as textiles, fabrics, and draperies, absorb the odors of inhabitation. Occupants' actions can determine the scent of each room, and consequently the scent suggests what behaviors are typical in various spaces of the home. In this way, the scent of the space and the scent of the person merge.

This unique condition provides many opportunities to use the taste-smell system not only to define space, but also to enhance everyday living conditions. Attention to material selection can identify various spaces with specific scents. For instance, rooms might be surfaced with odiferous materials such as rosewood or odor-reflecting materials such as porcelain. Smell might be used as an intuitive layer in home safety warning systems; alarms could emit odors as well as sounds to alert those who otherwise would not connect a sound with a warning. Circulation systems can be designed to bring outdoor scents into interior spaces (see Fig. 27.3).

Smell is linked to and strongly influences parts of the brain that deal with emotion (Harnett, n.d.). For example, the smell of baking bread might give a sense of comfort. Scents known to reduce stress, such as chamomile, might be introduced into rooms designed for resting. Rooms designated

FIGURE 27.3 The Simpson-Lee House in Mount Wilson, New South Wales, Australia, by architect Glen Murcutt has siting and interior circulation systems assisted by sliding windows that are designed to allow the scent of exterior elements to waft through the house when weather permits. (*Photograph © 2008 Kyle Briscoe.*)

Long description: This photo shows the Simpson-Lee House by architect Glenn Murcutt. A wood-slat ramp leads to a covered entrance and establishes circulation in the interior straight through the house. A large slanted roof shades a two-square transparent façade. Next to the exterior ramp is a rainwater storage area.

for productivity might contain materials such as cypress that have been demonstrated to increase alertness. To be effective in concert, however, the design of taste-smell systems in the home requires precision and restraint; overload cancels the positives.

Perhaps more important is the flexibility of taste-smell design elements to accommodate those with sensitivities. Air filtration and cleaning systems become an essential component of home design that allows occupants to control airflow and purification and, therefore, the type and level of odor contained in their living spaces. In addition, dangers detected by smell, such as gas leaks and fire, need supplemental warning systems that engage other senses. More than other sense systems, the inclusive design of the taste-smell system in the domestic setting is challenging because of its pervading nature. Rather than avoiding it altogether, designers might focus on innovations that offer adaptability and contain the infusion of taste-smell in ways that help us to enjoy its many benefits.

27.6 THE BASIC ORIENTING SYSTEM

The basic orienting system uses (1) the vestibular system (balance), (2) orientation (position in space), (3) kinesthesia and proprioception (position of the body parts), and (4) the boundary of the skin (where the outside world begins) to “place” the constantly changing person in a constantly changing environment. This system works with the other sense systems to establish a three-dimensional experience of space. Kinesthetic sensations begin with vestibular organs as equilibrium of posture is balanced with gravity. During this process, humans subconsciously define edges and contours of solids and reveal options for movement (Gibson, 1966).

Reed (1996) stresses the significance of the basic orienting system: “Without this basic ability to adjust one’s body and its parts to the surroundings, literally nothing else could happen.” This system

FIGURE 27.4 In the universally designed Kessler Residence, architect Robert M. Gurney, FAIA, accentuates the entrance by means of a columned porch with a bright red ceiling and a large glass door flanked by floor-to-ceiling windows. (*Photograph © 2004 Maxwell MacKenzie.*)

Long description: This photo shows the front façade of the Kessler Residence by Robert M. Gurney, FAIA, at dusk. The saltbox-shaped house is white with a black roof. A large two-story gridded window reveals interior vertical circulation on the left. Three rectangular six-paned windows light the second floor. The front entrance is a one story cutaway that forms a columned porch with a bright red ceiling and a large glass door flanked by floor-to-ceiling windows.

allows "the detection of the stable permanent framework of the environment" (Gibson, 1966). It plays a primary role in survival by establishing (1) a sense of gravity and the supporting surface (the ground), (2) the distinction between sky above and earth or water below (the horizon), (3) the location of events and objects in the environment, (4) oriented locomotion or finding one's way toward a goal, and (5) geographical orientation, where way-finding occurs over long distances.

Incorporating the basic orienting system in home design involves the establishment of reference points for occupants. For example, the home entrance is a key way-finding marker. Possible entrance accentuation strategies include positioning it on axis, using a change of material, incorporating a canopy or marquee, creating emphasis with landscape features, etc. (see Fig. 27.4).

Also important is the reciprocal relationship between inside and outside. For example, windows might be placed such that they mark the horizon line or positions of the sun. Air passages could be situated so that the sounds of front (e.g., traffic or street noise) and back (e.g., rustling trees) remind those inside of the way the house is sited. Often underestimated, basic orientation is a core means to instilling a sense of stability. It is the primary mediating device between humans and their environments.

27.7 THE HAPTIC SYSTEM

The haptic system "refers to our sense of touch extended to include temperature, pain, pressure, and kinesthesia (body sensation and muscle movement). It is thus a system in which human beings are literally in contact with their environment" (Gibson, 1966). The haptic system allows people to feel objects, surfaces, and air/water quality relative to the body and, reciprocally, the body relative to these features in the environment (see Fig. 27.5).

FIGURE 27.5 In Maya Lin's Vietnam Memorial in Washington, D.C., the experience of touching the engraved names and simultaneously moving down into and then up out of the earth evokes a haunting sense of another event, time, and place that is grounded in the haptic body. (*Photograph © 2009 Scott Nunemaker.*)

Long description: This photo shows a group of visitors walking along the ascending path of the Vietnam Memorial in Washington, D.C. Am image of the group is reflected in the polished black marble wall, and some people are touching the engraved names of soldiers as they move along.

The application of tactile strategies to residential architecture can characterize space, especially for those with varying perceptive capabilities. For example, the hard edges of concrete create rigidly defined spaces, whereas the flexibility of latex suggests greater ambiguity. Moreover, the tactility of materials is indicative of certain activities. Sleeping spaces, for instance, typically contain softer, warmer materials, suggesting places of rest. Kitchen surfaces might be harder, evoking places for food preparation and cleanup. Hall (1969) notes that, especially in contemporary Western culture, the "texture of surfaces on and within buildings seldom reflects conscious decisions; thus our . . . environment provides few opportunities to build a kinesthetic repertoire of spatial experiences."

Inclusive practices promote attention to the haptic system, and this is especially meaningful in the home. Rethinking the domestic environment to elevate its tactile qualities supports a wider population and provides richer information about their living environments. For example, changes in floor textures can identify various spaces, establishing a subtle yet effective map of the home. Floor temperatures can be regulated to provide seasonal balance—warmer during winter months; cooler in the summer. Wall surfaces can be designed to interact with the body (see Fig. 27.6).

Handrails can be textured to indicate beginnings and endings. Surfaces that come in contact with the body can be made safer: shower floors might be made of slip-free surfaces; faucet handles might indicate safe levels of hot and cold. Exploring the potential of the haptic system within the home allows for both grounding and extending the self through touch.

27.8 INTERDEPENDENT AND INCLUSIVE SENSORY SYSTEMS

The experience of architecture involves all the senses. Despite the longevity of this, "only a few studies have explored the way in which multisensory architecture influences the inhabitants of a space" (Blesser and Salter, 2007). While technological advances have "ordered and separated our senses"

FIGURE 27.6 The bathroom wall surface in the La Marche Residence in Derby, New York, is made of protruding thin rubber strips separated by strips of ash, resulting in a wall that can be used to squeegee off water after a shower and massage the back. (*Photograph © 2006 William Helm.*)

Long description: This photo shows one bathroom wall and a slightly ajar, translucent glass entrance door with a stainless U. The wall surface is constructed of black rubber strips that protrude ¼ in. separated by 1½-in. strips of ash.

(Pallasmaa, 2005), it is also that case that various forms of new architectural production can lead to integrated and multisensory modes of engagement.

Inclusive design is primary among the approaches most conducive to investigate sensory experience in architecture. Critics have accused inclusive design practitioners of neutralizing the built environment, of erasing difference. Inclusive design, if practiced conscientiously, actually does the opposite; it focuses on difference and empowerment through multisensory approaches to design. The challenge to designers is to (1) open sensory choices, (2) avoid the dangers of sensory overload, and (3) practice multisensory design with precision and balance. Only then can it fulfill the overall goal of life enrichment.

The home is the place to start this challenge. The incorporation of sensory design strategies to domestic language not only enhances the personalization of these places but also allows occupants of varying abilities to more fully access, be informed by, and enjoy the spaces of their daily lives.

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CHAPTER 28
DIVERSITY AND EQUALITY IN HOUSING: DESIGNING THE ARKANSAS PROTO-HOUSE

Korydon H. Smith

28.1 INTRODUCTION

Diversity and *equality* are apparent antonyms, yet both are valued in today's political and social climates and in contemporary design discourses. However, reconciling the *inevitability of diversity* and the *obligation of equality* is no small feat. The question remains as to how civil equality can be achieved as society becomes more diverse. How can housing both meet the variety of needs and preferences of a society and ensure equity among the various groups that comprise that society? Can equity be achieved in spite of the disparities; can equitable housing and neighborhoods be developed despite local economic and sociological imbalances?

Although these questions are universal, they are, perhaps, most salient in the American South. The South, and places such as Arkansas, is defined as much by mythology as by its divisive history: stark racial and economic rifts and inversely a warm climate, warm food, and warm hospitality. The reconciliation of diversity and equity is a prime marker in the physical and political landscape of the South. The South, rather unexpectedly, therefore, serves as a testing ground for universal design (UD). As such, the goal of this chapter is to explore how UD ideals can be applied in particular social and physical contexts. This occurs through the development of the Arkansas Proto-House. The overarching goal is to explore the common ground between diversity and equality, between the universal and the specific, in contemporary housing design.

28.2 DIVERSITY AND ARKANSAS

Many lessons have been learned in recent years, as universal design concepts have proliferated worldwide. Arkansas, however, is an unlikely place to look for lessons in good design. In fact, it may be the last place Americans look for counsel about anything. Arkansas is more likely to be the punch line of any number of "trailer trash" jokes than an exemplar of good housing practices. But as English Prof. Fred Hobson (2005) states, "The South always makes good reading. It features the virtues and vices, writ large, of the nation as a whole." From a broad perspective, Arkansas is often stereotyped as rural, poor, and unrefined. In a closer look at each region of the state, many of these stereotypes are upheld; some are not. An even finer view reveals a great deal of economic, educational, racial, topographic, and climatic diversity within the state.

Historically, political boundaries—between countries, states, locales, etc.—were often coincident with geologic, topographic, or other natural features, such as rivers, mountains, etc. Cultural migration, advancements in military and transportation technologies, and developments in commerce, however, have diminished the magnitude of these natural features. Many newly established political jurisdictions—especially local jurisdictions—operate independent of identifiable geographic figures and boundaries. The Great Mississippi Flood of 1927, for instance, shifted the flow pattern of the river, resulting in discrepancies between the state boundaries of Arkansas and Mississippi relative to the river. There are now oddities where parts of Arkansas (or parts of Mississippi) are "on the other side of the river."

Many states throughout the United States are defined by shifts in geological or landscape patterns, e.g., the border between Ohio and Kentucky. Yet other borders are merely circumstantial, geometric superimpositions upon an otherwise unmarked landscape, such as that of Colorado and Wyoming. Arkansas, not unlike Tennessee, North Carolina, and others, possesses both naturally defined borders, such as the Mississippi River to the east, and surveyed borders, such as the northern border between Arkansas and Missouri. The *Land Ordinance Act* of 1785 and the Jeffersonian grid established 1-mi^2 plots of land, which were superimposed on the existing natural features of the West and Midwest. What resulted, as evident in a states map of the United States, was a hybrid condition, where both the Jeffersonian grid and natural features work in tandem to define political boundaries. Sociological, economic, climatic, and topographic characteristics, however, are not homogeneous throughout any state or country. Differences between urban and rural, flat and mountainous, temperate and extreme exist within any given political or legal boundary. So, although Arkansas maintains the highest poverty rate and third highest rate of disability in the United States, poverty and disability are not evenly distributed. Neither is employment, nor is access to health services, public education, and suitable housing. This is common throughout the world.

The eastern part of Arkansas, "the Delta," is predominantly agricultural, is flat and prone to flood, and maintains a much greater prevalence of poverty and disability than the rest of the state. In comparison, the northwestern part of the state, the Ozark Plateau, has both pockets of economic vibrancy and impoverishment. While Benton and Washington counties comprise one of the 10 fastest-growing economies in the United States and are home to the largest company in the world, Wal-Mart, the nearby counties of Newton and Searcy, respectively, have 20.4 and 23.8 percent of individuals in poverty, according to the U.S. Census Bureau. The third major geographic region of Arkansas, the West Gulf Coastal Plain of the southwest, is predominantly rural and wooded, maintains poverty and disability rates higher than the national average, and relies on manufacturing for much of its employment.

Given this sociological, economic, environmental, and technological diversity, it is difficult to imagine the design of a singular prototype that accommodates these variations. Nonetheless, an economy of means through standardization is essential to providing high-quality, affordable housing. Pure customization is not viable. In addition, overarching housing policies set forth by state legislatures need to be applied at the local level. Housing prototypes, therefore, need to adhere to state policies and industry standards, while simultaneously, creating a physical and a psychological "sense of home" for individuals. As famed country singer and Arkansan Johnny Cash (1997) stated, it was essential to have "a place where I knew I could belong."

28.3 DESIGN CRITERIA AND PATTERNING OF THE ARKANSAS PROTO-HOUSE

Many factors influence the decisions people make about buying or renting a home, including location, cost, family structures and needs, and aesthetics. While the housing industry and popular culture tend to place emphasis on the fourth item—"looks"—the first three play a greater role in selecting a residence, e.g., proximity to work, school, and/or family, especially among less affluent rural Southerners. While Sec. 28.4 explores issues regarding site specificity, this section investigates the role that cost and family size/structure play in housing, in addition to overarching principles of design and construction.

First, design criteria were developed by analyzing Arkansas' diverse geologic, environmental, cultural, and economic characteristics as well as understanding the strong correlation between poverty and disability in the South. Eleven major principles, under the auspices of two overarching concepts—maximizing adaptability and maximizing efficiency—resulted (see Fig. 28.1).

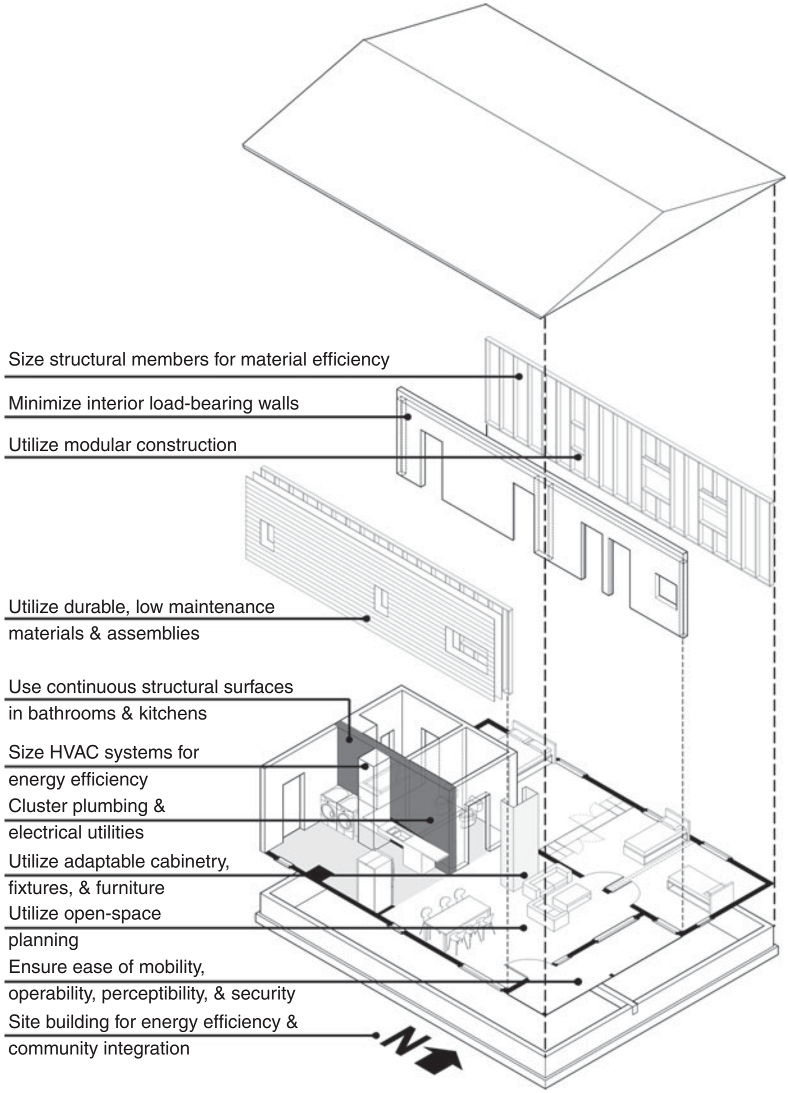

FIGURE 28.1 Maximizing adaptability and maximizing efficiency were the two overarching principles of the Arkansas Proto-House.

Long description: The axonometric diagram illustrates five design principles to maximize adaptability: (1) minimize interior load-bearing walls; (2) construct continuous structural surfaces in bathrooms and kitchens; (3) utilize easily adapted cabinetry, fixtures, and furniture; (4) utilize open-space planning and minimize space used exclusively as circulation; and (5) ensure ease of mobility, operability, perceptibility, and security for diverse users. The diagram also illustrates six principles for maximizing efficiency: (1) utilize modular construction, (2) cluster utilities together, (3) size structural members for material efficiency, (4) size HVAC systems for energy efficiency, (5) site building for energy efficiency and community integration, and (6) utilize durable, low-maintenance materials and assemblies.

Second, these design criteria led to the general design of the Arkansas Proto-House through a patterning of nine single-family types (see Fig. 28.2). This taxonomy included three major types: (1) a one-story family, (2) a one-story efficiency, and (3) a two-story family. Each major type included a range of three subtypes, including one family option and two live/work options. The family options centered on sleeping and family gathering spaces, while the live/work option included a home office accessible from the main porch entry and was able to be closed off to the rest of the home. The common features of all types included (1) a fully accessible ground floor, including access to living, eating, food preparation, bathing and toileting, and sleeping spaces; (2) a fully accessible porch, providing exterior living space and mediation between the public and private realms; (3) interior circulation enabling movement for diverse occupants or visitors; and (4) fixtures, e.g., door hardware, sink fixtures, etc., easily operable by diverse occupants and visitors.

It is a common practice among developers and homebuilders to establish a set of major typologies and a set of subtypes and options. Rather than negate this convention, the Arkansas Proto-House was developed such that the underlying principles, organization, and structure of the various Arkansas Proto-Houses are the same, facilitating a more efficient approach to urban, suburban, and rural housing

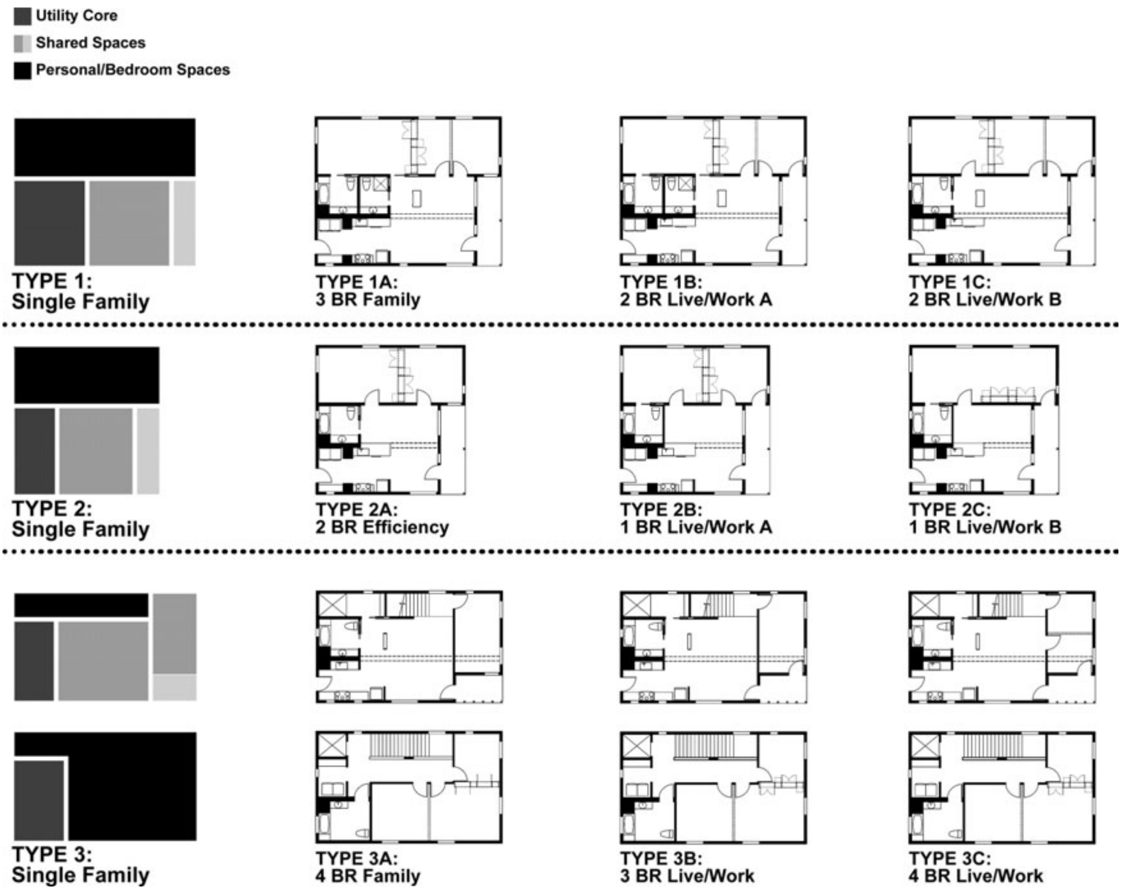

FIGURE 28.2 A framework of typologies comprises the Arkansas Proto-House.

Long description: The plan diagrams illustrate the three major typologies of the Arkansas Proto-House: (1) a one-story family, (2) a one-story efficiency, and (3) a two-story family. The diagrams also show a range of three subtypes for each typology, including one family option and two live/work options.

developments. It is, however, the subtle differences and transformability of the types that accommodate diverse family structures and disparate topographic, sociological, and climatic contexts.

28.4 DEPLOYING THE ARKANSAS PROTO-HOUSE

Clients, designers, developers, and builders negotiate a vast number of factors in the design and construction of housing, including sociological, technological, economic, environmental, and legal factors. All these factors include micro-, meso-, and macro-scale issues, which are often interrelated. The hierarchy of these issues may change greatly from one project to the next, as clients, sites, and material costs change. Although issues such as material costs or personal preferences greatly influence housing design, construction, and purchasing decisions, often site-based issues exert the greatest demands and limitations. Site factors include topography, orientation to the street, orientation to the sun, and parking.

The tendency in many single-family developments and tract housing schemes is to eliminate or ignore these features by flattening topography, ignoring the cardinal directions, and dogmatically repeating the housing across the landscape, resulting in increased site costs, increased heating and cooling costs, and decreased neighbor and community interactions. The generic Arkansas Proto-House, on the other hand, was modified by these four factors. The approach, threshold space and porch, and interior organization of each prototype were transformed to create a better fit and increased usability. The major design challenges and strategies employed are demonstrated in each localized case study discussed below. The goal is to illustrate how the aforementioned taxonomy of types might accommodate diverse sites and diverse household structures, while maintaining a certain degree of universality.

More specifically, one exemplar was designed for each of the three regions of Arkansas previously discussed—the Ozark Plateau, the West Gulf Coastal Plain, and the Mississippi Alluvial Plain—demonstrating how the general prototypes might be deployed within a given context. In each of these regions, lots were identified in three cities: Fayetteville, Hot Springs, and Arkansas City. These lots were chosen primarily for the design challenges that they presented, and they served to test how effectively the Arkansas Proto-House could be transformed to the idiosyncrasies of a given site. "Site-specific" design is important. According to Reed (1972), "Southerners seem to have retained a greater degree than other Americans a localistic orientation—an attachment to their place and their people. Although there are some cracks in this pattern, localism can be expected to color the outlook of many Southerners for some time to come."

In addition, each of these case studies—the Ozark prototype, the Ouachita prototype, and the Delta prototype—demonstrated circumstances that were prevalent not only in that given region but also throughout Arkansas and the South. As such, each resulting prototype is more typological than regional; each prototype maintains the possibility to be deployed in similar circumstances elsewhere. Although the prototype designs focused on the house proper, relationships to the surrounding infrastructure, natural landscape, and community were essential.

Ozark Prototype

The first site selected was in Fayetteville, a diverse college town in the Ozark region of the state. The site possessed numerous challenges. The site had a triangular lot with two adjoining streets, it was steeply sloping, and it sat on the border between commercial and residential zones. Type 1A (family) and type 1B (live/work) were utilized to create a stacked duplex. Duplex housing is quite prevalent in the area, but typically possesses two major shortcomings. First, it is often conceived of as two independent houses "merged at the hip," and not as an integrated whole. Second, parking, approach, and privacy between the units are seldom well resolved. The Ozark case study, conversely, is conceived as a whole unit and from the street appears as one large single-family home. This strategy enables the residence to appear more substantial and helps to combat the "not in my backyard" attitude often confronted in affordable housing. In addition, the Ozark prototype has two "fronts." The lower level faces a prominent main street, while the upper level faces a side street, although both are accessible

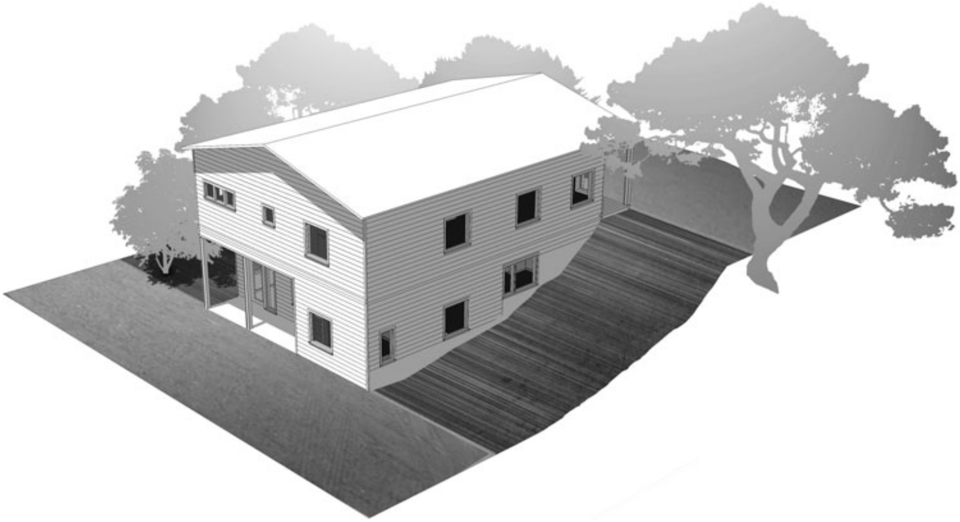

FIGURE 28.3 This two-level duplex contains an accessible live/work unit on the lower level, which faces the commercial district, and an accessible family unit on the upper level, which faces the residential district.

Long description: The aerial rendering of the Ozark prototype shows the two-level duplex, highlighting the accessible live/work unit on the lower level, which faces the commercial district.

at grade due to the topography. The lower-level, live/work unit faces the commercial zone and utilizes an on-site parking strategy, whereas the upper-level, family unit faces the residential zone and takes advantage of on-street parking (see Fig. 28.3).

Ouachita Prototype

The second site selected was in Hot Springs, a retreat town in the Ouachita region of the state. The site was steeply sloping; it sat amid an older residential neighborhood on a very narrow lot; it had no access on the primary public street due to a 6-ft-high retaining wall between the sidewalk and the property line; and it could only be accessed by a narrow dead-end alley. Homes typically marketed as "accessible" or "elder-friendly" are often one-level, but owing to the narrowness of the lot, a single level was not possible. The two-story type 3A (family) unit was used.

Most two-story homes follow a fairly standard organization, where the lower, or "ground," level contains the more public functions of living, dining, and food preparation, while the upper level houses sleeping and bathing spaces. The Ouachita prototype is a transformation of this standard typology. As the Ouachita is accessed by a rear alley on the high side of the property, the first and second levels are inverted in comparison to the norm. The top level is accessed at grade and contains living, dining, and food preparation spaces, in addition to one bedroom and one full bathroom. The lower level contains three additional bedrooms and another full bathroom. This house may not be defined as "universal," but it is "inclusive" to most families. While disability rates are incredibly high in Arkansas, families that have two or more people with mobility impairments are relatively rare. This home, because of the design of the fully functioning upper level, therefore, accommodates the needs of most families. In addition, the stair is wider than a conventional stair and is "straight-run." This design better enables assistance in ascending and descending or the future installation of a lift. The structural framing is also designed to easily accommodate the future installation of a residential

FIGURE 28.4 This two-level single-family home contains an upper level with sleeping, cooking, dining, bathing, and living spaces and a lower level with additional sleeping spaces. The upper level connects to rear parking via a wrap-around porch.

Long description: The aerial rendering of the Ouachita prototype shows the two-level single-family home, highlighting the wrap-around porch, which overlooks the neighborhood below.

elevator, if the homeowner so chooses. Despite the small footprint, the open plan, cathedral ceiling, and large glazing allow the interior to appear spacious. The Ouachita prototype also possesses a wrap-around porch that provides exterior living space, entry, and a "front face" to the public street (see Fig. 28.4).

Delta Prototype

The third site selected was in Arkansas City, a historic Mississippi River port town in the Alluvial Plain. The site was flat, prone to flood, hot and humid, and it was located on a fairly visible corner lot. Steeply sloping sites are often considered to be the most challenging for accessibility and the least desirable to many developers. This may be a bit of an oversight, however, as slopes can be used advantageously, like those of the Ozark and Ouachita prototypes. The biggest challenge to inclusive housing design in the Delta is the flatness of the landscape and its propensity to flood. This requires that homes be raised several feet above grade. So, how can entry and exit be accommodated efficiently without steps? In some cases, the surrounding land can be graded to slope up to the house. Typically, however, this is prohibitively expensive, and ad hoc ramp solutions often are the result.

Due to these factors and the prevalence of single-parent and single-resident households and high rates of poverty in the Delta, the type 2A (efficiency) was chosen. The home was raised 3 ft above the surrounding land, and a porch was provided. The porch was designed to wrap around the corner and transform into an integrated ramp. From the street, only the porch is visible. The porch also provides exterior living space and protection from the sun. The open floor plan facilitates ventilation and allows the interior to seem more spacious. The home is accessible from a rear parking area, from which an occupant or visitor can ascend the ramp/porch to the main living space or move directly into the kitchen via a small set of steps (see Fig. 28.5).

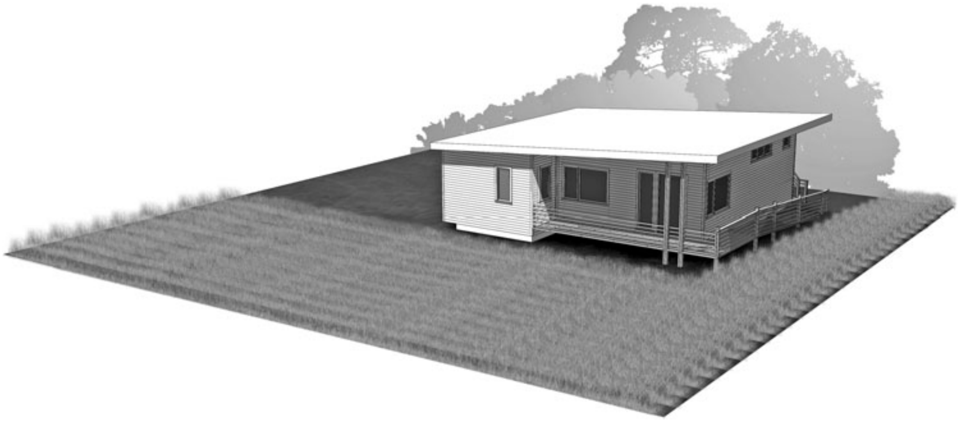

FIGURE 28.5 This one level efficiency unit is augmented by exterior living space and rural surroundings.

Long description: The aerial rendering of the Delta prototype shows the one-level efficiency home, highlighting the wrap-around porch, which serves as exterior living space and a transition into the home.

28.5 CONCLUSION

As housing production has slowed, health care costs have risen, and demographics make massive shifts, the United States confronts a tremendous question: How can housing (1) meet the variety of needs and preferences of society, (2) ensure equity among the various groups that comprise that society, and (3) be created at low cost and high quality? Nowhere is this question more pertinent, timely, and challenging than in Arkansas and the South, a region characterized by strong contrasts in economic, racial, geographic, educational, and health statuses, not to mention the political mythology of the "segregated South."

The Arkansas Proto-House is an attempt to address the varied economic, sociological, environmental, and technological conditions of the South. These residences tackle the challenge of developing prototypes that are both replicable and culture- and site-specific. Like so many universally designed homes, all versions of the Arkansas Proto-House contain kitchens, bathrooms, and living spaces that accommodate the needs of a wide range of families and individuals. Likewise, all examples address economic issues by maximizing material and environmental efficiencies.

The Arkansas Proto-House is an exploration in meeting the physical and psychosocial housing needs of the state, as well as an analogue for solving parallel concerns across the South, the United States, and the world. For example, one of the greatest challenges to attainable housing in areas experiencing economic and housing booms, such as northwest Arkansas, is the rapid rise in land values. Increased land costs push affordable housing to the outskirts of town, increasing the distance inhabitants must travel to access employment, education, health care, and amenities. The Ozark version of the Arkansas Proto-House takes advantage of a site that is typically considered "unbuildable" due to slope and zoning—a site that is centrally located, yet vacant. Each example illustrates how a "standardized" prototype can be deployed in a "custom" setting. The Arkansas Proto-House seeks to work within the diverse social and physical contexts of the South without pandering to stereotypes. Its design features are not exclamatory; this is a central value of universal design, or, quite simply, good design. The Arkansas Proto-House demonstrates how the universal becomes specific, how diversity results in equity.

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Reed, J., *The Enduring South: Subcultural Persistence in Mass Society,* Lexington, Mass.: D.C. Heath & Co., 1972, p. 43.

28.7 RESOURCES

Arkansas Proto-House, Studio for Adaptable and Inclusive Design, www.studioaid.org.

SECTION 3

PRODUCTS AND TECHNOLOGIES

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CHAPTER 29
SELLING BUILDERS AND REMODELERS ON UNIVERSAL DESIGN

Margaret H. Teaford, Susan L. Zavotka, and Christine A. Price

29.1 INTRODUCTION

Incorporating features of universal design into new housing and home renovations is an essential contemporary issue. Seventy-six million baby boomers are planning to purchase new housing upon retirement (Harney, 2006, p. I6). In addition, among adults 45 and older, almost 90 percent recognize a need for universal design (UD) features such as a full bathroom and bedroom on the ground floor, grab bars, nonslip floor surfaces, and a no-step entrance (Matthew Greenwald & Associates, 2003, p. 11). Of the 45 to 55 age group, 60 percent feel it is "very likely "or "somewhat likely" they will need to make changes to their current home in order to be comfortable as they age (Matthew Greenwald & Associates, 2003, p. 32). In addition, research shows that over 80 percent of families with young children or teenagers were very interested in the concept of universal design after visiting a UD exhibit (Zavotka et al., 2006).

As described by Maisel (2011), current housing stock fails to meet the needs of many in the general population, both with and without physical limitations. To enable individuals to modify their homes by incorporating universal design features, it is necessary to have home builders and remodelers who are familiar with universal design and willing to implement these concepts. This chapter will present a collaborative partnership model used to develop and implement a community education program on universal design. The purpose of this program was to introduce universal design concepts and features to both the general public and home construction and remodeling professionals.

29.2 COMMUNITY EDUCATION PROGRAM ON UNIVERSAL DESIGN

Faculty from The Ohio State University (OSU) and The Ohio State University Extension (OSUE) developed a partnership with aging and housing experts from state and local agencies to create a universal design education program. The partnership was designed around a community-based asset model (Kretzman and McKnight, 1993) that builds upon the resources and strengths of community partners. A goal of this collaboration was to educate the public about universal design and its benefits to people of all ages and abilities, including home construction and remodeling professionals. Initial members of the partnership were knowledgeable about universal design as it related to residential spaces, special populations, and effective ways to educate adults, but lacked expertise in specific product knowledge and an effective venue in which to hold educational workshops. As a result, the district manager affiliated with central Ohio Lowe's Home Improvement stores became a partner in the venture. This partnership developed a community education program that evolved into a three-phase project (Price et al., 2004).

29.3 PHASE 1: DESIGNING THE UD PROGRAM

The community partners in the project contributed expertise, time, and resources to develop educational materials and facilitate community workshops on universal design. The OSU faculty developed educational presentation materials, a home assessment instrument, and publicity materials for the project's web site. A universal design logo was created to provide recognition and continuity throughout the project materials. OSUE educators were trained in the educational program and held workshops in communities across Ohio. In addition, students were involved in an interdisciplinary course on home modifications and universal design at OSU. This class is still offered regularly and consists of undergraduate students from interior design, occupational therapy, health sciences, social work, physical therapy, engineering, and speech and hearing therapy. Students conduct community workshops on universal design as well as home assessments for workshop participants.

Lowe's stores provided space for community workshops, facilitated employee training on universal design, provided financial support for educational materials, and featured universal design products to the public. The educational program was initially piloted in one store. With September named "Universal Design Month," products with universal design characteristics were identified, and educational displays using the universal design logo were emphasized throughout the store. Workshops for customers and store employees were held. As a result of the success of this initial pilot project, managers of all Lowe's stores in central Ohio attended universal design training workshops, and eight managers committed to having a universal design event in their stores (see Figs. 29.1 and 29.2). Other

FIGURE 29.1 A universal design Lowe's employee training session involving OSU faculty, extension agents, and store sales personnel.

Long description: This photo shows a Lowe's employee training session involving OSU faculty, extension agents, and store sales personnel. Training sessions were held in a meeting room at the Lowe's store and lasted about one hour.

FIGURE 29.2 A photo of a Lowe's employee conducting a mini-workshop about universal design lighting features during a workshop day at the store.

Long description: This photo shows a Lowe's employee conducting a mini-workshop about universal design lighting features during a workshop day at the store. Five or six similar stations were placed throughout the store to inform customers about various universal design product categories.

settings for workshops have included community and senior centers, professional meetings, libraries, and schools.

In addition to the contributions of community partners, funding was acquired from an OSU seed grant, outreach and engagement grant, technology-enhanced learning grant, a service learning grant, as well as in-kind support from the state unit on aging, the local American Association of Retired Persons (AARP) office, and county extension offices.

CASE STUDY 1 LOWE'S HOME IMPROVEMENT STORES WORKSHOP PARTNERSHIP

The Partnership Agreement

- OSU faculty provided:
  - Universal design employee training sessions
  - Universal design customer workshops
  - Publicity/media coverage of the workshops

Displays on the selling floor

Signage on products in the store

Lowe's provided:

Meeting room for the workshops

$450 per participating store

Assistance from employees in identifying universal design store products

Display space for educational materials

Duplication of promotional materials

Mini in-store workshops about specific products

29.4 PHASE 2: EXPANDING OUTREACH

Owing to the success of the UD education program, the Lowe's district manager created a community outreach position for central Ohio. This person became a permanent member of the universal design project team and was instrumental in making connections with management in Lowe's corporate office and key persons in the central Ohio building and home remodeling industry. His mediating role led to the expansion of the UD project in two new directions: (1) the targeting of professionals in the housing and remodeling business and (2) the desire to make a national impact by increasing awareness about universal design.

Reaching Housing and Remodeling Professionals

Reaching home building and remodeling professionals became increasingly critical, as newly educated consumers reported difficulty in locating builders and remodelers who were knowledgeable about universal design. To address this problem, key companies in the central Ohio area were sent notices inviting their employees to receive training about universal design in residential construction. The workshop presentation was revised to include information more pertinent to these professionals, e.g., how to market universal design features to clients. Several builders contacted the UD team, requesting educational materials to conduct employee training. A workshop was held for contractors and remodelers working with a local in-home services program, and OSU faculty were invited as guest speakers at local National Kitchen and Bath Association (NKBA) and National Association of the Remodeling Industry (NARI) meetings. Three universally designed ranch condominium developments were built with information and consultation provided by the universal design project team. OSU students and faculty collaborated with a local builder to create a universally designed demonstration home for the local Parade of Homes and worked on the design of a Habitat for Humanity home at the Ohio State Fair.

One company in particular, Dave Fox Remodeling, requested a full training session for employees which resulted in a new partnership for the UD team. The Dave Fox Remodeling Company was interested in universal design to assist its efforts in marketing to baby boomers and senior clientele. After the initial employee training, a collaborative partnership was established to expand the concept of universal design in the central Ohio area. A home assessment project was developed that targeted two new Dave Fox Remodeling clients interested in aging in place. Students, OSU faculty, and a designer from Dave Fox Remodeling visited each client. Students conducted a universal design home assessment, while faculty and the designer interviewed clients about their needs and potential universal design solutions.

The project resulted in the expansion of knowledge about universal design for the Dave Fox Remodeling Company and the realization that more extensive training of professionals was needed. To facilitate a new direction for its business, Dave Fox made significant commitments toward marketing and implementing universal design. These changes included (1) hiring a professional with expertise in marketing to seniors, (2) requiring all staff to complete the NAHB Aging in Place Certification, (3) hiring student interns and sales and design staff with expertise in universal design, and (4) working with OSU faculty in arranging and presenting workshops to building professionals and the general public. To date, Dave Fox Remodeling has won two national NARI Universal Design Awards as a result of its efforts.

CASE STUDY 2 DAVE FOX REMODELING PARTNERSHIP

The Partnership Agreement

- OSU provided:
  - Training of Dave Fox Remodeling employees about universal design
  - Research expertise
  - Design consulting
  - Educational materials
  - Students with knowledge of universal design
- Dave Fox Remodeling provided:
  - Expertise in remodeling and related costs
  - Expertise in marketing and advertising
  - Access to clients for case study research
  - Construction and installation
  - Guest speakers, internships, and jobs for students

Making a National Impact

Another goal identified in the second phase of this project was to increase awareness of universal design at the national level. The UD team met with the Lowe's director of trends and marketing to identify a plan. The need for national coverage of universal design and for examples of universal design kitchens and bathrooms was discussed. Lowe's corporate office expressed an interest in sponsoring a permanent educational exhibit that would allow public audiences to experience universal design directly, and that could be photographed and featured in its *Creative Ideas* magazine (see Figs. 29.3 and 29.4). OSUE was able to provide a location for this exhibit at an agricultural exhibit property located in proximity to Columbus. An annual agricultural event, the Farm Science Review, takes place every September at this property, attracting thousands of consumers across the state of Ohio. A building used for exhibits during the event was identified as the site for a universal design educational exhibit. Through the collaborative efforts of Lowe's corporate offices, OSU faculty and students, OSUE faculty, and Dave Fox Remodeling Company, a three-room exhibit featuring an introductory universal design educational display with a model kitchen and bathroom was designed and installed in the exhibit building. This exhibit, which features numerous universal design elements, is now a permanent feature at the annual Farm Science Review and is utilized throughout the year for educational workshops and training sessions. Further, both the kitchen and bathroom exhibits were photographed and used as the cover story for the Lowe's *Creative Ideas* magazine in two separate issues. To date over 7000 individuals have visited the Farm Science Review UD exhibit, and the *Creative Ideas* magazine articles have reached 2.4 million persons.

CASE STUDY 3 LOWE'S CORPORATE PARTNERSHIP: KITCHEN AND BATHROOM EXHIBITS

The Partnership Agreement

- OSU provided:
  - A building to house a kitchen and bath model
  - A venue (Farm Science Review) to market the models
  - Kitchen and bath universal design expertise

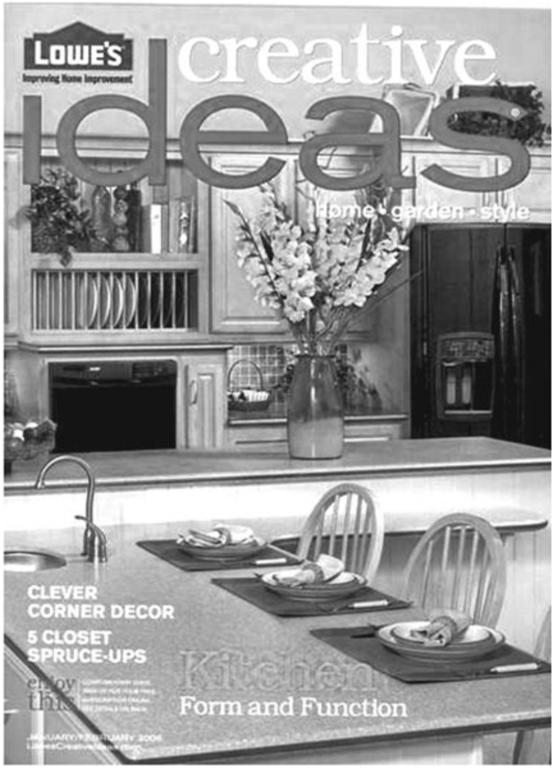

FIGURE 29.3 This photo shows the cover of Lowe's *Creative Ideas* magazine from January 2006 featuring the universal design kitchen at the Farm Science Review site. (*Copyright 2005 SPC Custom Publishing.*)

Long description: This photo shows the cover of Lowe's *Creative Ideas* magazine from January 2006 featuring the universal design kitchen at the Farm Science Review site. The magazine has a national circulation of 2.4 million to households and businesses.

