Ergonomics for Children

Designing products and places for toddlers to teens

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CHAPTER 27

*DESIGNING MUSEUM EXPERIENCES FOR CHILDREN**

JEFF KENNEDY AND MARJORIE PRAGER

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* All photographs in this chapter were taken by Kevin Burke at exhibitions designed by Jeff Kennedy Associates.

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INTRODUCTION

Who visits museums? At the turn of the twenty-first century, the answer is—families with children.

Figure 27.1 (Kevin Burke)
Adler Planetarium & Astronomy Museum, Chicago, Illinois.

The last 25 years has seen a boom in museum experiences for children. In the United States alone, the number of children's museums has jumped from 38 to close to 300.* And museums of all kinds—science centers, art and history museums, zoos, aquariums, and nature centers—have come to realize that in order to survive and thrive, they must offer experiences that engage and entertain children. Whether they visit in family groups or on school trips, the future of museums depends on children.

WHY DO PEOPLE LIKE TAKING CHILDREN TO MUSEUMS? HOW DOES THIS INFORM DESIGN?

Parents and caregivers like to visit places where they can spend time with their children.† They like active rather than passive places that are fun, pleasant, and safe, and where they can socialize with other adults. Museums rank along with great natural settings, theme parks, and shopping malls as parents' favorite places to take their kids.

What does this mean for design? It means it is critical to design environments in which both children and adults feel comfortable playing active roles. Museums conducive to socializing and active learning *do* feel fun, pleasant, and safe.

* Association of Children's Museums.

† Museum staffs conduct surveys and interviews to learn why parents and caregivers bring their children to museums and what things they like best or would like to add.

CHILDREN DO NOT COME ALONE

Children do not come alone. Design for parents, caregivers, and children

Figure 27.2a (Kevin Burke)
LEGO™ "Invention Adventure."

Figure 27.2b (Kevin Burke)
Stepping Stones Museum for Children.

Children and adults often play together in museums.
The experiences they share give adults insight into ways children develop and learn.

Museum spaces for small children often include labels and guidelines that illuminate aspects of early childhood behavior and development. Sometimes the labels suggest ways to extend the learning experience at home.

Staff and volunteers at many children's museums report that parents interact with each other. They share concerns, volunteer advice, and comment on the universality of behaviors common to their offspring.

Visitors value safety, comfort, and amenities, whether they visit once or return week after week. Museum designs therefore must attend to the needs of adults and children alike.

Figure 27.3a and Figure 27.3b (Kevin Burke)
Stepping Stones Museum for Children, Norwalk, CT. Increasingly, science centers are adding spaces with appeal for children aged 5 and younger while maintaining their offerings for the traditional children's museum target age range of 5- to 8-year-olds. This emphasis reflects changes in the population; many families now have children in this 3 to 5 age group.

Figure 27.3c (Kevin Burke)
The Kids Room, Maryland Science Center.
Many museums offer spaces specifically for toddlers. These spaces differ from those for older children. Toddlers are smaller and less agile. They enjoy full body activities and simple and direct interactions.

Parents need comfortable seating where they can watch their children play and socialize.

Figure 27.4a (Kevin Burke)
Stepping Stones Museum for Children, Norwalk, CT.
Bench type seating with adequate cushioning is often a good choice.

Figure 27.4b (Kevin Burke)
The Kids Room, Maryland Science Center.
Provide soft, cleanable floor coverings if you expect parents or caretakers to sit on the floor while sharing activities.

Adults with mobility impairments use benches with backs (and arms) as a means of support when getting up or sitting down.

Back support is welcome for all adults on a prolonged outing with their children. Parents with small children may also have babies to hold or nurse. Parents especially value benches with arms in spaces designed specifically for small children.

STAFFING, TRAINING, MAINTENANCE

STAFFING AS A PARAMETER FOR DESIGN

Children's museum spaces need ample staff, especially during busy periods, but in reality, adequate staffing is not always present.

The number of staff influences the design and less staff often means

- fewer full body activities (e.g., climbing) and
- open spaces with little clutter.

Designers should ask museum managers to provide a staffing plan before the design begins.

TRAINING

Adults and children notice when staff interact with them and are knowledgeable. Visits are more fun when the staff have good customer relations skills and can explain exhibits easily.

The design plan should include ongoing training in how to make the most of each exhibition. Floor staff positions have the highest turnover rate in museums—and institutional memory leaves with them. Ongoing training keeps employees up-to-date and communicates their importance to the success of the museum.

MAINTENANCE

Children's galleries often incorporate building activities, such as blocks, puzzles, computer pieces, and dress-up areas. Staff must keep these areas clean and neat by picking up pieces during the course of a busy day and at the end of the day. Items on the floor become stumbling hazards and impediments for wheel chair users and people with low vision.

Untidy areas also create a sense of disorderliness and lack of control. They do not feel safe and comfortable. Broken exhibits create a sense that museums do not put the visitors' experiences first. If maintenance staffing is minimal, components need to be simple and