Local assistance for the installation and photography sessions

Publicity (national and local) about the models

Lowe's provided:

Development of the design ideas

All products for the kitchen (2005) and bath (2006)

Construction and installation of the models

Two magazine articles in *Creative Ideas* (national circulation 2.4 million)

Professional photographs of the models for educational use

Dave Fox Remodeling provided:

Design, materials, and installation of bathroom 1 (2005)

Installation of bathroom 2 (2006)

FIGURE 29.4 A photo from Lowe's *Creative Ideas* magazine article showing how the universal design kitchen can be easily used by a variety of individuals. (*Copyright 2005 SPC Custom Publishing.*)

Long description: A photo from Lowe's *Creative Ideas* magazine article showing how the universal design kitchen can be easily used by a variety of individuals. This kitchen is a part of the universal design display at The Ohio State University Farm Science Review which is visited by about 2000 individuals per year.

29.5 PHASE 3: CREATING A MARKETING TOOL

To extend the educational use of the kitchen and bath models located at the Farm Science Review property, the UD team, again in collaboration with Lowe's and Dave Fox Remodeling Company, produced an educational video to share with builders, remodelers, and the general public (see Fig. 29.5). For the video to be an effective marketing tool for building professionals and still be informative to consumers, it needed to appeal to a wide audience. The video was filmed at a suburban home landscaped for a no-step entry and at the Farm Science Review UD kitchen and bathroom exhibits. It featured a family with young children at a neighborhood cookout at their newly remodeled home. The 12-minute video focused on the universal design features of the entry, kitchen, and bathroom of this suburban home. The story illustrates how the universal design characteristics are convenient for the family and all who attended the cookout including a neighbor with a broken ankle and a toddler in a stroller.

The video is being used by the NARI universal design education committee as a tool for its online course. Copies of the video are available to NARI members and have been distributed to educators and policy makers.

CASE STUDY 4 DEVELOPMENT OF THE EDUCATIONAL VIDEO

Partnership Agreement

- OSU provided:
  - Management of the project
  - Consultation in content and narrative of script

FIGURE 29.5 A former Ohio State student, now designer at Dave Fox Remodeling Company, demonstrating universal design features in its NARI award-winning kitchen.

Long description: Courtney Burnett, a former Ohio State student, now designer at Dave Fox Remodeling Company, demonstrating a seated sink work area. This universal design kitchen won a national NARI award.

Administration of legal and financial transactions
Recruitment of actors
Dissemination and sale of DVD
Web site location for DVD

Lowe's Trends and Marketing Department provided:
$10,000 for production and dissemination costs
Content consultation

Dave Fox Remodeling Company provided:
Script
Actors
Access to production company
Connection with NARI for professional distribution of DVD

29.6 DISCUSSION

To change behavior, one must identify educational objectives in the cognitive and affective domains (Gronlund, 2000). Cognitively, a learner must understand the educational content and value the information enough to pursue a change. From an affective standpoint, educational programs must reach individuals on an emotional level, i.e., one that has meaning to their everyday lives and/or livelihoods. In the case of universal design education, simply providing information is not enough. Builders and consumers view UD products such as grab bars as tools for persons with disabilities and not appropriate to everyone. To change these responses requires multidimensional instructional programs that provide both informational content and opportunities for experiential learning. Research indicates that changes in attitude usually happen as a result of a cumulative series of positive experiences (Gagne, 1977). By increasing awareness and broadening attitudes about the benefits of universal design, builders and consumers realize that home environments can meet unique needs and contribute to more comfortable living.

The universal design outreach project described in this chapter was the result of community partnerships, and the project itself developed organically. This experience brought about a number of recommendations for those pursuing community outreach relating to universal design. First, education programs about universal design need to target all markets simultaneously, i.e., consumers and housing professionals. When both builders and consumers learn the benefits of universal design, they can reinforce one another in positive ways. The current project initially targeted consumers, which led to frustration when they could not find knowledgeable builders, remodelers, or store personnel to assist them in implementing UD concepts and features. As demand for UD increased among consumers, builders needed to be made aware of both growing consumer interests and UD concepts. Without consumer demand for homes with universal design features, few builders will be interested. To address this dilemma, it is critical that consumers be informed about UD at the same time that builders are educated about it.

Second, educational programs on universal design need to find their origins at the grassroots level. To change attitudes and behaviors, educators must develop credibility through working relationships with contractors, empowering them to take leadership in their industry. Builders and remodelers must be actively involved in the process of educating the consumer as well as their own employees and peers. The successful case studies are examples of industry partners providing leadership, while faculty members were used for consultation and facilitation. The educational video, which featured a NARI member as the spokesperson, is an example of an industry partner being a credible role model for his or her peers.

Third, experiential models and hands-on physical spaces that provide an opportunity to see implemented universal design features are needed. Observing the reaction of visitors to the Lowe's kitchen and bathroom exhibit at the Farm Science Review confirmed the need for experiential education. Visitors were able to stand in front of countertops at varying heights and understand how this might impact their activities. By trying out the raised dishwasher, pull-down shelving, and lever handles, people could witness how universally designed features can result in easier living regardless of one's age or ability level. It became clear by the comments and exclamations of visitors that nothing beats the actual experience in educating people about universal design.

Fourth, one of the main goals of this outreach program was to market universal design as "easy living" for everyone. It is critical the universal design concept be shown as useful for all people, not as a form of accessible housing. Segmenting the market, i.e., targeting only older adults and persons with disabilities for universal design products, limits the potential consumer base and the public's general awareness about this design option. To overcome these common misconceptions, universal design features need to be marketed as relevant to young people and to families with children. Showing the benefits of no-step entries, wide doorways, and varied countertop heights to diverse populations is an effective way of bringing attention to universal design.

Fifth, one of the significant challenges in the current project was overcoming existing misconceptions about who would benefit from universal design. For example, following communications with members of the media about universal design, regardless of how the universal design concept was presented, the final article or news video would feature a photo of a person with a disability.

Supporters of universal design need to be very consistent in the way that they market or brand the concept if it is to become mainstream for the housing industry. Further, accessible features that are not attractive and seamless should not be identified as universal design.

Finally, those involved in universal design education should expect a long-term commitment that relies on building relationships with many community partners. To be successful, these partnerships must consist of mutual respect, a shared vision, and a willingness to learn from one another. Members should collaborate on general goals, yet also prepare themselves for an evolutionary experience where one successful project leads to inspiration for the next. For example, as this project team looks to the future, it may bundle the concept of universal design with the growing popularity for green building design. Making houses usable by everyone is clearly a sustainable design issue.

29.7 CONCLUSION

This project illustrates the successful collaboration of educators from a state university including those from the university's extension program with a national retailer and a local remodeler. Working together allowed all the participants to learn more about universal design and the needs of consumers and builders. The result was a hands-on learning laboratory that has been visited by students and the public as well as being featured in magazine articles, television shows, and the training video. With early support from a small university grant, this project has developed into an excellent outreach program.

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29.9 RESOURCES

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Building Industry Association (BIA) of Central Ohio: http://www.biaparade.com/.

Habitat for Humanity: www.habitat.org.

National Association of Home Builders (NAHB): http://www.nahb.org/page.aspx/category/sectionID=686.

National Association of the Remodeling Industry (NARI): www.nari.org.

National Kitchen and Bath Association (NKBA): www.nkba.org.

The Ohio State University Universal Design Project: http://ehe.osu.edu/ud/.

CHAPTER 30
UNIVERSAL BATHROOMS

Abir Mullick

30.1 INTRODUCTION

The development of the bathroom has closely followed the history of social attitudes and cultural values. This is not to say that technology played no role in bathroom development. The Minoan and Roman eras produced many advanced bathroom technologies, which were sources of pleasure for the rich Minoans and enriched the lives of everyday Romans. Community values that followed the Minoan and Roman periods set aside these technologies and kept them out of reach for many subsequent centuries. As a result, these advanced bathroom technologies were inaccessible to everyone, including the rich and powerful, and people were deprived of the benefits of using the bathroom. It was not until the late 1800s that a somewhat improved version of Minoan bathroom technology reappeared in the United States and was made minimally available to the general public. Bathrooms finally became part of U.S. homes as recently as the early 1900s, when indoor plumbing and running water became available in common buildings.

The basic design of the bathroom as a room for three containers—the tub and the sink for body washing and the toilet for disposing of body wastes—has remained practically unchanged since its inception many centuries ago. Depending on the social milieu and community support, either these containers were integrated into the building architecture, or supplied with running water and sewage disposal systems, or they were placed away from the home and provided with pumped water and a simple gravity-assisted waste disposal system. The Minoans were the first to have private bathrooms. These were followed by the early monasteries, which operated as protectors of culture and social values. As such, this chapter discusses need for and the emergence of universal bathrooms.

30.2 HISTORIC DEVELOPMENT OF THE BATHROOM

Bathrooms in middle-class U.S. homes first appeared in urban areas. In these bathrooms, fixture placement was driven by plumbing and drain technologies and cost conservation, not by usability or human considerations. The present 5- by 7-ft bathroom first appeared in the 1920s, when plumbing in private bathrooms became available in U.S. homes. Even though a great number of technological and design improvements have been suggested during recent years, including prefabricated designs, bathroom design has remained basically unchanged. None of these new technologies has received acceptance within the plumbing industry. This is so because the plumbing industry maintains a peculiar relationship with the home-building industry and continues to support on-site bathroom construction, which requires assembling thousands of unrelated parts. Not only has the plumbing industry denounced new bathroom designs, it has employed restrictive codes to limit new bathroom and technological innovations. Consequently, the modern bathroom has failed to serve as a place of comfort for most people, and users have compromised convenience for efficient water supply and waste disposal.

30.3 THE NEED FOR A UNIVERSAL BATHROOM

Life expectancy in 1900, when bathroom technology first found its way into the home, was 44 years. A shorter life expectancy meant that most bathroom users were young people, and they did not experience physical limitations associated with old age (Dychtwald, 1990). Most people, then, made use of bathroom facilities independently, children being the only recipients of bathroom assistance. Assistance in the bathroom did not become a factor of the early design, since most users did not live long enough to become old and experience physical limitations. The concept of early bathroom design, therefore, centered on independent use and use in complete privacy, and those who were unable to use the current design under these conditions had to seek assistance, thus compromising privacy, dignity, and self-reliance.

Advances in medical technology and health care have prolonged life, and this has contributed to demographic changes in society. Within a longer life span, therefore, people are encountering a greater number of disabling conditions, for which they must develop new coping strategies. Furthermore, while survival rates for previously fatal injuries and diseases are now much higher, chronic disabling conditions often result. Bathroom dependence among older people and those with disabilities escalates with age and severity of physical limitations, and this often compels them to move from residential settings to institutions. However, social trends are also changing the demographics of people with disabilities. The Independent Living movement encourages all people, including people with disabilities, to live as independently as possible, and everyone wants to be independent in the bathroom.

Bathroom users today are vastly different from the users when the bathroom first originated. They are a mixed population consisting of independent users, dependent users, and care providers of dependent individuals—they are tall and short people, young and old people, large and small people, able-bodied people, and people with disabilities.

Clearly, most bathrooms are not enabling environments, and they present a serious imbalance between an individual's capabilities and the demands of the environment. Current bathrooms continue to primarily support independent users, because they are based on the premise that all users will operate independently, and they do not support dependent users and their care providers, or those using assistive technology products. Even though providing care is a normal aspect of bathroom life, it is nearly impossible to care for children and dependent adults in the bathroom. Most care providers are seriously inconvenienced by bathroom design, and they operate in very unsafe conditions. The average bathroom is an unsafe and inconvenient place for all users, and it is inconsistent with the needs and requirements of most users.

At no time in the history of the bathroom has the need for a better bathroom been more urgent than now. A universal bathroom, an equal opportunity environment, stands for a better bathroom for everyone, and it should benefit all users and meet their individual and collective needs. Universal bathrooms must be for all people, must achieve consumer acceptance by everyone, must consider the range of users, must provide appropriate choices for different needs, and must accommodate everyone at all times. They must embrace new technology to provide a dynamic bathroom environment that adapts to people's changing conditions; allow users to customize their environment; offer a high degree of safety, security, usability, and independence to all users; provide individual satisfaction; and support the offering and receiving of assistance.

The universal bathroom is not one design for all people. The universal bathroom supports the idea of individualization and personalization through design flexibility and diversity, i.e., different designs for different users within the same system, or adaptability and adjustability that can accommodate all users. A universal bathroom is a place for all members of the family, and it will offer many different designs.

30.4 INNOVATIVE BATHROOM DESIGNS

The following bathrooms have been designed to provide safety, independence, and work efficiency. They suggest a unique design approach based on modular parts and mass production, which shifts the idea of the bathroom from a constructed environment to a manufactured environment. This allows for the introduction of new plumbing and drainage technology, necessary to incorporate important universal design features related to adaptability, adjustability, and personalization.

Bathroom for Elderly People

Robert Graeff, an architecture professor at Virginia Polytechnic Institute and State University, developed a bathroom that allows elderly people (Fig. 30.1) to maintain personal independence and prolongs their ability to stay at home (Singer, 1988). This bathroom, which can be located adjacent to, or as part of, the bedroom, is designed to provide easy access, safety, and privacy and to reduce walking distance, especially at night, to the customary bathroom. It incorporates many functional features such as wraparound handrails, skidproof flooring, enclosed storage and open counter space, shallow washbasin, spacious shower booth, equipment for perineal cleaning, and effective lighting. There are unobtrusive supports that guide users through the enclosure. Since it is next to the bedroom, removed clothing can be stored dry in the bedroom. The storage is designed to keep medications and related supplies organized in the cabinets, and the shelves have magnifying shields to make fine print on drug labels readable.

Metaform Bathroom

The Metaform bathroom system was designed to provide greater flexibility, safety, convenience, and independence for people of all ages and abilities, including children, able-bodied adults, older people, and people with disabilities (Design Continuum, Inc., 2000). Gianfranco Zaccai of Design Continuum, Inc., designed it for the Herman Miller Research Corporation (HMRC) and the Herman Miller Corporation (HMC). Made up of modular components and moving parts, the bathroom system can be easily transformed as people's needs change over time. It has been designed to blend with existing architecture and details and to require little labor and cost to install, maintain, and repair.

FIGURE 30.1 Bathroom for the elderly.

Long description: The picture shows two parts of the bathroom: a grooming area on the left, a showering area on the right, and a wall separating the two. The grooming area has a wraparound countertop with knee clearance for wheelchair access and under-the-cabinets lights. The cabinets are for storing bathroom accessories and medications. The wall that separates the grooming area from the showering area has vertical grab bars for support. Between the grooming area and the showering, there is a continuous bench for those elderly who wish to go from one area to the other area sitting down. The showering area is a giant shower stall with a handheld shower and several wall-mounted grab bars.

The Metaform system consisted of associated yet independent components that form three bathroom activity nodes—the lavatory, toilet, and bathing nodes. These components can be assembled to form activity centers and construct variable-size accessible bathrooms with the minimum size being 5 by 5 ft. The lavatory node, shown in Fig. 30.2, consists of a self-contained, height-adjustable assembly, and it has a sink, work surface, storage, lighting, and mirrors. This node can be installed within the thickness of a standard 4-in. studded wall, or retrofitted to the outside of any existing wall that provides for hot and cold water as well as waste lines and electricity.

The toilet node, as shown in Fig. 30.3, consists of a toilet that adjusts automatically in height to facilitate transfer and use by small children, tall adults, and people with disabilities. It incorporates optional features such as foldaway arms to facilitate transfer, bidet wand with dryer, and automatic self-cleaning/sanitizing. When not in use, the toilet bowl can be rotated into a cavity and out of the way.

The bathing node includes four basic components: (1) a "water column" assembly, (2) the shower floor pan/drain system, (3) resilient bathtub with optional hydraulically powered transfer chair, and (4) a support bar/accessory rail system (Fig. 30.4). The water column is a self-contained, preassembled unit, which contains the shower/hand wand controls, a range of showerheads, ambient and foot lighting, an integral support bar to facilitate safe transfer, and integral forced ventilation for the shower or shower/tub. The pan/grill system channels shower water into a trough underneath and drains into the bathroom drain. The tub, which is made up of a resilient outer surface, is designed

FIGURE 30.2 Self-contained height-adjustable lavatory

Long description: The picture shows a little girl using the lavatory in lowered position. In that position it is also usable by a wheelchair user. In the raised position, the lavatory is usable by a standing adult. The lavatory also has a built-in mirror and a light that lower and rise along with it. There are two sets of drawers, one on either side of the lavatory.

FIGURE 30.3 Height-adjustable toilet with foldaway arms.

Long description: The toilet has two hand rests that can be lowered for support or folded away when not in use. The toilet bowl comes with a bidet and dryer and it folds away into a cavity and is out of the way, clearing the floor space when needed. The toilet along with the hand rests is height-adjustable.

to facilitate transfer, while providing safety and comfort. The rim of the tub is bowed outward to facilitate seated transfer from a wheelchair. The support bar/accessory rail is a modular component. It can be installed over any existing stud wall and can support 1000 lb of load at any point. Made of a tubular steel core with a resilient urethane skin, it offers a secure and natural gripping surface for the hand and allows attaching and repositioning accessories, such as a folding shower chair, soap and shampoo dispenser, soap dish, shaving caddy, baby's bath bassinet, and such, thus enabling users to customize the bathroom environment.

IDEA Center Bathrooms

The Center for Inclusive Design and Environmental Access, with the support of the National Institute on Disability and Rehabilitation Research (NIDRR), U.S. Department of Education, developed two adjustable bathrooms, called the *movable fixtures* bathroom and *movable panels* bathroom (Mullick, 2000). These designs were based on the premise that bathroom use must prolong independence, allow the offering of care and assisting care providers. Unlike most current bathrooms, which are designed primarily for independent users, these bathrooms considered the needs of the human life cycle and addressed dependent use and care, providing alongside independent use of the bathroom.

FIGURE 30.4 Water column in shower.

Long description: The water column is a self-contained, preassembled unit, which contains the shower/hand controls, a range of showerheads, ambient and foot lighting, an integral support bar to facilitate safe transfer, and integral forced ventilation for the shower or shower/tub. The picture shows the water column and all its components.

In these bathrooms, the sink and shower moved around the bathroom wall to adjust for use conditions. Through fixture movement, the bathrooms reorganized and opened up spaces for both independent and dependent use, suiting various body sizes and preferences and specific care-providing situations. The fixtures also adjusted in height to accommodate variations in stature, and for standing users, sitting users, and children, in relation to user needs and capabilities, and the demands of the environment. Fixture movement is a result of technological innovation in existing plumbing and drain technology used unconventionally. Both the movable fixtures and movable panels bathrooms let bathrooms adapt to people, and not the other way around, resulting in a best "fit" between users and their environment.

The concept for the movable fixtures bathroom was based on the premise that the bathroom needs to be regularly adjusted to meet the changing demands of a variety of users living in the home. Furthermore, the technology must allow instantaneous and easy movement of fixtures to create larger spaces for bathroom activities based on user preference, as well as independent and dependent use. In this bathroom, the sink and shower rolled along the bathroom wall to create larger toilet, grooming, and showering areas. Fixture movement, in principle, instantly created three "large" bathrooms in one small space and opened up the bathroom for easy operation during dependent and independent use. The sink and shower units, which rest and roll on the wall-mounted bars, also adjusted in height for stature variations and usage. When not in use, the fixtures locked securely in place to prevent

FIGURE 30.5 The movable fixtures bathroom.

Long description: The toilet and the sink unit are on the left, and the shower and the shower door are on the right. The sink unit rolls horizontally along the handrail, close to or away from the toilet, creating different-size bathrooms. The sink unit has a built-in mirror, light, storage, and grab bars, and along with them it moves vertically and adjusts in height to meet the needs of standing and seated users.

FIGURE 30.6 The movable panels bathroom.

Long description: In the movable panels bathroom, the sink, shower, grab bars, and storage units are on panels, and they can be moved anywhere in the bathroom. The sink unit has a built-in mirror, light, storage, and grab bars, and along with them it moves vertically and adjusts in height to meet the needs of standing and seated users.

unplanned movement. Plumbing, drainage, and electricity are supplied through a flexible assembly, and these services are designed to support fixture movement. The shower area consisted of a fast-draining shower floor and a telescoping shower screen that moved with the shower to provide various-size enclosures. The screen stored flat against the bathroom wall when not in use.

The concept for the movable panels bathroom was based on the premise that users will only make major bathroom changes periodically, not every day. They will make environmental changes when there is a major change in the family composition, such as the birth of a child, temporary disability, or an elderly parent moving in to live with his or her children. In this bathroom, the sink, shower, and storage units were on panels, and they could be moved anywhere in the bathroom. The fixture designs were the same as those in the movable fixtures bathroom and allowed the same height variation and movement. The shower area consisted of a fast-draining shower floor and a shower curtain. There were other supportive and multipurpose features in this bathroom, such as the panels for accessory storage. These panels also served as recessed grab bars for support and assistance. When in production, panels were expected to be available in a range of colors, so they could be mixed and matched to produce a variety of attractive bathrooms, thereby making it easy and less expensive to redecorate over time.

These bathrooms reflect the social and inclusive philosophy of universal design. They have the potential to unify diverse population groups, so no one user group is excluded by their design. Existing bathrooms, with permanently installed fixtures, symbolize the idea that one bathroom design fits all users. They tend to homogenize through uniformity. The two innovative bathrooms, on the other hand, encourage individualization through flexibility and choice, so users can adapt their bathrooms to suit their personal tastes and preferences.

30.5 THE FUTURE OF THE UNIVERSAL BATHROOM

The current approach to bathroom development has focused on designing task-oriented fixtures—sink, toilet, and tub/shower—with little consideration for their use, placement, and how they make up the bathroom environment. These fixtures require people to use them individually and move around to perform bathroom activities. Emphasis on task-oriented fixture design, rather than on the bathroom as a place to carry out daily hygiene, undermines the relationships between fixtures and forces moving around to perform bathroom activities. For example, shower designs do not support shaving and brushing when showering, even though it is quite common among bathroom users to shave and shower at the same time. Users are forced to groom at the sink and travel to the shower for showering. Similarly, many people, including those who catheterize themselves, seek access to the sink when using the toilet. This access is denied because of the fixtures' distant placement. The task-oriented fixture design approach has produced distinctly different products that do not relate well to one another. Unlike the machines for contemporary industrial production, these fixtures do not interface well with one another, and bathroom activity requires time, movement, and effort. This may be fine for most people, but it can be very demanding for many others. Fixtures that allow performing multiple and related tasks can produce improved bathroom environments and provide significant benefits for everyone. Better fixture design will diminish time in the bathroom, reduce unnecessary movement, and benefit not only people with disabilities, but also many other user groups. Everybody will benefit from well-designed fixtures.

30.6 CONCLUSION

The future of the universal bathroom lies in recognizing that smart technology can ease bathroom use and add convenience to daily living for everyone. The successful universal bathroom will employ smart digital technology to establish communication within and between fixtures, so the bathroom environment would adapt to users and not the other way around. For example, smart technology in the IDEA Center's movable fixtures bathroom has the potential to make instantaneous fixture adjustment for stature variations, and to move them for better bathroom layout and fixture relationships. By activating coded information, it is possible for digital technology to customize the movable fixtures bathroom to suit people's individual and collective needs. Better integration of smart technology in the bathroom will increase convenience, eliminate unnecessary human intervention, facilitate hygiene maintenance, produce improved bathroom environments, and offer significant benefits for everyone.

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CHAPTER 31
UNIVERSAL DESIGN OF AUTOMOBILES

Aaron Steinfeld

31.1 INTRODUCTION

In most North American cities, automobile transportation is the means by which most people travel when trips are too far to walk. The basic fact is that people with disabilities and older drivers will need to use automobiles for the foreseeable future (Schieber, 1999), and automobiles are especially critical for rural residents due to the general lack of transit. Lack of mobility within the community corresponds to lack of access to employment, social interaction, and daily activities such as shopping and entertainment. This chapter examines the major issues related to universal design of automobiles.

In recent years, increased attention to applying universal design to automobiles has been motivated by awareness of the aging of populations in developed countries and the impact that this demographic shift will have (Waller, 1991). While the term *universal design* has not been popular in the automotive industry, there is interest in the subject. This language gap reflects an underlying ambivalence about addressing the needs of older people and people with disabilities directly. Too close an association with aging and disability has been perceived as a marketing liability, particularly if such features conflict with styling goals.

Despite their ambivalence and priorities, companies in the industry are now aware that the disability community and older adults are a growing consumer force. Some responses have been made in recent years. Modifications include the use of tools such as the "Third Age Suit," which allows designers to experience the limitations in performance associated with aging and makes them more sensitive to the impact of aging on driving and riding experiences (Block, 1999). Other automobile companies have similar efforts underway (Parker, 1999). Unfortunately, most developments in universal design of automobiles focus on interiors and have not addressed conflicts with structural, aerodynamic, performance, and stylistic design goals.

31.2 PHYSICAL ASPECTS

Limitations in motor abilities cause significant problems in entering and exiting vehicles for both drivers and passengers (James, 1985). About 50 percent of one large sample of the frail older population reported difficulties getting in and out of vehicles (Steinfeld et al., 1999). Vehicles with high floors are more common nowadays, and senior citizen transportation services frequently use vans and minivans. Many older adults have difficulty getting in and out of these vehicles. Another popular style is the sport coupe that is usually styled to look sleek and low. These require enough agility to bend the body under low ceilings and to rise up out of very low seats. This problem, combined with wheelchair access, has led the Vehicle Production Group (2009) to focus on a new vehicle design called MV-1 that supports easy entry and egress by all passengers. The vehicle includes a low floor, retractable wheelchair ramp, and a dedicated wheelchair parking area in the main cabin.

Back seats with narrow doors are impossible for many older passengers to use, and the rear seats of two-door models are particularly difficult for older frail people to use. Drivers who use wheelchairs and can transfer on their own, on the other hand, find that two-door models are best for entering and exiting and loading and unloading their chairs. The doors of these models are very wide, and having only one door on each side makes it possible to get the chair into the rear of the automobile. Models with small rear-hinged doors behind the driver's seat are also popular.

Seating and positioning play major roles in supporting driving tasks. The size of the "useful field of view," the "spatial area within which an individual can be rapidly alerted to visual stimuli," has been linked directly to accident frequency and driving performance in the older population (Owsley and Ball, 1993). Consumers in focus groups reported using cushions to prop themselves up to get a better view of the road (Steinfeld et al., 1999). Positioning also affects interaction with roadside devices and tollbooths. Limitations in range of reach or grasping strength can make it very difficult or impossible to use drive-in banking or restaurants. One solution is electronic toll collection. These wireless payment systems were originally designed to increase efficiency at tolls, but also have significant benefit to people with upper limb impairments.

Safety restraints have also been identified as a major problem. People over 55 who had been in accidents have a significantly higher proportion of deaths even though a higher proportion of the older group used seat belts (Cushman et al., 1990). One proposed explanation is that the incidence of inappropriate use of seat belts by older people is much higher than that in the younger population. Older people with disabilities have reported not using seat belts or moving the shoulder belt to a different location because the belts are uncomfortable or cause pain (Steinfeld et al., 1999). The difficulty of acquiring, moving, and buckling the belt was also a common complaint due to arthritis and limitations in range of motion. Participants also identified the location of controls for adjusting seat position as a problem. Many automobiles have the control lever located under the front edge of the seat. Participants reported that this position was very difficult for them to reach.

Recommendations Box 31.1 Physical Design

- Accommodate passengers with mobility impairments by reduced floor height, high door openings, and wide doors.
- Seats should be high enough to reduce the need to extend legs and reduce the need to push up while exiting and bend down while entering.
- Include adequate handholds and consider improving access by designing new seating systems such as swivel seats.
- Seating controls should be easy to understand and operate. Whenever possible, controls should be located in a visible and easy-to-reach location.
- Roadside devices and tollbooths should be designed to accommodate drivers with limited reach and upper limb mobility.
- Seat belt buckles should be located and designed so that they can be easily found and fastened by people with limited upper limb mobility without favoring one side of the body.

31.3 CASE STUDY: LEAR TransG

Lear Corporation, a major supplier of interior components to the global automobile industry, developed a concept interior that demonstrated how seating, instrument panels, environmental controls, and window and door controls can be made more usable for older people (Fig. 31.1). Lear called

FIGURE 31.1 Lear TransG interior.

Long description: Two photos of the Lear TransG concept car. The doors open at each end of the passenger compartment so that there is a lot of room to enter and egress the vehicle. The seats rotate toward the opening for even greater mobility. The steering wheel and instrument cluster is designed to support reduced vision.

their concept interior the "TransG" for transgenerational. It had features such as swiveling power front seats, enhanced graphic display of instruments, and a storage cart that could be stowed in the trunk.

The seats rotated out at a 45° angle to facilitate getting in and out and reduced dependence on good balance or strength. The integrated seat belts had a four-point arrangement with a center-positioned buckle that was easy to latch and see. This design made the act of fastening the belt much easier for people with limited dexterity or a limited range of head movement. They secured the occupant more uniformly and were more comfortable. The TransG instrument pod and pedals moved toward and away from the driver rather than having the seat move. A memory control automatically adjusted the seat, instruments, and pedals for each user. The floor of the concept interior had a lower step-up height and a flat load floor to enhance ease of ingress and egress.

31.4 PERCEPTION OF THE ENVIRONMENT

Aging, sensory disabilities, and in-vehicle factors such as loud car radios all can result in impaired perception of the surrounding environment. For example, when distracting stimuli are present, older drivers can exhibit reduced performance with respect to visual field size, dynamic visual acuity, velocity estimation, as well as other perceptual and cognitive factors (Hakamies-Blomqvist, 1996). The effects of multiple disabilities exaggerate limitations in performance. These drivers can have a reduced ability to detect horns, emergency vehicles, and other unusual events. Parabolic rear-view mirrors can sometimes help.

Night vision aids (Fig. 31.2) are particularly attractive to drivers who have impaired night vision. As such, it is possible that older drivers who, in the past, were unwilling to drive at night may begin doing so without any increase in risk. However, it is also quite possible that they may make matters worse. These systems provide only monocular views to the driver, thus reducing depth perception. Furthermore, night vision systems do not provide images that look normal, and drivers are still susceptible to glare from oncoming vehicle headlamps.

Head-up displays (HUDs) are sometimes attractive to vehicle designers, because they provide a means to superimpose visual information on the road scene. Experiments involving HUDs have shown promise, but there are serious perceptual and cognitive issues that need further research (Tufano, 1997).

One technology that is particularly promising for drivers who have limited neck motion is the parking aid. Parking aids include rear proximity sensors and other parking collision avoidance systems (e.g., Ward and Hirst, 1998). These systems typically utilize audible backup warning alerts when an object is detected. There is anecdotal evidence that such systems reduce mirror use, so rear-camera systems may be more appropriate, especially due to the poor performance of many noncamera systems (National Highway Traffic Safety Administration, 2006).

FIGURE 31.2 BMW night vision system. (*Courtesy of BMW NA.*)

Long description: A demonstration of the BMW night vision system. There are two pedestrians in the forward scene. They are hard to see since the picture is taken at dusk. The center console of the vehicle shows a thermal view of the forward road, and the pedestrians are clearly visible as white silhouettes.

Recommendations Box 31.2 Perception

- Ensure that the introduction of new technology does not introduce side effects with negative safety impacts that outweigh the benefits.
- Whenever possible, systems should provide redundant information in alternative sensory modalities.

31.5 NAVIGATION

As drivers age, some begin to lose their confidence and/or ability to navigate in unfamiliar territory. If they acknowledge this difficulty, these drivers only drive on very familiar routes. Thus, in-vehicle navigation systems are attractive as a means to compensate for poor or impaired way-finding abilities. The user interfaces of most navigation systems are small, flat-panel displays mounted on the dashboard. Audible directions are included in some systems, and HUDs are being examined as alternative display devices. Interaction problems can include difficult destination input methods (Steinfeld et al., 1996), visual attention conflicts, and poor understanding of imagery. The most serious problem is misinterpretation of instructions. For example, in a real-world experiment of one system there were four critical incidents in which subjects changed lanes upon instruction from the system without checking for other cars (Katz et al., 1997).

Clearly, it is important that such technologies not distract drivers or overload their mental capabilities. While systems that use speech output have limited visual impact, they exclude people with hearing impairments unless visual information is also provided. The task of selecting choices and commands can also distract the driver. Voice recognition systems are often heralded as the safest input method, but they should be usable for individuals with speech impediments or accents. Multiple language capabilities are also desirable.

31.6 CASE STUDY: PERSONALIZED NAVIGATION

Current navigation systems offer limited customization of routing preferences and lack robust destination and route prediction capability. In an ideal case, systems would learn a person's preferences and predict desired destinations with minimal input. The former is especially important for drivers who avoid certain types of intersections and road types (e.g., highways, roundabouts, etc.); the latter cuts down on data entry and distraction. These features can also support dynamic rerouting based on prior habits. For example, someone may avoid certain roads during rush hour but favor them at other times. The system would know this and reroute accordingly. See Fig. 31.3. Research on this front is advancing considerably, and good results are starting to appear (e.g., Ziebart et al., 2008).

31.7 SAFETY

Crash protection, or "occupant packaging" features, such as airbags and passive restraint systems will not be addressed here. This subject is heavily studied by a variety of laboratories and tracked by government agencies. Instead, the focus here is on high-tech, precrash safety developments.

Collision warning systems have been on the market but have mostly been installed on commercial trucks. These systems use forward sensors to determine the presence and trajectories of potential obstacles. A user interface indicates to the driver when dangerous scenarios exist, thus prompting corrective action. When tied to cruise control, the vehicle can automatically respond to forward obstacles by releasing the accelerator, shifting to a lower gear, and/or activating the brakes. This functionality is referred to as *adaptive cruise control* and is an option on some luxury cars and

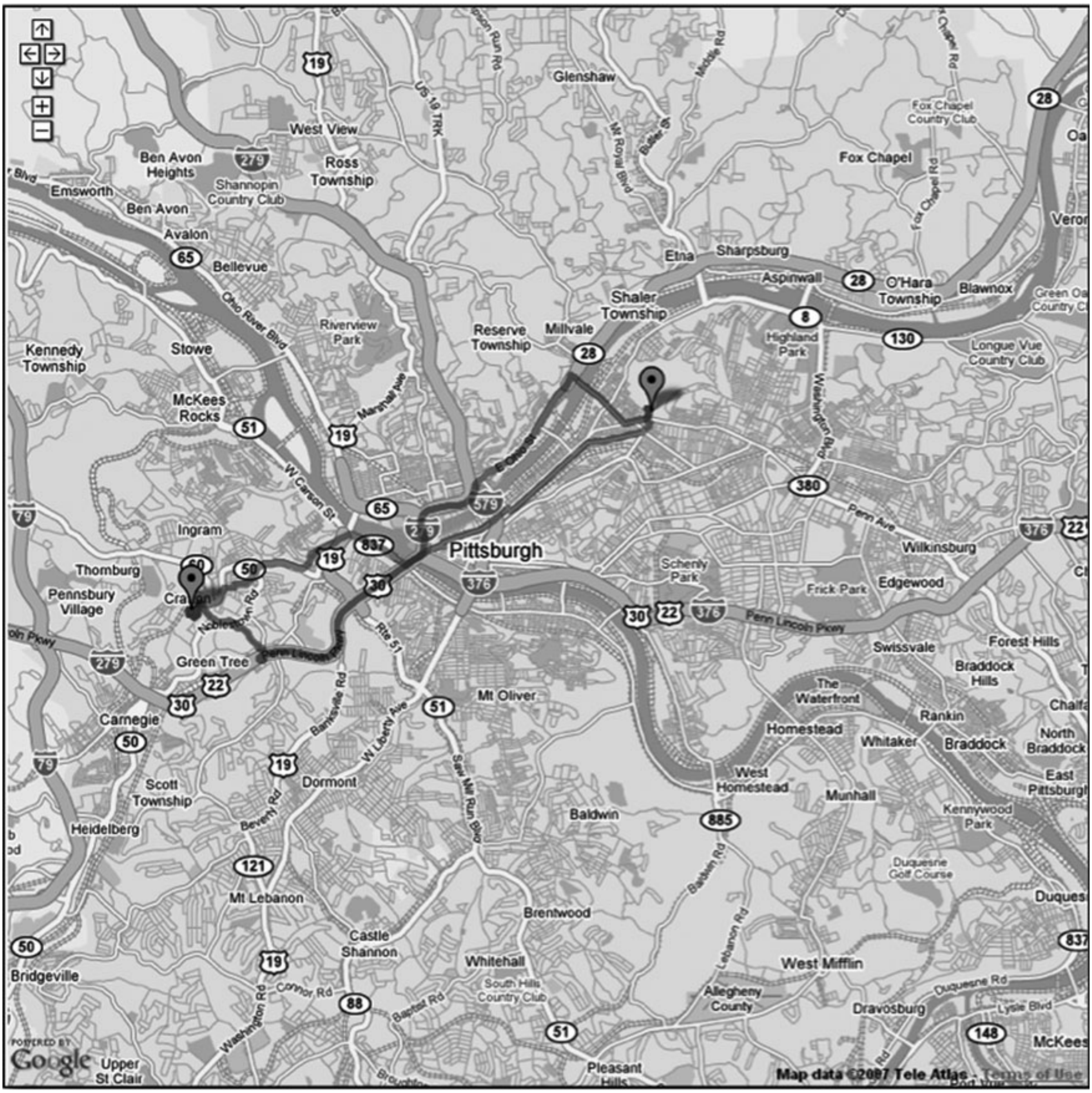

FIGURE 31.3 Personalized routing based on a learned preference (route that avoids left turns goes around the block occasionally).

Long description: A screenshot of Google Maps showing two different routings between the same endpoints. One has fewer left turns than the other.

commercial trucks. While these systems will likely improve safety for the general public, their cost is high and some design questions remain.

Some precrash warnings use both visual icons and audible tones. This redundancy is good, since using only audible signals does not provide sufficient information to drivers with impaired hearing. Approaches involving haptic sensations and vibration have been used to transmit safety-critical messages to the driver. The tactile modality is more direct and, like hearing, does not necessarily depend on selective attention to convey a message. However, there are some concerns that drivers will misinterpret such signals as maintenance problems.

Recommendations Box 31.3 Safety

- System functionality should be easy to understand.
- Alerts and other interfaces should utilize redundant sensory modalities in a standardized manner.

31.8 IN-VEHICLE INFORMATION

Consumers are expecting increasingly more complex information and entertainment options. Unfortunately, the addition of these features can lead to "button overload" and the potential for unsafe distraction while making selections. This has led to multifunction interfaces that integrate many in-vehicle features through a limited set of buttons and selections using a "menu tree" (Sumie et al., 1998). This supports a reduction in buttons and use of simpler interfaces, larger buttons, larger text, and more logical grouping of functions. However, the tradeoff could be a longer selection period and additional glances to the dashboard. The need to switch visual attention several times between the road and the dashboard is problematic for all drivers, especially older adults. Older eyes require more time to refocus, as attention shifts from a distant object (road scene) to a close object (control panel).

The main problem with many in-vehicle devices is that they are not accessible to people with hearing impairments. Some may argue that this is good since there are fewer potential distractions, but there are significant benefits for some of the features. For example, radio reports of traffic congestion or hazardous weather are immensely beneficial. Besides the time saved by route alterations, there is a safety benefit because advanced warning of congestion or weather leads to higher levels of alertness. Text-based alerts are useful to hearing-impaired drivers who have good eyesight, but small text may lead to difficulty for older drivers. Finally, the lack of entertainment beyond basic driving tasks during long trips can lead to increased boredom for drivers who cannot hear music or other audio entertainment due to a lack of mental stimulation.

Recommendations Box 31.4 In-Vehicle Information

- Provide redundant information in a form accessible to drivers with hearing impairments whenever possible.
- Activities that require high cognitive demands should be permitted only when the vehicle is not in motion, or safeguards should be provided to only permit passenger use while in motion.

31.9 POLICY

One area that could benefit from novel applications of universal design is policy. Many licensing approaches lack appropriate attention to managing the middle ground between driving and not driving. Some states have restrictions for younger drivers based on time of day, but do not support similar restrictions for other drivers based on capability. Likewise, some states explicitly prohibit license restrictions based on location. Drivers who have trouble on highways or in unfamiliar areas are forced to relinquish their license for driving scenarios they intentionally avoid. Geographic restrictions would permit continued independence and mitigate fear of losing one's license when considering driver rehabilitation. This lack of a managed progression from driving to no driving results in disruptive lifestyle changes and loss of quality of life. Insurance companies have entered this discourse, exploring concepts such as lowering rates if the driver submits to monitoring. These same monitoring concepts could be utilized to support managed independence in this middle ground.

31.10 CONCLUSION

In contrast to mass transport systems (see Chap. 19), automobile design can change rapidly because of the "loose fit" between vehicles and the highway infrastructure. The marketing focus of automobile design is a means for introducing innovation in universal design. There is clearly a move in the industry to address the purchasing power of the aging baby boomer generation in industrialized countries. The initial focus appears to be on the easy problems of interior styling and features. Hopefully attention will shift to some of the more important and difficult issues, where usability conflicts with structural, aerodynamic, and styling concerns. For example, the older generation would be well served by vehicles that have low floors but high roofs and high seats. However, this combination provides neither a sleek, sporty appearance nor a tough, off-road look, two of the most popular styles of the times.

Of particular concern for the future is the rapid introduction of new technologies. Many early information and telecommunications products do not demonstrate a universal design philosophy. If the designers and manufacturers of these new technologies incorporated more universal design strategies, these new products would likely be safer and easier to use for the whole consumer population. Clearly, there are new products that can have significant benefits to the driver with a disability or simply an older person seeking to continue driving safely for as long as possible.

31.11 ACKNOWLEDGMENT

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CHAPTER 32
UNIVERSAL DESIGN OF PRODUCTS

Molly Follette Story and James L. Mueller

32.1 INTRODUCTION

The term *products* describes a wide range of objects, from the tiny (e.g., hearing aids) to the very large (e.g., recreational vehicles). In this chapter, products can be defined as encompassing objects that can be found

- In the home (e.g., appliances, furniture, cabinetry)
- At work (e.g., office furniture, equipment, tools)
- In public spaces (e.g., elevators, vending machines, restroom fixtures)

While each product presents its own unique challenges, many of the issues of universal usability are common across environments and applications. This chapter discusses universal design of products and clarifies the similarities and differences between assistive technology and universal design.

32.2 DEFINING UNIVERSAL DESIGN

> "Universal design is the design of all products and environments to be usable by people of all ages and abilities, to the greatest extent possible." (Mace et al., 1991)

While this definition makes universal design an unattainable goal, it remains an ideal well worth striving to achieve. Universal design accommodates the range of variation inherent in diverse populations and varied circumstances. Variations in functional characteristics can happen to anyone at any point in life, e.g., as a result of illness, injury, or aging. In addition, functional limitations can be caused by situation and environment. Noisy environments impair anyone's hearing; darkness impairs anyone's vision; and having the flu reduces anyone's stamina.

Only someone who has personally experienced disability can fully understand the challenges of living with a disability in a world designed for the most part as if such persons did not exist. However, individuals without disabilities can get a modicum of first-hand knowledge by participating in exercises that simulate the effects of having a functional limitation. For example:

- Zip up your jacket—with one hand.
- Carry on a conversation—while a train goes by next to you.
- Count the money in your wallet—in the dark.

- Write your name using your nondominant hand—and then ask someone else to read your signature.
- Read the instructions for your new VCR—in another language.

These situations point out that unusual circumstances can cause functional limitations that make even common, simple tasks difficult for persons of average abilities. Everyone who lives long enough will experience situations like these—at least sometimes, at least temporarily, and often, eventually, permanently.

The U.S. Department of Education's National Institute on Disability and Rehabilitation Research (NIDRR) recognized this in the paradigm of disability it published in its long-range plan of 1998 (National Institute on Disability and Rehabilitation Research, 1999). In the plan, they postulated that disability is not a personal trait but rather a characteristic of the complex and dynamic relationship between an individual and his or her environment. NIDRR's paradigm built on the growing appreciation of the impact that the environment has in enabling or disabling individuals, and the shift from the rehabilitation/medical model of care that focused on treating only the person to the independent living model that emphasizes societal factors. This approach depends on personal conditions as well as environmental and programmatic attributes, and it has significant implications for designers, businesses, and governments, which should anticipate and accommodate a wider diversity of individuals than they typically do.

Traditionally, the needs of individuals with disabilities have been addressed by providing assistive technologies. These devices are designed for populations with specific functional, sensory, or cognitive limitations, and generally the technologies are neither useful for nor appealing to other users.

The quality that makes the critical difference between successful universal design for diverse user populations and assistive technology for limited populations is integration of the accommodating features. Accessible features must be functionally and visually designed into the product, ideally from the beginning of the process. When accessible features are integrated, they are less noticeable, cost less, and benefit more people in a wider range of situations.

32.3 PRODUCTS WITH UNIVERSAL DESIGN FEATURES

In 1997, a set of seven Principles of Universal Design was developed by a group of universal design experts, coordinated by staff of the Center for Universal Design (see Chap. 4, "The Principles of Universal Design," by Story). The purpose of these principles was to articulate the concept of universal design in a comprehensive way in order to guide the design process, allow systematic evaluation of designs, and assist in educating both designers and consumers about the characteristics of products and environments that make them more broadly usable.

The following designs satisfy the Principles of Universal Design and illustrate what is meant by universally usable product design. Most of these images were reprinted from *The Universal Design File: Designing for People of All Ages and Abilities,* published by North Carolina State University's Center for Universal Design (Story et al., 1998). These designs are not necessarily universal in every respect, but each is a good example of a specific guideline and helps convey its intent.

Principle 1: Equitable Use

Guideline 1B: Avoid segregating or stigmatizing any users.

A weight scale with a large platform that is recessed into the floor (Fig. 32.1) saves floor space, and everyone can use the same scale, whether they walk or use a wheelchair or scooter. The scale may also have audio output, which is particularly beneficial for people with visual impairments.

Principle 2: Flexibility in Use

Guideline 2A: Provide choices in methods of use.

FIGURE 32.1 Weight scale with large, recessed platform is convenient for all.

Long description: A woman sits in a wheelchair on a weight scale platform, approximately 1 m^2, which is recessed into the floor. The scale has a bent metal tubing railing along the back edge, and its large display is mounted on the wall at her eye level.

Computer software features (Fig. 32.2) offer users a choice of input and output options. Input can be controlled via a mouse, trackball, touch pad, graphics pad, joystick, keyboard arrow keys, sip-and-puff switch, even a tongue-activated touch pad or eye gaze software. Output can be presented through a monitor (with custom appearance, such as specific colors, fonts, and graphics), speakers, a printer, Braille printer, dynamic Brailler, and other devices.

Principle 3: Simple and Intuitive Use

Guideline 3B: Be consistent with user expectations and intuition.

Simple cell phones, such as Jitterbug in the United States and Raku Raku in Japan, are easier to use than most (see Fig. 32.3). These phones have fewer buttons and options; large, color-coded buttons; and a bright display, on-screen "hints," volume control, and operators standing by ready to help. The phones are more accommodating and less intimidating to use.

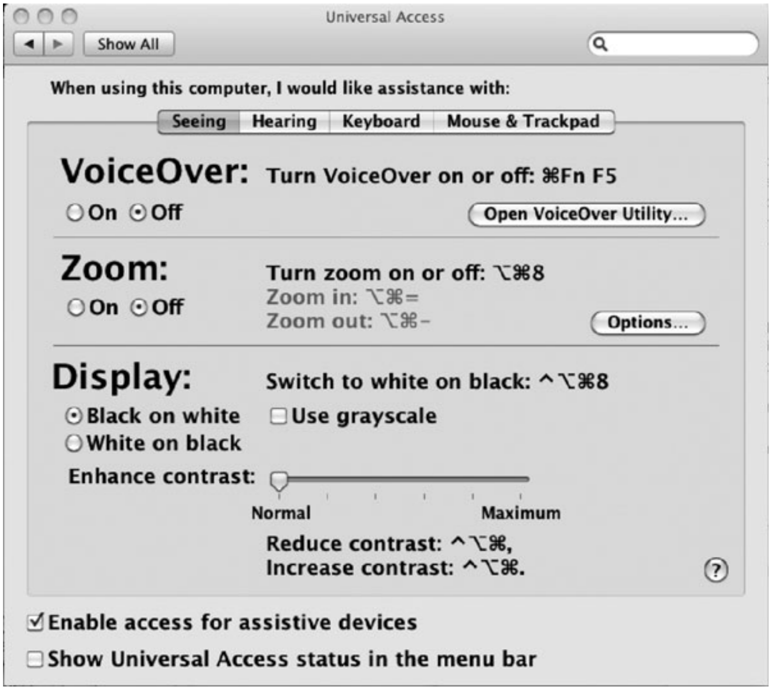

FIGURE 32.2 "Universal access" software offers computer users choices.

Long description: Screen capture of the "Universal Access" dialog box on a Macintosh computer. It offers options for seeing (audio output, display zoom, and contrast) and hearing (screen flash for alerts), and use of keyboard (sticky keys and slow keys) and mouse or track pad (delay, speed, and cursor size) as well as access for assistive devices.

Principle 4: Perceptible Information

Guideline 4A: Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information.

Appliance manufacturers should supply use and care manuals in large print, Braille, and audio and video formats (Fig. 32.4), as well as on their web site, to suit individual user abilities and preferences. Online information is particularly useful because it can be updated as needed, and users can employ whatever computer technologies they need (e.g., font enlargement, screen reader, sip-and-puff mouse).

Principle 5: Tolerance for Error

Guideline 5B: Provide warnings of hazards and errors.

The red tip on a bottle of contact lens cleaner warns the user not to confuse it with the bottle of eyedrops, which has the same shape but a white tip (Fig. 32.5).

Principle 6: Low Physical Effort

Guideline 6A: Allow the user to maintain a neutral body position.

FIGURE 32.3 Jitterbug offers basic cell phone functions and is easy to use.

Long description: The photo shows two white clamshell-style Jitterbug phones, both open, with a display in the top half and buttons on the bottom half. The telephone on the left has two buttons at the top, labeled "YES" and "NO." Below them is a standard telephone keypad with a black background and large white numbers for the keys. The telephone on the right has the same two buttons at the top and three buttons below, labeled "OPERATOR," "TOW," and "911."

A computer keyboard that is split in the middle and has its two sides angled outward to align with the user's forearms allows a computer operator to maintain a neutral body position from elbows to fingertips (Fig. 32.6).

Principle 7: Size and Space for Approach and Use

Guideline 7C: Accommodate variations in hand and grip size.

Open-loop door handles (Fig. 32.7) and cabinet and drawer pulls do not require grasping and accommodate hands of all sizes and shapes.

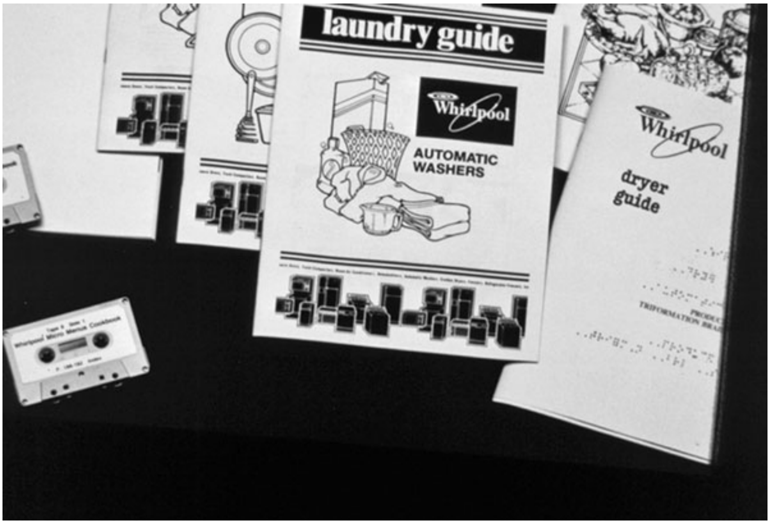

FIGURE 32.4 Manufacturer's care and use manuals should be provided in multiple formats.

Long description: The photo shows several examples of documentation for home appliances, including print, large print, Braille, and audiotape.

FIGURE 32.5 Different contact lens solution bottles are distinguished by color.

Long description: The photo shows two bottles of contact lens solution with their caps removed. The tip of the cleaning solution bottle is red, and the tip of the wetting solution bottle is white.

FIGURE 32.6 Ergonomic keyboards allow wrists to maintain neutral postures while typing.

Long description: The photo shows a keyboard that is raised in the middle and has a triangular space between the keys operated by the left and right hands, to allow the forearms to maintain a neutral posture from elbow to fingers while typing.

FIGURE 32.7 Open-loop door handles accommodate hands of all sizes.

Long description: The photo shows a large, cylindrical, white loop door handle being hooked by a left hand.

32.4 THE RELATIONSHIP BETWEEN UNIVERSAL DESIGN AND ASSISTIVE TECHNOLOGY

The distinction between universal design and assistive technology depends on both the user and the application. Depending on the situation, the same device can be perceived differently. For example, when a magnifying lens is used for examining tiny objects such as a splinter, it is considered a tool; when the lens is used by someone to read the newspaper, it is called assistive technology. When television headphones are used by one member of a household to watch a show without disturbing others, they are dubbed a clever gadget; when those headphones are used by an individual who has impaired hearing, they are considered assistive technology. When an electric cart is used by a golfer, it is considered sports equipment; when an electric scooter is used by an individual with limited stamina, it is perceived to be assistive technology.

Ron Mace discussed the distinctions between assistive technology and universal design at the conference *Designing for the 21st Century* (Mace, 1998). Using both his personal and professional experience, he described many examples of personal equipment that some people need, such as eyeglasses and portable oxygen tanks, which will never be attractive to individuals who do not need them.

However, products sometimes move across the dividing line from assistive technology to universal design and become appealing to a larger number of users. Mace mentioned a number of devices that had crossed this line, such as TV headphones and extra large toilet stalls. Other products that started as accessible and became mainstream include the following:

- *OXO Good Grips*. The OXO Good Grips line of kitchen utensils was conceived when founder Sam Farber retired from the kitchenware business he founded (Copco) and moved to France with his wife, Betsey. While cooking, Betsey noticed that using the kitchen utensils aggravated the pain of the arthritis in her hands. This motivated Sam to develop better handles for these tools and come out of retirement to start a new company, OXO International. Betsey, a designer, became OXO's director of design. The handle designs were not sold as assistive technology but were introduced without promotion as standard kitchen products. Today, the popular soft, rounded Good Grips handles can be seen on OXO products ranging from kitchen peelers to garden trowels and have inspired many imitators. (For more information, see Mueller, 1997.)
- *Voice recognition technology*. Early military research in voice recognition technology was applied to create some of the first systems used by persons with severe disabilities. At the same time, some developers recognized the potential mainstream civilian uses of this technology. Research advanced in parallel in both rehabilitation technology centers and the computer and communications industries. Today, voice recognition systems are available on the open market at a much lower cost than initially, and they are used by people with and without disabilities.
- *Tacky surface materials*. Tacky plastic sheets, marketed as Dycem or Vykem by assistive technology suppliers, were originally used to stabilize telephones, writing pads, dinner plates, and other items that might be difficult to use for persons with limited coordination. Today, this material is used for many applications, such as table mats used in boat galleys that keep plates and glasses from slipping off the table in rough seas.

At the same time, some products start as mainstream and become accessible. The need for affordable and easily available assistive technology has caused persons with disabilities and rehabilitation technologists alike to creatively adapt mainstream commercial products for unforeseen uses. For example:

- *Bicycle grips.* Soft foam tubing sold as bicycle grips can be easily purchased in most sports, toy, and hardware stores to replace inferior or worn-out parts. They also provide a readily available and inexpensive way to improve grasp for persons having difficulty holding a variety of items. Smaller-diameter foam tubing sold as pencil grips can be used on smaller utensils to make them easier to grasp.

- *Magnifying glasses*. Magnifying glasses are available over the counter in a wide selection of powers and sizes and in any price range. As a result, people with vision limitations can use these in the workplace or at home as an alternative to more complex and expensive assistive technologies.
- *Cordless headphones*. Cordless headphones are a popular gift "for the person who has everything." They can also be a very useful assistive technology for the person with a hearing impairment who doesn't want to disturb other members of the household by setting the TV or stereo volume at a high level.

32.5 WHY PRACTICE UNIVERSAL DESIGN FOR PRODUCTS?

Product designers and their clients are beginning to understand and take advantage of the business incentives that have been created by federal legislation, by improved survival rates after trauma and illness, as well as by aging populations worldwide.

Accessibility Legislation Supports Universal Design

Various pieces of U.S. legislation require access for persons with disabilities. The Trace Research and Development Center conducted a research project to identify the factors that motivated businesses to adopt universal design; for many companies, legislation such as the Telecommunications Act of 1996 provided critical incentives (Trace Research and Development Center, 1999). The Americans with Disabilities Act (ADA) of 1990 has done much to promote accessibility of the built environment by persons with disabilities. The ADA required the removal of barriers in the built environment as well as "reasonable accommodation" for qualified employees with disabilities. (For a thorough discussion of the incentives for practicing universal design in the workplace, see Chap. 23, "Office and Workplace Design," by Mueller, in this handbook.)

Universal design can provide cost-effective solutions to environmental access problems. The home of the Baltimore Orioles baseball team is just one example. Orioles Park at Camden Yards was designed to incorporate gradual ramps, handrails, and Braille signs as well as 426 seats that will accommodate wheelchair users. The Camden Seat folds up and pivots out of the way to one side to create space for a wheelchair user, yet can also be used conventionally by nondisabled fans. These seats offer a choice of locations and seating prices throughout the stadium (see Beasley and Davies, 2001).

Several recent laws have drawn attention to the accessibility and usability of electronic data processing equipment and telecommunications equipment: the Telecommunications for the Disabled Act of 1982; the Hearing Aid Compatibility Act of 1988; the Television Decoder Circuitry Act of 1990; Sec. 255 of the Telecommunications Act of 1996; and Sec. 508 of the 1998 Amendments to the Rehabilitation Act of 1973, which has remarkable incentives for universal design (see Vanderheiden, 2001).

Changing Demographics

Consumer businesses are beginning to understand what rehabilitation professionals have always known: Disability is a common fact of life. Most people with disabilities develop them during the course of their lives (National Organization on Disability/Harris Survey of Americans with Disabilities, 1994). Medical progress has had a profound effect on the treatment of illnesses and injuries that a short time ago were fatal. Between 1970 and 1997, the survival rate from strokes more than doubled, and the rate of survival from traumatic brain injuries improved from 10 to 90 percent. The survival rate from spinal cord injuries has also increased steadily each decade since the 1950s (Jones and Sanford, 1996). These changes result in more people living with disability now than at any previous time. People with disabilities make up approximately 20 percent of the U.S. population (McNeil, 1997).

In addition, as life expectancy increases, so does the incidence of disabilities. Persons who are 65 years of age and over made up 11.9 percent of the total U.S. population at the end of 1994, but they accounted for 30.0 percent of all persons with any disability and 40.1 percent of all persons with a severe disability (McNeil, 1997). In the United Kingdom, France, Germany, Japan, Sweden, and Norway, the proportion of persons over 65 years of age is greater than in the United States and is increasing at a greater rate (Ministry of Welfare, Japan, 1998). Importantly, disability also affects the families, friends, and business colleagues of people with disabilities.

International Markets: Additional Challenges for Universal Design

Beyond the challenges of language, cultural conventions affect user intuition when faced with a new design. However, when successful, a product can be an international ambassador for universal design, as products such as OXO Good Grips have proved. While examples of universally usable buildings or communities can serve as models only through images and description, one product can directly affect the quality of the daily lives of millions of individuals around the world. It can enhance their capabilities, independence, and self-image.

32.6 CONCLUSION

Practicing universal design makes sense for product manufacturers in many respects:

- Legally—accessibility is the law in many venues; universal design not only satisfies but also goes beyond minimum accessibility standards.
- Politically—practicing universal design can attract beneficial publicity and provide good public relations.
- Economically—universal design increases the sizes of target markets and consequently, through economies of scale, reduces unit costs.
- Socially—everyone in society is enriched when all its diverse citizens are able to participate fully.
- Morally—providing maximum access and optimal usability is the right thing to do.

The most significant effect of successful universal design practice is on the social integration of people with disabilities into their communities. With better product designs, individuals with disabilities can manage independently in their own homes, communicate using various media and seek a wider range of jobs, travel safely along streets, use public transit, and interact with various environmental features as easily as anyone without a disability. When products are created using universal design, individuals with disabilities have more opportunities to become active participants in, and contributors to, the society in which they live, to the enrichment of all.

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CHAPTER 33
ACCESSIBILITY OF THE WORLD WIDE WEB: TECHNICAL AND POLICY PERSPECTIVES

Judy Brewer

33.1 INTRODUCTION

The recently passed United Nations Convention on the Rights of Persons with Disabilities declares the right of access to information as a fundamental right of all persons including those with disabilities. The World Wide Web is the cornerstone of the information society; in most countries it is now a primary gateway to information, education, employment, government services, citizen participation, social networking, entertainment, and more. To what extent does the web welcome people with disabilities and older users, or does it place barriers in their path? This chapter examines issues of accessibility and universal design of the web from several perspectives—user requirements, public policy, technology support, guidelines, evaluation, and education—highlighting activities and resources at the World Wide Web Consortium (W3C) such as the Web Accessibility Initiative (WAI).

33.2 A RANGE OF ACCESSIBILITY REQUIREMENTS

While there are no overt physical barriers such as stairs on the web, and while access to web-based information is in some ways a vast improvement over the barriers in printed information, the web is just as prone to accessibility barriers as is any other environment. Accessibility barriers on the web affect people with many different disabilities. For example, users with visual disabilities such as blindness or low vision may miss information that is represented in graphics or video unless it is accompanied by alternative text. Users who are deaf or hard of hearing may miss information in audio files unless it is captioned. Users with physical disabilities may have difficulty navigating through some web sites by voice recognition. Web sites without consistent navigation options, or with flashing or scrolling text, can make navigation and comprehension difficult for users with dyslexia, short-term memory problems, and other cognitive or neurological disabilities. Older users sometimes have combinations of several of these same requirements, although they may not consider themselves "disabled."

Given that the web has already largely displaced traditional means of accessing information—for instance, local offices where in-person contact is possible, or telephone-based information services where voice contact is possible—it is paramount that industry, government, and the user community work together to ensure accessibility of web-based services. Otherwise, for many people with disabilities, continued expansion of the web will mean exclusion from educational and employment opportunities, and from participation in commerce, civic life, and more.

Accessibility and Universal Design of the Web

Accessibility of the web contributes substantially to universal design. Besides accessibility, other aspects of universal design of the web include device independence, internationalization, usability, and affordability. In the context of this chapter, *accessibility* refers to access by people with disabilities and older users. *Device independence* refers to access to the web regardless of the type of device that one is using, e.g., a desktop computer with a mouse, a mobile phone, an information kiosk, a TV, a landline-based telephone. *Internationalization* means ensuring that web technologies can represent web content equally well across all the world's languages. *Usability* refers to general human factors issues. *Affordability* refers to issues of economic access to computers and Internet services.

Efforts to promote accessibility of the web first emerged in 1995. In 1997 the World Wide Web Consortium (W3C) launched the Web Accessibility Initiative (WAI). Since then, WAI's efforts, in partnership with the efforts of hundreds of organizations around the world, have generated a large stream of resources to address accessibility of the web. As mobile phones converged into the web space, interest emerged within industry around the carryover benefits of web accessibility for device independence, including access to the web over mobile phones.

The Web Accessibility Initiative at the World Wide Web Consortium

The W3C is an international, vendor-neutral, and primarily industry consortium that develops the core technologies used on the web. It has over 400 member organizations and is hosted jointly by MIT's Computer Science and Artificial Intelligence Lab (CSAIL) in the United States, by the European Research Consortium on Informatics and Mathematics (ERCIM) in France, and by Keio University in Japan.

WAI is one of four main divisions of W3C's technical work. W3C's Web Accessibility Initiative addresses accessibility at multiple levels in order to identify and promote comprehensive accessibility solutions for the web. On the most fundamental level, WAI ensures that the core technologies of the web can support accessibility in over 100 different W3C specifications, for instance, by supporting captions for audio and descriptions of video in Synchronized Multimedia Integration Language (SMIL) 3.0 (Bulterman, et al., 2008).

WAI provides guidance on how to use web technologies in ways that support accessibility through three WAI guidelines and supporting techniques documents. In the Web Content Accessibility Guidelines (WCAG) 2.0 (Caldwell et al., 2008a), WAI describes how to design web content and applications that are accessible yet also advanced from a technical and design standpoint. The Authoring Tool Accessibility Guidelines (ATAG) 2.0 (Richards et al., 2009), under development, addresses developers of software used to build web sites by providing guidance on the use of web standards, on support for accessible authoring practices, and on accessibility of the user interface. The User Agent Accessibility Guidelines (UAAG) 2.0 (Allan et al., 2009), also under development, provides guidance for developers of user agents, including browsers, multimedia players, and their interoperability with assistive technologies. The focus in UAAG 2.0 is on accessibility of the user interface and on access to accessibility information in web content and applications.

In addition to development of these guidelines, WAI is developing Accessible Rich Internet Applications (WAI-ARIA) 1.0 (Craig et al., 2009), which addresses accessibility of dynamic web content. WAI also works on different approaches for evaluation and retrofitting of web sites and transformation tools for inaccessible sites, develops education and outreach materials, and coordinates with other organizations researching future web technologies.

33.3 A POLICY CONTEXT FOR ACCESSIBILITY OF THE WEB

Over the past decade, WAI guidelines have become a common reference point in many government policies relating to web accessibility around the world. Because the web is not a single entity, but rather a decentralized information space to which individuals and organizations all over the world contribute in various ways, no one set of laws can apply consistently across all these communities.

However, use of a consistent set of web accessibility standards is not only possible but also helpful. From the perspective of web users with disabilities, the functional requirements for accessibility to the web are identical around the world; while from a developer's perspective, consistent standards for web accessibility can make their jobs far easier.

Regulation of Rapidly Evolving Technologies

It can be challenging for public policy to keep pace with the rapid evolution of information and communications technologies (ICT). Innovative technologies may seem a curiosity in their initial introduction to market, but then suddenly become essential elements of business communications. This often occurs before policy makers have learned about the technologies, let alone had time to consider appropriate policies to mitigate potential ramifications on accessibility. Similarly, the disability community may not always be able to learn about the potential impact of each new technology quickly enough to articulate and protect their interests. Without a fluency in the technical jargon and sufficient understanding of the development and standardization processes within industry, the disability community has less chance of gaining timely access to policy discussions that can affect the extent to which accessibility and universal design are considered in the development of new technologies. Yet direct participation of people with disabilities is essential to the identification of barriers and the development of appropriate and useful solutions.

Public Policy Trends around Web Accessibility

There are several commonly used approaches to regulating accessibility of information technologies. Governments can establish that individuals with disabilities have a civil right to certain kinds of information; they can require that products or services sold within a country meet certain criteria for accessibility; and they can require that information technologies procured by certain kinds of organizations be accessible.

The first approach—establishing that access to certain kinds of information by individuals with disabilities is a civil right—is usually tied to a disability discrimination act, such as the Disability Discrimination Act in the United Kingdom, or in Australia, or the Americans with Disabilities Act (ADA) in the United States. Usually, this approach applies primarily to government web sites, but in some cases it can extend beyond those to apply to certain kinds of commercial sites. An example of the second approach is Section 255 of the Telecommunications Act, which requires accessibility to the extent readily achievable of telecommunications products and services sold in the United States.

An example of the third approach is Section 508 of the U.S. Rehabilitation Act, which sets requirements for accessibility of electronic and information technology procured by the federal government, including web sites. It has the dual goal of ensuring that federal employees with disabilities have comparable access as do nondisabled employees to the information technology in their workplaces, and that members of the public with disabilities have access to government information in accessible formats. Given the extent of government information technology purchasing power, estimated in the multibillion-dollar range, this approach has significant leveraging impact on the web industry in the United States with regard to promoting awareness of accessibility, development of accessibility expertise within the web design community, and demand for authoring tools that support accessible design.

33.4 ACCESSIBILITY OF CORE WEB TECHNOLOGIES

As new web technologies advance through stages of development from initial concept to finished specification in W3C, WAI reviews these specifications to assess their potential impact on accessibility. This process starts with reviewing working group charters, requirements documents, and early working drafts; then last-call drafts, candidate recommendations, and proposed recommendations. It continues until the specifications are issued as final W3C Recommendations, equivalent to web standards. Such reviews have resulted in improved accessibility support throughout W3C specifications.

33.5 GUIDELINES FOR ACCESSIBILITY TO WEB CONTENT

The Web Content Accessibility Guidelines (WCAG) 2.0, completed in December 2008, addresses accessibility of web content, web sites, and web applications. WCAG 2.0 is an advancement over WCAG 1.0 in a number of ways: WCAG 2.0 addresses advanced web technologies including dynamically generated web content; WCAG 2.0 is technology-neutral, as the guidelines can be applied to any web technology; WCAG 2.0 is more precisely testable, facilitating conformance testing; and WCAG 2.0 allows improved accessibility for people with disabilities. As with WCAG 1.0, the components of WCAG 2.0 were developed with international input from a broad range of stakeholder organizations, including disability organizations, industry, government organizations, and more.

WCAG 2.0 has four main principles of accessibility: that web content should be perceivable regardless of the abilities of the user, and that it should be operable, understandable, and robust. These four principles underlie the specific guidelines and success criteria that make up WCAG 2.0, and also form the organizing principles of the Authoring Tool Accessibility Guidelines (ATAG) 2.0 and the User Agent Accessibility Guidelines (UAAG) 2.0. The normative and testable portion of WCAG 2.0 is the success criteria. Extensive supporting technical guidance for web developers is provided in “Techniques” documents, which address applicability of WCAG 2.0 to web technologies such as HTML, CSS, SMIL, and scripting. As web technologies evolve, WAI updates each of these resources to address new technologies.

33.6 GUIDELINES FOR ACCESSIBILITY OF AUTHORING TOOLS

Accessibility of the web relies on implementation of complementary accessibility solutions at several different levels—the content, browsers, and media players; but also improved authoring tools that enable more automatic creation and production of accessible web content. Authoring tools such as HTML editors and content management systems increasingly include features that can be used to evaluate, transform, or retrofit web sites for improved accessibility.

Authoring tools hold the greatest promise for dramatically increasing the amount of accessible content on the web. First consider that the web is an “information space,” where tens of millions of people are already publishing information. Then consider the effort involved in educating every one of those people to understand and use accessibility guidelines whenever they put information on the web. It is far easier to ensure that the authoring tools that people use to publish web content facilitate production of accessible web content than to expect each content developer to follow accessibility guidelines.

W3C’s Authoring Tool Accessibility Guidelines explains to the developers of authoring tools how to support production of accessible content. For instance, when images or videos are added into web content, authors can be prompted for descriptions; and when audio is added, authors can be prompted for captions. In addition, ATAG explains how to ensure that the authoring tools themselves are accessible to people with disabilities, so that people with disabilities are equally able to publish information on the web. For example, mouse-driven commands should also be accessible from the keyboard, since authors with physical or visual disabilities may not be able to use a mouse.

33.7 GUIDELINES FOR BROWSERS, MEDIA PLAYERS, AND INTEROPERABILITY WITH ASSISTIVE TECHNOLOGIES

Improved accessibility is also needed in the browsers, media players, and assistive technologies that people use to access the web. WAI provides guidance for developers of these types of applications through the User Agent Accessibility Guidelines. UAAG addresses the accessibility of browsers and media players for people with disabilities, for instance, by explaining the need to render certain types of accessibility information such as descriptions for complex charts or graphs, or captions for audio files. In addition, UAAG addresses interoperability between mainstream browsers or multimedia players and various kinds of assistive technologies such as screen readers, screen magnifiers, or speech recognition software.

33.8 CONFORMANCE EVALUATION

Evaluation is important throughout the design and development of web sites, as well as when a web site is completed. WCAG 2.0 has been specifically designed to be more testable than WCAG 1.0 through a combination of semiautomated evaluation tools and evaluation by knowledgeable human experts. In addition, evaluation by users with disabilities can be helpful in ensuring usable accessibility. There are over 100 different evaluation tools that can be used to test for different aspects of web accessibility. WAI resources such as Selecting Web Accessibility Evaluation Tools and Tools Search can help designers and developers identify evaluation tools that can help with the particular technologies used in a web site.

33.9 EDUCATION AND OUTREACH

Given the number of people contributing content to the web worldwide, it is essential to have a variety of educational and outreach materials, both to promote awareness of the need for web accessibility and to support training on implementation of web accessibility. Online resources available from the WAI site (www.w3.org/WAI) include introductory resources on web accessibility and resources on specific topics, such as the business case for web accessibility. Additional educational resources focusing on web accessibility are emerging on many other web sites.

33.10 CONCLUSION

While work on web accessibility has been underway since 1997, key challenges remain. These include the need to monitor emerging web technologies for potential new barriers to accessibility, and the need to exercise vigilance over technologies such as mobile devices, digital television, geolocation, e-reading, and more, which are converging into web space. Challenges also include the need to develop better methods of evaluating conformance to web accessibility standards, and the need to accelerate support for production of accessible content by authoring tools. In a field that is evolving and expanding as rapidly as the World Wide Web, interest in accessibility does not automatically translate into widespread and comprehensive implementation of accessibility solutions. Therefore, one challenge is to ensure that the availability of educational resources and accessibility solutions keeps pace with—or, better yet, outstrips—the availability of new technologies for the web.

To a far greater extent than with the built environment, it is important to avoid the fragmentation of standards for web accessibility, since so many web accessibility solutions rely on complementary approaches on several levels at once. WAI will continue to play an important role in bringing together international collaborations around web accessibility. These collaborations should reinforce an awareness of the importance of harmonizing standards.

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United Nations, *Convention on Rights of Persons with Disabilities*, 2008; www.un.org/disabilities/convention/conventionfull.shtml.

33.12 RESOURCES

How to Meet WCAG 2.0, A Customizable Quick Reference to Web Content Accessibility Guidelines 2.0 Requirements (Success Criteria) and Techniques; http://www.w3.org/WAI/WCAG20/quickref/.

WCAG 2.0 at a Glance; http://www.w3.org/WAI/WCAG20/glance/.

Web Accessibility Initiative (WAI), http://www.w3.org/WAI/.

World Wide Web Consortium (W3C), http://www.w3.org/.

CHAPTER 34
UNIVERSAL DESIGN IN MEDIA

Trisha O'Connell and Larry Goldberg

34.1 INTRODUCTION

People with disabilities have long advocated for technologies and practices that include them in the media-viewing audience and enable their participation in media-based services. This effort has resulted in great successes such as television captioning for people who are deaf or hard of hearing and great frustrations such as inaccessible on-screen menus in DVDs and cable set-top boxes, and Internet sites that cannot be easily navigated by people who are blind or have low vision.

As analog technologies give way to the all-encompassing digital domain, universally designed media technologies become more and more possible. Universal, inclusive design also becomes more and more urgent as media are increasingly integrated into every aspect of our lives. This chapter provides an overview of media access solutions in the United States, both deployed and in development, and details opportunities for universal design in new technologies and industry standards.

34.2 TELEVISION AND RADIO ACCESS: FROM ANALOG TO DIGITAL

Television Closed Captioning

In 1972, the WGBH Educational Foundation aired the first television program with open captions for deaf and hard-of-hearing viewers. By 1980, a collaborative public/private sector effort produced the "line-21" closed-captioning system that embeds caption data in the analog signal to be decoded in the home by set-top decoder boxes. These stand-alone set-top decoders were the antithesis of universal design—separately purchased, difficult to install, and expensive. Low decoder sales hampered the growth of captioned programming as many networks and producers pointed to low sales as an indication of lack of interest in, and need for, captioning. At the same time, the rapid growth of cable networks in the 1980s made captioned programming hard to find in a 300+ channel universe. In response, Senator Tom Harkin of Iowa and Representative Edward Markey of Massachusetts enabled passage of the Television Decoder Circuitry Act of 1990 which mandated built-in closed-caption decoding capability in all television sets 13 in. or larger sold in the United States Congress ruled that inclusion of caption decoding capabilities in most TVs represented a minor manufacturing cost due to economies of scale, while the benefits to people who are deaf or hard of hearing, and people learning English as a second language, were significant.

Today, built-in caption decoding capability is cited as one of the best examples of universal design in widespread use, right after the sidewalk curb cut. It is important to note, however, that it took an act of Congress to achieve, and it did not solve the problem of the failure of market forces to foster the growth of captioning. Although the Decoder Act created a huge installed base of potential end users in rapid fashion and created an industry standard for formatting caption data (EIA-608), many local TV stations, syndicators, and basic cable networks lagged behind in providing captions. Consequently, consumers and their advocates succeeded in adding a little-noticed requirement for closed captioning of virtually all TV programs in the Telecommunications Act of 1996 (Telecomm Act), the nation's first major rewrite of communications law since 1934. With billions of dollars at stake for industry in the other provisions of the Telecom Act, captioning requirements did not generate much controversy. Once the act was passed, the Federal Communications Commission (FCC) established a compliance schedule, and today, except for certain narrow exemptions, U.S. TV broadcasters, cable-casters, and satellite TV providers are required to caption nearly 100 percent of their programming.

Television—Video Description

Video description also began at WGBH where it was launched in 1990 under its trademark, Descriptive Video Service or DVS. The service provides descriptive narration, inserted within the natural pauses in dialogue, that communicates key visual elements such as actions, settings, gestures,

FIGURE 34.1 WGBH's Design Squad TV program with sample video description: "In the workshop, one of the kids wears a face mask, a protective jacket and gloves. Using a chopsaw, she lowers the blade and sparks fly from the cutting table."

Long description: This photo shows a Design Squad contestant in the workshop. She wears a face mask, a protective jacket, and gloves. Using a chopsaw, she lowers the blade and sparks fly from the cutting table.

facial expressions, scene changes, and on-screen text. It is provided free via broadcast, cable and satellite by public television and, to a limited extent, by commercial networks such as CBS and Fox.

Funding for most broadcast and cable description is provided by the U.S. Department of Education, but is restricted to programming appropriate for use in the classroom. The Telecom Act recognized the need to support the growth of video description and directed the FCC to "assess appropriate methods and schedules for phasing video descriptions into the marketplace, technical and quality standards for video descriptions, a definition of programming for which video descriptions would apply, and other technical and legal issues that the Commission deems appropriate." This led to an FCC requirement for video description that required four broadcast networks and five cable networks to each provide video description for 4 hours of programming weekly. This mandate was challenged and overturned in federal court based on an interpretation of the FCC's jurisdiction as granted by the Telecom Act. Consequently, most television programming offered with description is PBS programming such as *Nova, Masterpiece Theater, American Experience, Nature,* and many children's programs as well as a few hours per week of programming on CBS and Fox. Older movies in the public domain are also offered with description by the Narrative Television Network on a dedicated cable channel and on their web site. Efforts to reestablish video description requirements have been constant, and requirements are included in pending legislation introduced in Congress in 2008.

Digital Television Transition

With federal funding, WGBH participated in the deliberations of the Advanced Television Systems Committee (ATSC) to ensure that emerging DTV origination, transmission, and display standards enabled carriage of closed captions, as required by the Decoder Act and Telecom Act. The DTV captioning standard, EIA-708, includes many new capabilities such as up to 63 caption services, viewer-sizable fonts, multiple font choices, multiple caption windows, and additional color, border, and drop shadow options. As of 2009, user-controlled caption styles are widely available as TV providers translate 608 caption data into 708 data for inclusion in digital TV signals. Government-subsidized converter boxes have been made available for Americans who own analog TV sets and who do not want to purchase new DTV sets or cable TV services. These converters are required to support 608 caption decoding, and many offer 708 caption features as well.

DTV also holds great promise to make descriptive video widely accessible to consumers. In analog broadcasts, DVS was broadcast via the Second Audio Program (SAP) which meant the viewer had to have a stereo TV or a stereo VCR that included the SAP feature. Digital television, however, supports multiple audio tracks and offers built-in access to descriptive video.

Yet finding caption and description controls on new DTV sets or on DTV converter boxes is not always easy. Also, many viewers who subscribe to cable or satellite experience caption or description problems caused by carriers' inadvertent errors passing through the signal. This illustrates how access features can be impacted by both user interface designs and the technology distribution chain. An FCC task force has been established to address some of the problems encountered by caption and description users in the new DTV environment.

34.3 MULTIMEDIA AND THE WEB

Multimedia combine dynamic and interactive elements such as text, audio, video, graphics, and animation and are most commonly packaged within DVDs, web-delivered software, or dedicated web sites. Accessibility requirements include text display of captions of audio, description of static and dynamic images and video, and accessible user interfaces. Solutions depend on adherence to the W3C's Web Content Accessibility Guidelines (WCAG 2.0) and the authoring of accessible videos, pdf's, Flash, and other media.

Currently, the major formats for providing media via the web—QuickTime, Flash, Windows Media, and RealMedia—can all support captions and descriptions and provide user controls. WGBH

FIGURE 34.2 Captioned Web Media on WGBH's PEEP and the Big Wide World site.

Long description: This image shows a page from the PEEP and the Big Wide World web site. The page is titled Music and Videos. A media player shows an animated video of Chirp, a small round bird with a pointed beak. Below the video, captions read, "Chirp: I like that it's blue."

has produced a suite of web caption and description web tools, (i.e., MAGpie, CaptionKeeper, CC for Flash) to foster creation of accessible web-based media. However, proprietary media technologies create challenges related to conversion and reuse of access tracks for different platforms and distributors. In 2008, the Society for Motion Picture and Television Engineers (SMPTE) established a working group for development of an interoperable caption format for media files. The W3C's Timed Text Working Group is also defining a nonproprietary text-display format, known as DFXP (Distribution Format Exchange Profile), for captions and subtitles. Similarly, the Advanced Television Systems Committee Mobile/Handheld S4 working group is defining packaging and distribution methods for captions and descriptions as broadcasters and third-party providers begin to utilize the DTV parallel multimedia broadcast networks to transmit content directly to mobile devices.

Overall, new multimedia technologies are deployed well in advance of both access solutions and standards. Constant attention and development is needed to catch up to new technologies and influence production practices. For example, the distribution of movies via download from such web sites as NetFlix, Amazon, Blockbuster, and others has been frustrating to consumers since none of these movie services carry captions or descriptions. This is despite the fact that captions and descriptions have been created for most films by WGBH's movie theater access system, MoPix, or captioned for the DVD release of almost all major movie titles. The lack of described movies via web download is particularly frustrating since, unlike captioning, DVDs are not carrying description. In the early 1990s, the DVS Home Video service was created by WGBH with federal funds to distribute open-described VHS home videos through a mail order service. As federal funding for DVS Home Video was eliminated, the DVD format held the promise of easy provision of an additional audio track containing video description on mainstream DVDs. Unfortunately, problems related to lack of available disk space (due to the inclusion of director's commentaries and other DVD special features) have kept description tracks from being included on most mainstream DVD movies. This is an unfortunate illustration of how technology and industry standards can enable universal design only to be derailed by existing production and business practices. A number of major studios are reviewing these policies, and expected updates on availability of DVS on DVDs will be posted on NCAM's web site.

34.4 PENDING MEDIA ACCESSIBILITY REQUIREMENTS

As video programming migrates to desktop computers, laptops, and handheld devices, decade-old legislative requirements for television accessibility no longer apply. Yet there are tremendous opportunities for universal design as the consumer electronics industry and the computer industry become competing or complementary gateways to the same media. Two potentially transformative national activities may help bridge these gaps as well as the problem of inaccessible user interfaces offered by new digital media devices (HDTVs, Blu-ray DVD players, digital video recorders, electronic program guides, and other home media components).

In 2008, recommendations for updates to Section 508 of the Rehabilitation Act and Section 255 of the Telecommunications Act were made by the U.S. Access Board's Telecommunications and Electronic and Information Technology Advisory Committee (TEITAC). These recommendations covered media accessibility among many other topics and will inform a Notice of Proposed Rulemaking for public comment prior to the issuance of final standards and guidelines.

Also in 2008, the disability community renewed efforts to secure legislative mandates for accessible services and technologies with the introduction of the 21st Century Communications and Video Accessibility Act. The act proposes accessibility requirements for Internet captioning, broadcast video description, and accessible menus in consumer electronics equipment. As of this writing, passage of this bill in 2010 is a major priority for many disability-focused organizations.

34.5 THEATRICAL MOTION PICTURES ACCESS: FROM FILM TO D-CINEMA

People with hearing or vision loss are eager to experience movies in theaters independently and enjoy first-run movies at any time in any theater, with the same freedom and flexibility as their friends and families. This remained an elusive goal until 1992 when WGBH's "Motion Picture Access" project (MoPix) was funded by the U.S. Department of Education. MoPix design criteria were developed in collaboration with disabled consumers, membership organizations, advocates, and industry. Consumers, theater exhibitors, and film distributors set technical and aesthetic criteria for personalized access and iterative field tests in theaters with deaf, hard-of-hearing, blind, and low-vision consumers ensured ease of use.

The resulting two technologies are installed at hundreds of theaters (including IMAX theaters and theme parks) throughout the United States. DVS Theatrical delivers video description via infrared or FM listening systems, enabling blind and visually impaired moviegoers to listen using headsets without disturbing other audience members. The Rear Window Captioning system displays reversed captions on a light-emitting diode (LED) text display which is mounted in the rear of a theater. Deaf and hard-of-hearing patrons use transparent plastic panels attached to their seats to reflect the captions so that they appear superimposed on the movie screen. The reflective panels are portable and

FIGURE 34.3 WGBH's Rear Window captioning system in a movie theater.

Long description: This photo shows a woman sitting in a movie theater. She reads captions on a transparent acrylic panel, which is attached to the cup holder in the arm of her seat. At the back of the theater, the captions are shown backward on an LED screen. The woman's panel reflects the captions and reverses them so they appear superimposed on the movie screen.

adjustable, enabling the caption user to sit anywhere in the theater. The system makes it possible for movie exhibitors to provide closed captions for those who need or desire them without displaying them to the entire audience, and without the need for special prints or separate screenings.

Currently, synchronized display of captions and delivery of descriptions to headsets is enabled by a theater's digital sound system which is operated separately from the film projector. A digital audio system reader reads a time-code track printed on the film and signals the digital audio to play the audio in sync with the film. This technology has been adapted to synchronize caption and descriptive narration tracks with the audio track and to send the captions to the LED display and the descriptive narration to an infrared or FM emitter.

However, new technologies are transforming the process and the equipment used in the creation, distribution, and display of movies. Among other things, digital cinema systems integrate digital audio directly into the digital film file, making it unnecessary for theaters to purchase and maintain separate digital audio servers. This means that caption data and description files must now be embedded *directly* into a film's original digital file—a potentially huge advance in universal design if producers and distributors agree to commission caption and description tracks during file preparation, as opposed to afterward as is the norm today.

WGBH is working within the SMPTE DC28 Engineering Committee to ensure that digital cinema standards include provisions for captions and description. Systems adhering to these standards will enable theaters to offer open- or closed-captioned displays and to send captions to seat-back, handheld, or Rear Window displays and to send description tracks directly to headsets or for personalized access via handheld devices. The specification also includes other services long desired by people with disabilities including one for the hard-of-hearing community: an alternate soundtrack that minimizes the music and sound effects that can sometimes overwhelm the dialogue. The transition to digital cinema systems with the accompanying benefits of standards-based universal design is occurring somewhat more slowly in the United States than in Europe, but full availability of "d-cinema" across the United States may be complete within a decade, if not sooner.

34.6 ENVIRONMENTAL MEDIA

Captioning and description systems also provide access to live events, rides, interactive multimedia exhibits, and artifacts in museums, theme parks, and sporting venues. Some handheld devices offer captions and include navigation features as well as user-controlled description. WGBH has enabled handheld and/or MoPix systems to enhance a visitor's experience at venues such as the Whitney Museum of American Art, Disney theme parks, the Baseball Hall of Fame, and national park visitors' centers across the country.

WGBH has also developed solutions for in-flight entertainment systems to allow air travelers to access captioned and described media and accessible user interfaces on seat-back displays. As media installations pervade taxis, bus shelters, hotel lobbies, and countless other public and private places, equal access to this content will grow in importance.

FIGURE 34.4 Duratech handheld device used in theme parks and museums.

Long description: This photo shows someone's hands cradling a Duratech handheld device which is slightly larger than a deck of cards. The device has a screen and several tactile buttons. The screen instructs the user to Select Guest Application and offers four options: Assistive Listening (ALS), Handheld Captioning (HC), ALS and HC, and Descriptive Narration.

34.7 RADIO

Hybrid DIGITAL (HD) radio enables broadcast of multiple program channels from a single radio station as well as text display for captioning and time-shifted, targeted content. These features can provide easy access to radio reading services as well as new services for users with disabilities, such as audio description channels and text displays to be used for emergency announcements and captioning. The development of new radio receiver designs to enable multiple offerings creates an opportunity to implement accessible controls, displays, and menu options. For blind users as well as drivers who can not, or shouldn not, take their eyes off the road, a speech input and output interface for digital radio command and control makes the ultimate universal design sense. For deaf users, radio text display of essential weather, traffic, or emergency alerts offers significant and critical safety benefits. WGBH and National Public Radio (NPR) are exploring use of scrolling-text capabilities in HD radios to provide deaf and hard-of-hearing viewers with a “captioned radio” service. A demonstration of this service was offered during the 2008 Presidential election when NPR’s election night radio coverage was captioned live by WGBH and fed as scrolling text to prototype HD radio receivers at participating NPR stations.

34.8 CONCLUSION

The digital age has resulted in an exponential growth in the amount of new media and systems and a concomitant growth in the vigilance needed to ensure accessibility. In the United States, many of the leaps forward in media accessibility have been accomplished through federal law, regulations, or

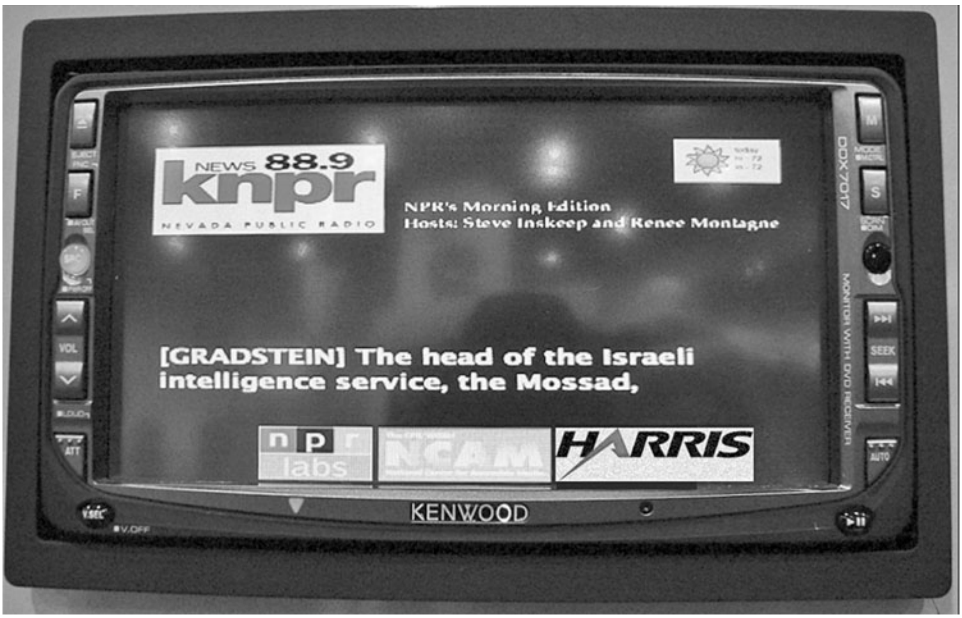

FIGURE 34.5 Captioned HD radio display prototype.

Long description: This photo shows a prototype model of an HD radio able to display captions. A screen on the radio displays the show title, captions, several logos, and the weather. The title reads, “NPR’s Morning Edition, Hosts: Steve Inskeep and Renee Montagne.” The caption reads, “[GRADSTEIN] The head of the Israeli intelligence service, the Mossad…” The logos are KNPR 88.9 Nevada Public Radio, NPR labs, NCAM, and Harris. The weather icon shows the sun and the current temperature.

public sector funding. The constantly shifting media environment will likely require further regulatory interventions in the coming decades to ensure accessibility. Since new media technologies are usually developed and proliferated well in advance of potential access regulations, people with disabilities frequently lose ground as each new technology is introduced, in ways that impact education, public safety, and personal and professional experiences and opportunities.

A commitment to universal design by media technology developers and distributors is critical, as our global society increasingly relies on media as a key method of communication and learning. Reaching this goal involves complex interactions of multiple parties, including manufacturers, content providers, ancillary service providers, and distributors. Engaging early with these stakeholders is essential, since it takes years of consistent effort to gain traction with all the players, and to design solutions that can fit the many parallel efforts which eventually converge toward a final product. In the final analysis, universal design principles must be applied to the *education* of the next generation of engineers, designers, software programmers, and media producers to ensure that at the very moment that each new technology is imagined, the creator's imagination is universal as well.

34.9 RESOURCES

Advanced Television Systems Committee Mobile/Handheld (ATSC M/H) Candidate Standard; http://www.atsc.org/standards/candidate_standards.php.

Analog Television (NTSC) closed-captioning standard EIA/CEA-608; http://www.ce.org/Standards/browseByCommittee_2523.asp.

Digital television (DTV) closed-captioning standard CEA-708; http://www.ce.org/Standards/browseByCommittee_2525.asp.

FCC Consumer Advisory: Closed Captioning for Digital Television (DTV).

FCC Consumer Advisory Tips On Filing Closed Captioning Complaints.

FCC Report and Order on Television Closed Captioning, 47 CFR Part 791.

FCC Reports and Orders on Implementation of Video Description Rules; Court of Appeals Ruling Overturning FCC Video Description Rules.

Federal Communications Commission's Disability Rights Office; http://www.fcc.gov/cib/dro.

Motion Picture Access Project; http://www.mopix.org.

Narrative Television Network; http://www.narrativetv.com.

National Public Radio (NPR)/WGBH Captioned Radio Project; http://www.nprlabs.org/research/accessibleradio.php.

Section 508 of the Rehabilitation Act of 1973, as amended 29 U.S.C. § 794d; http://www.section508.gov/.

Society of Motion Picture Engineers (SMPTE) Broadband 23B Standards Committee.

Society of Motion Picture Engineers (SMPTE) Digital Cinema (DC28) Engineering Committee.

Telecommunications Act of 1996, Public Law No. 104-104; http://www.fcc.gov/telecom.html.

Television Decoder Circuitry Act of 1990, Public Law 101-431; http://www.fcc.gov/Bureaus/OSEC/library/legislative_histories/1395.pdf.

Twenty-First Century Communications and Video Accessibility Act-U.S. H.R.6320; http://www.coataccess.org/node/32.

U.S. Access Board's Telecommunications and Electronic and Information Technology Advisory Committee (TEITAC); http://www.access-board.gov/news/teitac-report.htm.

Web access tools: MAGpie, CaptionKeeper, CC for Flash; http://ncam.wgbh.org/webaccess/.

WGBH Educational Foundation: Descriptive Video Service (DVS), http://www.dvs.wgbh.org; The Caption Center, http://www.caption.wgbh.org; WGBH National Center for Accessible Media (NCAM), http://ncam.wgbh.org.

World Wide Web Consortium (W3C), Web Content Accessibility Guidelines (WCAG) 2.0; http://www.w3.org/TR/WCAG20/.

W3C Timed Text Authoring Format 1.0—Distribution Format Exchange Profile (DFXP); http://www.w3.org/TR/ttaf1-dfxp/.

CHAPTER 35
DIGITAL CONTENT FOR INDIVIDUALS WITH PRINT DISABILITIES

Charles Hitchcock

35.1 INTRODUCTION

A significant number of individuals with print disabilities find it difficult, if not impossible, to benefit from information that is typically provided in print or in inaccessible digital formats. Limited access to essential information required at home, school, and work can severely limit opportunities to function and succeed in any environment where print is the primary medium for obtaining information (Rose and Meyer, 2002). Individuals with print disabilities include those who are blind, have low vision, have physical disabilities that prevent using standard print and books, and have reading disabilities due to organic or physical causes. Although a variety of production and distribution systems for Braille, large print, audio files, and e-text are now in place, timely preparation and delivery of such specialized formats continues to be problematic. Students with print disabilities are not always identified by school personnel, and even when they are, the delivery of specialized formats appropriate to their needs is generally not provided in a timely manner, if at all. At the time of this writing, requirements for providing accessible formats for print have been enacted, but the infrastructure and technologies necessary to deliver and use them have been slow to evolve. It is important to add that many of these students have been supported with specialized formats available from the American Printing House for the Blind (APH), Bookshare, and Recordings for the Blind and Dyslexic (RFB&D), along with services that may be provided by individual states. This chapter provides background information on this topic and current efforts to develop and deliver new tools and appropriate formats to support individuals with print disabilities within elementary and secondary schools in the United States.

35.2 THE PROBLEM WITH PRINT AND PROGRESS

For individuals with print disabilities, print is a nonstarter. To make it usable, it is often scanned and then converted to live text with optical character recognition (OCR) software so that it can be read with a screen reader or other technologies that facilitate conversion of the text to audible speech. Scanning can be tedious and time-consuming, involving significant resources due to duplication of effort, with many scanned versions being created by many teachers and others—and this duplication occurs throughout the world. Print is inflexible and cannot be easily modified to suit the needs of individuals.

For educational publishers, print is generally not the best outcome for a creative work flow. Localized demand for textbooks aligned to state learning standards often requires additional time and expense for content customization. Although demand for digital versions is growing, most print editing tools are generally not optimal for generating custom versions and varied formats.

A solution to this problem has begun to emerge. Some publishers are now employing Extensible Markup Language (XML) to create source files and are finding that, with appropriate markup, they can deliver multiple electronic, print, and embossed formats as end products, all from a single source file. Such an approach has the advantage of reducing duplication of effort and providing the flexibility needed to generate accessible HTML, DAISY Digital Talking Books, Braille, large print, audio books, and traditional print. Although these specialized formats could be produced and sold by an educational publisher, access to XML source files makes it possible for third-party accessible media producers (AMPs) to develop accessible instructional materials (when allowed by current copyright exemptions implemented to support individuals with print disabilities). Some publishers have begun to realize that a market is growing for accessible alternate formats and are developing versions for sale along with or in place of inaccessible print versions.

New standards are emerging that make it possible for software and services to use common source files from different publishers to create specialized formats from publisher-developed XML source files. The National Instructional Materials Accessibility Standard (NIMAS), based on the international DAISY standard, is one such endeavor (Fig. 35.1)

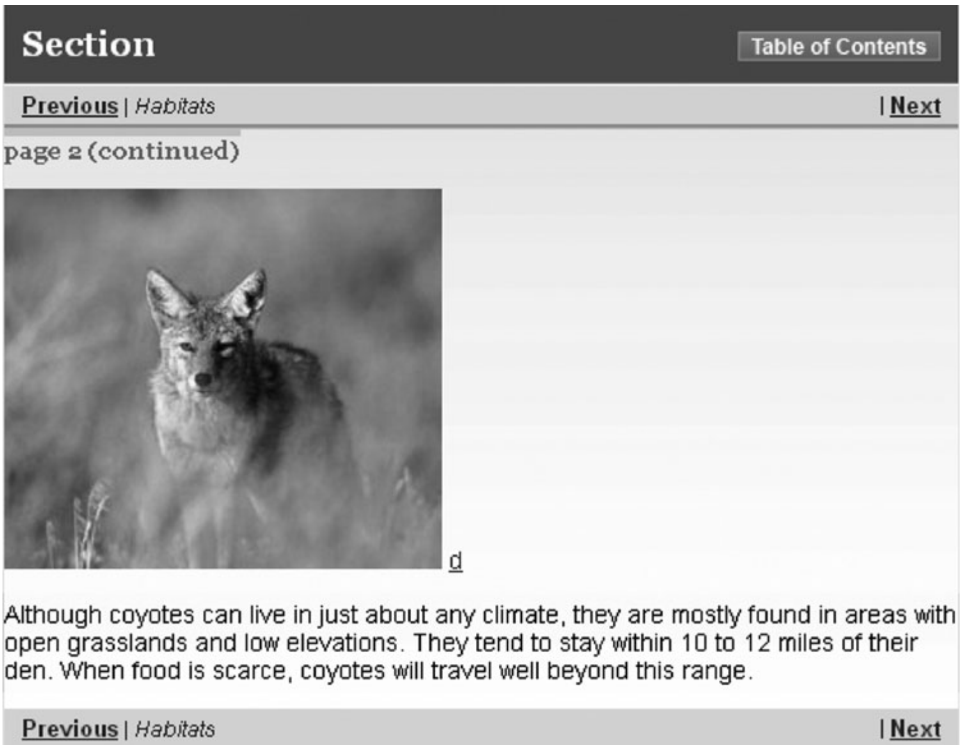

FIGURE 35.1 Low-resolution PDF version of NIMAS HTML created by the open-source NIMAS Conversion Tool.

Long description: Image of page 2 of the *All About Coyotes* UDL Editions Book converted from a NIMAS file set to an HTML version. The image shows the title as Section, a link to the table of contents, navigation links for previous and next pages, and a photo of a coyote standing in the grass. Text below the image reads, "Although coyotes can live in just about any climate, they are mostly found in areas with open grasslands and low elevations. They tend to stay within 10 to 12 miles of their den. When food is scarce, coyotes will travel well beyond this range." The bottom of the image shows previous and next navigation links with the names of those sections.

35.3 BACKGROUND

The Act to Provide Books for the Adult Blind dates to 1931 (Pratt-Smoot, Chap. 400. Sec. 1, 46 Stat. 1487, 1931). It has since been amended to include children and those with physical and reading disabilities. More recently, the Chafee Amendment of 1996 was enacted to enable authorized entities to prepare and distribute specialized formats without obtaining permission from the copyright holders (Copyright Law Amendment [H.R. 3754]; P.L. 104-197, 1996). It refers to the amended Act to Provide Books for the Adult Blind to define the population who may benefit from Braille, audio, and e-text specialized formats. Those that qualify include individuals who are blind, have low vision, or have physical or reading disabilities due to organic dysfunction. Guidelines are provided by the National Library Service (NLS), a division of the Library of Congress within the United States, to indicate who may certify each population (Nail-Chiwetalu, 2000).

The Individuals with Disabilities Education Improvement Act (IDEA) of 2004 added large print to the allowed specialized formats and also required state education agencies (SEAs) to adopt the NIMAS and to indicate whether they planned to coordinate with a national database established to validate and store NIMAS file sets. Whether they do or not, states are required to assure the U.S. Department of Education that appropriate accessible instructional materials will be provided to students who are served by IDEA and have print disabilities. IDEA 2004 also established the National Instructional Materials Access Center (NIMAC) at APH so that authorized users and AMPs have access to high-quality XML source files provided by educational publishers. An emerging problem is that not all students with print disabilities have an individualized educational plan (IEP) under IDEA, and those students may not qualify for specialized formats created with NIMAS file sets. For those students, local scanning with OCR software may still be necessary until educational publishers are able to sell specialized formats directly to local education agencies (LEAs).

35.4 A NEW APPROACH

A NIMAS file set is comprised of four components. It includes an XML file of the complete textbook marked up using the NIMAS specification. It also includes all the images of the textbook provided in one or more of three specified formats at a resolution of 300 dots per inch (dpi). It also includes a package file that contains metadata about the textbook along with a complete manifest of the file set's contents. Finally, it includes a PDF of the textbook's title page(s) (or wherever copyright information is provided) for reference purposes (NIMAS Technical Specification v1.1, 2006). Note that the NIMAS requirements apply primarily to textbooks and core related instructional materials (such as workbooks and blackline masters). In some cases, this may also include supplementary reading materials that accompany the textbooks when they are sold to schools.

Ideally, publishers would establish an XML production work flow that produces a NIMAS file set as a part of the production process as a textbook is on its way to becoming a high-quality, print-ready PDF file. Such a production process would also allow for the development of, e.g., HTML versions for sale alongside or in place of print versions. It is strongly recommended that HTML versions, whether provided via the Internet or on CD-ROM, be developed in compliance with the W3C's Web Access Initiative (WAI) Content Guidelines so that these versions may be rendered by a variety of browsers and be usable with a wide range of assistive technologies.

At the time of this writing, most publishers deliver files in a variety of formats to third-party conversion houses to produce NIMAS file sets under contract. Although an XML work flow is not generally how most publishers work at this time, it is relatively safe to predict that it will become fairly common as production and markup tools become easier to use in the years ahead.

35.5 ASSISTIVE TECHNOLOGIES AND NEW DEVELOPMENT TOOLS

Both commercial and open-source XML authoring tools are now available to any publishers that wish to prepare their own NIMAS XML source files. Since these authoring tools reference an appropriate document type definition (DTD) such as the one developed for DAISY digital talking books, validation of the files is relatively easy to obtain. Once consistent and valid source files are available in XML, it is relatively easy to transform such source content into specialized formats with available technologies. High-quality conversions are now possible with both commercial and open-source transformation tools.

Staying with HTML as an example format, once a source file is converted to HTML and enhanced by an AMP to comply with WAI Content Guidelines, textbooks may be viewed in, navigated with, and spoken by modern assistive technologies. The same applies to Braille-ready files, audio files, text files, and DAISY digital books. Some of the newer reading software available to students with print disabilities supports multiple file formats and even performs conversions from one format to another to provide for individual preferences and needs. HTML and DAISY versions generally also include images that have been reduced from 300 to 72 dpi resolution for on-screen use. NIMAS file sets may also be used to generate large print and are likely to include large images in the original 300 dpi resolution. Testing with available 300 dpi images is also underway to see if they might be suitable for creating tactile graphics.

35.6 POLICY, STATUTE, REGULATIONS, AND GUIDELINES

Much progress has been made over the past few decades with respect to improving learning opportunities for learners with print disabilities. The concept of print disabilities evolved in part from the 1931 Act to Provide Books to the Adult Blind and was refined by means of various amendments to the act that shaped services provided by the NLS.

In 1975, Public Law 94-142, known as the Education for All Handicapped Children Act, became law and supported states and districts in protecting rights of access to education for all students with disabilities. The law provided important rights to students and families and required that local education agencies identify and serve students with disabilities, guided by an IEP. In 1990, the reauthorization of the Education for All Handicapped Children Act was renamed the Individuals with Disabilities Education Act (IDEA), and, with minor amendments, passed in 1991. It emphasized a free and appropriate education within the least restrictive environment for students with disabilities (Individuals with Disabilities Education Act; enacted 1975; amended 1997 and 2004).

Section 504 of the Rehabilitation Act provided a foundation for the concept of a civil right to access materials in higher education in 1973 (Rehabilitation Act; Section 504). Universities extended services to support students with disabilities, and eventually this included adapting instructional materials to provide access for students unable to use print (Hall and Stahl, 2006). Only recently was language included in the Higher Education Act to address the needs of students with print disabilities. Although it should apply to K–12 education as well, Section 504 services are generally offered to support students with disabilities that do not require an individualized education plan under IDEA.

The 1990 passage of the Americans with Disabilities Act did not generally improve the availability of accessible instructional materials. Although it is often referenced with regard to housing and workplace accommodations, only recently has it been used effectively to argue for the accessibility of information on the World Wide Web, as exemplified by the class action settlement between the National Federation for the Blind and Target.com (Case No. C 06-01802 MHP, 2008).

Until the passage of Public Law 104-197 in 1996, usually referred to as the Chafee Amendment, the preparation and distribution of specialized formats were dependent upon the cooperation of authors and publishers who granted NLS and others permission to reproduce copyrighted works without royalty. Authorized entities, as defined by the Chafee Amendment, could now produce and deliver specialized formats to students who qualified by means of the amended 1931 Act. This permissions process often created delays in providing specialized formats to those who qualified.

In 1998, amendments to Section 508 of the Rehabilitation Act of 1973 included specific requirements regarding the accessibility of federal government and contracted web sites, software, telecommunications, technology, and office devices. The U.S. Access Board developed a streamlined version of the W3C WAI Web Content Guidelines (WCAG) to support federal government sites and products. WCAG and Section 508 have provided important guidance for the development of accessible HTML used in schools and higher education over the past decade.

The 2004 reauthorization of IDEA included the NIMAS and created the NIMAC at APH. The NIMAS language was designed to address the national need to increase the availability and timely delivery of appropriate instructional materials in accessible formats to blind or other students with print disabilities in elementary and secondary schools. NIMAS established a new technical standard for publishers to use in producing electronic versions of all their textbooks sold for use in U.S. public schools. As noted earlier in this chapter, those electronic versions (called NIMAS source files) are highly flexible and can be used to develop many different specialized formats such as Braille; large print; HTML versions; DAISY talking books, using human voice or text-to-speech; and audio versions.

One source of confusion regarding the NIMAS is how best to support students who do not qualify for NIMAS-derived instructional materials. The original regulations did not actually define what a print disability is, but instead specified the types of individuals who would qualify as print-disabled: those who are blind, those with a specified degree of low vision, and those certified by a competent authority as unable to read printed material in a normal manner because of physical limitations or organic dysfunction. This definition has persisted and remains part of the NIMAS legislation. The IDEA regulations associated with the statute require that all students with an IEP who require accessible instructional materials be provided with appropriate specialized formats in a timely manner. This has proved problematic for states and local school districts that are not able to benefit from the efficiencies of NIMAS. Some have resorted to scanning their own instructional materials and/or attempting to purchase accessible materials directly from educational publishers.

35.7 UNIVERSAL DESIGN OF TEXTBOOKS

Ideally, local school districts, colleges and universities, and states would not have to worry about the source of specialized formats. The best possible outcome for many would be the option to purchase accessible formats directly from educational publishers. We have only begun to see the emergence of a "market model" for such instructional materials and look forward to a time when that is an option available to all learners. Such an approach requires that the publisher purchase the electronic rights to all the included text and images, and this has proved to be both difficult and expensive in the past. It is becoming more common, in the negotiation of newer contracts with copyright holders, and a limited number of products are beginning to emerge.

It seems unlikely that publishers will consider the market for Braille and large print sizable enough to develop and sell such formats, but providing a combination of print, HTML on CD-ROM or via the Internet, DAISY digital talking books, and audio books does appear to be feasible, and such products are likely to be purchased by schools and students on the basis of both personal preference and needs. The universal design of textbooks seems close at hand, and it is quite likely that publishers will use their own NIMAS file sets to develop specialized formats.

Examples of NIMAS file sets and various accessible digital instructional materials created with existing conversion tools (see Fig. 35.2) can be viewed at the NIMAS Technical Assistance web site.

```
<?xml version="1.0" encoding="UTF-8" ?>
<!DOCTYPE dtbook (View Source for full doctype...)>
– <dtbook xmlns="http://www.daisy.org/z3986/2005/dtbook/" version="2005-3"
   xml:lang="En-US">
  <head />
  – <book>
   – <frontmatter>
     <doctitle>Exemplar 10: All About Coyotes</doctitle>
     <docauthor>CAST</docauthor>
   – <level1>
      <pagenum id="pi" page="front">page i</pagenum>
       –   <h1 class="intro">
```

Sample NIMAS XML from “All About Coyotes”.

FIGURE 35.2 Low-resolution PDF version of sample NIMAS XML from *All About Coyotes*.

Long description: This image shows a portion of XML code marking up content according to the NIMAS technical specification. The code reads as follows:

35.8 UNIVERSAL DESIGN FOR LEARNING AND TEXTBOOKS

Accessible instructional materials provide an important foundation, but many educators question if this is adequate to meet the critical learning needs of our diverse student population. An accessible digital HTML textbook, e.g., may feature live text that can be read with text-to-speech; may feature a font that can be modified with regard to size; may be easily navigated by chapter, section, or page number; may have images supported by alternative text and long descriptions when appropriate; may have math equations provided as images with alternate text or, even better, as MathML; and may have content order, levels, and headings determined by publisher tagging. Digital agents that can be incorporated into HTML versions have been developed as well to provide important hints and models. This would make an HTML textbook reasonably accessible to available assistive technologies.

A key question is whether accessible is good enough for an education environment where learning and improved outcomes are the primary objectives. The Center for Applied Special Technology (CAST) has furthered our thinking about this matter by developing guidelines to support universal design for learning (UDL) for educational settings (Rose et al., 2005). They include a baseline of accessibility features and promote the inclusion of key scaffolds and supports that enhance learning. Although they are intended to apply to a full range of educational goals, instructional materials, teaching strategies, and assessments, the focus here is primarily on what can be accomplished with instructional materials. A few examples of learner supports that exemplify UDL might include a table of contents with links to appropriate locations within the body of the text, vocabulary supports with links to a contextualized glossary, comprehension supports such as prompts and scaffolds for applying reading strategies, optional highlighting of critical features and big ideas, opportunities to interact with the core content and embedded prompts at varied levels, and hints and models to support responding.

CAST has developed exemplars for such features within an assortment of literacy-oriented materials and has made them freely available on the Internet as models (Fig. 35.3). At the time of this writing, many are featured on the Google Literacy Project web site as part of UDL Editions and are directly available from CAST's server.

35.9 CONCLUSION

This discussion emphasizes that accessible and appropriate instructional materials are critical to the success of students with print disabilities. Universally designed media are also proving to be of similar benefit for recreational reading and for productive work. Much progress is being made by

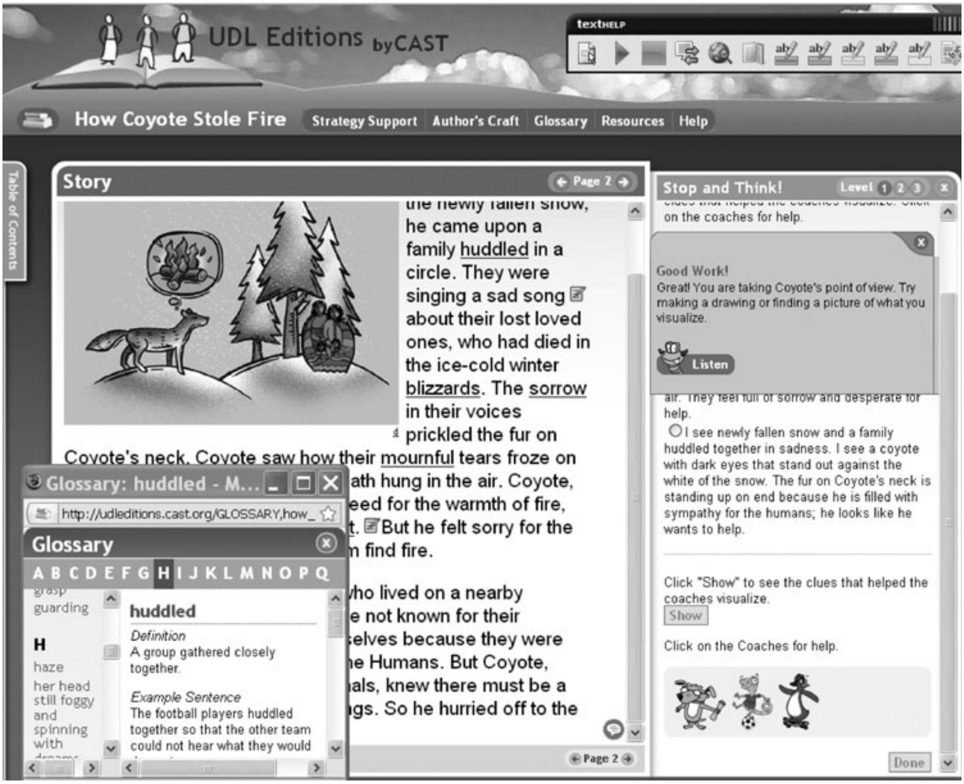

FIGURE 35.3 Low-resolution PDF version of *How Coyote Stole Fire*, a CAST UDL Edition.

Long description: This screen shot shows an HTML page of the CAST UDL Editions book selection entitled *How Coyote Stole Fire.* The top of the page shows a logo that is an illustration of three humanlike figures standing on an open book, followed by the heading "UDL Editions by CAST."

On the top right is a toolbar offering text-to-speech and highlighting features.

On the navigation bar below this, the book's title and links to book features are shown. Features are Strategy Support, Author's Craft, Glossary, Resources, and Help.

In the main window below the navigation bar the story is displayed. On the left is a tab to open the book's table of contents. The upper left shows a picture of a coyote thinking about fire and looking over the hills toward pine trees and a family of Native Americans. The story text is shown on the right and underneath the picture and includes key words that are linked to a glossary.

A glossary window is open at the bottom left of the screen, showing the word *huddled* and its definition and a sample sentence. On the right side of the screen an open Stop and Think window is shown with buttons for three levels of support. A response window is open, indicating that a correct response was provided. Three digital agents or coaches are shown at the bottom right.

means of standards such as DAISY and NIMAS (a subset of DAISY), but much remains to be done. Publishers need to produce and sell accessible content for individuals with print disabilities and those with other needs and preferences. Using audio-based alternate formats as an example, such needs might include listening while walking or as a passenger in a bus or car, reading or listening in environments with reduced light, focusing attention with highlighted text while listening to a human-voice narration or a text-to-speech conversion, and listening to varied content at slower or more rapid rates. All this is possible today.

It is important to continue to research and implement the types of supports promoted by universal design for learning (Rose et al., 2005). Only then will it be practical to suggest that the playing field has been leveled with regard to access and learning performance. Early phase exemplars have been developed and made freely available for replication, and it should soon be possible to say that individual differences within a diverse learning and work population will be both respected and valued.

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———, ———, and C. Hitchcock, *The Universally Designed Classroom: Accessible Curriculum and Digital Technologies*, Cambridge, Mass.: Harvard Education Press, 2005.

35.11 RESOURCES

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Americans with Disability Act
http://www.ada.gov

Bookshare
http://www.bookshare.org

CAST UDL Editions
http://udleditions.cast.org

CAST UDL Guidelines
http://www.cast.org/publications/UDLguidelines/version1.html

Chafee Amendment
http://www.loc.gov/nls/reference/factsheets/copyright.html

DAISY Consortium
http://www.daisy.org

Google Literacy Projects
http://www.google.com/literacy/projects.html

Individuals with Disabilities Education Improvement Act (2004)
http://idea.ed.gov
http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=108_cong_public_laws&docid=f:publ446.108

National Library Service FAQ
http://www.loc.gov/nls/faq.html

NIMAS Conversion Tool
http://aim.cast.org/experience/technologies/nimas_conversion_tool

NIMAS Development and Technical Assistance centers' web site
http://aim.cast.org

NIMAS/NIMAC Glossary
http://aim.cast.org/glossary

NIMAS Technical Standard
http://aim.cast.org/learn/policy/federal/spec-v1_1_anno

Recordings for the Blind and Dyslexic (RFB&D)
http://www.rfbd.org

Rehabilitation Act of 1973 (Title V, Sections 504 and 508)
http://www.access-board.gov/enforcement/Rehab-Act-text/title5.htm

W3C Web Accessibility Initiative
http://www.w3.org/WAI

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5

EDUCATION AND RESEARCH

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CHAPTER 36
INCLUSIVE DESIGN RESEARCH INITIATIVES AT THE ROYAL COLLEGE OF ART

Jeremy Myerson and Yanki Lee

36.1 INTRODUCTION

A distinctive theme of design research at the Royal College of Art, London, over the past 40 years has been work that combines social activism with application by industry. From Kenneth Agnew and Bruce Archer's pioneering project to develop a new standard hospital bed for the National Health Service in the late 1960s to the DesignAge program set up by Roger Coleman in 1991 to explore design for aging populations (see Chap. 21), the Royal College of Art has maintained a practical interest in people-centered design research that jointly benefits society and business.

It was within this culture of practice-based action research that Roger Coleman and Jeremy Myerson established the Helen Hamlyn Centre in January 1999 as the successor to DesignAge, positioning a new unit dedicated to research initiatives in inclusive design at the heart of the world's only postgraduate university wholly of art and design (see Fig. 36.1). From the start, the approach of the RCA's new center was to collaborate directly with businesses, charities, and public sector bodies, uniting social need with commercial application through design, and involving the students and graduates of the college's studio-based design culture in the process.

This chapter explores the Helen Hamlyn Centre's flagship research initiatives over a 10-year period between 1999 and 2009. It describes how a series of interactions with three distinct design communities—students, new graduates, and professional designers—helped to form a distinctive program of inclusive design education and research which responded to the call in the Royal Charter of the College (1967) to "advance learning, knowledge and professional competence' in art and design in relation to 'social developments."

Many key aspects of the Helen Hamlyn Centre extended the social agenda of DesignAge at the Royal College of Art, in particular a focus on "design for our future selves," which provided a persuasive platform for students to engage in an awards scheme. Furthermore, there was a focus on industry partnership, which gave new graduates an opportunity to test themselves in the field via the Helen Hamlyn Research Associates program. Likewise, there was a focus on rapid, team-based design challenges for professionals, which enabled hundreds of designers to address extreme user needs via the Challenge Workshops.

FIGURE 36.1 The Jay Mews entrance of the Royal College of Art, Kensington Gore, London, United Kingdom.

Long description: This black-and-white photograph taken in summertime shows the Jay Mews entrance of the Royal College of Art in Kensington Gore, London, seen from midway down the cobbled mews which leads up to it. In the background is the modernist brick and concrete Darwin Building completed in 1959 and designed by then RCA staff member H. T. Cadbury-Brown. The mews serves as the car park for the RCA and is packed with cars. Many people can be seen leaving the RCA after a daytime event. Some are talking in groups while others are walking down the mews toward the camera.

36.2 METHODOLOGY: DESIGNER AS RESEARCHER

A key to the DesignAge experience at the RCA (1991 to 1998) was that bringing design-excluded communities, such as older adults and people with disabilities, from the margins to the mainstream of society required a new generation of designers. Another important lesson was the outlook that designers would bring—one of seeing the bigger picture of social change and designing for their own futures, not restricting their view to the design of disability aids for the excluded. Thus, from the outset, the Helen Hamlyn Centre (HHC) set its own overriding research question—how to equip designers in all disciplines, from students to seasoned professionals, with the means to practice a more inclusive form of mainstream design.

In their emphasis on user participation and social engagement, the Helen Hamlyn Centre's activities can be seen as confronting core practices in art and design education, which has historically trained design students and professional designers to think egocentrically and look within themselves for answers to design problems (Moggridge, 2001), each participant designing according to his or her own aesthetic values and preferences. The role of users, however, is central within the design process, carefully framed in terms of who is included and who is excluded (Myerson, 2001). Mindful of its place as part of the RCA's rich tradition of designer-led practice, the Centre has initiated activities that are themselves designer-oriented in that research methods and tools can be demonstrated as designers' activities.

The designer is encouraged to perform as both researcher and creator within one seamless process, observing human behavior and designing in response to it. It has been the HHC's belief that the designer should be educated to act as an advocate on behalf of the user. In this case, each participant is encouraged to listen carefully to her or his “voice,” never abdicating creative responsibility and always retaining the capacity to act and innovate autonomously, balanced by rigorous research.

36.3 ENGAGING STUDENTS

As part of the RCA, the HHC has access to a large pool of postgraduate design students across various art and design disciplines. By introducing inclusive design practices to students, it was anticipated that essential methodologies would diffuse outward into practice after graduation. Given that published data about the employment patterns of RCA graduates indicate that 93 percent will work at a high level in the professional fields for which they trained, engagement with the college’s design students was given a high priority. But there was a further objective in working with students; the intention was to identify and recruit designer-researchers to advance the HHC’s own research agenda.

The HHC decided to adapt the DesignAge Competition (1992 to 1999), which gave RCA students awards for designing for older people, by broadening it to address a wider range of social groups and issues. A larger, more general design awards scheme was devised under the banner of “Design for Our Future Selves,” encompassing how we might live, work, and travel in the future. This broader framework enabled design for aging, changing patterns of work, new ideas for health care, and emerging themes such as sustainable communities to be considered; and a range of commercial and charitable sponsors signed up to offer prizes in different categories.

Between 2000 and 2008, around 800 students from art and design disciplines across the RCA entered this revised awards program. More than 300 student projects were short-listed, and in excess of £60,000 was awarded in prize money from sponsors. A key element was that each short-listed student have a learning experience in inclusive design, with access to HHC researchers and user groups to discuss, hone, and test ideas and prototypes. Critically, award winners, such as cycle designer Ben Wilson with his Tilting Trike for children with minimal lower body strength (see Fig. 36.2) and architectural designer Yanki Lee with her urban park for different generations to share, advertised their capacity to join the HHC upon graduation as research associates.

36.4 INTERACTION WITH NEW GRADUATES

DesignAge had experimented with industry projects, but the Helen Hamlyn Research Associates program, which took its first cohort of 10 RCA graduates in October 1999 and teamed them up with a range of external organizations, was devised as a way to systematize such experiences for newly minted designers at the college. The format was to employ the graduates within the HHC for one calendar year and facilitate real-world projects with industry and the voluntary sector. Immediately, the scheme hit a rich seam of collaboration, introducing graduates to inclusive design in a more in-depth way than the student program had done. Over the next decade, more than 100 RCA graduates would follow this route, working with nearly 70 industrial partners including Unilever, GlaxoSmithKline, Orange, Ford, Toyota, IDEO, Nokia, Philips, Hewlett-Packard, B&Q, and the British Heart Foundation.

A glance back at that first cohort of 1999 to 2000 reveals themes that have endured. For example, there were projects that addressed the needs of people socially excluded due to age and disability as well as those marginalized by economic and technological change. In that first year, the HHC began a study of ways to improve personal navigation around Heathrow Airport for BAA (formerly the British Airports Authority), a project that would eventually result in a set of guidelines for way-finding in Heathrow Terminal 5, the Richard Rogers building which opened in 2008 as Europe’s largest airport terminal.

FIGURE 36.2 The award-winning Tilting Trike by RCA design products graduate Ben Wilson (2002). This new pedal-powered tricycle for children can be adapted to the needs of those without lower body strength.

Long description: This photograph shows a young boy aged around 12 with short hair seated on the prototype of the Tilting Trike designed for children by RCA graduate Ben Wilson in 2002. It can be adapted to the needs of those without lower body strength as is the case for the boy in the picture. His legs are stretched out straight in front of him. and he is raising his arms in triumph after a test run. This new-generation trike is modular in design, advanced in bicycle technology and contemporary in style with a multicolored patterned frame and wheel spokes. Importantly, it can be reconfigured swiftly from a foot pedal–powered vehicle to one that is pedaled by hand because it is assembled using existing readymade bicycle components in different configurations. The version shown is the hand-pedaled one. It also has a unique steering mechanism that enables the user to steer by redistributing his or her body weight.

The program worked with the National Group on Homeworking, the Design Council, and Leonard Cheshire Homes to devise practical tools and furniture to support low-paid and disabled home workers, some of the poorest and most vulnerable groups in society. It also conducted research for Dyson and Levi-Strauss to develop innovations that help older people to clean their homes more easily and avoid injuries through falling. That first year set a pattern to which future cohorts of Research Associates over the next 10 years would adhere. In a time of rapid demographic change, the program deliberately focused the skills and knowledge of RCA's studio departments on issues related to social inclusion. Within the college, the Departments of Architecture, Communication Art and Design, Design Interactions, Design Products, Industrial Design Engineering, and Vehicle Design became regular design collaborators. Among the applied artists, for instance, ceramics and glass designers joined the program to develop a new walk-in bath for older adults.

As the HHC emerged as the college's center for inclusive design, its Research Associates broadened both the subject matter and the research partnerships. An early emphasis on design for age and disability broadened to embrace research projects dedicated to improving patient safety and developing innovative ideas for business as digital technology opened up new opportunities. No corner of the

FIGURE 36.3 Easy-to-open food packaging, a design study by Helen Hamlyn Research Associates, Richard Hartshorn and Edward Goodwin (2002), for the U.K. supermarket chain Waitrose.

Long description: This photo is an aerial view of three aluminum drink cans showing their ring-pull openers only. At the top and to the right are conventional versions. In the foreground is the improved ring-pull designed with a significantly enlarged ring that is wide at the base and tapers toward the tab that fastens it to the can and enables it to be pulled open easily. This project set out to improve the openability of Waitrose's own-brand ranges, starting with a detailed audit of own-brand and proprietary food product packaging and extensive user research among older consumers. Five of the most problematic pack types were redesigned: bacon packs, fresh soup pots, ring-pull tins, jam jars, and sardine tins. Improvements were proposed that can be introduced quickly at low cost with minimal disruption to machinery. Waitrose was given a "research map" to address openability issues across its own-brand range in the future.

design map was left untouched in the search for more inclusive solutions—from street lighting and urban transport to office design, food packaging (see Fig. 36.3), and hospital patient safety.

Blanchard (2003) wrote of the program: "The Helen Hamlyn Centre is all about encouraging young designers to think beyond yet another ergonomic shiny toaster, or the lemon juicer that looks like a UFO. Rather than making things consumers want because they look pretty in a glossy magazine, these designers make things we need, things that might improve our lives in some way."

36.5 DISCOVER-DEFINE-DEVELOP-DELIVER

As an applied research program, the Helen Hamlyn Research Associates deliberately sits midway between academia and business. Graduates unconstrained by M. Phil. or Ph.D. demands are paid RCA staff researchers undertaking projects directly with industry. Companies pay to collaborate with graduates at the HHC, which manages both selected design graduates and business partners in order to cocreate inclusive design exemplars.

Each project is divided into four distinct phases in line with the three terms of the RCA academic year and the summer break: the *discover* phase (autumn term), *define* (spring term), *develop* (summer term), and *deliver* (summer break). The discover phase follows an induction period with professional skills training in such areas as project management, presentation, user research, writing, and filmmaking. This is a period for exploration. Researchers investigate the context of the project and learn to conduct market analysis, reviewing the literature and building a working relationship with the research partner. The define phase is a time to focus—preliminary user studies help to define a point of view and decide which areas or ideas to prioritize. Early design concepts are generated through prototyping.

The third phase of the program, develop, consolidates design directions in partnership with the research partner. Scenarios and prototypes are created. Relevant processes and technologies are investigated. Ideas are validated with experts and in user trials. Modifications are made, and final communication outputs are determined as the project enters the final straight. The deliver phase completes the project by giving the partner the results and outcomes of the study in a form that is of the most practical and applicable use to the organization—whether exemplar designs, prototypes, films, guidelines, or publications. The final results of the Research Associates projects are publicly disseminated via an annual show and symposium at the RCA each September, held as part of the London Design Festival.

36.6 EXPANDING RESEARCH THEMES

Short applied projects of the kind practiced by the Helen Hamlyn Research Associates did more than just enable the HHC to address its core research question of how to help designers work more inclusively. They also acted as a forerunner to larger research programs funded by the major U.K. research councils, by demonstrating expertise in particular areas. For example, the clustering of three years of Research Associate studies related to giving older people better access to the workplace (supported by industry partners DEGW Architects, Steelcase, Kinnarps, and others) resulted in a major award to the HHC from Designing for the 21st Century, a joint initiative by two U.K. research councils for a project entitled Welcoming Workplace (see Fig. 36.4).

Similarly, a cluster of projects for patient safety by Research Associates led directly to a two-year multidisciplinary research project funded by the EPSRC (Engineering and Physical Sciences Research Council) to redesign emergency mobile health care services (see Fig. 36.5). This radical rethinking of the traditional ambulance teamed up the HHC and RCA Vehicle Design with four other U.K. universities.

The HHC might have been expected to focus its research effort exclusively on the development of inclusive design, following the introduction of the concept in the early 1990s (Coleman, 1994). Indeed, in 2000, under Coleman's direction the center became a key player with the Engineering Design Centre at Cambridge University in a research consortium called i~design, dedicated to giving tools and guidance to designers and business decision makers on the practice of inclusive design. But as its research program expanded, the center diversified into two adjacent areas of people-centered design: workplace design and design for patient safety. In autumn 2008, e.g., the HHC began a new funded collaboration with clinicians and psychologists at Imperial College London entitled DOME (Designing Out Medical Error). Former Research Associates were recruited into more senior research roles to undertake the project.

36.7 WORKING WITH PROFESSIONALS

While RCA students and graduates were gaining inclusive design methodologies on HHC programs, the wider design industry in the United Kingdom was also a target for inclusive design education. To work with professional designers, the center adopted a different approach. It collaborated with the Design Business Association (DBA), the major trade body for design firms in the United Kingdom, to establish the DBA Inclusive Design Challenge.

FIGURE 36.4 Front cover of a design guidance document for architects and developers from the Welcoming Workplace study (2006–2008), www.welcomingworkplace.com.

Long description: This photo shows the cover of the report, entitled "Welcoming Workplace—Designing Office Space for an Aging Workforce in the 21st Century Knowledge Economy—Guidance for Architects and Developers." This research project was conducted between January 2007 and December 2008 by the Royal College of Art Helen Hamlyn Centre and funded as part of the Designing for the 21st Century initiative. The graphic elements of the rectangular (A4) cover are the title, a light colored background with two cutout clouds and a sun placed on a diagonally striped darker background.

Beginning in 2000, the challenge was set up as a five-month, designer-friendly mechanism to transfer knowledge to design consulting firms and their industry clients about inclusive design concepts and processes. The format was an immediate success with DBA member firms eager to participate, expose their teams to working with disabled creative partners, and compete for an annual award given by the RCA.

In January 2005, the design firm Sieberthead asked the HHC to devise a short, three-day innovation workshop for staff of the multinational giant Reckitt Benkiser, based on the principles

FIGURE 36.5 Concept for the design of the future ambulance from the Smart Pods project (2007–2009), which set out to rethink emergency mobile health care. Designer: Niki Merriman, RCA Vehicle Design, www.smartpods.co.uk.

Long description: This computer-generated illustration shows a side view from the designer's perspective of the exterior of a mobile clinic that transforms from an ambulance. When the ambulance stops, the back of the vehicle unfolds in the center and becomes a two-part "walk-in clinic" with a central ramped entrance. The illustration shows this scenario.

of the DBA Challenge, which it had entered twice. Sieberthead wanted the creativity, rapid knowledge transfer, and teamwork processes to be condensed. The short workshop was a success, and a series of Challenge workshops of different durations were subsequently devised and delivered in the United Kingdom and overseas, including Norway, Singapore, Hong Kong, Japan, and Israel.

Some Challenge workshops lasted just 24 or 48 hours; all made their mark on how participating designers think. Clive Grinyer, Director of Customer Experience at Cisco and keynote speaker at the 2006 DBA Inclusive Design Challenge, described the impact: "It is the perfect example of design thinking, building on new knowledge, placing designers in unfamiliar situations and forcing them to understand that the extremities of ability creates a powerful force for innovation."

Workshops explored new areas, such as design for dementia (DBA Inclusive Design Challenge, 2008) (see Fig. 36.6), and living with rheumatoid arthritis (BMe Challenge Workshop, March 2008, sponsored by Roche). The Challenge model also provided a platform for different experts to work together. For instance, a workshop with the College of Occupational Therapists in London (October 2007) brought together occupational therapists, designers, manufacturers, and disabled consumers to explore the innovative possibilities of new materials in the design of clothing for extreme needs.

36.8 CONCLUSION

In its design interactions with students, graduates, and professionals, the HHC's research culture has developed, over the past decade, a strong, practical linkage with industry. At each level of

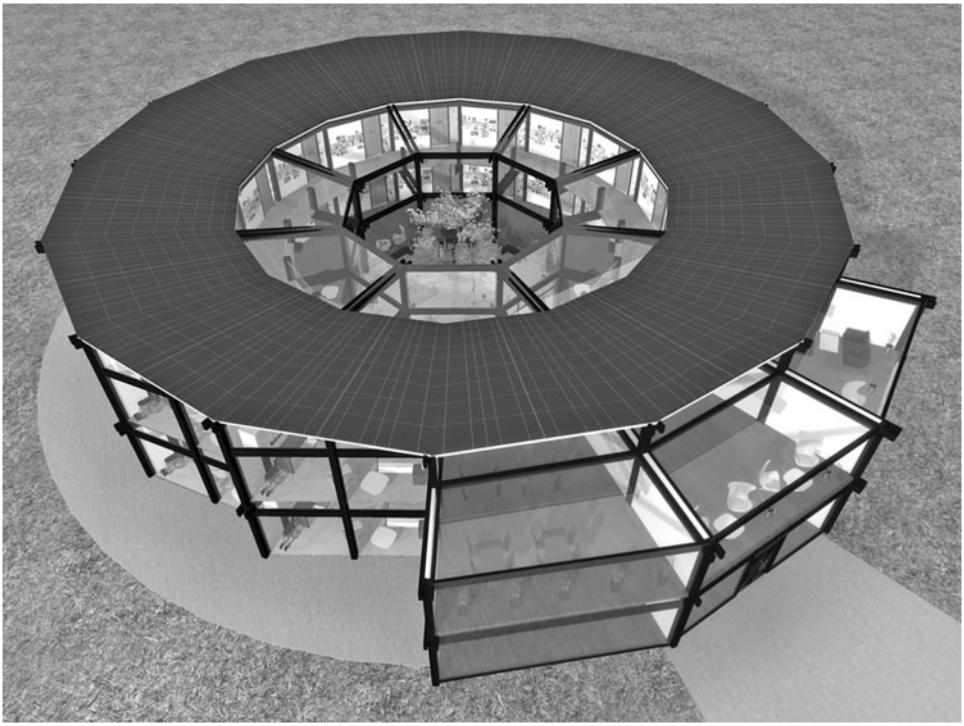

FIGURE 36.6 Modular care home design for people with dementia. Winning entry in the 2008 DBA Inclusive Design Challenge. Design by Judge Gill.

Long description: This computer-generated image is an aerial view from the designer's perspective of a modular care home building based on a circular plan to ensure its residents never got lost and can be effectively monitored. Constructed mainly from steel and glass that maximizes the available light, the building also has a central garden area that offers a place to enjoy the changing seasons. The rooms with their floor-to-ceiling windows are angled from the central corridor and look outward while the roof is composed of solar panels.

experience, designers have exercised empathic skills as ethnographers and social researchers, as well as expressing themselves as creative practitioners in a constant inquiry into the tools and techniques required to transform practice and design. The HHC has also actively sought to commercialize its research, regularly linking up with the college's business network, InnovationRCA, to effect real-world change.

Such an approach has given designers both inside and outside the college rich user experiences, while introducing industry partners to a body of research about people-centered design. Clearly, this strategy has owed more to the European tradition of inclusive design or design-for-all, in which business opportunity is a key driver of change, than to the North American model of universal design and its emphasis on social policy and legislative levers. These characteristics illustrate the historical link between the contemporary Helen Hamlyn Centre and Agnew and Archer's pioneering National Health Service project to research a new standard hospital bed in the late 1960s. Today, however, the center's flagship NHS project is a redesign of the standard hospital resuscitation trolley (see Fig. 36.7).

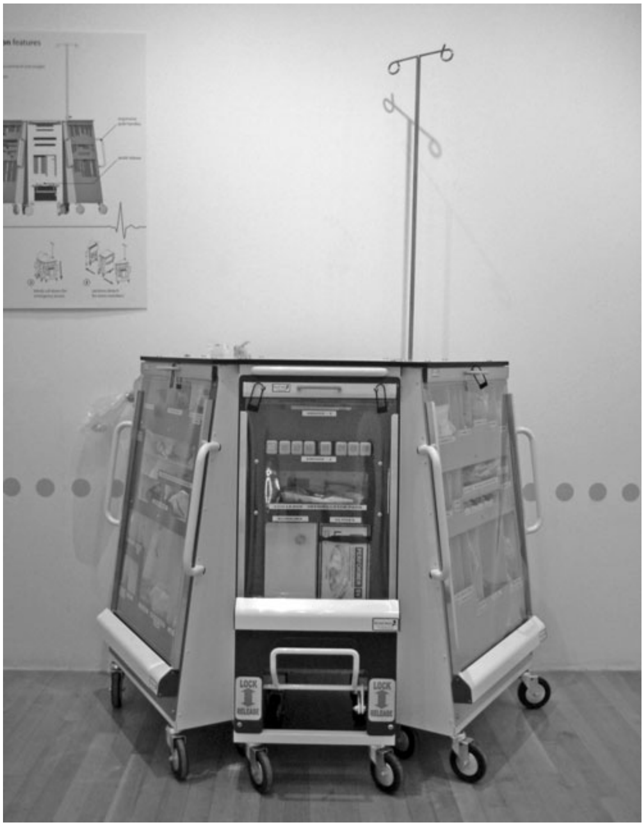

FIGURE 36.7 The hospital resuscitation trolley has been redesigned to reduce medical errors. Designers are Sally Halls and Jonathan West. The trolley is now in clinical trials in a U.K. hospital.

Long description: This photo shows the new design for a resuscitation trolley, seen from the front, in a hospital corridor. Designers Sally Halls and Jonathan West took this standard item of hospital equipment that is vital in emergencies and redesigned it completely to help reduce medical error. Their modular version splits into three parts so that defibrillators, drugs, and airway equipment can be stored separately in a systematic way in three glass-fronted modules with handles attached to the main body.

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www.designingwithpeople.org

www.education.edean.org.

www.inclusivedesigntoolkit.com

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CHAPTER 37
AN INTERNATIONAL WEB-BASED COLLECTION OF UNIVERSAL DESIGN EXEMPLARS

Valerie Fletcher

37.1 INTRODUCTION

The international universal design movement has generated an expanding audience and with it, a growing demand for information about practice and precedent. Today's audience includes designers, academics, clients, advocates, and policy makers in the developed nations and, increasingly, an equally diverse audience in emerging nations. The literature of the field, however, is limited and out of practical reach for many. Good educational content about universal design is available on the World Wide Web, but specificity is lacking, the majority of the content focuses on private homes, and much of the content is United States–centric.

There remains skepticism, especially among design practitioners and many design academics, about whether inclusive design can be good design. It is a common concern about many value-driven design movements. Other entities with different agendas are using the web to establish a measure of good design that embeds a stated value—better public buildings by the Commission on Architecture in the Built Environment in the United Kingdom, environmental sustainability by the U.S. Environmental Protection Agency, or the multiple social and design values of the Aga Khan Architectural Excellence Awards for buildings in nations with significant Islamic presence. A web-based global collection of universally designed projects, which is the focus of this chapter, provides a valuable understanding about current best practices as well as information about the design details and process.

37.2 BACKGROUND

The Institute for Human-Centered Design (IHCD), formerly Adaptive Environments, witnessed this rising demand for information directly in global forums. The organization hosted or cohosted five international universal design conferences between 1998 and 2006. Those events offered an opportunity to bring leaders and acolytes of a burgeoning movement together and define the state of the art at the time. With each event, expectations rose for content that was sufficiently robust to support replication but that would also identify gaps and frontiers for the next chapter of exploration.

In addition to the episodic large events, increased demand for detail about real projects could be measured in requests to IHCD from journalists, students, academics, design practitioners, consumers, and policy makers. The passage of the 2008 United Nations Treaty on the Human Rights of People with Disabilities caused a surge in interest among governments and disability activists in the developing nations newly aware of universal design and anxious to acquire expertise.

Demand for substantive information was clearly a positive trend. A negative trend was also on the rise that dismissed universal design as little more than a politically correct term for the familiar compliance-based requirements of accessibility, more in line with the unavoidable fact of the plumbing code. The field needed a refreshing resource of good design stories that would nourish the interested and persuade the dismissive to reconsider.

The U.S. National Endowment for the Arts (NEA), through its 2008 Leadership in Universal Design Award, recognized the need and provided initial funding to Adaptive Environments (renamed the Institute for Human Centered Design in 2008) to create a web-based collection of case studies. Each case study would include a narrative describing the project as well as photos, images, and information about the process and the team that designed and built the project. The categories of the built environment were health, outdoor places, transportation, commercial, culture, education, housing, public buildings, historic preservation, and religious spaces. Available anywhere anytime, the web site would offer an efficient opportunity to grasp current practice, appreciate emerging trends, and identify people and organizations doing the work.

37.3 DEFINING THE AUDIENCE: PERSONAS

All kinds of people in all kinds of places were looking for information not currently available. No single resource would meet everyone's needs and expectations. If the case study collection were to be effective, a first task was to analyze the fit between IHCD's strengths and the right subsets of potential audiences. IHCD was used to creating "personas" as a discipline that is a defining technique of user-centered design, most often industrial or information design (see Mueller, 2004). The content, look, and feel of the web site and programming decisions could only be made effectively if the audience that was targeted was clear.

The project team narrowed an initial set of 18 categories of potential users down to 9. Aligning organizational assets to unmet needs within the spectrum of potential audiences resulted in a focus on universal design as good design. Nine named personas were created, each of which had a photo, a role, a national and local identity, and a reason for the interest in universal design along with a specific set of information needs. The user personas for the case study collection were as follows:

"Charlie"—an architect in San Francisco in the United States with a large architectural firm.

"Sangesh"— a mixed-use developer in Mumbai, India.

"Rebecca"—a community advocate in Toronto on the Development Committee for a new synagogue.

"Roger"—a global nonprofit organization community planner in Nigeria charged with planning for 10 new schools in the region with funding from the World Bank.

"Mary"— a professor of architecture in the United States at a prestigious university known for its commitment to environmental sustainability.

"Haru"—a CEO of a mixed-use development firm in a midsize Japanese city.

"Melania"—an urban planner in Montevideo, Uruguay, overseeing a large transportation project that will incorporate light rail and bus rapid transit.

"Hans"—an executive in a design-build firm in Germany with a contract to create an affordable, green, and inclusive residential renovation of an historic factory building.

"Ahmed"—an architect and urban planner for Basrah, Iraq, leading the team to create a new full-service hospital.

37.4 CASE STUDY TEAM

The organization's team is a culturally diverse mix of designers, educators, and humanists aged 20 to 76. Salaried staff is supplemented by consulting project staff and by interns. International interns and fellows expand both the linguistic capacity and the perspective of IHCD. The entire team comprises approximately 40 percent people with disabilities.

The executive director wrote the proposal to the National Endowment for the Arts (NEA) AccessAbility Leadership in Universal Design 2008 Award. The project director was the IHCD Director of Design, Barbara Knecht, a registered architect and an architectural writer. As a student at the University of California at Berkeley in the mid-1970s, she worked with Prof. Lifshez (1981) and began a lifelong exploration with the power of design to minimize limitations.

Interns and IHCD consultants, e.g., a landscape architect, a cultural facility consultant, and a senior educator/architect, supplemented internal staff. IHCD professional staff included three architects, an interior designer, an industrial designer, the director of a national housing project, and the director of transit and urban projects. International colleagues assisted with translation and supplemented a limited use of paid professional translators.

Jury members were invited based upon deep expertise in at least one of the 10 categories of the case studies, and they were chosen to ensure a mix of roles and a variety of global perspectives. Fifteen jurors from eight nations agreed to serve. Jurors were asked to commit to a two-stage process. In the first collection of case studies built with the NEA funds, the jury's role was to recommend potential projects and to review penultimate versions of the case studies. The jurors' second-stage role was to review potential case study submittals for consideration after the initial collection was open.

The project web site needed to reflect the same overarching commitment to universal design as good design as the case studies. The web site had to be attractive to a design audience and usable by anyone across a broad range of physical, sensory, and cognitive abilities. An extensive roster of testers was engaged to review accessibility and usability.

37.5 GENERATING THE PROSPECT LIST

IHCD had an extensive global network and the collected experience of hundreds of workshops and keynote presentations it sponsored or conducted. By the time of the NEA Universal Design Leadership award in March of 2008, the definition of good design was being upended by the stark realities of environmental degradation, profligate energy use, and global warming. Suddenly, an aspiring environmental sustainability movement, fueled by a sense of urgency, seized the imagination of the design community as well as clients, policy makers, the media, and ordinary people. The redefinition of good design was underway. No effort to promote design in relation to human diversity could ignore it.

The sustainability transformation had its impact on universal design. Some leaders in the movement in the European Union promoted inclusive design as a logical concept to integrate into socially sustainable design. They pointed to new global policy definition of disability and health as an opportunity to make universal design a linchpin of socially sustainable design. The World Health Organization's (WHO) 2001 publication of the *International Classification of Functioning, Disability and Health* (*ICF*) mainstreamed functional limitation as a universal human experience and went beyond previous policy to define disability as a contextual phenomenon subject to being exaggerated or minimized by the choices about the design of the environment. WHO policy called for moving beyond the elimination of barriers to the development of environmental "facilitators" that would enhance everyone's experience (Walsh, 2001).

Universal design paired with environmentally sustainable design emerged in the 2004 conference in Rio de Janeiro, including a keynote presentation by C. J. Walsh. The trend strengthened in the 2006 conference in Kyoto hosted by the International Association for Universal Design (IAUD) and

FIGURE 37.1 Panasonic Corporation’s Eco-UD model home opened to the public in January 2006 in Tokyo.

Long description: Photo of the wide tile walkway over a shallow “moat” for rainwater to the main entrance of the Eco-UD House. A long canopy extends over a deck area along the entire side of the house. A glass entry includes automatic sliding doors.

included not only a rising emphasis on Eco-UD in product innovation but also in built environment projects (see Figs. 37.1 and 37.2).

An open solicitation for case study submittals seems to be the most natural option for gathering them. An open-ended call would harvest a large set of potential case studies from people around the world who recognize the nomenclature of universal design, inclusive design, and design-for-all. That would be an advantage and a problem. A quick volume of submittals would arrive, and they would represent an easy-to-access sense of the field. Yet it would be only a slice of the quality of work underway around the world. Many advocates of universal design have moved only incrementally beyond the dominant concerns of accessibility and a focus on mobility, dexterity, and safety. The challenge was to identify good inclusive design without assuming the designer or client overtly framed universal design as a value.

With an open call, the majority of projects would be residential. It is simply the largest volume of activity worldwide. Designing homes is also the most natural place to illustrate design that works

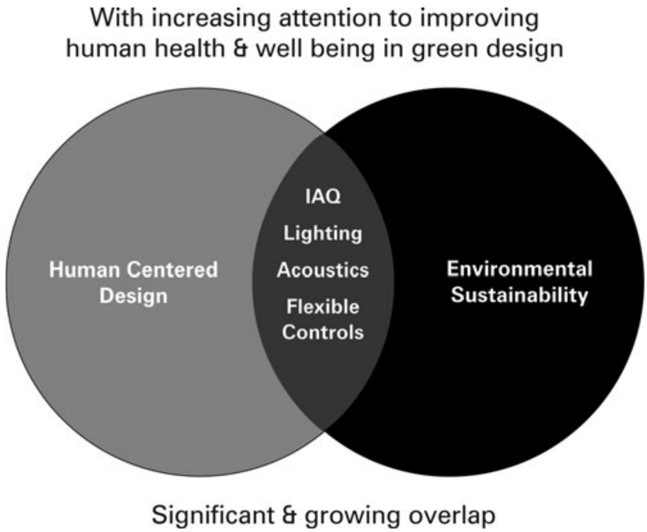


FIGURE 37.2 Illustration with overlapping circles representing environmental sustainability and universal design.

Long description: The illustration depicts two circles, one for universal design and one for environmental sustainability, with the overlapping area listing indoor air quality (IAQ), lighting, acoustics, and flexible controls.

across the spectrum of ability and age. Fine residential work has been done around the world with a large number of leaders in the field choosing housing design and construction as their primary focus. Without duplicating effort, the challenge was to identify good residential design that illustrated new precedents for quality. The English-speaking world would likely predominate an open call, because material about the call would be formatted in English. Although excellent projects can be found throughout the English-speaking world, it would result in a distorted sense of the state of the art.

IHCD chose a different and more deliberate route, with a great deal more work and higher level of risk. The collection needed to convince skeptics by showing projects that stimulate a sense of excitement and confidence that universal design is a fundamental aspect of design and not a peripheral set of ideas.

Having selected 10 types of environments—housing, health, outdoor places, transport, commercial, education, housing, public buildings, historic preservation, and religious spaces—the team broke the project into 10 categories and built a central database to manage potential candidates. The project manager set up a server where all the digital files could be uploaded and available to the team. The project director and executive director functioned as team leaders and set priorities based upon meeting the needs of the perceived audiences. Priorities included these:

- Projects should be recently constructed or renovated, ideally within the last decade.
- Projects should demonstrate a starting point of basic accessibility but offer examples of "facilitators" in line with the World Health Organization's call in the 2001 International Classification of Functioning, Disability and Health (see World Health Organization, 2002) going beyond barrier-free design with features that enhanced experience for everyone.
- Projects should illustrate design features attentive to sensory, cognitive, mental health, and chronic health conditions, such as breathing problems and chemical sensitivity.
- Projects should embody a commitment to good design.

An assumption was made at the start that good projects might not use the language of universal design or its synonyms of *inclusive design* or *design-for-all*. The leaders sent the team on a quest to identify potential projects to bring to the full team for consideration. They suggested initial resources such as books, articles, conference proceedings, and IHCD's international database of designers. Design media, both print and digital, and the web were a constantly expanding resource of potential projects. The team met weekly to triage and identify gaps in the categories and in the geographic regions.

37.6 TOOL FOR GATHERING INFORMATION

In addition to generating the prospect list, the full team worked to build a standard instrument for gathering information. What do we need to know? From whom do we need to get it? What volume of information would be necessary to write a narrative? What types of images do we need?

It required many iterations of the form and testing of the tool to generate a final Project Information Form (PIF). The form asked for a mix of factual information, brief essays in response to questions, and a range of images, especially those illustrating universal design features. The blank PIF was nine pages long with one page for internal use. The team designed the PIF to be completed digitally, and almost all were sent and returned via e-mail.

37.7 CHALLENGES

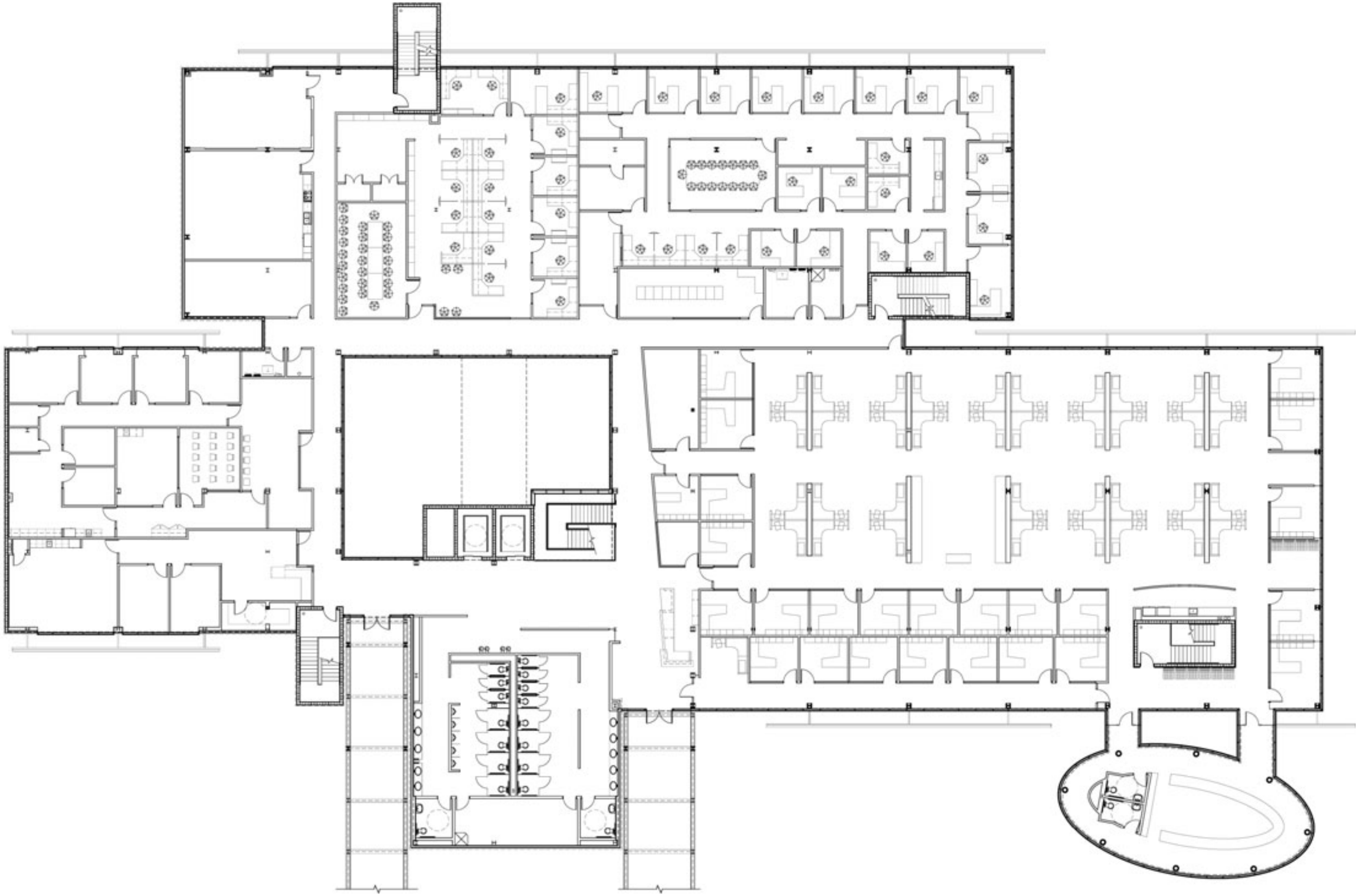
Completing the demanding form required a substantial commitment of time from the design firm, which proved challenging. Some firms were immediately responsive and quick to return completed forms. Most quickly agreed to participate, but required repeated requests with deadlines and extensions, sometimes for many months.

The engagement of user/experts (Ostroff, 1997) was one of the questions to designers. As the case study project evolved, it was clear that a mix of strategies was needed to deliver an accurate understanding of how well the building worked, such as postoccupancy evaluations. There was no fully reliable measure of exemplary performance without a site visit from a member of the IHCD team, the jury, or someone based near the project who could provide a user/expert perspective. It was an imperfect system, but it caught problems that resulted in some case studies being removed from the collection.

Given that there are substantially more examples of universally designed homes than any other building type, it was necessary to weigh what to include. In the end, IHCD included homes that integrated universal design and green sensibilities, in addition to being outstanding in the quality of design or in places where the project was among the first examples of universal design.

There was little question of Japanese leadership in universal design across all design disciplines. There were major difficulties in getting full information back on Japanese projects unless the primary contact was directly with a designer who was bilingual in English. Too often, government officials responsible for universal design initiatives were the primary point of contact and provided information suitable for a conference presentation, but not for the case study collection. It was necessary to translate the Project Information Form into Japanese, seek out the designer for case study projects, and translate from the Japanese as necessary. When all conditions were right, as was the case with the Nanakuma subway line in Fukuoka, the stellar quality of current Japanese work proved easy to communicate.

Important audiences for the collection were designers, developers, and advocates across a wide range of nations. Although attention to universal design is growing, IHCD assumed that there were limited built projects at that time, which proved true. However, some of the finest examples of inclusive public realm projects came from Latin America. IHCD hopes that the commitment to maintaining and expanding the web site will result in capturing emerging nations' projects as they are built.



upper level floor plan

FIGURE 37.3 The Disability Empowerment Center (DEC) of Arizona is a 64,000 ft^2 campus that is an adaptive reuse of a 1970s building.

Long description: The floor plan for the upper floor of the Disability Empowerment Center in Phoenix, Arizona, shows the main office floor of the building and the interior courtyard center core. The plan shows the attention to accommodating a large number of people who use wheeled mobility. Both the functional and circulation spaces are laid out to enhance seamless navigation. In addition to corridor windows over a central courtyard, all corridors maximize access to natural light and views.

FIGURE 37.4 Robert Konieczny designed this country home in Ruda Śląska in southern Poland with priorities for ease of use and maintenance, inexpensive materials, and extremely efficient energy use.

Long description: The photo montage shows a mix of images of the simple wood and glass exterior and interior of the small home revealing the concrete path to the front door with dual side lights and floor-to-ceiling windows in the main living space with an angled glass ceiling that maximizes natural light and warmth in the cold climate.

FIGURE 37.5 Front façade image of one row of Vandkunsten cohousing in Nødebo, Denmark.

Long description: Image shows a view of the front of a row of homes in Egebakken cohousing in Nødebo, Denmark. Each private entry is marked by a sloping dark gray zinc roof set back from a walkway which is level with the street and divided by color, texture, and a lit bollard.

FIGURE 37.6 The Nanakuma Line, opened in 2005, in Fukuoka, Japan, consists of 16 stations and newly designed railcars.

Long description: The photo of the Nanakuma Line in Fukuoka, Japan, shows a young woman with large bag pushing a baby in a stroller across a level platform with a bright yellow tactile strip in the pavement and tactile markings along the edge across a narrow and level gap into the train.

37.8 CONCLUSION

Initial expectations proved true that the recent transformation of the definition of good design includes a commitment to environmental sustainability. As concerns and design ideas proliferate that focus on human health and well-being as defining qualities of sustainable design, there is more evidence that places that work for people are also environmentally sustainable.

It is also true that places winning attention and awards reveal a trend toward seamless integration of inclusive design. It is time to celebrate that evolutionary milestone and to understand the motivations and practices of exemplary practitioners so that they can inspire replication and innovation.

FIGURE 37.7 The city of Sao Paulo, Brazil, created an inclusive welcoming pedestrian realm in this city of 11 million.

Long description: The photo of Avenue Paulista in Sao Paolo, Brazil, depicts a very wide pedestrian area with zones for walking, street furniture including benches and shelters, and a boarding area for public transit. The sidewalk measures 25 ft wide, and the surface is smooth 4-in.-thick concrete with precast rubber joints.

There are still frustrating missed opportunities where attitudinal barriers—the "just tell me what I have to do" mind set—minimize the very real challenge of design that succeeds in transforming human experience. Unless designers recognize that there are creative frontiers needing explorers and visionaries in human-centered design, universal design will be condemned to another cycle of rules outside the engagement and excitement of the design process. If the universal design case study collection succeeds in its mission, it will generate an enticement to be part of something big, to create a new generation of places that celebrate human diversity while communicating a welcome to all.

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CHAPTER 38
TOWARD UNIVERSAL DESIGN PERFORMANCE ASSESSMENTS

Wolfgang F. E. Preiser

38.1 INTRODUCTION

Following the ratification of the Americans with Disabilities Act (1990), the U.S. federal government has made a sustained effort in creating research centers through the National Institute of Disability Rehabilitation Research (NIDRR) and its funding mechanisms. These centers have focused on topics ranging from housing to transportation, from wheelchair design to information technology, to name just a few (IDEA Center, 2007). Only one of these centers had been tasked with developing assessment methodologies (N.C. State Center for Universal Design, in collaboration with Jon Sanford at the Atlanta VA) over the past 10 years. The only other effort in this regard known to the author was undertaken in Belo Horizonte, Brazil. Based on his dissertation research at the Center for Universal Design at North Carolina State University, an attempt was made by Guimaraes (2001) to develop rating scales for the assessment of universal design.

For the emerging field of universal design to mature and be accepted by the general population and the design and business worlds, it is imperative for it to become operational in terms of demonstrable and objectively measurable performance criteria. The purpose of this chapter, then, is to create a road map toward the development of universal design (UD) assessment methodology.

A conceptual framework for universal design evaluation was outlined by the author (Preiser, 2001) in the *Universal Design Handbook* (first edition). It represented an extrapolation from the building performance evaluation framework first developed and presented in *Time-Saver Standards: Architectural Design Data* (Preiser and Schramm, 1997), and was based in part on the author's post-occupancy evaluation of medical facilities. In recent years, the number and kind of manifestations of the field of universal design have been rapidly expanding on a global basis, as is evidenced in new legislation, public initiatives, conferences, and publications.

The promise of UD as an ideology, however, is contrasted by the sober reality of the implementation of the seven Principles of Universal Design (Story, 2001). In short, the need exists to align the principles with building and life safety codes, as well as other design guidelines that set benchmarks of expected building performance.

38.2 EVOLVING ASSESSMENT FRAMEWORK AND METHODS

The history of assessment research in universal design is rather short and consists primarily of case study evaluations of built projects or developed products, as well as use of expert judgments and direct, verbal user feedback. Due to the lack of a systematic and comprehensive tool kit of evaluation methodologies, the case studies rely primarily on field-based evidence, which is often anecdotal and observational. In other words, no comprehensive tool kit for assessing universal design exists to this date. Evaluations or assessments link evaluation methods with the appropriate criteria according to which a product or design is judged. Traditionally, and as indicated above, such criteria existed in codified format, such as codes, American National Standards Institute (ANSI) standards, Time-Saver Standards, as well as agency-specific standards and guidelines, which have evolved over time. In some cases, and due to intellectual property protection, such standards are not accessible to the public. They are guarded heavily by user agencies, such as the military, chip-making corporations such as Intel, or global consumer goods manufacturers, such as Procter & Gamble. Since UD primarily addresses the human dimension of designed products and environments, it makes sense to create an evaluation framework according to the scale of the item being evaluated (see Table 38.1).

For example, the "Mr. Good Grips" line of kitchen utensils by OXO has been tested, first in the laboratory and then in thousands of kitchens. Feedback on their performance can be obtained using consumer suggestions and focus groups. Similarly, at the scale of an automobile, the Japanese have made the most progress when it comes to universal design features. These can include ramps that allow a wheelchair user to roll directly into the back of a van, or a driver's seat that swivels and allows the driver to enter and exit the vehicle more easily, especially when he or she has limited use of the legs.

The above framework serves to illustrate the pervasive nature of universal design as it reaches into virtually every aspect of our life space: at home, at work, or during travel to near and distant destinations. Field-based research using real-world settings and actual users of UD items and features will generate the basis for knowledge building in universal design performance. A case in point is the controversy surrounding the use of Segways by persons with disabilities in indoor public spaces (Watters, 2007a, 2007b), and so is the emerging trend to better accommodate persons with disabilities in tourism, and the travel industry in general.

At this time the only guideposts for universal design assessments are the above-referenced seven Principles of Universal Design (Story, 2001). The principles were created by the Center of Universal Design at North Carolina State University and its consultants from throughout the United States. The principles constitute lofty ideals, accompanied by subsets of guidelines and design recommendations, which are rather general and not quantified at all. Thus, they are helpful in pointing the designer into the right direction, but not adequate to let him or her know what to do in a specific situation.

The challenge is to operationalize the seven principles and to align them with the type of performance criteria standards and guidelines with which designers and planners are accustomed. For

TABLE 38.1 Universal Design Assessment Framework

Scale of UD Item	Examples of UD Features	Assessment Methods	Assessment Measures
Fiskars scissors	Left-handed use	Time/motion study	Ease of manipulation/ cutting speed
Appliances; e.g., washer/dryer	Left or right mounts	Observation Time/motion study Verbal feedback	Ease of use
Interior Architecture	Hard floors	Time/motion study Observation	Abrasion Ease of movement
Buildings	Wayfinding system	Tracking of building users	Ease of orientation/ speed of wayfinding
Urban environment	Mixed-use vertical integration	Transportation hub method Time-lapse video/observation/ still photography	Ease of movement Different conditions of crowding
Information technology	Global access to services via the Internet	User feedback Questionnaire survey	Satisfaction Speed of access Efficiency of services

TABLE 38.2 Universal Design—Relevant Disciplines

Discipline	Examples of Universal Design Applications
Industrial Design	See 3 sub-fields below
Product Design	Utensils, tools, furniture, equipment
Graphic Design	Directories and guidance systems
Fashion Design	Clothing for various disabilities
Interior Design	Accessible design of dwellings, offices and other spaces and places
Architecture	Equal access and circulation for all user groups and levels of disabilities
Urban Design and Planning	Accessible design of transportation facilities, university campuses and communities in general
Information Technology	Access to services and Internet commerce
Health Facilities Planners	Accessible hospital, rehabilitation and care facilities
Administrators	Enlightened governance regarding accessibility in organizations
Facility Managers	Operation and maintenance in line with accessibility requirements
Environmental Psychologists	Research in support of constituencies with disabilities

example, fire codes clearly spell out the maximum distance from an occupied space to the legal fire egress location. In staying with this example, various factors play a role in the establishment of such criteria, such as type of occupancy, construction type, space sizes, and general layout considerations (e.g., open versus closed/compartmentalized spaces), not to mention any hazardous conditions, such as seismic or biohazards. In summary, the still-emerging field of universal design has a long way to go before it can consider itself established, as far as building performance criteria and assessments are concerned.

As is evident from this book and the multidisciplinary backgrounds of its contributors, a great number of disciplines are affected by universal design. These range from planners and designers to facility managers and groups that utilize facilities, especially health care and rehabilitation employees, as well as individuals dealing with all sorts of disabilities. Therapists and people studying human behavior and interactions are involved, and so are administrators/managers of communities and facilities that cater to seniors. Disciplines that are relevant to UD are listed in Table 38.2.

The building industry, especially housing (Preiser, 2006), is also beginning to take note of universal design by creating and building prototypes of universally designed houses, such as the home built by the National Association of Home Builders (NAHB) (2002) near Washington, D.C., and a similar demonstration home by the IDEA Center by the University at Buffalo (Tauke and Schoell, 2010). The question arises whether assessments of these universally designed homes have been done in a thorough manner, if at all, and whether the lessons that have been learned will be applied to future generations of such homes.

Furthermore, information technology is a particularly fertile ground for exploring universal design concepts. Just consider how the VISA card, perhaps the most universal of all universal designs, has revolutionized the business world by permitting customers to carry out transactions in several hundred countries with different banking systems and currencies. The VISA card provides true universal access to merchants and services on a global basis (Hock, 2005).

38.3 EXAMPLES OF CULTURAL, LEGISLATIVE, AND PROFESSIONAL ISSUES

Disability is conceptualized differently across various cultures, including diverse subcultures within the United States. One example is the concept of "visitability," which connotes the ability of a person with disabilities to enter a place, but not necessarily to live in it (Nasar and Evans-Cowley, 2007).

Due to the lack of operational performance criteria, codification of universal design assessments has not progressed enough. Ideally, UD assessments should relate to regulatory devices such as building codes, but should also transcend the minimum requirements of the ADA. There are ethical dilemmas and potential conflicts of interest and litigation in cases where universal design and its potential are not achieved, e.g., in senior living communities. Segways (Watters, 2007a, 2007b) can aid persons with disabilities in navigating through neighborhoods, shopping centers, and establishments such as Barnes & Noble bookstores, but they can also create controversy in the business world for safety reasons and fear of litigation.

Some tourist destinations and cruise lines improve accessibility for disabled persons (Craeger, 2007). For example, the Rocky Mountaineer Railtour from Vancouver, British Columbia, to Calgary, Alberta, provides spectacular vistas of the Canadian Rockies. It features an elevator to lift wheelchair users to the top level of railcars. Near Newport, Oregon, at Yaquina Head Outstanding Natural Area, wheelchair users can roll on paths around the tide pools at low tide. At Fantastic Caverns near Springfield, Missouri, a tram “follows an ancient riverbed and gives visitors a great look at some of the magnificent stalactite and stalagmite formations” (Harrington, 2008).

38.4 NEEDED ASSESSMENT METHODS—CREATING A RESEARCH AGENDA

The goals of creating a universal design assessment research agenda are twofold: (1) To collaborate with colleagues in the emerging field of universal design (called *inclusive design* or *design for all* in Europe), in an effort to create a research agenda which will advance it to the next level of pragmatic application in the real world; and (2) more specifically, to develop a tool kit of methodologies.

Tables 38.3 and 38.4 constitute the rather complex universe of data-gathering methods and measures. When they are utilized in a selective fashion, it is hoped that this will allow universal design solutions to be evaluated in a systematic manner. Furthermore, this could support the creation of performance criteria, which relate to regulatory mechanisms such as zoning and health and safety codes. Functional requirements can be developed, as documented in design guides for different building and space types. Finally, psychological and cultural needs of the users of universal design can be distilled.

In adopting the field of human factors as a possible role model for evaluative research, it becomes clear that a comprehensive universal design assessment framework implies a sophisticated, multimethod approach. This would involve hard and quantitative as well as subjective and qualitative measures with a focus on the human-environment interface. Furthermore, it would include field and laboratory studies of spatial, physiological, psychological, and even cultural dimensions of universal design.

For universal design to transcend its “soft” ideals and to be taken seriously in the pragmatic world of planning, designing, and construction, a rigorous and accountable approach must be taken in measuring and analyzing universal design performance. Just as in the precedent-based medical diagnoses or legal determinations, universal design needs to move into the direction of “hard” science and facts, Multiple medical diagnoses or legal precedents form the basis of acceptable

TABLE 38.3 An Overview of Data Gathering Methods and Measures

1. Behavioral Observations	Behavior Inventory and Taxonomy
2. Mechanical Recordings	Occupant and Environment Patterns
3. Visual Recordings	Occupant and Environment Change
4. Physical Measurements	Physical Measures
5. Verbal Response Measurement	Perceived Performance Measures
6. Expert Judgment	Point Ratings

TABLE 38.4 Detailed Data Gathering Methods and Measures

1. Behavioral Observations	**Behavior Inventory and Taxonomy**
Direct Observation	• Behavioral Mapping • Behavioral Identification/Classification • Occupant Tracing
Participant Observation	• Interaction Patterns/Dynamics • Social Dynamics • Utilization of Resources
2. Mechanical Recordings • Counting • Event Recording • Light Sensor Gate/Contact Switch Plates • Location Mapping	**Occupant and Environment Patterns** • Frequency of Events • Space Use • Location of Occupants • Use of Preferred Spaces/Resources
3. Visual Recordings	**Occupant and Environment Change**
Still Photography	• Space Inventory • Archival Records/Photo Annotation • Ambient Environment Quality (Color, Light)
Video Recording	• Macro and Micro Behavior • Occupant Movement • Conflict Identification
Time-Lapse Photography	• Behavior Sequences • Occupant Speed/Tracking • Individual vs. Group Interaction
4. Physical Measurements • Gauge • Chemical Test Kit • Scale • Light Meter • Sound Meter • Inclino-Meter	**Physical Measures** • Temperature • Humidity • Air Velocity • Light • Chemical Agents • Abrasion • Elasticity • Live-loads • Decibels • Light Levels
5. Verbal Response Measurement	**Perceived Performance Measures**
Occupant Interviews	• Generic/Open-Ended Questions • Forced Choice Questions
Occupant Surveys	• Numeric Ratings • Generic/Open-Ended Questions • Forced Choice Questions
6. Expert Judgments	• Aesthetic Quality Comparisons • Point Rating Systems

"truth" or evidence that has been proved in the real world. Medical therapy or legal fixes are predicated on knowledge vetted in databases and clearinghouses that could specialize in types of products, buildings, infrastructure, as well as information technology. As such, the author envisions three next steps to progress in this endeavor:

1. Prior to the creation of a conceptual framework for universal design performance assessment, there is the need for the development of a distinct and widely accepted terminology. An example of an initiative in that direction is Chap. 9 on creating a universal design thesaurus (by Duncan, et al., 2010).

2. Chapter 37 presents a web-based international collection of universal design exemplars (Fletcher, 2010), a beginning for establishing universal design guidelines for a cross section of common building types that makes a lot of sense.

3. A recent development occurred in the area of developing standards for universal design (http://www.globaluniversaldesign.org), to be carried out by the Global Universal Design Commission. Their goal is "to develop standards for building design, product design, facilities management and business practices. All standards will be developed using an ANSI approved process, but they will not be ANSI designated standards." There is a plan to review first-draft standards for commercial buildings in 2010.

Building upon the aforementioned, the following are elements and potential outcomes of the future development of a research agenda for universal design performance assessments:

1. Expand the conceptual basis for a systematic UD assessment process, using key elements from the *Universal Design Handbook* (Preiser, 2001, Chap. 9) and the present chapter.

2. Create an outline of tasks, time-line, deliverables, and comprehensive and global literature review.

3. Field-based assessment research must include these on-site activities:

- Workshops to raise public awareness of UD, also with professional associations and the building industry as a whole
- Lecture presentation(s) and colloquia for students, professionals, and relevant government entities
- Research focus groups with representatives of the disability community
- Site visits of exemplary UD solutions and select UD assessment case studies
- Carrying out UD performance case study assessments

4. Liaison with relevant organizations, including The Global Universal Design Commission; the International Association for Universal Design (IAUD) in Yokohama, Japan; the CIB Committee W064 in Rome, Italy; the Design for All Foundation in Barcelona, Spain; the biannual INCLUDE conferences organized by the Royal College of Art in London, United Kingdom; and, the Designing for the 21st Century conferences held jointly by the Center for Universal Design at North Carolina State University in Raleigh and the Institute for Human Centered Design (formerly Adaptive Environments, Inc.) in Boston.

In the true spirit of universal design, prosperity is expected not just for the sake of creating more products, environments, and infrastructure, which better support the human aspects of access and usability, but this will also greatly enhance the future of business. To reiterate, the approach to be taken sees universal design defined as making products, spaces and buildings, urban infrastructure, as well as information technology accessible to and usable by (almost) all people. Significant strides have been made in Europe, the United States, and Japan in creating and developing this field, which, in its true spirit, aims to transcend government-issued minimum standards, such as the ADAAG guidelines that have emanated from the Americans with Disabilities Act (ADA).

38.5 ACKNOWLEDGMENTS

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CHAPTER 39
UNIVERSAL DESIGN FOR LEARNING IN THE COLLEGE CLASSROOM

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39.1 INTRODUCTION

This chapter presents the rationale for incorporating universal design for learning (UDL) principles into higher education. It also presents examples of how faculty integrate UDL strategies into college classrooms to enhance learning outcomes for all students. Today's college students are becoming more diverse, including students with varied ethnic and cultural backgrounds; students whose first language is not English; students who are older than the traditional college student; and students with an array of learning, attention, psychological, and physical disabilities (McGuire and Scott, 2006; Rose and Meyer, 2002). This increase in diversity challenges faculty members to recognize impacts of multiculturalism in the classroom, embrace a broad range of students, and address needs of students with disabilities to make higher education more accessible (Zeff, 2007). To help address these challenges, legislation (Higher Education Opportunity Act of 2008), educational research (Pliner and Johnson, 2004), and teaching practice (Rose and Meyer, 2006) promote UDL as a strategy for raising academic standards for all students. This chapter discusses foundational principles of UDL and universally designed teaching practices that result in increased achievement.

39.2 UDL BACKGROUND

UDL is growing across universities, a practice increasingly referenced in the research literature, faculty development, and articles and books. Despite increasing enrollments and benefits of a college education, underrepresented students—including culturally and linguistically diverse (CLD) students and students with disabilities—lag behind the general population in college participation and retention (Leake et al., 2006). According to the 2000 Census, 71 percent of four-year college students were white, 7 percent were Hispanic, 11 percent were black, and 11 percent were from other races (US CensusScope.org). Harvey (2001) reported that 59 percent of white students at four-year colleges graduated, whereas Hispanic and black students graduated at rates of 48 and 38 percent, respectively. Clearly, CLD students seldom enroll in college and often struggle to complete a quality college education at the same rate as white students.

As diversification continues in higher education, development of new strategies to improve student learning remains a priority at national, state, and local levels (Spelling Commission on the Future of Higher Education, 2006). The universal design movement began in architecture in the 1980s and has come to represent a cohesive approach to promoting inclusion. UDL considers how curriculum, instruction, and assessment can meet the learning needs of the greatest number and diversity of students while maintaining academic rigor (Izzo et al., 2008). UDL capitalizes on instructional best practices and technology to ensure that students have access to multiple representations of critical concepts, become engaged in learning, and experience flexibility in expressing what they know.

UDL is a teaching approach that ensures students with a wide range of abilities can access course content and materials and ultimately succeed in college. From a neurological standpoint, students learn in different ways regardless of their cultural, economic, or disability characteristics. People process information using many strategies; no two people have the same strengths and weaknesses in learning styles (Izzo et al., 2008). College students do not have one general learning aptitude, but many learning abilities; a disability or challenge in one area may be compensated by abilities in another area (Block et al., 2006). Adopting flexible teaching strategies that eliminate barriers helps meet the needs of diverse learners.

Unfortunately, some faculty members continue to teach students using traditional methods, such as using purely passive lectures to teach and memorization-based exams to assess learning. The dean of a large college at a Midwestern university shared his concern about this approach in response to the following interview question: What is your teaching philosophy ... at the College of Engineering?

> I fundamentally believe there's a mismatch between the way many engineering faculty teach and the way many engineering students learn…. [F]aculty tend more to teach the focus of "how" to solve a specific problem. Engineering students prefer to reason visually, but most of their instruction is verbal, more by lecture. One of my fundamental beliefs in teaching is you should use as many different teaching styles and as many pieces of information to reach as many different students as possible…. I take advantage of the technology students are using and often have visual learning, methods of both induction and deduction and lots of active and peer-to-peer learning. We have to appeal to all of the different ways in which students learn. This is important for diversity because our students have a much more diverse background and thought process in terms of how they learn ("Meet Greg Washington," 2008, p. 2).

39.3 UDL DEFINED

One of the leaders in applying the idea of universal design to education was the Center for Applied Special Technology (CAST). The theoretical framework developed by CAST provided a strong foundation for the definition of UDL included in the Higher Education Opportunities Act of 2008 (HEOA):

> Universal Design for Learning is a scientifically valid framework for guiding educational practice that—(A) provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged; and (B) reduces challenges in instruction, provides appropriate accommodations, supports, and challenges, and maintains high achievement expectations for all students, including students with disabilities and students who are limited English proficient [HEOA, P.L. 110-315, §103(a) (24)].

The inclusion of UDL in the reauthorization of the HEOA demonstrates its escalating importance. In contrast to the incorporation of universal design into the architectural design field, UDL concepts and practices are not broadly integrated into policy within higher education. The framework of UDL consists of instructional approaches that provide students with choices and alternatives in the materials, content, tools, context, and supports they use. According to CAST, there are three basic principles of UDL (Rose and Meyer, 2002):

1. *Multiple means of representation*, including multimodal teaching, rely on a mixture of media to relay concepts, such as lectures, podcasts, texts, and web resources ranging from YouTube videos to multiple versions of class notes posted by several students for each class.
2. *Multiple means of strategic engagement* maximize student learning through motivation and relevancy so students have opportunities to interact with and connect the content to related information to enhance retention.
3. *Multiple means of expression* allow students opportunities to demonstrate their learning through multiple assessment opportunities, such as multimedia projects, written papers, or multiple quizzes and a project instead of one comprehensive exam.

These principles provide students with options for learning and different methods of assessments to express knowledge. The UDL framework challenges educators to rethink the nature of their curriculum and empowers them with flexibility to serve a diverse population of learners (Izzo et al., 2008).

39.4 UDL STRATEGIES

UDL integrates strategies good teachers use—multimodal teaching, differentiated instruction, cooperative learning, self-monitoring, embedded assessment, relevant context, and demonstrated learning via multiple media—to create a constructivist model of learning where students generate knowledge rather than receive it (Harrison, 2006; Rose and Meyer, 2002). In addition, UDL integrates accessible technology into the teaching and learning process, thereby harnessing a set of technological innovations such as YouTube, podcasts, and electronic voting machines often called clickers. UDL encourages a student-centered approach whereby the learning environment enhances the independence of all learners with a minimum of retrofitting, reducing the need for individual accommodations (Block et al., 2006).

Establishing a clear understanding of the learning objectives of a course renders subsequent decisions about UDL approaches employed much easier. For example, if "be a responsible, scientifically literate citizen" is a learning objective for a large, general education curriculum (GEC) biology course, then teaching—and testing—the names of the stages of cell division takes low priority. Similarly, engaging in small-group discussions about policy options regarding breast cancer, where some understanding of cell division applies, takes high priority; that such discussions provide an alternative means for strategic engagement is even better. Discussed below are several UDL strategies used within higher education among specific disciplines and settings, applied across a broad range of course levels (introductory to graduate) and sizes (5 to ~500).

Architecture

One required course for all city and regional planning (C&RP) students encourages integration of information from many disciplines, including the seven Principles of Universal Design, as students learn to incorporate different purposes and users into a facility. C&RP classes offer multiple examples and nonexamples of factors one must consider in planning the design requirements of facilities. Accessibility features are discussed in groups and assessed through projects, papers, and exams. Because classes employ audio streaming with visual presentation of facilities, students can view lecture portions of classes at their convenience and use asynchronous, threaded discussions to comment on the accessibility of design features.

Because architecture is an applied field, C&RP faculty also use multiple means of strategic engagement. For example, many courses and studio classes have students apply what they learned to solve real-world problems with real clients. Instructors offer multiple means of expression; e.g., students select and complete four of five potential projects as a team. Team members also select a final project in which they summarize key points of the course with a mix of text and images. In some courses, students also design their midterm exam according to format, including, essay, true/false questions, multiple-choice questions, or a mix of those, and weighting of multiple formats. Students receiving time accommodations for exams can receive oral exams that include nested sets of questions according to previous answers.

Physics

To increase engagement of students, they use handheld electronic voting machines called clickers to answer multiple-choice questions during lectures. The instructor asks a sequence of questions to test students' understanding of key concepts. The distribution of answers chosen for each question appears, and the instructor then leads class discussion to clarify any misconceptions. In an experiment to test the effects of clicker technology, two sections of the same physics class were compared. One class used the voting machines followed by discussion of the questions asked during voting; the other class did not. No statistical differences on pretest measures of students' knowledge of physics concepts existed between the two treatments. Students who used the clickers earned final examination scores approximately 10 percent higher—the equivalent of a full letter grade—than those of students who participated in traditional physics lecture (Reay et al., 2008). Students reported that using voting machines helped them learn. These data could not be disaggregated by diversity due to inadequate power within ethnic and disability categories. Students with visual or hearing impairments in classes using voting machines will require appropriate accommodations, e.g., questions in accessible formats for students with visual impairments and interpreter services for students with hearing impairments.

The above clicker use data were also analyzed for gender differences. In traditional physics classes, male students outperform female students. However, in clicker classes, the performance of male and female students was not significantly different, suggesting that clickers and class discussions improve performance of female students. Such methods may increase the performance of women in challenging courses and could encourage more women to pursue science, technology, engineering, and mathematics disciplines, a priority of many colleges and the National Science Foundation.

Large General Education Curriculum Classes

Required GEC classes can prove vexing; because everybody at a university has to take them, they are often quite large and impersonal. The multiple methods of representation and engagement inherent in UDL provide the breaks that punctuate an otherwise long lecture. Students work in cooperative groups; at least once each class period, each group must provide responses to questions from the current lecture topic, such as "Should our state screen for more genetically based birth defects, even though this is expensive?" Groups are called randomly to report their thoughts; subsequent groups are called to add comments. All groups submit their answers at the end of each class period for credit. The lecture groups are the same as those in the multiple recitation sections associated with the course, and recitation sections sit together in reserved blocks of seats in the lecture hall.

Many instructors of courses with a large number of students with disabilities, who require extra time to take exams, often come to realize that performing well on an exam within some arbitrary period is not consistent with their stated learning objectives. This can place the instructor in a quandary: Why *are* there time limits on exams? UDL principles can come to the rescue and suggest that unlimited-time exams will meet the needs of the students with disabilities *and* all other students who may benefit. One finding was that the major benefit of this unlimited-time policy reduced apprehension among some students. In fact, very few students take more time on exams; the major exceptions include foreign students using dictionaries, who are accommodated by "assigning" a teaching associate (TA) to proctor the exam, just as with time-limited exams.

Another UDL strategy for administering exams that reduces anxiety and increases opportunity for students to demonstrate what they know is to permit each student to bring one page of notes to exams. This has the added benefit of helping some students organize the material covered on the particular exam. In practice, it was also found that permitting such notes helps students appreciate that the instructor will make good on a promise to not produce a "memory exam."

UDL principles can be liberating for faculty members. For example, the objectives for GEC science courses at most universities include expectations for students to recognize connections between science and political issues such as global warming or stem cell research, to appreciate the history of science, and (often) to recognize ethical implications of scientific applications in society today. These topics are difficult enough to teach, much less assess in students. UDL principles provide useful insights in such situations. Standard testing methods do not lend themselves easily to such topics. The multiple means of student expression inherent in UDL guidelines provide a solution. For example, students are asked to prepare policy statements on issues such as breast cancer that include sufficient biology to justify the proposed policy or policies, as well as discussion of societal impacts and ethical implications, to meet the underlying course goals. TAs grade the statements according to rubrics developed by faculty. The TA workload is managed by training them (and their students) in grade-norming tutorials using exemplary policy statements representing a range of quality (and grades), by limiting the number of pages for the policy statements, and by requiring group submission of some statements, thereby reducing the number of statements to grade by a factor of 4.

Recitation or Laboratory Classes

Many classes include recitation or laboratory sections that provide numerous opportunities to expand on UDL principles. In addition to providing an alternative medium to present information to students, these sections permit numerous opportunities for students to demonstrate what they have learned. For example, the recitation sections combine pedagogical tools such as cooperative learning and jigsaw with opened-ended assignments to understand issues at the interface of biology and public policy, such as global warming, stem cell research, or other complex, relevant and biologically rich issues. Student projects include locating, reading, and summarizing articles from a national newspaper relevant to issues discussed in class. Engaging students in relevant content and providing multiple means of expression increase opportunities for learning to occur that meets course objectives and prepares students to become active and informed citizens.

Consistent with UDL principles, special emphasis has been placed on multimodal learning by the students. In practice, this has translated into developing laboratory exercises that begin with a campus tour to either collect samples of multiple species of trees or observe firsthand university efforts at sustainability. Recently, it was demonstrated that approaches that maximize students' ability to engage directly in the project and explore questions through inquiry result in greater levels of student learning than traditional, expository approaches (Rissing and Cogan, 2009). UDL principles provide instructors with strategies to engage all their students more effectively.

39.5 CONCLUSION

Faculty members are attuned to the increasing diversity of college students and to the need for greater flexibility in instructional design while maintaining high standards to teach effectively in the twenty-first century. Universal design offers a promising approach to meeting the learning needs of all students. The UDL framework challenges educators to rethink the nature of their curriculum and empowers them with the flexibility to serve a diverse population of learners. Researchers must further develop and validate universal design principles and strategies across contexts and constituencies, so that more students with diverse backgrounds continue to access and succeed in college and gain the skills needed to join the workforce and make significant contributions to our global community.

39.6 ACKNOWLEDGMENT

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CHAPTER 40
CAMP ALDERSGATE: A NEW MODEL FOR ARCHITECTURAL EDUCATION

Laura M. Terry

40.1 INTRODUCTION

The education of an architect has a unique tradition. From the apprentice and atelier model where specific ideas of design, composition, and materiality were passed from master to student to the Rural Studio, where students design and build for families and communities living in extreme poverty, architectural education has addressed a broad range of design, social, and safety issues. The Camp Aldersgate design-build program at the University of Arkansas layers accessible and universal design into a traditional design-build model. Camp Aldersgate, located in Little Rock, is the only camp in Arkansas serving children with physical and developmental disabilities as well as children with chronic illnesses. The camp is located on 100 acres in the heart of Little Rock with a preserved forest, a lake stocked with fish, and plenty of wildlife. Typical camp activities, such as canoeing, archery, fishing, ropes courses, and nature studies, are reinvented to accommodate every camper. The camp's motto, "Common ground for extraordinary people," accepts every camper's individual abilities and achievements, and it celebrates them in simple ways. The philosophy of inclusive and adaptive design was seen as an ideal situation for a design-build program that transforms the way architecture students are educated. This chapter discusses the development and outcomes of this unique program.

40.2 HISTORY

The program, modeled after Auburn University's Rural Studio (Dean and Hursley, 2002), was begun in 2002. The pedagogical goals of the program include advancing collaborative design and creative problem-solving skills, enhancing technical and construction knowledge and skills, and fostering new approaches to accessible and universal design. The last goal has been the most evident and, simultaneously, the most difficult goal to achieve. Students are immersed in camp life and activities so they can experience the workings of the camp on a daily basis, the challenges and triumphs experienced by campers, as well as the unique skills of camp staff and counselors in working with the campers. Most importantly, students learn from the campers the vital aspects of a camp experience: racing down the hill to see who is first to the fishing dock (whether on foot or in a wheelchair), making the most bull's-eyes at the archery range, or excelling at the "adventure challenge" zip line.

The camp facilities, many of which have been retrofitted from the 1950s, pose many obstacles, some of which are dealt creatively, while others become part of the "camplike" atmosphere. Camp Aldersgate is committed to adapting to the needs of each camper, while also fiercely dedicated to maintaining a traditional camp experience, including rugged trails, natural terrain, and secluded settings. From an experiential point of view, this is one of the best qualities of Camp Aldersgate. From an accessibility mind set, this is one of the camp's greatest challenges.

40.3 DRAMATIC SITES DEMAND ACCESSIBILITY

Site design is one of the most abstract components of any hypothetical studio project. At Camp Aldersgate, the site is the protagonist and must be addressed from the beginning in order for designs to be functional and successful. Two of the most successful projects at Camp Aldersgate—the tree house and the stage and amphitheater—provided creative solutions while celebrating the unique character of the place. As a result, the site and projects are so closely linked that without one, the other would not be as interesting. For the tree house, completed in 2003, and the stage and amphitheater, completed in 2005, site and accessibility issues were solved creatively and opened two areas of camp that had previously been unusable.

The Tree House

The primary challenge of any tree house lies in getting from the ground into the tree. Add accessibility into the equation, and the problem is exponentially more difficult. The site for the tree house was chosen for its dramatic slope, enabling a bridge to extend 40 ft from the natural dam of the lake, resulting in a height of 22 ft above ground. A tree house of over 20 ft is memorable for almost anyone, but for a child who relies on a wheelchair or crutches, the experience of being off the ground and among the treetops is exhilarating. Although the structural aspect of building the tree house was a daunting task, the students immediately appreciated the experiential possibilities. Their discrete design creates open views to the lush landscape, so the tree house becomes a space through which nature is viewed and experienced. A distinct vertical composition camouflages the tree house among the tall tree trunks, and the lush green site obscures the tree house from the approach, making the discovery of the project an experience in and of itself (see Fig. 40.1).

Orienting the tree house to frame-specific views is another example of the keen observation of the students and their desire to celebrate the natural beauty of the site for the campers to witness. In the heat of Arkansas summers, the tree house captures the gentle breezes from the lake and is a haven from mosquitoes. Since 2003, the tree house has been the beginning of the nature course and is now filled with leaves, sticks, pinecones, and other natural "treasures" that have been collected by campers over the years.

In the case of the tree house, the steeply sloping site was both the problem and the solution. The simplicity of the project is its strength: a single bridge that delivers campers into a 300-ft^2 tree house. The inclusive nature of the tree house is not limited to young campers. Camp Aldersgate also has a seniors program, and the tree house is a favorite respite for octogenarians, who spend each Thursday at camp, fishing, canoeing, and being a kid again. The bridge equalizes the experience for all campers, regardless of ability or age, with a hidden approach, distinct views, and a sense of being in the trees.

The Stage and Amphitheater

The goal for the project in 2005 was to create an accessible stage and amphitheater with seating for 75 campers for weekly campfires, marshmallow roasting, and talent shows. A site near the lake was chosen for its scenic view, which became the backdrop for the stage, and its gentle, natural slope,

FIGURE 40.1 The entry to the tree house is a 40-ft bridge providing universal access to the tree house which stands 22 ft above the ground.

Long description: This photograph shows the 40-ft bridge that allows one access to the tree house. The bridge is the only entry offering all campers, regardless of ability, the opportunity to experience a tree house that is 22 ft above the ground.

which became the seating area. The site was also located off one of the main camp trails, making it easy to access, but still providing an element of discovery. The site was filled with small trees and some larger specimen trees, thereby providing a canopy for blocking the summer sun. Lake breezes are funneled across the stage and into the seating in the evenings.

The primary challenge was the seating. The makeup of each week of camp is different. During some weeks, the majority of campers use wheelchairs, while other weeks no campers use wheelchairs. This means that in any given week more or less fixed seating is needed. The students studied the site, pulled strings from trees to find the best sight lines, and created gently curved rows of seating. The natural slope of the site created tiers for the rows, providing unobscured views of the stage. Benches in 3-, 5-, and 6-ft lengths were spaced with 5 ft between them, so campers in wheelchairs could fill in the seats. To accommodate more campers, steel and cedar bench caps were designed to span from one bench to the other. This low-tech solution added an additional 20 seats (see Fig. 40.2).

FIGURE 40.2 The steel and cedar benches span the permanent, concrete benches to create additional seating when needed.

Long description: This photograph shows how the steel and cedar benches span the permanent seating to create additional seating when needed. These can be removed to allow campers using wheelchairs to more freely move through the amphitheater.

The stage presented its own challenges. Keeping the stage low to the ground meant the view to the lake would be preserved, but it would also be easier for campers in wheelchairs to access the stage. Once the stage was sited and basic construction began, the students realized the back corner of the stage was 3 ft off the ground. This meant a 36-ft ramp was needed to access the stage. Ramps are rarely an interesting experience, and more times than not, they seem like an afterthought. Students surveyed the site and realized that 36 ft from the stage created both a level and ideal entry sequence. Because of the slight slope of the site, the ramp was level: a bridge. In plan, the bridge is armlike, reaching out to enclose the seating. A second, smaller bridge allows campers to exit the other side of the stage, and it, too, captures and encloses the seating (see Fig. 40.3).

As they do with the tree house, all campers enter the stage via a bridge on the night of the talent show. From the path at the back of the amphitheater, campers can negotiate the sloping site and choose where to sit and, more importantly, by whom to sit.

The tree house and stage and amphitheater projects required thoughtful and creative situating to maximize the experience, while integrating issues of accessibility. A bridge for the entry means all campers have the same experience, since the ritual procession is part of the activity. These two projects blur the line between accessibility and good design: Are they good because they are accessible? Or are they accessible because they are well designed? The students argue they are both.

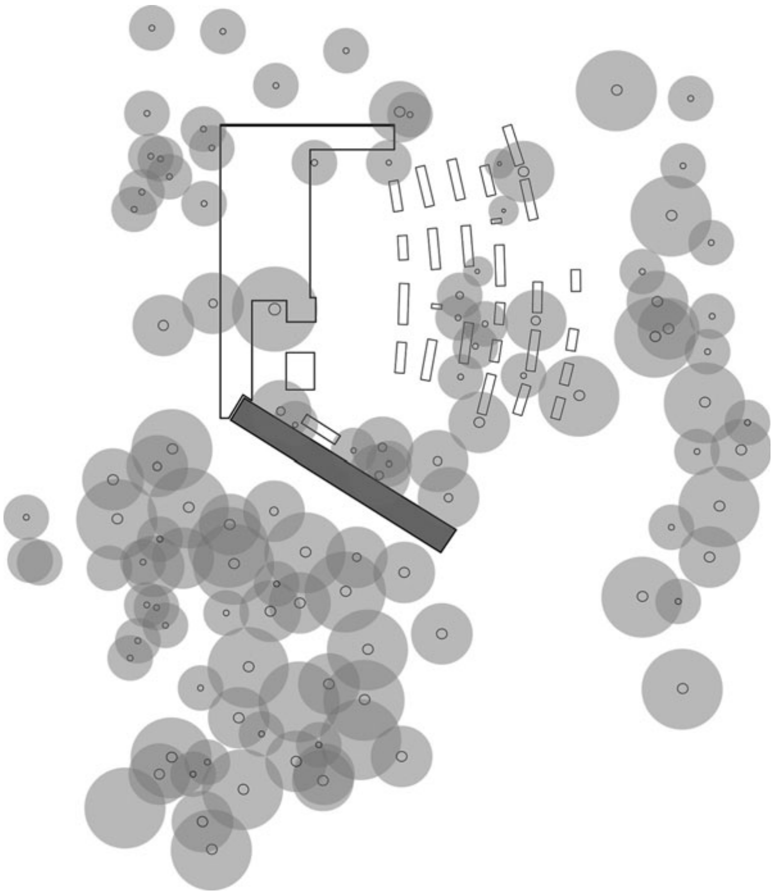

FIGURE 40.3 The site diagram shows the relationship of the stage to the entry bridge and the seating.

Long description: The site diagram reveals the careful arrangement of the seating to maximize view and accessibility. The entry to the stage is via a 36-ft bridge. A shorter bridge on the far side of the stage provides another way to enter or exit the stage.

40.4 ORDINARY SITES DEMAND CREATIVE DESIGN

The previous section described the benefits of dramatic sites for creating extraordinary experiences. With a more ordinary, flat site, the design must create the drama in order to heighten the sensory experience. Two projects—the Archery Pavilion and the Picnic Areas, the first and the most recent projects, respectively, at Camp Aldersgate—operate this way.

The Archery Pavilion

In 2002, the inaugural project of the Camp Aldersgate Design-Build program was to design an archery pavilion. A site was chosen for its proximity to one of the main camp trails but also for its secluded quality. The students responded to the L-shaped site by locating the pavilion to maximize the experience of discovery. A stone path intersects the main trail and leads one to the back of the pavilion. From this perspective, the four accessible shooting stations are revealed to the campers. A louvered wall shields the stations from the path, so they are not discovered until the pavilion is entered (see Fig. 40.4).

The experience of discovery is important in the projects of Camp Aldersgate. After observing the campers with muscular dystrophy, the students realized that many campers have little or no mobility, so other kinds of interactive or sensory experiences were necessary. Color and textures are important design elements in the archery pavilion. The shooting stations, designed from discarded car parts, old bicycles and other found objects are the highlight of the experience. Campers can choose which station they want to use and watch as the station is adjusted to their height, whether in a wheelchair or standing. The stations also allow for the bow to be used crossbow-style, further expanding the range of accessibility (see Fig. 40.5).

FIGURE 40.4 The site diagram shows the L-shaped site that creates an extended entry sequence into the Archery Pavilion.

Long description: The Archery Pavilion makes use of an L-shaped site to create a dramatic entry sequence. A long path leads one to the back of the pavilion, and a louvered wall conceals the archery shooting stations from view.

FIGURE 40.5 The four, adjustable shooting stations are unique in their design and adapt to all campers.

Long description: The four, adjustable shooting stations are created from found objects like old bicycle and car parts, an airplane propeller, and a basketball goal. Each station raises and lowers to accommodate campers of all sizes and can be used with a cross-bow to accommodate all abilities.

The stations, in many ways, represented the deep understanding of accessibility gained by the students. Through observation of the range of abilities of the campers, the students designed a functional, experiential, and accessible component to the archery pavilion. The stations celebrated the philosophy of the camp and solved a real accessibility issue with a creative, "outside the box" solution.

Picnic Areas, Phase 2

In the summer of 2008, two picnic areas were designed to expand on the camp's accessible gathering spaces. A large site was selected for its beautiful, wooded setting and proximity to another one of the main trails. The camp requested that the two sites be physically connected, but also visually independent. The students began their investigation of the site by observing the light throughout the day, walking the site to determine the best location and views, and tagging significant trees that would be part of the experience. A natural drainage ditch ran through the site, creating an obstacle in the path that needed to be addressed. The solution was simple but dynamic: a boardwalk that winds through the woods, delivering campers to the two sites and creating a direct path from one trail to another at the top of the site. The boardwalk is the only way the sites can be accessed so the experience is one shared by all campers regardless of ability (see Fig. 40.6).

The boardwalk is level, so the ground falls and rises underneath it. In one place, the boardwalk is 6 ft off the ground, in other places, only a few inches. This change in the ground plane is part of

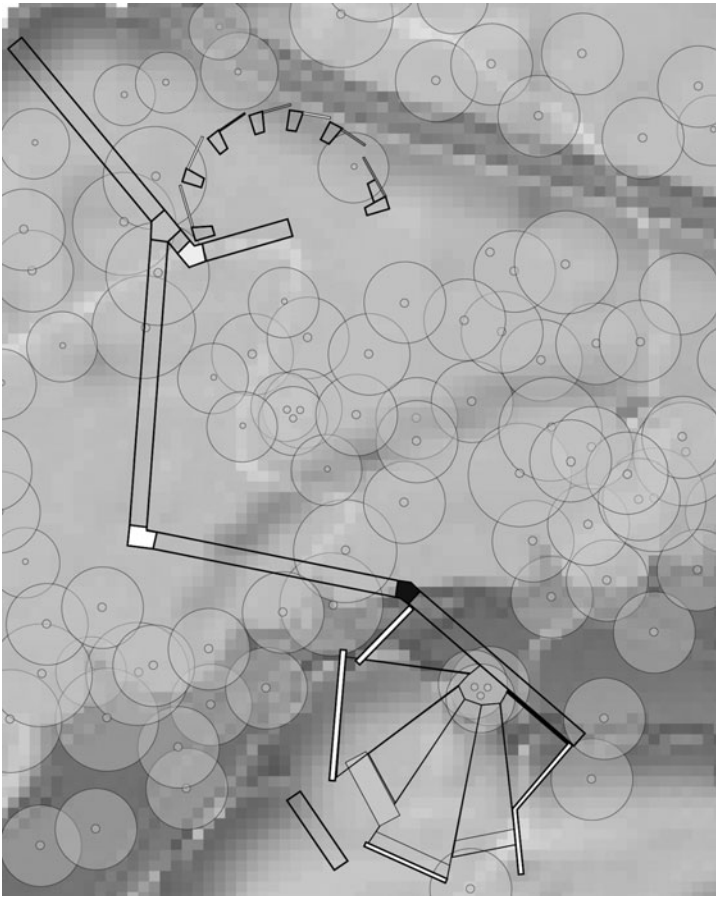

FIGURE 40.6 The site diagram shows how the boardwalk creates a path that connects the two picnic areas.

Long description: The boardwalk connecting the two projects creates a unique experience through the woods. Each site is accessible from the boardwalk.

the experience, as the path winds through the trees, turning to frame specific views. The two sites, designed by separate groups of students, are unique to their relative locations, one focused inward, the other, closing off an area but framing specific views out into the landscape. For this reason, the two sites have become favorite gathering places for different camp activities. The enclosed site prevents campers from being distracted by other activities, and the other site offers great views for observing nature. The real success of this project is the multiple ways in which it can be adapted to the camp's various needs.

40.5 THE REALITY OF ACCESSIBILITY

One of the greatest challenges of the camp and the Camp Aldersgate Design-Build program is the ground surface. The camp has avoided paving every surface in an effort to maintain a camplike atmosphere: the natural setting is a significant part of any summer camp experience. But the different surfaces are challenging from an accessibility standpoint, as well as a functional one. Drainage and run-off are a constant battle for the facilities manager.

For the design-build projects, with a limited budget, the ground plane is always the greatest challenge. Projects like the Tree House and the Stage used built elements that re-negotiated the ground plane, but those projects had additional challenges. Other projects, like the Archery Pavilion and the second Picnic Area, found ways to make the ground plane work. But the reality of accessibility does not always conform to the demands of the site.

Picnic Areas, Phase 1

One of the most challenging projects was completed in the summer of 2008. The first two picnic areas, though relatively small in scale compared to the other projects, encompassed the largest site where campers would be directly in contact with the ground. The design was for an undulating, curvilinear form, with benches that provided places for seating or lounging. The different heights of the benches and the adjustable tables allow the camp counselors to accommodate the facilities for their campers' needs on a weekly basis. These qualities are the real success of the project. Where the project suffers is the design of the ground (see Fig. 40.7).

Once the site was cleared of underbrush, the earth revealed a tangle of rocks, roots, and uneven surfaces. Rocks were gathered and used to line formal pathways, but their removal left holes that needed filling. Small pea gravel was chosen to cover the ground, but it was initially spread too thickly, and a test with a wheelchair quickly exposed the flaws of that material choice. The majority of the gravel that was spread was later raked up, leaving only a thin layer that provided traction, some leveling, and enough cover to enhance the design. It worked, but not in the way some of the other projects excel with respect to accessibility. The camp has learned to adapt, and the campers enjoy the natural quality of the cedar benches. Still, from an accessibility standpoint, some flaws remain.

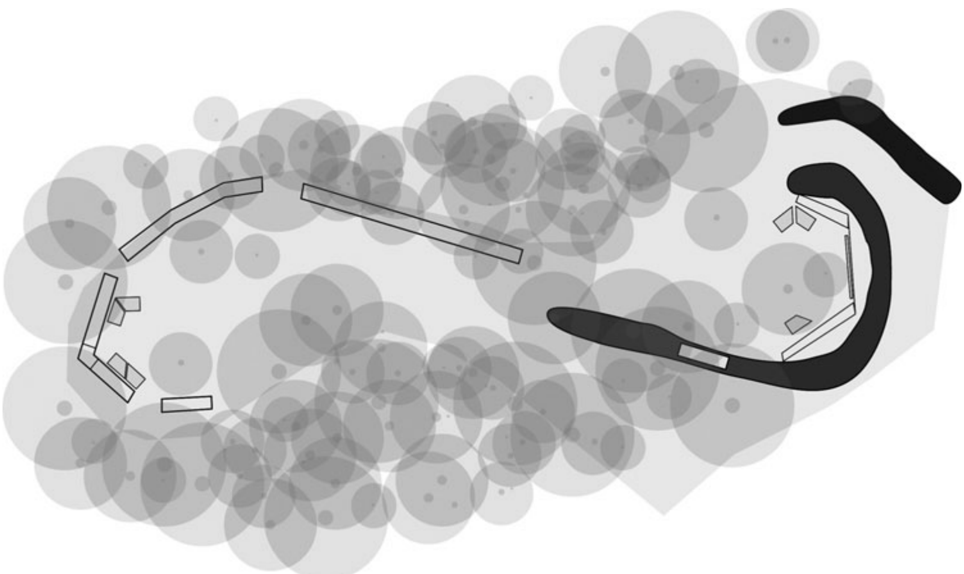

FIGURE 40.7 The organic quality of the Picnic Areas celebrates the natural setting.

Long description: The slope and composition of the site inspired the serpentine design. The two separate sites are designed differently, one, light and airy, the other, heavier and more rooted to the earth.

The ground plane is essential for mobility, and this project does not address that issue successfully. It is a lesson learned.

40.6 CONCLUSION

Design-build is difficult work, particularly in the Little Rock heat. Construction often falls behind, due to rain or other delays, and long days make everyone tired and tempers raw. Every summer, a new project creates new challenges, and different student groups deal with them differently. At the end of each workday, students walk away from the site with a tangible account of their accomplishments for the day. Memories of any arguments that took place during the day quickly fade as the students part ways for the evening. The reality of what they are accomplishing is reinforced each week at the closing ceremony for that week's camp. Images of the campers canoeing, fishing, sliding down the ropes course, and swimming made the students aware of the importance of their work. At some point during each 10-week process, the students forget that they are architecture students. Their original ideas, which were more academic than contextual, evolve into an architecture serving the campers. Slowly the students realize the "place" of Camp Aldersgate, and their willingness to make architecture specific to the campers and the context is apparent. They struggle to overcome their personal beliefs about architecture, and instead, listen to, or at least observe, their clients, children at camp who happen to have disabilities. The result of this realization is five projects that capture the place and the spirit of Camp Aldersgate. The individual designer is absent in the work, but the team members usually agree the project is better because of its collective design. Instead, the five projects, designed by 36 different students over the course of six summers, weave a common thread throughout the camp. The projects create new opportunities for the campers each summer and exist within the camp landscape as if they have been there from the beginning. They are sensitive to the experience of place and the making of memories, and where they do falter, they make up for it in other ways.

The relationship between Camp Aldersgate and the University of Arkansas Department of Architecture is unique. The camp benefits from acquiring new facilities each summer, and the university benefits from an opportunity to educate students in a hands-on, service learning setting. Each project serves a new role and teaches its own lesson. Upon completion of the Archery Pavilion, one student stated, "The opportunity to build and create a fun environment for the campers was the greatest reward. To see the children's faces while they were using the pavilion had such an impact on me. They made me realize you can achieve so much through architecture." These are the rewards of sweat.

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40.8 RESOURCES

For additional information on Camp Aldersgate, see www.campaldersgate.net.

CHAPTER 41
ARE RETROFITTED WHEELCHAIR ENTRIES SEPARATE AND UNEQUAL?

Jack L. Nasar

41.1 INTRODUCTION

To comply with the Americans with Disabilities Act (ADA) (1990), many buildings were retrofitted to make at least one entry accessible to people in wheelchairs. ADA called for "full and equal enjoyment;" and as a civil rights act, it follows the precedent from *Brown v. Board of Education* (1954) that "separate is not equal." Do the retrofitted separate entries offer full and equal experiences when compared to the older front entries? How do new "universally designed" entries fare? To answer these questions, two studies were conducted. The first had a diverse sample of adults evaluate the pleasantness of 31 entry routes (13 main, 13 retrofitted, and 5 accessible entries for new buildings); and the second obtained responses to the same routes from a more diverse sample of people who use wheelchairs or other aids to access buildings.

41.2 BACKGROUND

At a national conference on design research, wheelchair users had to go through the kitchen to access events, even though hotel staff had claimed the hotel was accessible. In a limited sense, the hotel was accessible to people in wheelchairs. They could get to events. But the separate access gave them a different, and presumably less enjoyable, experience. Designers may design front entrances to convey a special feeling of entry and to uplift the spirit. For example, Frank Lloyd Wright designed entrances to lead people through a series of experiences—separating the entry from the street, confining the entry path, and then opening it into a large space—a sequence that conveys surprise and an uplifting sense of entry. Other building entries have ceremonial steps and distinctive treatment in form, size, and detail to make the front door stand out. In contrast, retrofits to buildings to comply with the Americans with Disabilities Act (1990) and to give people who use wheelchairs access often use side or back doors not designed to convey a feeling of entry or to uplift the spirit. Even people who do not use wheelchairs may need accessible entrances. People using various types of walking aids may also use them. These retrofitted entries may give people who use them a separate and unequal experience. The present study sought to test that hypothesis.

In terms of accessibility, the United Kingdom led the way covering accessibility in housing, transportation, employment, and education in 1944 (Sandhu, 2001). In the United States, a series of laws led to the Americans with Disabilities Act, which set minimum standards for accessible design.

Three years later, the United Nations (1993) adopted standards for accessibility. While these efforts have led to improvements in accessibility, Lawton (2001) argues that they do not respond to the full spectrum of human needs and do not address affective experience. An environment may afford basic accessibility and satisfy a range of needs (such as, safety, function, cognition, autonomy, privacy, stimulation, and affiliation). It may fail, however, to afford satisfactory affective experience, in relation to psychological comfort and perceived dignity of individuality (Lawton, 2001; Preiser, 1983).

The ADA is a civil right. Section §302a states that "No individual shall be discriminated against on the basis of disability in the full and *equal enjoyment* of the goods, services, facilities, privileges, advantages or accommodations of any place or public accommodation." [author's italics]

Do entries retrofitted to meet the ADA minimum standards of access give people who need to use them "equal enjoyment" to the front entrance available for people who can walk in?

Universal design calls for more than the minimum standards of accessibility set by the ADA. *Brown v. Board of Education* set the precedent that "separate is not equal." Following this precedent, universal design, in its call for equity and social justice, is socially inclusive and calls for designs that "can be used by everyone" (Mace, 1988; Mace et al., 1991). It has seven principles: (1) equitable use, (2) flexibility in use, (3) simple and intuitive use, (4) perceptible information, (5) tolerance for error, (6) low physical effort, and (7) size and space for approach and use (Center for Universal Design, 1997; Preiser, 2007). While all these principles apply to building entries, one has special relevance to the psychological experience of retrofitted ones: principle 1, equitable use. For equitable use, everyone should have equal access to places. Consider retrofitted entries in terms of selected aspects of equitable use. Do such entries give all users the same means of use, identical when possible and equivalent when not? Do they avoid segregating or stigmatizing any users? Do they make provisions for privacy, security, and safety equally available to all users? Are the designs appealing for all users?

The seven Principles of Universal Design have three additional levels: guidelines, tests, and strategies (Center for Universal Design, 1997). The present research centers on the second level—tests—in relation to equitable use. Preiser (2007) referred to three levels of performance criteria for universal design: (1) health, safety, and security; (2) function and efficiency; and (3) the social, psychological, and cultural. The present study examined the psychological experience of building entries (from the third level). An earlier study had found that non-wheelchair users judged the routes for retrofitted entrances as least pleasant, the routes for the old main entrances as more pleasant, and the routes for the new accessible entrances as most pleasant (Nasar, 2009). Would those results hold for people who use wheelchairs and other aids to accessibility? The present study had several expectations.

1. For older buildings and setting aside concerns of accessibility, people who use wheelchairs and other mobility aids will judge the experience of main entry routes as more pleasant than retrofitted ones.
2. They will judge the experience of new (universally designed) entry routes as more pleasant than retrofitted ones.
3. They will judge the experience of new (universally designed) entries routes as more pleasant than old (less accessible) main entries.

The latter two represent lesser expectations because the test of these involves at least one other variable (building age) that may bias the results in favor of the newer entries.

41.3 METHOD*

To get participants, the researcher e-mailed four people who might have access to lists of people who use wheelchairs and asked them to circulate an e-mail request to participate in the study.

*All procedures were performed in compliance with relevant laws and institutional guidelines.

There were 24 people (8 males, 10 females, and 6 who did not indicate their gender). The mean age ($n = 18$) was 52.2 years (SD 11.2 years), making them older than the sample in study 1. Most described themselves as Caucasian (62.5 percent), with a college degree or more (75.0 percent), married (54.2 percent), and more reporting no children under 18 living at home (45.8 percent) than those reporting one or more children living at home (33.9 percent). Also 20.8 percent did not report their race/ethnicity, education, marital status, or number of children living at home. Some reported that they were single (12.5 percent), divorced (8.3 percent), or other (4.2 percent). In addition, 16.7 percent reported one child living at home, 12.5 percent reported two, and 4.2 percent reported three or more. Also 4.2 percent had some college or an associate's degree, 37.5 percent were college graduates, 12.5 percent had a graduate degree, and 25.0 percent had a postgraduate degree. Three participants were eliminated from the study, because they did not complete the ratings, resulting in a sample of 21 people.

Each participant saw and evaluated 29 building entry routes in one of four different orders. This sample came from 24 older buildings selected at random on the main campus of The Ohio State University. The sample included photos of the old and retrofitted entry route for 12 buildings plus the entry routes for 5 newer buildings, each of which had a main entrance usable by walkers and people who use wheelchairs or walking aids. These entries had powered doors with remote buttons. While these entries would not be considered universally designed (because they require more interaction than no doors, "air doors," power doors with a motion detector, or powered doors with a pressure sensor mat), they require less interaction than many other doors (Mace, 1988). Each route was photographed at equal intervals, or where the route changed direction. For each, participants would see a sequence of digital photographs of the route to the main atrium from the main entry, and from the retrofitted ADA entry. Research indicates smaller size effects from participants than from the environment (Stamps, 1999). The analyses centered on the entry conditions for old buildings, retrofitted buildings, and new buildings (see Figs. 41.1 through 41.4 for examples of each).

To lessen order effects, participants saw the entry routes in one of four different orders. They responded via an online survey. The e-mail request for participants asked people to go to one of four web sites depending on the first letter of their last name. This resulted in 8, 10, 5, and 2 respondents for each order of the entries.

The routes for wheelchair users and others using walking aids required more photographs on average (retrofitted entrance: mean = 14.77 photos, SD 6.37) than the routes for the older main entrances (mean = 6.31 photos, SD 1.84) and the new entrances (mean = 8.2 photos, SD 0.84). In addition, while many of the retrofitted entries were on the side or back of the building, no signs were found directing people to them. Although the study intended to focus on equitable use, the selection of the stimuli suggested that compared to other entrances, retrofitted entrances were less simple and intuitive to use, had less perceptible information, and required more physical effort; and in terms of those criteria, they were not equitable in use.

The survey instructions told respondents that the research team was studying people's evaluation of building entrance routes. They would see a sequence of photos of routes into buildings and rate the pleasantness of each route on a 7-point scale for pleasantness (from very unpleasant to very pleasant). To have them focus on the pleasantness of the route rather than its accessibility (the retrofitted routes were more accessible than the old ones), the instructions stated that "while accessibility is important, the survey centers on visual quality. *It aims to assess the visual quality of building entrance routes.* When evaluating each route, please ignore barriers to access (such as stairs, narrow doors, etc.). Imagine you are floating through the route, and simply rate the pleasantness of the experience of the route." The instructions indicated that there were no right or wrong answers, and the research team was interested only in their honest opinions.

41.4 RESULTS

The results confirmed that the retrofitted entries are perceived as separate but not equal. Participants rated the "equal access" entries as most pleasant, the retrofitted entries as least pleasant, and the "old main" entrances as in between (see Fig. 41.5). These differences achieved statistical significance

Building	Old Main Entrance	Retro Fitted Entrance	New (accessible) Entrance
Weigel Hall			
Sullivant Hall			
Caldwell			
Brown Hall			
Orton Hall			
Derby			

FIGURE 41.1 A table with three columns shows photos of 12 pairs of old main and retrofitted entrances, plus 5 new (accessible) entrances to new buildings.

Long description: The figure shows photos of 12 main entry routes, 12 retrofitted entry routes to the same buildings, and 5 new (accessible) entrances to new buildings. The main entries are designed to communicate that they are the main entrance. They often have large doors, set back and framed by building ornament or an arch, and steps leading up to them. The retrofitted entrances often look undistinguished. They are plain side or back service entries. The new (accessible) entrances to new buildings are designed to communicate that they are main entrances, but they have no stairs blocking access.

Health Center			
Psychology			
Math Tower			
Main Library			
Scott Laboratories			
Wexner Center			
Page Hall*			
Baker Systems			

FIGURE 41.1 (*Continued*)

Classroom Services			
Knowlton Hall			
Faculty Club			

* The renovation of page (completed in 2006) at the time of the study replaced the former main entry (shown on the right) with the entrance shown. However, because wheelchair users can only access it through an indirect route, we included the two routes in the study as old and retrofitted.

FIGURE 41.1 (*Continued*)

FIGURE 41.2 Eight-photograph sequence from outside, toward an arch-enclosed double door, up the stairs to the double door, into the ornate atrium space, down a hall to the main interior stairway and elevator.

Long description: The figure is an eight-photograph sequence from the outside of an old main entrance into the building, and to its main interior stairway and elevator. The first photo shows the raised arch-enclosed entrance in the distance. The second one (horizontally) shows a closer view (about 5 yd away) of the same entrance. The third one takes you inside the arch to the stairway of 15 stairs leading to the main double door. The fourth shows a close-up of the tall metal-framed glass double door. The fifth brings you inside the building to an ornate atrium, which has a row of white columns, with wood benches between them, on each side, one bright square overhead light, an ornate marble floor, and an exit door (similar to the entrance one) beyond the columns. The sixth shows an open door into a plain corridor. The seventh shows the plain corridor, which has carpet, hung ceiling with three overhead fluorescent light boxes, and two doorway alcoves on each side. The last photo shows an open area, with a stairway to the left, and another plain corridor straight ahead.

FIGURE 41.3 Thirteen-photograph sequence of retrofitted route from outside the same building as in Fig. 41.2 through a convoluted path to the same open area with the interior stairway and elevator.

Long description: The figure is a 13-photograph sequence from the outside of a building along the retrofitted route into the building and to its main interior stairway and elevator. The first photo shows the same raised arch-enclosed entrance in the distance as the first photo in Fig. 41.2. The second photo (horizontally) turns left to a tree-lined path. The next three photos (3 through 6) move along the tree-lined path. The seventh photo, along the same path, shows a bike rack with three bikes on the left and the building on the right. The eighth photo moves past the bike rack (to the last bike) and shows a 6-ft-high brick wall on the right. The ninth photo shows a more open view. The ninth photo turns right toward a single steel-framed glass door, with panels of glass on each side. The tenth photo moves closer to the door. The eleventh photo shows a view inside from the door to a small space with an elevator about 5 ft away. The twelfth photo shows the view from inside the elevator looking out as the metal elevator door closes. The thirteenth photo shows the same open area as the last photo in Fig. 41.2.

($F_{2,927} = 46.20$, $p < 0.001$). Post hoc comparisons between each pair of entry routes separately (old main versus retrofitted, old main versus equal access, and equal access versus retrofitted) showed that participants rated the equal-access entries as more pleasant than either the old or retrofitted one, and that participants rated the old entries as more pleasant than the retrofitted ones, and these differences achieved high levels of statistical significance (p's < 0.001). According to Cohen (1988), in the social sciences, effect sizes vary from small ($d = 0.20$) to medium ($d = 0.63$) to large ($d = 1.16$). The comparison of the equal access to the old main and the comparison of the old main to the retrofitted entrances represented medium-size effects; and the comparison between the equal-access and the retrofitted entries represented a large effect.

FIGURE 41.4 Seven-photograph sequence from outside a new building with an equal-access entry to the main interior atrium with elevator and stairway.

Long description: The figure is a seven-photograph sequence from outside a new building through its equal-access entry to its main interior atrium with elevator and stairway. The first photo shows a diagonal path toward a corner indented entrance on a four-story primarily glass and steel building. The second photo (horizontally) moves closer to the entry. The third photo shows a roughly 20-ft^2 concrete area outside the entrance and the entrance. The fourth photo moves toward the double glass door entrance. It is in an enclosed place, at the far end of a glass and steel wall on the left. A similar wall straight ahead helps frame the entrance. The fifth photo moves closer to the double glass door. The sixth photo shows the view inside the door of a wide, shiny, well-lit corridor, with glass to the right and what looks like a broader open space farther ahead to the right. The seventh photo shows the well-lit, shiny, open atrium space.

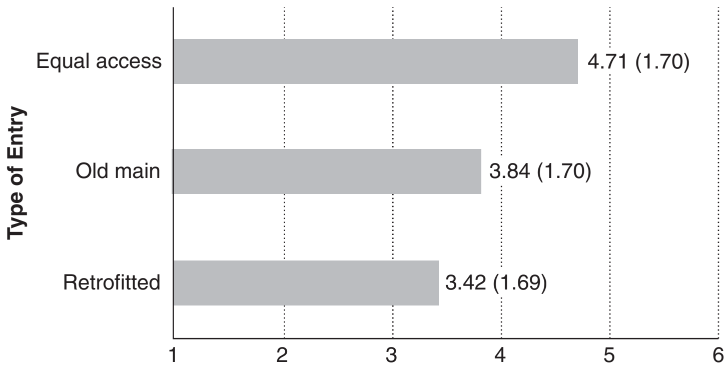

FIGURE 41.5 A bar graph shows that people rated the equal-access entries as most pleasant, followed by the old main entrances, and then the retrofitted entrances.

Long description: A horizontal bar graph for pleasantness ratings. The top bar (the longest) is labeled *equal access* and has a mean score of 4.17 and standard deviation of 1.70. The next bar, shorter, is labeled Old Main and has a mean score of 3.84 and a standard deviation of 1.70. The third bar, the shortest, is labeled *retrofitted* and has a mean score of 3.42 and a standard deviation of 1.69.

Recommendations

- Consider the visual appeal of the entry route for people who use wheelchairs or other aids to walking.
- Retrofitted entry routes, in addition to being accessible, should be appealing. When retrofitting an entry for wheelchair access, design the route and its characteristics to look good.
- For the best entrance experience for access and visual appeal, use a universally designed entrance, usable by everyone.

41.5 CONCLUSION

The Americans with Disabilities Act calls for "equal enjoyment" and, as a civil right, recognizes that separate is not equal. The results suggest that buildings retrofitted for wheelchair access offer separate but not equal entrances. Participants judged such entrance routes as least pleasant. Although the entrances to new buildings did not have the highest level of universal access, the remote, automatic door opener button did offer substantial access; and participants rated them as the most pleasant. Perhaps doors requiring less interaction by users (Mace, 1988) would achieve higher scores. However, this preference for the new entries may be an artifact of building age, design standards, and upkeep. The building with new entries opened a year or two before the study, while the newest of the other buildings opened more than 25 years before the study. Future research could use controlled simulations to test people's responses to entries varying in the level of interaction required.

Although it had a diverse sample of respondents, the study did not gauge long-term exposure to the entrances. People who use wheelchairs and other mobility aids must repeatedly use retrofitted entries every day. They do not have a choice (or control); and the repeated exposure to such separated and possibly stigmatized entries and the lack of perceived control might well depress the perceived quality of the experience, but it is possible that they adapt to the experience and thus perceive it as more acceptable.

This study centered on buildings on the main campus of The Ohio State University in Columbus. Perhaps different results would emerge for other campuses or other kinds of buildings. In addition, the static photographs (even though shown in sequence) probably evoked less intense responses than would occur for dynamic experience (Heft and Nasar, 2000). Future work should test on-site evaluations of entries to a variety of public and private facilities by people who use wheelchairs, walking aids, and others to ascertain their dynamic real-world experience.

To meet the integration requirement implicit in ADA, people with disabilities should, if possible, enter from the main entrance. A "practicality" exception may apply to historic front entrances that would have to change to become accessible, or to topographical issues that would make a ramp to the front entrance too steep. Because of the degree to which some side and rear entrances lack full functionality (because they are locked, require assistance, or do not result in entry to the main area), they do not comply with the ADA policy preference toward integration.

Beyond basic functionality, the present research looked at the psychological experiences of various participants. Universal design has the promise of "lifting the spirit beyond the minimum requirements of the Americans with Disability Act" (Preiser, 2007, p. 11). Vision dominates human experience of the environment. To lift the spirit and have equitable use, entrances and other aspects of the design should, at a minimum, look appealing to all users and avoid segregation and stigmatization. They should integrate rather than segregate users.

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CHAPTER 42
GUIDEPATHS IN BUILDINGS

Jon Christophersen and Karine Denizou

42.1 INTRODUCTION

The function of guidepaths is to aid and simplify orientation in buildings. The main aim is to improve way-finding between important functions or groups of functions. People with visual impairments are of primary concern, but well-designed and correctly placed guidepaths are helpful for everyone who attempts to find the way through a complex building. As such, this chapter is based on a study of guidepaths for persons with visual impairments done by the Norwegian research organization SINTEFByggforsk (Denizou and Christophersen, 2008).

42.2 RESEARCH ON GUIDEPATHS

The study was limited to conditions inside buildings and was commissioned by the DELTA Centre, a public body under the Directorate for Health and Social Affairs in Norway. The original project design focused on test results, evaluations, and practical user experience. However, an extensive search for literature through libraries and personal contacts in Europe and America gave few results. Guidepaths in outdoor areas dominate the literature. Studies evaluating and testing guidepaths in buildings were hard to find and dated from the 1990s or earlier. The available sources thus proved insufficient to merit a project. It was, therefore, decided that the study would deal with actual, built solutions and include a brief survey of existing guidelines and regulations. The former includes an international selection of examples. A comprehensive examination covering all varieties of guidepaths, however, was not attempted. All that was necessary was simply to record an adequate set of existing systems and designs to construct a typology. User requirements and testing were included as a short analysis of the existing literature. Criticism of solutions and requirements were mentioned where documentary evidence exists, or where problems or successes are clearly evident.

42.3 A TYPOLOGY OF GUIDEPATHS IN BUILDINGS

For the purpose of the typology and an investigation of design elements, guidepaths in buildings were defined as architectural elements that identify logical lines of connection between focal points. The term *guidepath* is used in a broad sense and includes architectural elements that guide circulation (such as walls, railings, and parapets); fixtures and ornamentation that indicate lines of traffic flow; and features that are designed and positioned specifically to aid persons with visual or (in some cases) cognitive impairments.

Guidepaths may be created by architectural elements, components, or markings that due to their form, color, or texture aid people with cognitive or sensory disabilities as well as other groups of users or individuals. People with reduced eyesight must be able to see the guidepaths; and blind people should be able to feel or hear them. The markings should not hinder other users or impede any building functions, and they should be aesthetically integrated.

The examples identified display considerable variety, particularly with regard to detailing (see "Design Elements" later), and they fall broadly into four main categories, which stem from major architectural elements:

1. Guidepaths as a main architectural feature or concept
2. Guidepaths in floor surfaces
3. Guidepaths on walls
4. Guidepaths in ceilings

Electronic guidance systems form a separate category, but are largely outside the scope of this chapter, which was strictly limited to architectural design. To be meaningful, a separate study, and a somewhat different approach, would be needed just to cover existing systems, if not the possibilities for future developments. Electronic systems are therefore only briefly mentioned toward the end of this chapter.

Guidepaths as a Main Architectural Feature or Concept

In two famous examples of twentieth-century architecture, the building layouts work as guidepaths. Thus, no additional guidepath features are needed. One, the Guggenheim Museum in New York City, is essentially a multistory spiraling guidepath. The other, the Louisiana Museum outside Copenhagen, Denmark, is laid out as a meandering route through and past the exhibition areas. Of more general architectural interest are solutions in which the spatial organization and, thus, the circulation pattern follow the dominating architectural grid lines to the point of coinciding with them. Obvious examples are Christian churches, in which the traditional central aisle is, in effect, a guidepath, that runs without a break from the entrance to the altar.

Guidepaths in Floor Surfaces

Guidepaths in floor surfaces (see Fig. 42.1) may be tactile and thus provide a surface contrast that can be felt through the soles of footwear or with a cane. Guidepaths may also be colored or give off light to set them apart from the surrounding floor surface, or they may emit acoustic signals. Likewise, all three strategies may be used in combination. An interesting development is the "tactile block," a type of floor tile that not only has tactile markings and comes in a variety of colors, but also gives off a sound that differs from surrounding flooring materials when tapped with a cane. The primary function of floor markings without tactile qualities, but only with contrasting colors, is usually ornamental rather than an aid to orientation. Many such markings, however, appear to give good indications of the direction of flow, turns, etc., and work well for many users with visual impairments.

Guidelines on Walls

Although walls give people with severely reduced eyesight a crucial means of orientation, guidepaths on walls (see Fig. 42.2) are a relative rarity. When used in the form of a handrail, a contrasting color, or a different material than the rest of the wall, the primary function is support, decoration, or to protect the wall surface from being damaged by knocks and blows. Examples are handrails, boards, or strips of metal along the corridor walls of institutions such as nursing homes and hospitals.

FIGURE 42.1 Guidepaths in floor surfaces. Left: Knobs attached to the flooring material. Cones signal a change of direction; tongues indicate the line of flow. Right: Dark lines indicate the direction of the flow (Severance Hospital by Ellerbe Becket, Jung Lim Architects, and Kesson International, Seoul, South Korea). [*Photos: Ed Steinfeld* (*left*), *Jon Christophersen* (*right*).]

Long description: The photos show guidepaths in floor surfaces, one tactile and one in color-contrast only. The tactile guidepath consists of raised tongues and knobs. The tongues indicate flow, and the knobs serve as attention indicators that signal change of direction and the end of the guidepath. The color-contrast guidepath is created by dark lines contrasting with light gray floor tiles.

FIGURE 42.2 Left: A combination of wall and floor markings in San Diego Center for the Blind. Right: Markings on the walls of a corridor in Ullern Finishing School, Oslo, Norway. [*Photos: Roberta Null* (*left*), *Karine Denizou* (*right*).]

Long description: Two photos of corridors. One, of San Diego Center for the Blind, has a strip of wood attached to the wall to indicate the line of flow. The wooden strip is placed at about the same height as a handrail. There are, in addition, contrast color floor markings along the walls. The other photo shows a main corridor in Ullern Finishing School, Oslo, Norway. The sections of walls between each of the classroom doors have a darker color and timber decorations. Both contribute to give the effect of a guidepath.

FIGURE 42.3 A strip of daylight can serve as a guidepath. (*Vals, Switzerland. Architect: Peter Zumthor. Photo: Karine Denizou.*)

Long description: A strip of daylight in the ceiling creates a guidepath on the floor and an attention indicator on the end wall of a corridor.

Guidepaths in Ceilings

Ceiling lights, particularly in the form of strip lights in the direction of the traffic flow (see Fig. 42.3), may provide some guidance for people who are able to distinguish between light and dark. However, as most people with reduced eyesight usually focus their attention on the floor, the utility of ceiling lights is probably limited. The most common feature is strip lighting placed in the direction of travel. Acoustic features may well play a part, but such examples are not known to the authors.

42.4 BUILDING TYPES

Guidepaths are most common in large, public buildings and in special-purpose designs such as institutions for older adults, schools for children with special needs, and workplaces with large proportions of people with visual or cognitive impairments. A handful of countries, Japan is the best known, require tactile and contrast colored floor markings in all public buildings.

Guidepaths are very common in transport terminals, particularly railway stations, where both tactile and contrast colored paths are systematically applied. Guidepaths are also used in educational, cultural, and health services buildings, but not always in a systematic manner and usually in contrast colors only. In shopping malls, libraries, and museums, guidepaths appear to be designed mainly for decoration rather than as an aid to orientation. Some big stores, such as IKEA, often employ a form of guidepath that leads customers through the entire store, from the entrance area, throughout the store, and to the checkout area.

42.5 DESIGNING GUIDEPATHS

Guidepaths may be planned as an integral part of the overall architectural solution, but are often installed after a building is completed. The former, however, is becoming increasingly common for public buildings, and many designers presently try out new materials and solutions, or rely on ready-made products that can be bought on the market.

Design Elements

Advice from local and national user organizations has established two or three basic design elements. These include (1) raised stripes or tongues indicating direction of movement and (2) short columns, cones, or a corduroy pattern as attention signals. In the Netherlands, Sweden, and Denmark, however, a termination-of-movement indicator commonly serves as attention indicator. A third type of marking, usually similar to the attention indicator, is often used to warn of a possible danger. Some countries have legislation or standards that require danger markings, for instance, at the top of stairs.

At the time of this writing, there is no internationally agreed upon guidepath standard, not even within the European Union, but some national norms and standards exist. The Japanese system of yellow floor tiles is the best known. The Danish accessibility standard (Danish Standard, 2001) is under revision and will include specifications for guidepaths. A Norwegian standard for universal design is in its final stage of development (Norwegian Standard, 2009 draft), and the EU is also working on new accessibility and usability standards. Lack of standards allows freedom for experimentation, but there is no record of results. Knowledge of user needs seems to be underdeveloped, and according to literature on the subject, existing designs may be based on severely flawed test methods. Planners and designers who were contacted as part of the study mentioned said that they would like to see a wider range of products, but also had difficulties orienting themselves in a somewhat diverse market.

Basic Design Principles

First, changes of direction need to be considered. Several national user organizations maintain that changes of direction should be right-angled. The Danish user organization, however, has recently concluded that curves may be used when it is commensurate with the predominant direction of flow.

Second, obstructions must be avoided. The Danish user organization (Danish Society for the Blind, 2004) recommends that clear space be at least 500 mm wide on either side of the guidepath. Further recommendations include a hierarchy of guidepaths, e.g., wide markings for the main circulation route and narrow strips (minimum of 20 mm) for secondary routes (see Fig. 42.4).

Third, contrast is an essential feature. The entire length of tactile guidepaths should have a surface texture that differs significantly from the rest of the flooring material, and the texture must be coarse enough to be felt through heavy winter boots. Contrast color is then not always essential, as the texture makes the guidepath easy to detect. The height of the projecting tongues, columns, or cones must, however, be balanced against the dangers of tripping, and the pattern must be spaced

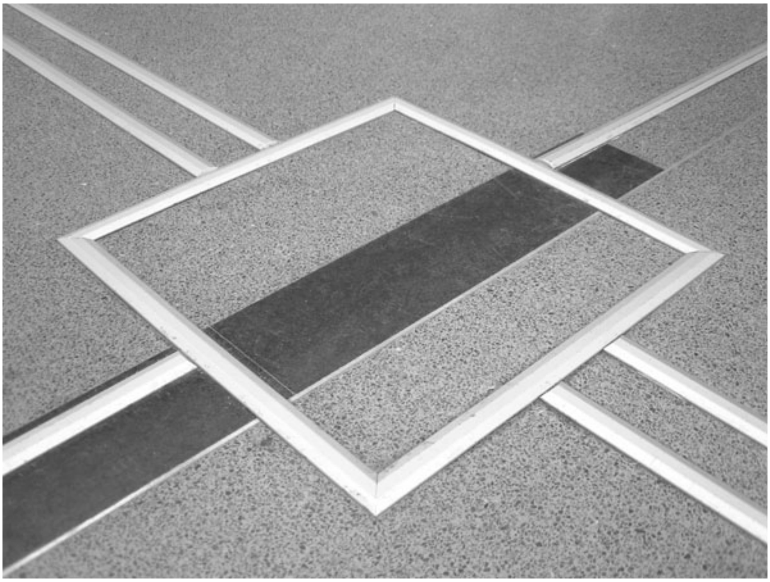

FIGURE 42.4 The outline of a square marks an intersection of two guidepaths at the University of Agder, Norway. Double aluminum strips mark the main route; single strips signal a secondary route, while the square serves as an attention signal. (*Photo: Wibeke Knudsen.*)

Long description: At the University of Agder, Norway, two types of tactile markers are used to create a hierarchy of guidepaths. Both are made from narrow stainless steel strips, but the main path is marked by a double line and the secondary route by a single line. Intersections are outlined by a square.

widely enough to avoid canes becoming stuck. Color contrast may be created by means of edge markings alone.

Fourth, the widths of guidepaths need to be considered. There is no general standard for the width of guidepaths; in fact, recommendations vary. However, there appears to be some consensus that guidepaths inside buildings do not have to be as wide as guidepaths outdoors. The reason is that acoustic and tactile signals are easier to detect, depending on the size of the space, noise levels, and various acoustic factors. Both Japan and Holland use the same guidepath widths indoors and outdoors. The recommendations from the Norwegian user organization (Norwegian Society for the Blind, 2004) discriminate between “guide-field” and guidepath. The former should have a width of 800 mm (32 in.) and may be combined with narrower guidepaths to form a hierarchy. The minimum width of a guidepath is quoted as 100 mm (4 in.).

Fifth, heights and locations of guidepaths are important. European and U.S. guidelines recommend lower tactile indicators (3 to 5 mm or 1/8 in.) than the Asian (particularly Japanese) tiles of about 5 mm (1/5 in.). The practical, built solutions vary—an example is that grooves about 2 mm (1/12^{t} in.) deep in the past have been used in some places in Europe. There are also recommendations for open floor space of about 0.5 to 0.75 m (20 to 30 in.) on either side of the guidepath.

Sixth, attention markings need to be considered. They have to be designed differently from the rest of the guidepath and should be found (1) at the stop and start of guidepaths, (2) at intersections and where directions change, and (3) at points of interest or destinations, such as counters, information boards, or machines.

Attention markings (see Fig. 42.5) vary considerably among countries. Some do not use attention markings at all, to avoid confusion with tactile markings signifying danger. Others use a different material from the rest of the guidepath. Yet others use cones or ribs at right angles to the direction of

FIGURE 42.5 Two types of markings. Steel knobs as found in front of the main entrance door to the Severance Hospital in Seoul (left) are fairly common. The Danish solution (right) in Kalundborg Central Station, made from white steel tiles, uses both tactile and contrast color. [*Photos: Jon Christophersen* (*left*); *Dansk Blindesamfund* (*right*).]

Long description: Photos showing two types of attention indicators. One is made from stainless steel knobs attached to a tiled floor and warns that the main door to the Severance Hospital, Seoul, South Korea, is immediately ahead. The other is a square made from white floor tiles and is intended to draw attention to an intersection between too narrow guidepaths.

traffic. Swedish (Svensson, 2001) and Danish recommendations, notably the Danish railway (Danish Railways, 2007), include a smooth area of 600 × 600 mm (24 × 24 in.). In Denmark this presupposes a guidepath with two ribs and a totally smooth floor. Under other conditions, the Danes recommend knobs over an area of 900 × 900 mm (36 × 36 in.).

Seventh, danger markings are crucial, but no consensus seems to exist as regards their use and design. For instance, recommendations have been removed from the guidelines to the Americans with Disabilities Act (ADA). The Norwegian Society for the Blind (2004) recommends knobs over an area at least 600 mm (24 in.) deep. Danger markings will typically be found at the top of stairs, at level changes, and at the end of guidepaths (see left half of Fig. 42.5).

Recommendations Box 42.1 Design Principles of Guidepaths

- Changes of direction should follow the general traffic flow, but the number of changes should be as low as possible.
- Avoid obstructions.
- Provide contrast, preferably both tactile and color.
- Consider the width of the guidepaths and possible needs for a hierarchy of guidepaths.
- Make sure that there is some free floor space on either side of the guidepath.
- Make tactile indicators sufficiently high, but not so high as to induce a risk of tripping.
- Attention and danger markings need consideration. The former should be used at changes of direction and at the start and end of the guidepath; the latter should be found in front of doors, at the bottom and top of stairs, or at other level changes.

42.6 TECHNICAL AIDS

Aids such as electronic guidance systems are sometimes combined with guidepaths in complex buildings. The systems rely on electronic devices that give off auditory or tactile signals, usually in the form of vibrations. The former is received through headphones or a telephone; the latter may be handheld or attached to a cane. In principle, any electronic guidance system has three functional components. One determines the user's position in space, the second is a special database of the environment, and the third is the user-controlled device.

Most of these systems are developed for outdoor environments; few can be used indoors. In many cases, they appear to be based on good, solid research (e.g., Loomis et al., 1998; Loomis, n.d.; Preiser, 1992). However, there remains the problem of knowing where to pick up the devices and learning how the system works. Guidepaths avoid this type of problem, but international standardization remains to be solved.

As with guidepaths, a variety of systems are in operation. Some recent developments utilize GPS technology and may be operated through a normal mobile phone, but GPS is not yet reliable inside buildings. Successful combinations of guidepaths and electronic guidance systems can be found in Utrecht central station in the Netherlands and the new Oslo Opera House. A prototype of the system described by Preiser (1992) was built at the University of New Mexico. Future developments may include using the camera in mobile phones to read pictograms and written signage and to read them out to the user (Helft, 2009). If this technology becomes widely available, it might render guidepaths obsolete.

42.7 OTHER FUNCTIONAL ASPECTS

Finally, in addition to aiding orientation, guidepaths must meet other requirements such as easy maintenance and cleaning, safety, and flexibility, and there are potential conflicts between these considerations and the main design aims. The importance of the additional aspects will vary according to the building type. For instance, there is a particular need for flexibility in many commercial buildings. Offices, shops, and restaurants are subject to frequent alterations as the demands for office spaces change, and displays and equipment are moved about, or the type of service changes (see Fig. 42.6). In contrast, most guidepaths are parts of a highly durable flooring material with a fairly long life span. Although guidepaths in floor surfaces must have a permanent contrast color, and preferably also be tactile, it should be possible to move them about as other parts of the building change.

With regard to cleaning and maintenance, the main problems appear to be: removal of excess water; cleaning between the tongues, cones, or columns; and damage caused by cleaning machines and general wear (see Fig. 42.6). Machines avoid the problem of excess water, but it is not sufficiently well known how far into the relief they are able to clean. They have also been known to rip off strips and knobs attached to the flooring. New products have largely overcome these problems, but the choice of cleaning methods and machines is important. Because it wears badly, the least satisfying but possibly most common solution is contrasting colored tape or paint.

42.8 CONCLUSION

There is a clear need for evaluation and development of reliable methods that test how users orient themselves inside buildings, how they may make use of guidepaths, and what information they might gain from them. In addition, methods and studies need to be developed that test architectural properties, such as easily understandable solutions, clear and legible plans, etc. This might be of particular interest at present, when planners and designers are experimenting with solutions, materials, and products. The relationship between guidepaths and other systems for way-finding also needs to be addressed. For best results, evaluation and testing should be done in actual buildings, rather than

FIGURE 42.6 Guidepaths have to be properly maintained—not as in the left photograph. They must also be left unobstructed; conflicts such as in the left photo must be avoided. [*Photos: Karine Denizou* (*left*); *Jon Christophersen* (*right*).]

Long description: Two photos showing building management problems. In one, there is a tripping hazard because damaged rubber floor tiles have not been replaced and the attempts at repairing them are unsuccessful. In the other example, an ATM has been positioned so that it obscures a part of the guidepath; there is thus a danger of collision.

laboratory environments (see Steinfeld and Danford, 1999). It should include both first-time visitors and regular users of the buildings, and it should test the usefulness of guidepaths for users with various disabilities, including sensory, mobility, and cognitive impairments.

A fair amount of psychological literature on way-finding and advanced technical solutions exists, but little is available on guidepaths in buildings. The articles by TG Lining (undated) and Steinfeld and Danford (1999) are critical to establishing evaluation methods, but need to be augmented by a more comprehensive means of testing.

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CHAPTER 43
REDEFINING DESIGN AND DISABILITY: A PERSON-ENVIRONMENT FIT MODEL

Jennifer Webb, Brent T. Williams, and Korydon H. Smith

43.1 INTRODUCTION

In 1962, Ed Roberts entered the University of California, Berkeley, against the protests of university and state officials who claimed he could not be successful in school or later in the workplace. "Special Ed" remembered one dean on campus, who stated: "We've tried cripples before and it didn't work" (Shapiro, 1994). Living in the university hospital, Roberts and 11 classmates with severe disabilities fought to overcome an inaccessible campus and community, attitudinal barriers, and stereotypes. Ed Roberts' life story illustrates the important role that social customs and design conventions play in activities of daily life, especially regarding persons with disabilities. More importantly, Roberts and his classmates helped to transform the popular and political definitions of disability locally and internationally. Through concepts such as universal design, the definition of disability is still evolving.

At their foundation, universal design and parallel concepts call into question the complex, dynamic, and reciprocal relationships between persons and the built environment. While theories have attempted to explain various physical and social facets of this relationship (e.g., Altman and Chemer, 1984; Bronfenbrenner, 2005; Gibson, 1977; Lawton and Nahemow, 1973), three primary challenges remain. First, no single theory explains all the complexities of human-environment relationships. While some theories have focused on the psychosocial and behavioral aspects of the person-environment (P-E) interaction, other theories have focused predominantly on ergonomic and other physical factors. A synthesis of multiple theories is required. Second, the P-E construct is ever-changing, as personal factors, e.g., aging, and environmental factors, e.g., moving, affect the overall structure and hierarchy. Change, as a dynamic concept, is difficult to model. Third, technological, economic, environmental, and sociological changes have led to innovations in design and shifts in cultural ideologies. Capturing both the zeitgeist and the potentiality for change in the P-E relationship is a challenge that needs to be addressed.

The purpose of this chapter, therefore, is to propose a new P-E Fit model that illustrates the complex, dynamic, and reciprocal relationship between people and their environments. Central to this discussion is the goal to eliminate the person-centric notion of disability. The P-E fit model undoes categorical definitions of disability and instead illustrates that "ability" and "disability" overlap as part of a continuum. This parallels the U.S. Census Bureau's redefinition of race in 2000 to include 63 possible race combinations, reflecting the increased diversity of the population.

Society, however, has been slower to see it this way. Brubaker and Cooper (2006) argue that the "reduction of American society into a multi-chrome mosaic of monochrome identity groups hinders rather than helps the work of understanding the past and pursuing social justice in the present." Effective design solutions, responding to the full spectrum of personal and environmental factors, must reinforce this new definition of (dis)ability. As such, the P-E fit model also proposes more expansive definitions and roles of design and medicine.

43.2 PERSON-ENVIRONMENT FIT

"Fit" is a concept familiar in clothing. Consider the perfect pair of jeans: size, color, style, and cost are just a few of the most relevant factors. The search for perfect jeans is often a lifelong pursuit (Reda, 2006). Achieving perfect fit in a home or community can be equally elusive.

The concept of person-environment fit was developed with regard to people and their occupations and vocations, and it has been applied to a variety of contexts (Caplan et al., 1974). Fit is simply the correspondence between two distinct elements, person and environment in this case (see Fig. 43.1). Fit is the central component of the model, illustrated in Fig. 43.1 as the overlap of person and environment. P-E fit exists on a continuum from complete lack of fit to optimal fit. The extremes, however, rarely occur. Instead, some degree of correspondence as well as incongruity is usually present, necessitating changes to aspects of the person and/or aspects of the environment (Lawton and Nahemow, 1973).

In the model, P represents a unique set of characteristics inherent to the individual, including both physiological and psychosocial aspects (see Fig. 43.2). Physical characteristics include biological health, sensory and motor skills, and cognitive ability, many of which can be objectively listed

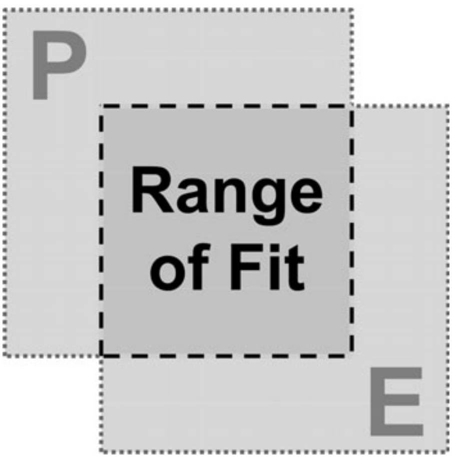

FIGURE 43.1 The range of fit model illustrates fit as the convergence of the person's and the environment's attributes.

Long description: Figure 43.1 illustrates range of fit as a function of personal and environmental factors. The person is represented by a square labeled P. The environment is represented by a similar square labeled E. The boundaries of both squares are dotted to illustrate they are permeable and dynamic. In a diagonal arrangement, the two squares overlap to form a third square, labeled range of fit. Range of fit is the degree of congruence between the person and the environment.

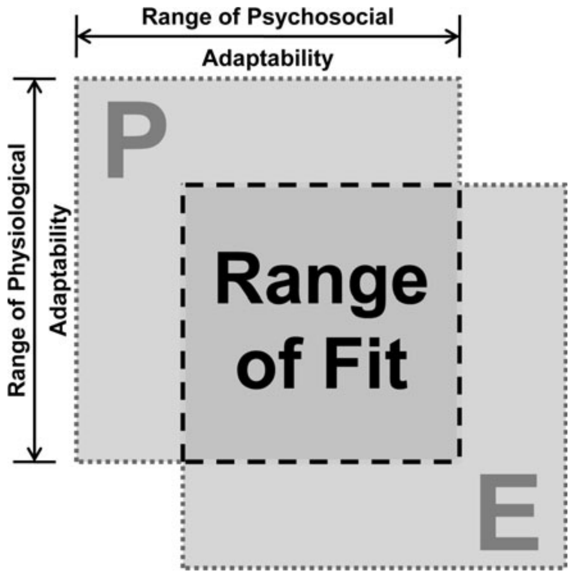

FIGURE 43.2 The second step in the creation of the range of fit model illustrates the additional components of a person's psychosocial and physiological attributes.

Long description: Figure 43.2 illustrates two attributes of the person P in the range of fit model: physiological attributes and psychosocial attributes. The vertical dimension is labeled range of physiological adaptability, and the horizontal dimension of the square is labeled range of psychosocial adaptability. Along each of these edges, there is a line with arrows at each end. The arrows hit barriers, suggesting that there is a finite range of adaptability for each person.

and quantitatively measured. Height, gender, pulmonary function, aural acuity, tactile sensitivity, long- and short-term memory, and presence of disease are a few factors (World Health Organization, 1980, 2001). Additionally, the psychosocial domain includes behaviors, emotions, world view, and self-concept. For example, these aspects are influenced by perception, religious beliefs, mores, and self-efficacy (Altman and Chemer, 1984).

More accurately, a person is defined through the interaction of all these factors rather than by an independent list of variables. For example, a person who has diabetes can experience serious, long-term consequences of the disease including heart and kidney damage, vision impairment, or damage to the vascular system. If this individual values good health, he or she will be motivated to control diet, exercise regularly, and take medications. If health and well-being are not a priority, disease outcomes can be severe. Additionally, poor health resulting from diabetes can negatively impact, by reducing the range of functioning, the individual's adaptability. Fit, however, is also influenced by the environment.

Like the person (P) side of the model, the environment (E) can be divided into two realms: the physical environment and the cultural environment (see Fig. 43.3). Natural environments (e.g., topography, climate, and flora) and constructed environments (e.g., transportation, sidewalks, and buildings) comprise the physical realm. Equally significant is the cultural environment, comprised of shared values and mores, political and legal codes, and cultural definitions and hierarchies (Altman and Chemer, 1984). Cultural environments include family and household structure, community ideals, and social and health care programs (World Health Organization, 1980).

As with people, environments are not defined solely by individual variables but also by their interactions, the interface between physical and cultural facets. Ed Roberts and his determination to

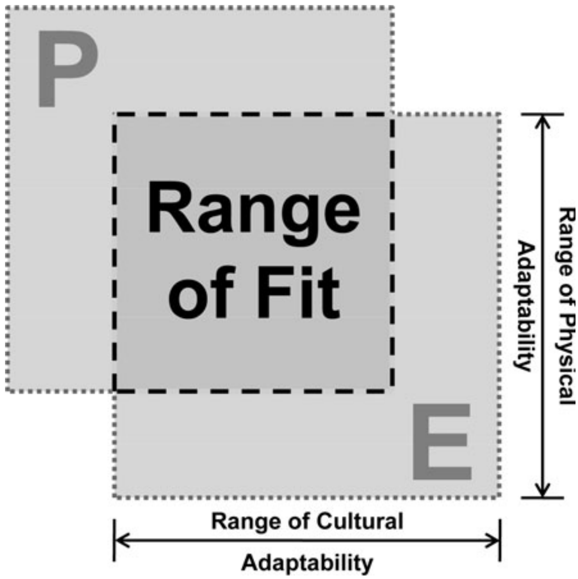

FIGURE 43.3 The third step in the creation of the range of fit model illustrates the additional components of an environment's cultural and physiological attributes.

Long description: Figure 43.3 illustrates two attributes of the environment E in the range of fit model: physiological attributes and cultural attributes. Range of physiological adaptability is represented vertically, and range of cultural adaptability is represented horizontally. Both edges are illustrated with a line with arrows at each end. The line, at each end, hits a barrier, suggesting that there is a finite range of adaptability for each person.

change the University of California, Berkeley, campus is a good example. A single person facilitated his use of the campus hospital as a dormitory. Combined with the financial resources to pay personal attendants, Ed changed attitudes of campus administrators, faculty members, and students. In six years, the hospital-turned-dormitory became a formalized program, and the city of Berkeley committed $50,000 to improve sidewalks. Likewise, students facilitated physical changes in the environment by changing values in the cultural environment (Shapiro, 1994).

43.3 THE DYNAMICS OF FIT

It is important to place all these examples in a larger context. Completing the 100-m dash, e.g., can vary from the world record holder requiring a few seconds to the individual who needs hours. Just as important as the total range of variability between people is the variability experienced by each individual. While a sprinter runs faster in a particular race, there is a range of time associated with everyone's day-to-day performance. A poor night's sleep, mental distraction, or temporary change in health status can alter performance. Arthritis can be influenced by temperature or time of day. Chronic illnesses can be long-lasting or cyclical, thereby influencing human functioning on highly variable schedules. For some individuals, functioning can be relatively static with incremental changes over time. For others, changes in functioning could be sudden and extreme. Judy Heumann coined the phrase "temporarily able-bodied," a concept suggesting that no person is or will be without a disabling condition in his or her life span (Rae, 1989). Temporary conditions include the aftereffects of flu, chemotherapy, stroke, or a car accident. Even careful lifestyles and health regimes do not negate eventual age-related changes. Individual changes occur asynchronously as a function of genetic makeup, lifestyle, and other factors. Representational models, therefore, are snapshots in time. Figure 43.4 illustrates how physical or psychosocial changes of a person (P) cause changes to the range of fit.

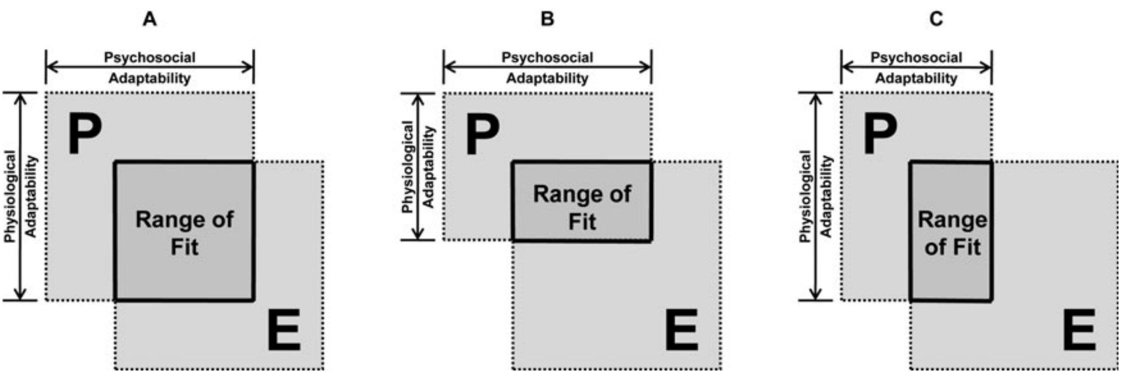

FIGURE 43.4 The sequence of diagrams illustrates (A) the person's unique attributes, (B) a decreased range of fit as a reduction in the person's psychosocial attributes, and (C) a decreased range of fit as a reduction in the person's physiological attributes.

Long description: Figure 43.4 uses three diagrams (A, B, and C) to illustrate the change in range of fit when a person's physiological and psychosocial adaptability is reduced.

Figure 43.4A illustrates the full range of human functioning along both physiological and psychosocial continuums (defined in Fig. 43.2).

Figure 43.4B illustrates a reduction in a person's physiological adaptability. A shorter, vertical dimension for physiological adaptability is drawn while the psychosocial adaptability dimension remains unchanged. The range of fit is smaller than previously illustrated as the person's physiological adaptability is smaller. Therefore, the person is now represented by a wide, short rectangle. The resultant intersection illustrating range of fit is also a wide, short rectangle.

Figure 43.4C illustrates a reduction in a person's psychosocial adaptability. A more narrow, horizontal dimension for psychological adaptability is drawn while the physiological adaptability dimension remains unchanged. The range of fit is smaller than previously illustrated as the person's psychosocial adaptability is smaller. Therefore, the person is now represented by a tall, narrow rectangle. The resultant intersection illustrating range of fit is also a tall, narrow rectangle.

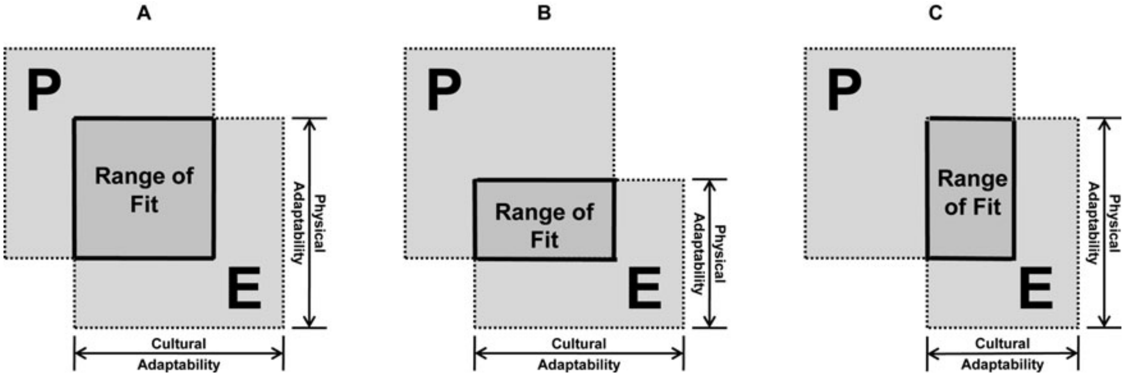

FIGURE 43.5 The sequence of diagrams illustrates (A) the environment's unique attributes, (B) a decreased range of fit as a reduction in the environment's cultural attributes, and (C) a decreased range of fit as a reduction in the environment's physiological attributes.

Long description: Figure 43.5 uses three diagrams (A, B, and C) to illustrate the change in range of fit when an environment's physiological and cultural adaptability is reduced.

Figure 43.5A illustrates the full range of environmental factors along both physiological and cultural continuums (defined in Fig. 43.2).

Figure 43.5B illustrates a reduction in an environment's physiological adaptability. A shorter, vertical dimension for physiological adaptability is drawn while the cultural adaptability dimension remains unchanged. The range of fit is smaller than previously illustrated as the environment's physiological adaptability is smaller. Therefore, the environment is now represented by a wide, short rectangle. The resultant intersection illustrating range of fit is also a wide, short rectangle.

Figure 43.5C illustrates a reduction in an environment's cultural adaptability. A narrower, horizontal dimension for cultural adaptability is drawn while the physiological adaptability dimension remains unchanged. The range of fit is smaller than previously illustrated as the environment's psychosocial adaptability is smaller. Therefore, the environment is now represented by a tall, narrow rectangle, and the environment remains a square. The resultant intersection illustrating range of fit is also a tall, narrow rectangle.

Human functioning also can be measured in discrete units on a variety of scales. Additionally, some factors will be more relevant than others in particular contexts. Cognitive functioning may be significant in employment type and performance but not relevant in social relationships. Decreased visual acuity may prevent one from playing baseball but not influence one's ability to work collaboratively, to perform housekeeping or parenting tasks. Variation in either psychosocial or physiological adaptability circumscribes the potential range of fit, from person to person. Figure 43.4 illustrates how physical or psychosocial differences from person to person lead to different ranges of fit.

If each person is unique, so, too, is each environment. Environments possess similar ranges of diversity. For instance, temperatures vary by more than 100 degrees from one region to the next. Likewise, services enabling independent living, e.g., job training, health care, and housing advocates, may be diverse in urban areas or nonexistent in rural settings. Figure 43.5 illustrates how physical or cultural differences from one environment to the next lead to different fits. These same factors may also change over time. Most public buildings, for instance, host a wide range of users over time. A hotel hosts a wedding reception one weekend and serves as the conference site for a local area agency on aging the next. Rural schools likewise house students during the day, extracurricular activities in the afternoon, and community groups in the evening. As such, multiple functions and multiple user groups require design solutions that are responsive and inclusive. Similarly, weather, position of the sun, and rainfall changes over the course of a day, a week, or a season influence building performance and context.

43.4 RECIPROCITY OF THE PERSON-ENVIRONMENT RELATIONSHIP

What universal design, visitability, life span design, and similar concepts illustrate is that the physical and cultural aspects of the environment and the physical and psychosocial aspects of people are interrelated. When the environment exerts pressure on the individual that falls within the person's range of functioning, the adaptive range is considered positive. Generally, this adaptive range would mean that the individual finds the environment to be challenging in a positive way because skills and abilities are being used. When the pressure falls outside of the person's range of functioning, adaptation may be negative as a function of atrophy or discouragement (Lawton and Nahemow, 1984).

For example, for a traveler with Parkinson's disease, traversing the distance between airport security and the boarding gate could be hazardous. Transitions from carpeted to hard surfaces designed to delineate space are difficult for individuals with shuffling gaits. Moving sidewalks, instead of facilitating movement, are treacherous for those with balance and reflex impairments. Trams designed to shorten travel time are only accessible to those capable of quick, well-controlled movements. Airports can exert pressure on persons with disabilities that fall beyond their range of functioning. Thus, an environment designed to facilitate movement behaves as a dynamic impediment to those whose range of functioning exists outside the reciprocity of the P-E relationship.

Just as important as specific reciprocity, as individuals pursue their daily activities, is the need for a broad range of spaces and places to incorporate inclusive design solutions. The range of P-E fit encompasses micro- and macroenvironments, as well as the continually changing range of functioning across the life span. We all want to live in a livable community. The reciprocity of a community plays a major role in facilitating independence and inclusion. A safe pedestrian environment, easy access to grocery stores and other visitable shops, a mix of housing types, and nearby health centers and recreational facilities are all essential elements that can positively affect the range of P-E fit.

43.5 CONCLUSION

The proposed model suggests that aspects of persons and their environments are contextual and circumstantial. People and their environments are not static entities. Human functioning changes on a moment-by-moment basis due to environmental factors, such as weather or location, as well as human factors, such as activity or illness. Similarly, preferences and needs change as life circumstances and roles change. Individuals must balance priorities and resources with needs and preferences. In spite of these forces, however, fit can be transformed.

Purposeful manipulations must be carefully weighed against one another to create a good person-environment fit. First, the interdependence of the major facets of fit—person and environment—must be understood. Second, person-environment fit must be assessed across scales: federal to local, policy to practice, and society to individual. Third, P-E fit must be understood across domains: health and housing, needs and preferences, physical and psychosocial. Finally, policy makers, health professionals, design and construction professionals, and the general public need to understand the ever-changing status of person, environment, and resultant fit, not categories.

Fit is a dynamic and complex process. The person-environment relationship is contingent upon the complexities of human intentions and changing priorities of the individual's role at a particular time and place. Improving person-environment fit requires changes to the person, the environment, or both, requiring emotional, physical, and/or monetary resources by individuals, families, society, or all the above (see Fig. 43.6). For example, alterations to the environment require materials, labor, money, and time. In parallel, changes to individual health, aptitude, knowledge, and attitudes require financial and other resources. In some cases, improving fit may necessitate a combination of medical and design interventions. As a result, inadequate fit is sometimes not fully addressed. Nevertheless, as with Ed Roberts, personal and environmental challenges need not be viewed as insurmountable, but can be viewed as catalysts for innovation.

It is critical for the proposed model that fit be defined by the interface of persons and environments at all scales. As the P-E fit model illustrates, variability is the norm. While the medical model focuses on the person, universal design (UD) focuses on the environment. The P-E fit model, however, illustrates the relevance of both, and that design interventions can be in either realm (P or E) as a means to improve fit. If the costs of improving fit are examined, it becomes clear that for some individuals, a medical intervention—pharmaceutical, surgical, psychological, or physical therapies—may be the most effective method of improving functioning. Medical interventions can,

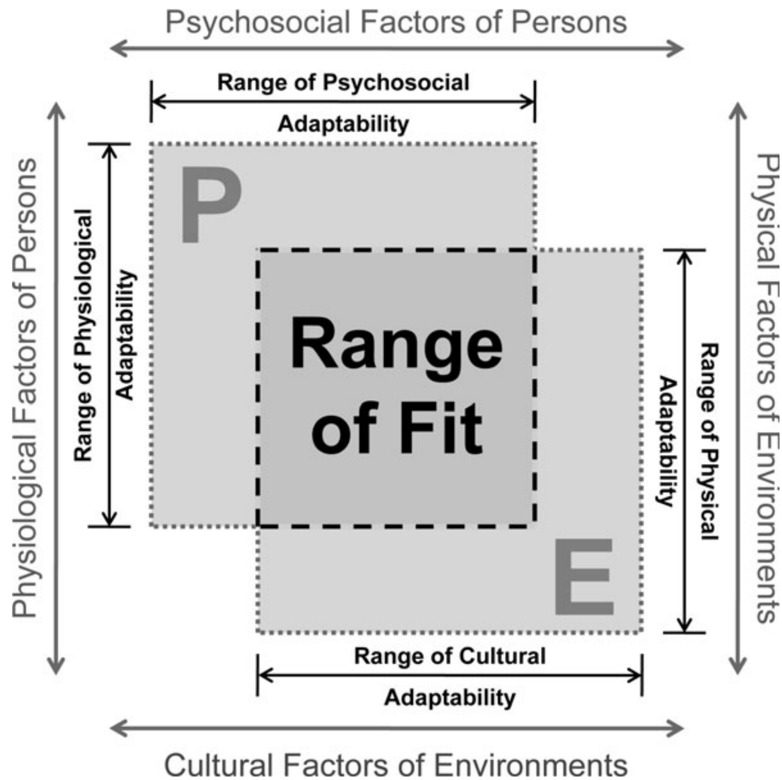

FIGURE 43.6 This diagram illustrates the person's and the environment's unique range of attributes in the context of all possible variation in people and their environments.

Long description: Figure 43.6, through the compilation of the previous figures, illustrates the comprehensive person-environment fit model.

As described earlier, the model is comprised of two large squares, representing the person and the environment, arranged diagonally with the overlap representing the range of fit (Fig. 43.1).

This arrangement exists inside a larger square, which represents the context of all possible people and environments. The diagram held inside the square, therefore, represents a specific individual in a specific environment.

at times, be the least invasive, least stigmatizing, and/or least costly of available options. In parallel, modifications to the cultural or physical environment may be the most effective or necessary means of improving fit. The P-E fit model places the onus neither on medical intervention nor on design, but rebalances the two, more accurately reflecting the realities of unique individuals in particular environments.

Through this model, the concept of UD evolves. The transformed definitions of (dis)ability and design allow for the separation of UD from its historical roots as a response to "specialized design" for "special" populations. Alternately, in the construct of the P-E fit model, UD comes to exemplify the fluid and contextual nature of people in the environment. Like many college students, Ed Roberts wanted to "go out and drink a little" (Shapiro, 1994). Later in life, like many parents, his priorities shifted toward family. While Ed's particular circumstances may have been "special," the overarching goal of achieving fit, as both a student and a parent, was universal. As such, the task for UD proponents may very well be to acknowledge the limits of environmental design as well as the vastness of human conditions.

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P • A • R • T
6

THE PAST AND FUTURE OF UNIVERSAL DESIGN

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CHAPTER 44

THE RHINOCEROS SYNDROME: A CONTRARIAN VIEW OF UNIVERSAL DESIGN

Jim S. Sandhu

44.1 INTRODUCTION

As overlapping design philosophies, universal design (UD), human-centered design, or the preferred European terms *inclusive design* (ID) and *design-for-all* have come a long way since their inception. Despite their separate beginnings, their overarching concepts developed in parallel. They all have two common origins: (1) the disability movement and (2) the impact of user-centered design on quality of life. In the context of this chapter, the abbreviation ID covers them all in a general sense, while UD refers specifically to American developments.

As can be gleaned from various chapters in this book, by far the most positive evolutionary change has been a move away from a particular group of people to a broader population regarding the impacts of design. Nevertheless, there remains a gap between theory and practice, indicating both problems and limitations. There is an urgent need to understand what these are in order to help rectify and to make the various approaches more effective. One key problem is the lack of application of UD/ID in the *majority world* (see Chap. 3), where even small changes can make a tremendous difference to the quality of life. Despite various claims, few practitioners are involved in UD/ID that affects the majority world. Another major stumbling block to evaluating the benefits of the UD approach is the recent practice of labeling conventional use of good human-centered design as UD. Adherents of the latter frequently incorporate these as exemplars and outcomes of the seven Principles of Universal Design (see Chap. 4).

Alongside the shift in focus to as many potential beneficiaries of good design as possible, where the prime objective was on usability and functionality, there is now an increasing trend to open UD/ID to include wider social, political, and legal issues. While this broadening of the concept is interesting and challenging, it is seriously worrying in epistemological terms. In some cases, UD/ID has moved away from the activity of designing, i.e., producing objects and environments for users, to mere abstractions, such as codes and standards authoring. Problems have resulted in sorting out UD/ID approaches, outcomes, principles, impacts, methodologies, and standards. This is not to be little the fact that demographic, legislative, and social changes are keys to understanding the broader implications of UD/ID. This broadening is of serious concern in the light of the seven principles, as they only apply to design and designing.

The author remembers the misinterpretation of the conference title *Design for the 21st Century* by many nondesigner friends who thought it was a new utopian approach to sort out the whole of society. In a similar vein, the author remembers the tussle between the promoters of design methods in the 1970s and its opponents. The latter did not acknowledge that design methods had anything to do with creativity; they believed the methods stifled it. Similarly, there is little evidence that the seven principles make any positive or negative impact on creativity either. Interestingly, there was a similar accusation when Goldsmith's (1963) guidelines were published. Architects and designers applied the given anthropomorphic data without translating them into other design aspects. Dimensions and anthropometric data were deemed more important than serious user or usability considerations. All this has been coupled with a highly United States–centric conception of universal design, as discussed below.

44.2 A CRITIQUE OF UD

Ron Mace's coining of the phrase *universal design* in 1985, although held in high esteem by many, is problematic for multiple reasons. One problem is the terminology itself; another is the way in which the term has been applied. In the absence of any other credible reference, aside from the "universals" of philosophy, one is forced to rely on the dictionary definition of universality: "That quality in a work of art which enables it to transcend the limits of the particular situation, place, time, person, and incident in such a way that it may be of interest, pleasure and profit (in the non-commercial sense) to all men at any time in any place" (Cuddon, 1999). In the context of UD, this is an inapt definition and does not take us any further to clarify and articulate that concept. Whatever its genealogy and claims, UD is largely an American phenomenon. A few European politicians have mentioned it in the context of broad European objectives for equalization of opportunity for its citizens, but unlike design practitioners in Europe and other parts of the world who rarely use the term, the politician's approach is largely conditioned by a process that lies at the hub of the American zeitgeist: the marketing of a lifestyle.

Having labeled something in such an amorphous manner as *universal design*, one would expect the inclusion of some developments outside the United States, to show some understanding of the term and to encapsulate *universality.* But there is not a single reference or awareness of key developments in any other parts of the world, least of all Europe, in Mace's aforementioned work. This isolationist mind frame persists, to some extent, to date. At the politico-commercial level, developments clearly indicate that the United States is not the world leader in implementing inclusive design, but better at packaging and marketing it. It is a prime case of McLuhan's (1994) statement, "The media is the message." Adequate packaging is the completion of the process. The 2008 U.S. Presidential election and the right-wing focus on the packaging of "patriotism" is one example. The recent blatantly untruthful packaging and diatribe against the British National Health Service in order to belittle U.S. President Obama's health service plan is another.

Conversely, the European approach is low key, more focused on context, process, and practice. The essence of the message is in the process and its implementation. At the hub of the European approach is the recognition that without people any ideology based on design is utterly meaningless, however well packaged it may be. People appear to be an abstraction in the UD approach, despite the long existence of excellent organizations, such as Adaptive Environments, the Trace Centre, and the Veterans Administration. Consequently, one by-product of this repeated mantra of universal design is that it has become academic, formulaic, and remote. Strangely, these very qualities are at the hub of its attractiveness to countries such as Japan and Korea, but have made little impact on emerging giants such as India and China. Thus far, universal design has had little connection with poverty and rural populations, even in the United States (see Chap. 28). The only marginalized groups upon which UD focuses in the so-called developed world are older adults and persons with disabilities. As this was the very starting point for inclusive design, design for all, and universal design in the mid-1990s, there would appear to be hardly any progression. In this regard, American proponents of universal design have failed to understand that European designers were already concentrating on the needs of persons with disabilities since the mid-1960s.

In spite of his promises, Mace makes no attempt at drawing out the links between demographic, legislative, economic, and social changes throughout the twentieth century. This is a serious remiss. Without these links, in the context of both the United States and other developed countries, the use of the term *world* much less *universal* becomes problematic. It simply reverts to a cliché, implying little understanding of *universality* by Mace and other UD proponents. Their continuing use of the term subscribes to a very narrow spectrum—a highly limited scope of cultural experiences and design contexts. Not only is the link between demographics, legislation, and economics deficient, but there also is an underlying assumption that there is somehow a United Nations of universal design to which all should subscribe.

For example, there is no mention or acknowledgment of Goldsmith's pioneering work, first published in 1963, in the majority of the U.S. literature. *Designing for the Disabled*, however, made no pretense at being embedded in civil rights or antidiscrimination. In the historical context, Goldsmith's work was ahead of anything yet published on accessibility guidelines in Europe, the United States, or the world. Despite focusing largely on domestic developments, the American UD movement has, at times, been open to outside influences, e.g., the Nordic *normalization principle*. For the most part, however, as described in much of the U.S. literature, UD is predominantly an American phenomenon. A deeper look at the history of UD, nevertheless, illustrates a different account.

At the time of the struggle for civil rights in the United States, which mostly focused on racial equality, the EU had passed *Resolution A.P. (72)5: On the Planning and Equipment of Buildings with a View to Making Them More Accessible to the Physically Handicapped* (Council of Europe, 1972). The resolution covered some basic accessibility guidelines long before any other country, excluding the United Kingdom. Two years earlier, the United Kingdom passed the key *Chronically Sick and Disabled Persons Act* of 1970, which made accessibility to the home a core issue and a legal right. Since 1944, the United Kingdom has been in the forefront of legislative measures to benefit persons with disabilities, such as *Disabled Persons Employment Act* (1944 and 1958), *The Education Act* (1970), *The Housing Act* (1974), *The Transport Act* (1968 and 1982), *The National Health Service Act* (1946), and others.

Starting from the early 1960s, one of the key developments in the Nordic countries was the concept of *normalization*. It sounds strange and out of place in 2008, but by the early 1970s, it was a key concept driving design and social policy changes in northern Europe. Normalization was also a major influence on U.K. legislative measures. Initially its focus was entirely on people with learning disabilities, but in practice it slowly began to include a much broader population. To paraphrase, normalization meant "making available to those with learning and physical difficulties conditions of everyday life which are as close as possible to the norms and patterns of the mainstream of life" (Nirje, 1969). At the time, aside from Goldsmith's guidelines, there were no serious efforts to formulate an overarching design philosophy. Small-scale efforts, such as Sandhu's course Design for the Non-Average at the School of Architecture, Polytechnic of Central London (starting 1974), were geared toward broadening students' awareness rather than formulating and packaging a design philosophy. The packaging of formal standards is not typically a European approach.

Standardization of design approaches to social issues is fraught with dangers and misunderstanding. Arguably, this has been the case for universal design. One main reason UD has survived to date is the power of the American image and international public relations. The marketing of UD is a product of its time and therefore possesses a "sell by" date. Upon reaching that date, UD begins to lose value and veracity, unless seriously updated as a concept. Other design concepts and styles, such as modernism, have seen a similar fate. Not only has UD not been updated, but its very origins lack empirical credibility and a deep historical analysis. To repeat again, there is very little universality in the very process of developing the concept.

44.3 THE RHINOCEROS SYNDROME

In 1515 the great German painter and printmaker Albrecht Dürer created a woodcut of an Indian rhinoceros (see Fig. 44.1), which he had only heard about, but never seen. Despite its anatomical inaccuracies, Dürer's woodcut became very popular in Europe and was used by other artists to represent rhinos. In the absence of facts, everyone subscribed to the artistic licence until about 1750 when a few real Indian rhinos were shipped to Europe. For the first time, people realized how wrong

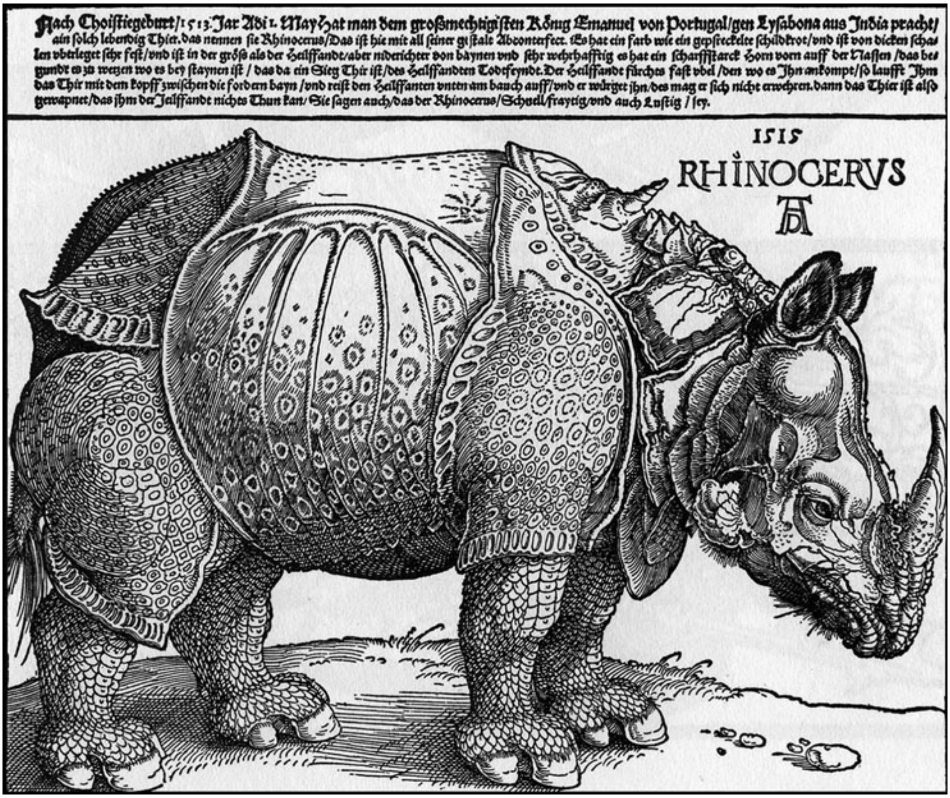

FIGURE 44.1 A black-and-white woodcut print of an Indian rhinoceros by the German engraver Albrecht Dürer done in 1515 from written descriptions of the animal.

Long description: Black-and-white woodcut print of an Indian rhinoceros by the German engraver Albrecht Dürer completed in 1515 from written descriptions of the animal. The image was treated as a true likeness for many years until Indian rhinoceroses arrived in Europe.

Dürer had been. This anecdote—the *rhinoceros syndrome*—exemplifies the concept of something existing on a false premise or misunderstanding. In many ways, universal design is like Dürer's woodcut rhinoceros.

Why be earthbound when you could design for the Venusians, whatever they were, or creatures from the nearest galaxy? It is a typical Hollywood hyperbole. Go for the biggest, greatest, all-encompassing—*universal*—to a point where no other expression could surpass it. The term becomes even more absurd when seen entirely from its original architectural perspective. What about other design disciplines that impact our daily life and environment? How universal could they be? Could the next fashion be *multiversal* design?

For instance, Nielson's (1993) *Usability Engineering* (see also *Common Functional Specifications: Usage Implications*, 1991) was among the first to contain diagrams on usability. Nielsen's work, plus the European Commission's RACE (Research in Advanced Communication Applications in Europe) program, which had multimillion Euros allocated to ergonomic and human factors research, provided the basis of the seven Principles of Universal Design, among other sources. The major problem is, aside from Japanese designers, who champion UD and who have seriously endeavored to contextualize it, few practicing designers worldwide utilize the seven principles as a prescription for good design. Most great contemporary designers, such as James Dyson and Jonathan Ives, use their experience, design methods, creativity, common sense, and knowledge of materials and fabrication

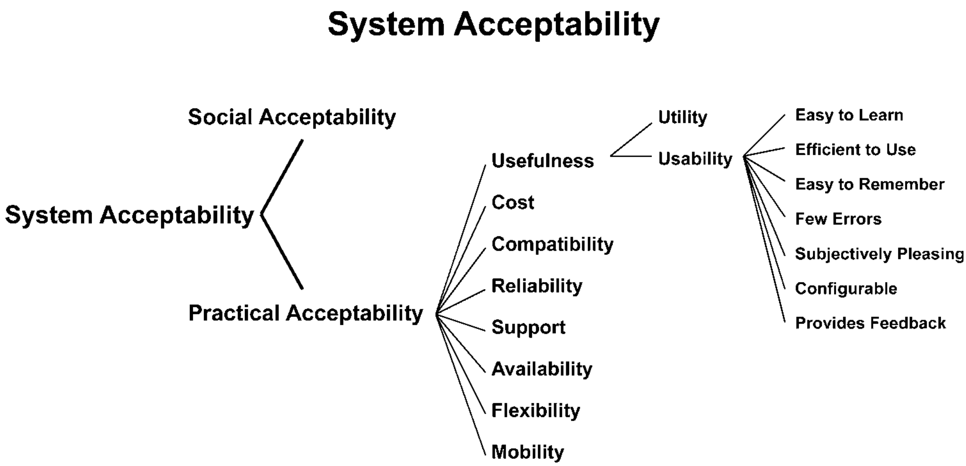

FIGURE 44.2 The system acceptability diagram describes attributes that impact the usability of a product or system. **Long description:** This diagram was evolved by Sandhu from various sources in 1991 to clarify usability issues for a European Commission–funded project called RACE-TUDOR 1088 which focused on telecommunications, disability, and aging. Since then it has been used at over 20 international conferences and in several publications.

techniques and ergonomics to produce good design. As a practicing designer with over 80 designs in the marketplace since 1971, the author does not know of a single instance where UD, as formulated, has been used to help people in the majority world. Why? Principles, prescriptions, and formulas do not bring about knowledge, understanding, or better design. It is only when these are tempered by experience that user-centered design results.

Figure 44.2 was assembled by the author from his experience, various RACE projects, and one 1991 BT publication mentioned earlier. It was, subsequently, modified in the light of Nielson's findings and was first published in the Newsletter of the European Institute for Design and Disability (EIDD) in 1993. The main drive for evolving the diagram was to clarify usability issues for a pan-European Commission-funded project called RACE-TUDOR 1088.

The column to the left in the diagram is a key to this chapter, as it puts everything in the context of historical developments. Surprisingly, the diagram has seven attributes of usability, but makes much more holistic sense than the seven Principles of Universal Design. In the context of the majority world, it presages topics such as cost, compatibility, availability, and support, further clarifying what is meant by the rhinoceros syndrome.

Integral to the rhinoceros syndrome of UD is that it is often presented as a formula for solving complex problems that require much more substantial investment by governments, not simply design interventions. The rhinoceros syndrome of UD exaggerates the promise of what design can do for the world, raising false hopes and expectations, expectations that UD is in no position to fulfill. The very term *universal design* may have reached its linguistic apogee, and may only proceed further by drawing on the theater of the absurd. The newly formed World Commission on Universal Design, founded in the United States, signals this, especially with its predominant focus on architecture. What next, the U.S. Global Council on Universal Design for the Prefabrication of World Happiness? Subjective expressions such as *Beautiful Universal Design* (Leibrock and Terry, 1999) simply exacerbate the problem. Add to that the notion that UD is somehow tied to humanity and associated social sciences, and one gests a movement that pushes the tectonic plates of design to their breaking point. Most recent to these developments is "The Potential Ritual for Universal Design" (Rajabi, 2009), which endeavors to introduce religion into the conundrum of design. Of course, it is all well meant, but the focus is more on *universal* and less on *design*. As design is a direct agent of change, it would be preferable if *universal* were subservient to the tangible activity of design.

44.4 THE WAY FORWARD

In contrast, to the aforementioned criticisms, several U.S. groups have made key advancements, such as the web site designersaccord.org. In addition, another U.S. organization deserves the highest respect for its pioneering work and focus on exemplars and case studies as teaching tools. The Institute for Human Centered Design emerged out of Adaptive Environments in Boston at the turn of this century. Over the years, it has taken careful and systemic steps to be inclusive of the majority world. It has a long, challenging journey ahead, but it has taken all the right steps to ensure a positive direction.

The third exemplar is this book, though largely United States–focused, speaks for itself as a base for discussion, communication, exchange, and development of ideas centered on UD/ID. It is most welcome that the editors are seriously concerned about including the needs of the majority world and other key issues, such as sustainability, and have enabled a contrary view to be included.

Key Issues Raised in the Various Chapters of the Book

Many of the key issues raised in the book are evident by their absence. Some of these have been discussed earlier. Many of the chapters give the impression that UD is concerned with exclusivity rather than giving voice to the widest range of users. Some adherents are beginning to sound like high priests possessing arcane and esoteric knowledge. This has resulted in a lack of critical questioning of UD. Coupled with the lack of focus on *design* discussed in the previous section, the American notion of universal design may be a discredited movement within a few years.

Developing the Seven Principles for Greater Inclusiveness

The seven principles were culled from a number of existing European and U.S. sources. To be viable in the coming years, it is clear that the seven Principles of Universal Design must continuously develop and evolve. Revisions must include the concepts of coherence, cost-effectiveness, design for self-sufficiency, sustainability, cultural contexts, modularity, environmental considerations, poverty, designing out waste, sustainable packaging, designing for emergencies, design for disaster relief, patient safety, standards, and other human-centered issues in order to be a comprehensive tool. While it is clear that few of these topics have been addressed by UD to date, they are increasingly at the forefront of mainstream design. This presents an interesting paradox. On one side, much of the UD movement has been relatively static since 1993 including the evolution of the diagram seen in Figure 44.2, which started in 1991. On the other side, mainstream design encapsulates the elephant paradigm—strong, reliable, dynamic, trusted, flexible, and embedded in the best principles of design history—a critical questioning of future viability. While UD protagonists focus on dependency on their so-called principles, designers who focus on the elephant paradigm believe that design will evolve to be an outcome enabler rather than deliverer, creating tools to enable people to design for themselves. Design that incorporates the elephant paradigm will be far more dynamic, evolutionary, and superior to anything that UD has delivered to date. This is a mind set on which UD could build.

The Role of Standards in the Process

Addressing needs earlier rather than later in the design stage enables producers, at little or no extra cost, to design and produce products, services, and environments that more people can use. Standardization greatly influences the design of products and services that are of interest to the consumer and therefore can play an important role in propagating UD/ID. The implementation of standards can ensure faster development and enhance the quality of life in the majority world.

Consumer Focus

ANEC stands for the European Association for the Co-ordination of Consumer Representation in Standardisation, in short, the European consumer voice in standardization. ANEC, of which the author is a founding member, was established in 1995 as an international nonprofit association under Belgian law to defend consumer interests in European standardization and to counterbalance industry agendas. ANEC's prime focus is on standardization in child safety, design for all, domestic appliances, the environment, information technology, and traffic safety. ANEC's user-centered approach has been specifically geared to meet these requirements. To synthesize, ANEC strives for

- *Access:* Can people actually get the goods or services they need or want?
- *Choice:* Is there any? And can consumers affect the way goods or services are provided through their own decisions?
- *Safety:* Are the goods or services a danger to health or welfare?
- *Information:* Is it available, and in the right way, to help consumers make the best choices for themselves?
- *Equity:* Are some or all consumers subject to arbitrary or unfair discrimination?
- *Redress:* If something goes wrong, is there an effective system for making it right?
- *Representation:* If consumers cannot affect the supply of goods or services through their own decisions, are there ways for their views to be represented?

The association, which has an excellent track record in Europe, could be a model for parts of the world that lack a consumer voice, which is the majority of the world.

Methods and Metrics to Assess Impact

To progress further and to validate itself, UD requires empirical evaluation metrics to assess effectiveness based on extensive case studies (see Chap. 38). Without the metrics, no amount of rhetoric about UD will be convincing. To be viable, the metrics have to focus first and foremost on the effectiveness of UD as a whole, followed by evaluation metrics for each of its discrete parts. To be credible, the overall metric has to be distinctive and specifically geared to UD as it claims to be on a higher level than conventional design practice. The objective to be addressed is: by what empirical measures and criteria can one assess UD's effectiveness in the various contexts of its use? The last phrase is an important key. The first edition of *Universal Design Handbook* (2001) did not lack impact assessment or evaluation methodologies of UD. Most of these were good and culled from systematic design methods. However, they lacked context and the complexity of in situ experience. There is a vast difference between carefully controlled laboratory experimentation and the real-life theater of the majority world.

The metrics for its discrete parts are easier to apply to UD as it has a framework of its principles. Aside from empirical validation of each of the seven Principles of Universal Design, further questions need to be addressed. How would one apply *equitable use* to those who cannot afford, cannot access, or are aware of one's design? What is the degree and extent of *flexibility of use* in the context of a slum dweller? To what extent can design compensate for illiteracy, lack of know-how, etc., i.e., *simple, intuitive use*? Similar questions apply to all the other principles in terms of effectiveness, usability, efficiency, and satisfaction. What is clear is that the protagonists cannot under any circumstances use examples such as the *universal house* or curb cuts, because the first is not universal by any account, and the second goes back to 1958. Rather than simply evolve the UD principles from existing work, it may be more useful to evolve tools for assessing the principles.

The metrics need to reflect elements of the U.N. Standard Rules for the Equalisation of Opportunity, the U.N. Millennium Development Goals, Fundamental Human Rights—in other words, design that caters to poverty, marginalized groups, and mainstream populations. Closely related to these is the requirement that design ensure seamless provision of services, social participation, a sustainable environment, and respect for an individual's dignity, autonomy, and independence.

A final task for the protagonists would be to undertake risk analysis of UD, generally, and the principles, in particular. If they claim originality for the principles, then they must accept serious responsibility if things go wrong, especially for products and services for vulnerable people. For instance, why was fire safety in relation to buildings only briefly mentioned in the thousand-plus pages of the first edition of *Universal Design Handbook* (2001)?

Public Procurement

Public procurement, like cost-effectiveness, affordability, and standardization, does not figure directly or indirectly in the seven principles of UD. In Europe, as in the U.S. Amendment Acts 504 and 508, public procurement is a major agent of change and provision. Where it works well, it promotes good design. There is strong evidence that suppliers and manufacturers who cater to public bodies pay particular attention to this regulatory and equal-opportunity measure.

The Case for the Majority World

One-third of the world population lived in cities in 1950. In just 50 years later it had risen to one-half and it has been estimated that it will continue to grow to two-thirds, or 6 billion, by 2050. In terms of population densities, spatial distribution, economic activity, and social attitude, the world has become urbanized. After a half-century of intense global urban growth, the United Nations and its individual member states now recognize the powerful developmental role that cities play as well as the challenges they face. By far the most alarming aspect of this urbanization process has been the deepening urban poverty and the growth of slums that now envelop nearly 1 billion people worldwide. If unchecked, it has been estimated that this figure will multiply to 3 billion by the year 2050.

Designers seriously need to be involved in ameliorating the situation. To repeat, there are no easy formulas that can be applied here. Fundamentally, urban poverty and slums are not just a matter of local improvement but of regionwide and national development policy. It is extremely rare for design and designers to be involved in the ameliorative process, but it needs to become more central in the future. In this author's recent experience of working in south India, it is not effective to present solutions to bureaucrats in terms of UD and the seven principles. It is more beneficial to focus on the economic and social roles that design can play relative to larger government policies and local issues.

The Impact of Globalization

In some ways, the world is smaller than it has ever been. Its 6 billion citizens are closer to one another than ever before in history. Jobs in Europe and the United States depend on trade with or investment from abroad. People travel more, but so do pollution and disease, as seen in the recent spread of SARS and swine flu. Paradoxically, people are also farther apart. While the quality of life rises for many, as a result of globalization, more than 1 billion people live in extreme poverty, forced to live on a tiny income and inadequate services. More than 600 million among this group have a disability, largely due to poverty, malnutrition, environmental pollution, and social attitudes.

The downside of globalization needs to be noted. One definition of globalization is that capital flows from rich countries to poorer ones in order to exploit cheap labor and natural resources. Over the past 20 years this has frequently resulted in bribery of local officials, exploitation of women and children, unequal opportunities, terrible environmental disasters, and suppression of trade union activity. Another feature of globalization is the provision of state subsidies in richer countries to producers, which nullifies the development grants given to poorer countries. The United States subsidizes its cotton producers to a point where it is cheaper than any produced in the majority world. The same applies to the EU's sugar manufacturers or Italian tomatoes, which are cheaper than the local ones in Ghana.

Reducing poverty is not just a moral issue. The closer people are connected across the continents, the more they become dependent on one another. Moreover, if humans do not take action now to reduce global inequality, there is a real danger that life for everyone—wherever and however they live—will become unsustainable. Climate change, mass migration, and terrorism are manifestations of this.

44.5 CONCLUSION

Sustainability issues are predicated on government policies, unbridled consumerism, and power inequalities that allow the rich to continue plundering the earth. For instance, an average citizen of the United States "consumes 50 times more steel, 56 times more energy, 170 times more synthetic rubber and newsprint, 250 times more motor fuel, and 300 times more plastic than the average Indian citizen" (Deb, 2009). There are several suggestions for ameliorating this situation. First, introduce ID and sustainability issues into the curriculum at the school level and most certainly into all graduate design courses. Second, ensure that design promotion organizations are fully clued up about these issues and possess the requisite literature or electronic media to promote them to industry, commerce, retail, etc. Third, ensure that all design professionals are fully apprised and committed to ID and sustainability through their professional bodies.

Fourth, users and designers should be active practitioners and promoters of recycling materials that are presently dumped in landfills or burned. As well, eco-efficiency designers should use their design skills to add value to recycled materials. This also means not supporting or designing products that are meant to be thrown away. This includes not only disposable shirts, razors, etc., but also more complicated gadgets that are simply thrown away because they are more expensive to repair. In fact, they are designed that way from the start. This also means that designers become more conscious of reducing material and energy at the start of the design process. This could lead to products that have a longer life and are adaptable and repairable.

Fifth, designers should design for effectiveness and usability rather than speed. Well-designed public transport can meet these requirements. It also means focusing on ways and means of reducing transport costs of half-processed parts, which travel around the world.

Sixth, governments should promote and support community-leasing activities, such as for cars, which can be temporarily but conveniently leased for journeys from the carpool. The idea of renting or leasing could be taken many stages further to include many household items except those that have a sentimental value.

Seventh, governments should support village and farming communities to practice eco-efficiency by sharing common appliances such as lawn mowers, electric drills, ploughs, water pumps, and sewing machines. Sharing in urban communities needs to be especially promoted. Finally, there is an urgent need to create a world platform on the Internet focusing on sustainability and ID. It does not have to be at any specific physical location but could be part of a network concentrating on best practices, case studies, design guidelines, eco-friendly processes, etc. The platform would promote wider access and enable a large part of the globe to learn directly from one another's experiences. In the end, universal design will be effective to the extent that it rejects the rhinoceros syndrome and lives up to its name as a majority world endeavor.

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7

EPILOGUE

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CHAPTER 45
MY STORY

Rosemarie Rossetti

This personal story is told from the author, of how her home intensified her disability after a spinal cord injury and what steps she took to learn how to design and build a universal design home, resulting in the Universal Design Living Laboratory.

45.1 INTRODUCTION

Sometimes life suddenly changes direction.

On June 13, 1998, our third wedding anniversary weekend, my husband, Mark Leder, and I went for a bicycle ride on a wooded bike trail in Granville, Ohio. After riding for about 10 minutes, Mark thought he heard a gunshot and slowed down to investigate. As he scanned the scene he saw a large tree falling. He shouted, "Stop!" But the warning was too late. Instantly, I was crushed by a 7000-lb tree and paralyzed from the waist down.

When we were first married, we started building our home. We asked our builder to put in a few wider doors in the master bedroom and bathroom to accommodate wheelchairs, should our visiting parents need them for mobility as they got older. We also had lever handles put on all the doors to make them easier to open. We were thinking ahead to our future and selected a two-story floor plan with the master bedroom suite on the first floor, to make the home more accessible. We expected to live in our home indefinitely.

45.2 TRADITIONAL HOME DESIGN PROBLEMS

After six weeks in the hospital, I returned home seated in my wheelchair with a different worldview—that of a person with a spinal cord injury. Our traditionally designed home had many problems, the first of which were the steps at all four entrances.

The temporary ramp to the front door built by my husband, family, and neighbors was very steep. The carpeting in my home was hard for me to roll on. Doors had to be removed so I could enter the laundry room, toileting area, and shower. Privacy was lost! Cramped quarters in the laundry room made me angry as I banged up the washer, dryer, and walls with my wheelchair. I used a top-loading washer and had to use a reacher to pull out every single item. It takes forever to do a load of laundry.

Mark and I operated our separate businesses out of our home. Half of our house was "off limits" to me due to the steps to the basement and steps to the second floor, which contained his office and our guest bedroom and bathroom. Accessibility was a problem for me because as I sat in my wheelchair, I was 4 ft 2 in. tall. Mark in contrast was 6 ft 4 in. Due to my limited reach, my independence was compromised.

Our dream home had become more of a nightmare, with stairs that I couldn't climb; cabinets, pantry shelves, microwave oven, freezer, electrical outlets, and light switches beyond reach; no grab bars on the walls; bathtubs that I couldn't enter without assistance; no knee space under the cooktop or sinks; countertops too high for food preparation; thick padded carpet; and an oven with a bottom-hinged door. Since my injury, we have been planning to build a home that would better accommodate both of us.

The first I heard about universal design (UD) was through a magazine article. I saw pictures of a woman in a wheelchair in her UD kitchen and realized that if I could build a new house, someday I, too, could have a kitchen like hers. A UD kitchen would make cooking so much easier for me! Since cooking was a passion of mine, I was excited about the possibilities. Encouraged by the concept, I devoted my time to research, including trips to the library, Internet searches, speaking with others who use wheelchairs, and a visit with our city's independent living center (ILC) director. I got floor plan books from the library and from builders. We visited homes built and occupied by wheelchair users and took extensive notes on what features limited accessibility for the owners and which features worked well. After months of information collection, Mark began to sketch out a floor plan for our new house.

45.3 ARCHITECT SELECTION AND DESIGN TEAM APPROACH

The process began with choosing a home site location. In the summer of 2004, we drove around the section of town where we wanted to live and found a new subdivision. Two builders had several lots available. Each builder had only one ranch-style floor plan to offer. Neither builder discussed UD features to offer us. We went through many model homes and became discouraged. Mark had to push me up the steps in my wheelchair to each model home. Our analysis of space within the home revealed that these floor plans did not meet our needs. When we asked if these builders had UD options that they could include, they said they had built homes for people with disabilities in the past and could modify the plans to accommodate me.

Based on referrals, we selected our builder. He told us we could modify his existing floor plan by erasing all interior walls and redrawing a new floor plan within the original house footprint. So we put a deposit on a lot. Mark and I quickly became overwhelmed with the design process, so began our search for an architect. We contacted the ILC and Bureau of Vocational Rehabilitation for architect recommendations.

Our builder recommended an architect who, when asked, "How would you approach the design of the kitchen for our universal design home?" answered, "I would let the cabinet company lay out the floor plan." He clearly had no experience with UD and simply wanted to delegate the whole task. When working with a builder or the builder's architect, one should not assume that either of them is familiar or proficient in integrating UD features in a house plan.

A colleague recommended architect Patrick Manley (www.manleyarchitects.us). Manley came to our home with his construction manager and feng shui consultant, Cathy Van Volkenburg. He brought us his reference list and described previous projects where he worked on ADA-compliant housing projects, as well as residential universal design.

We hired Manley in September 2004. Over the next few months, we held meetings with Manley in our home as well as in his office (see Fig. 45.1), and we realized we were spinning our wheels trying to "shoehorn" our space needs into the builder's existing footprint. The only logical solution would be to create a unique floor plan from scratch.

We monitored the square footage to keep the costs lower. We avoided space wasters such as a too large foyer. The house was designed from the inside out. First we positioned rooms in relation to one another to best accommodate our need for sound and sight privacy, as well as looked at how the space was to be used. Then we sized each room based on the measurements of our existing rooms and furniture. Existing and new furniture was placed on the plan, and pathways of travel and circulation patterns were determined, allowing space for my wheelchair. To comply with UD, doors were designed to be 36 in. and hallways 48 in. wide. Finally, the exterior shell of the home was detailed.

FIGURE 45.1 Architect Patrick Manley and the author's husband, Mark Leder, review and evaluate the house plans for the Universal Design Living Laboratory.

Long description: In this photo, architect Patrick Manley sits with the author's husband, Mark Leder, to discuss the house plans for the Universal Design Living Laboratory. Leder initiated the design process by sketching out a block layout of the rooms. Manley created the blueprints and details for the house plans. Manley started with the interior floor plan design. Working from the "inside out," he later created the exterior elevations of the house.

We also looked at how space could be used for multiple functions as well as the point where items or equipment would be used. We considered *point of use* when locating appliances. This point of use mind-set helped us to determine our need for space. We found that the laundry area would better serve us if it were incorporated in the master closet area (see Fig. 45.2), so we created a wardrobe area. Manley also designed one of the hallways to serve double use, by utilizing one wall to serve as our library (see Fig. 45.3). The kitchen center island serves as a workstation for multiple cooks and also can be used as an informal dining area.

This ranch-style home is approximately 3500 ft^2, containing two bedrooms and two home offices on the first floor and a full basement. The home was designed to be easy to maintain with ample space for working, entertaining, and housing extended-stay family or guests.

To give the kitchen and bathrooms expert consideration, in January 2005 we hired Mary Jo Peterson, a kitchen and bath universal design specialist (www.mjpdesign.com). She worked closely with Mark and me to accommodate our needs. She analyzed all our height and reach specifications and carefully thought out the sequence of events that I go through to store, prepare, cook, serve food, and clean the kitchen. She designed the kitchen (see Fig. 45.4), all bathrooms, and the master closet (see Fig 45.2), and she helped in the selection of the fixtures and appliances. Her plans were incorporated into Manley's floor plan.

Anna Lyon, an interior designer and best friend (see Fig. 45.5), worked with us to design the floor plan (www.annalyoninteriordesigns.com). She provided feedback that we shared with Peterson and Manley in order to modify the plan. Lyon was particularly interested in the room size and layout in relation to the circulation flow. She made suggestions on furniture placement and sketched in furniture to scale. Lyon also accompanied Mark and me to showrooms to select bathroom fixtures, cabinets, countertops, flooring, hardware, tile, and paint colors.

FIGURE 45.2 This is the architect's rendering of the combination laundry room and master bedroom closet.

Long description: The elevation drawing shows the utility sink, washer, dryer, and ironing center. There is knee space under the sink so a person seated in a wheelchair has ample room. Some of the clothing rods are installed in two tiers. Special pull-down hardware will be installed on the upper clothing rods in order to access them from a seated position. This room is adjacent to the master bathroom. Tall windows provide natural light and privacy. The island also provides a space to fold clothes as well as pack and unpack luggage which will be stored in this room. Folded clothing will be stored in the center island.

In January 2005, Mark and I met with our mastermind group for the first time. This is a group of eight other professional speakers, trainers, writers, and consultants who met to help suggest ways to develop our businesses. They suggested that our home be a national demonstration home and be open to the public and the media. They also advised us to seek corporate contributors and other partners to help us with the funding and educational mission of our project.

Mark and I began contacting international, national, and local corporate contributors. Thanks to the efforts of S. Robert August (www.srobertaugust.com) whom we hired in October 2005 as our Executive Business Development Strategist, contributors pledged their support for the project.

The house, named the *Universal Design Living Laboratory* (www.UDLL.com), will serve as a national model prototype. The mission is to bring about awareness of the quality of indoor and outdoor lifestyle through universal design, green building, safety, and healthy home construction practices to the public, as well as the construction and design industries. The UDLL will serve as a resource for others to learn from—today and tomorrow. The landscape will incorporate UD fundamentals, including raised landscape beds and large pots of plants placed on the patio that are tall enough for a person to access from a wheelchair.

The lighting design process began with seven graduate students and faculty members, Patricia Rizzo and Russ Leslie at the Rensselaer Polytechnic Institute (www.lrc.rpi.edu). In January 2006, the class interviewed Mark and me by telephone, and I met with the students (see Fig. 45.6) to teach them about universal design and share our vision of the style of lighting fixtures as well as the lighting effect we were trying to achieve. We also reminded the students that this home would be certified

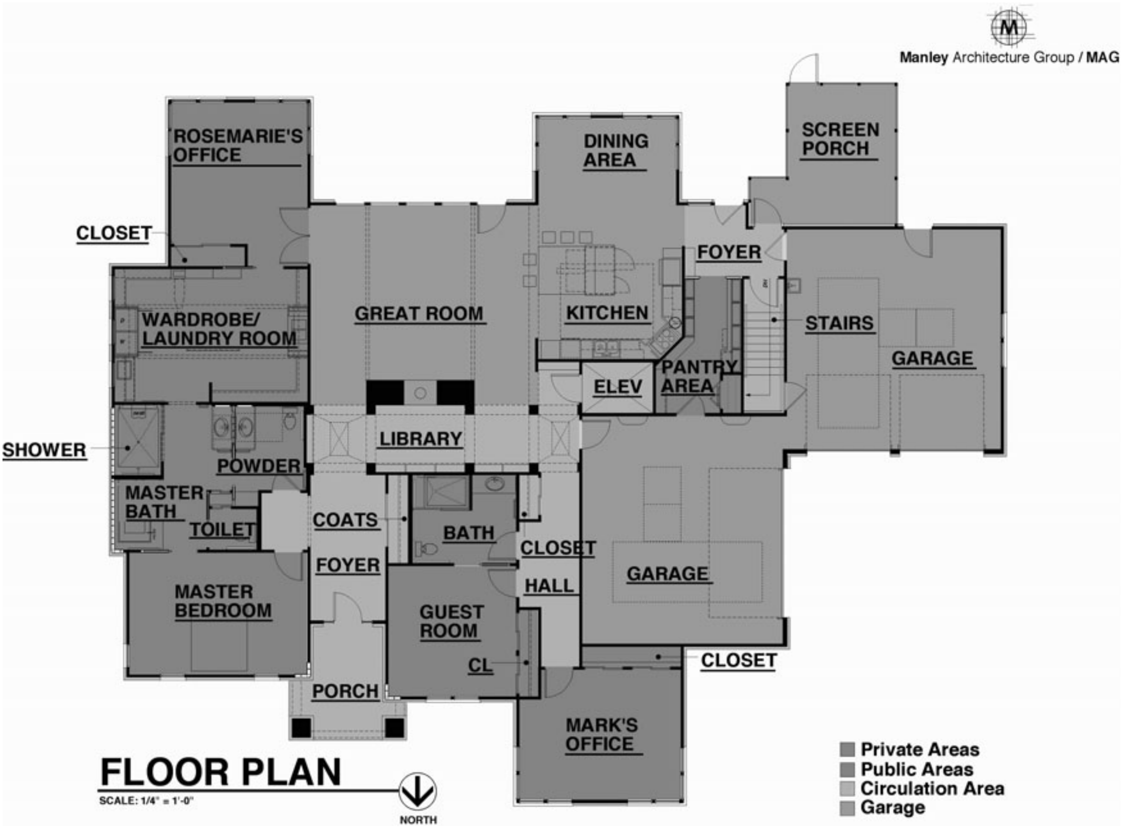

FIGURE 45.3 The 3500 ft^2 floor plan for the Universal Design Living Laboratory.

Long description: The 3500 ft^2 floor plan of the Universal Design Living Laboratory shows the room layout for the public, private, and circulation areas of the home, as well as the four-car garage. The home contains two bedrooms and two home offices on the main floor. The master bath is adjoined to a laundry room that includes the master closet.

green through the U.S. Green Building Council in their LEED for Homes program, so all lighting needed to be energy-efficient and incorporate LED and halogen light sources. The students presented a house lighting design for us to share with Manley and Lyon.

In February 2006, the project stalled when the homeowner's association where the home site was located met with Mark and me. They asked us not to build in their neighborhood due to the anticipated traffic from the tours and media, since this house would be open to the public. Mark and I began searching for a new lot, not in a subdivision.

In December 2006, we purchased a 1.5-acre lot and asked Manley to redesign the house roof line and entry to be more in line with the architectural Prairie style that Frank Lloyd Wright made famous. Manley added a clerestory and portico to the house and created a dramatically different look to our home (see Fig. 45.7). Due to the increased ceiling height in the great room and kitchen, as well as the additional windows in the clerestory, we needed to revise the lighting design.

In May 2007, I got a call from our builder indicating that they were having financial problems that led them out of business. Mark and I interviewed a dozen other builders and in September 2007 decided to be our own general contractors. To assist in this endeavor, we hired Bob White and Chris Vandenoever to be our construction managers. Our design and building team was growing, and we asked our new managers to review the plans and make suggestions for improvements to lower the budget and facilitate the building process. Lighting designer Ardra Zinkon (www.tecinc1.com) joined the team in February 2008 and met with Lyon to revise the lighting design.

FIGURE 45.4 This is the architect's rendering of the kitchen in the Universal Design Living Laboratory.

Long description: The kitchen elevation of the Universal Design Living Laboratory shows the side-by-side refrigerator, cooktop, sink, as well as the microwave and oven in the center island. There is knee space under the cooktop and sink so a person seated in a wheelchair has ample room. The wall cabinets are slightly lower than traditional cabinets, and the countertops are 34 in. high. There will be a pot filler by the cooktop. The kitchen is under the clerestory area with windows above.

Box 45.1 Features Included in the UDLL

Front Entry

- Stepless entrance
- Level threshold no higher than 1/2 in.
- 42-in.-wide door with lever handles
- Porch shielded from the weather
- Package shelf or bench

Kitchen

- Sufficient clear floor space for work/traffic flow
- Hardwood flooring
- Flexible pantry storage
- Rollout carts for storage of cookware
- Single lever faucets, mounted on the side of a low-profile sink
- Pot filler at cooktop

FIGURE 45.5 Author, Rosemarie Rossetti, with Anna Lyon, interior designer.

Long description: At an early meeting in her current home, Rosemarie Rossetti sits at her kitchen table with interior designer Anna Lyon to select countertop colors for the Universal Design Living Laboratory. Silestone countertops will be in the kitchen and bathrooms. This quartz material solid surface will also be used on the roll-in shower walls. A leather-look finish is being examined so that light does not glare off the countertops.

- Garbage disposal mounted in the rear of the sink
- C- or D-shaped handles on cabinets and drawers
- Countertops at a variety of common heights: 30, 34, 36, and 42 in.
- Rollout full-extension shelves and drawers in lower cabinets
- Pull-down articulated hardware to lower shelf contents stored in wall cabinets
- Toe kick area at the base of lower cabinets: 9 in. high by 6 in. deep
- Pantry cabinets with pullout shelving for most used items
- Side-by-side refrigerator/freezer with full-extension shelves
- Side-hinged doors on oven and microwave at counter height
- Dishwasher elevated 8 in. above the floor
- Front-mounted controls on all appliances with easy-to-read print
- Knee space under sink and cooktop
- 5-ft turning radius in working areas
- Electrical outlets 18 in. above the floor
- Light switches 48 in. above the floor
- Adjustable lighting controls with dimmer switches

Bathrooms

- 36-in.-wide swinging doors with lever handles and/or pocket doors
- 5-ft turning radius in key areas

FIGURE 45.6 Design Program Manager Patricia Rizzo of the Rensselaer Polytechnic Institute with her graduate students as they discuss the lighting design.

Long description: In January 2006, seven graduate students and Design Program Manager Patricia Rizzo of the Rensselaer Polytechnic Institute discussed the lighting design for the Universal Design Living Laboratory. Rosemarie Rossetti was present and taught the students about universal design in the home. The students were each assigned a room to design and presented their lighting design to Rossetti and Leder at the end of their course.

- Multiple-height vanities with flexible knee space under the sink
- Toe kick area at the base of lower cabinets: 9 in. high by 6 in. deep
- Grab bars in the toileting, shower, and tub areas
- Walls reinforced with ¾-in. plywood for grab bars
- Antiscald fittings on tub and shower
- Nonslip ceramic flooring
- Controls for windows, lighting, and fixtures that are easy to operate
- Vanity mirror at height for a seated person
- Curbless shower and bench
- Towel bars at various heights
- Handheld shower spray on a sliding vertical bar, with 60-in.-long hose
- Water controls on shower and sink within arm reach while seated
- Tub deck with 15-in. extension
- Tub with nonslip bottom and built-in grab bars
- Comfort-height toilets 17 to 19 in. from the floor
- Increased lighting from varied sources with adjustable controls
- Electrical outlets and lighting controls within arm reach while seated

FIGURE 45.7 This is the architect's rendering of the front elevation of the Universal Design Living Laboratory.

Long description: Architect Patrick Manley refers to the "Prairie Style" when he describes the Universal Design Living Laboratory. The Prairie Style home usually has low horizontal lines, a central chimney, an open floor plan, overhanging eaves, a low-pitched roof, and clerestory windows. This ranch-style home was designed with 6 ft overhangs, determined by solar angle calculations, and a clerestory to provide natural light to the interior and solar heat gain in the winter. The portico at the front entry affords protection from weather in all seasons.

45.4 REFLECTIONS ON THE DESIGN PROCESS

By working with the above referenced team of professionals, we feel that our decisions on space planning were carefully considered. The skills of all persons complemented one another. Each brought her or his own area of expertise, experience, and wisdom. Many suggestions were presented for consideration. Mark and I made the ultimate decisions. Since our project was a custom home, we were able to create the space to be any size, and we selected products from around the world.

It was an interesting dialogue among our team members, and our periodic face-to-face meetings always were productive. I took detailed notes of any changes that were needed in the plan and summarized them for the team. Constant communication was a key to the coordination of the design process, with e-mails, telephone calls, and electronic floor plans being exchanged on a continuous basis.

The time spent in the design process will make the house more usable, accessible, and aesthetically beautiful. Construction dollars will be saved due to our constant vigilance over the total square footage and product selection. Better planning helps to keep construction costs within budget. Changes made during the construction process, or worse yet, after the construction process, can be terribly expensive! The architectural drawings will serve us and the contractors as we create this one-of-a-kind prototype which is expected to be replicated in whole or part throughout the country. Construction began in September 2009 and is expected to end in the summer of 2010. Net proceeds from tours for the month the home is open to the public will benefit spinal cord injury research.

It is our intent that people will borrow a few good ideas from this house in order to create their own homes that will be more accessible and usable. Homes that include UD features enable the occupants to live with greater independence throughout their lifetimes.

45.5 BIBLIOGRAPHY

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45.6 PROFESSIONAL ORGANIZATIONS AND RESOURCES

To assist in finding design and building professionals, contact these organizations.

American Institute of Architects: www.aia.org

American Institute of Building Design: www.aibd.org

American Society of Interior Designers: www.asid.org

International Interior Design Association: www.iida.org

National Association of Home Builders, Certified Aging-in-Place Specialist (CAPS) Program: www.nahb.org/caps

National Association of the Remodeling Industry: www.nari.org

National Kitchen and Bath Association: www.nkba.org

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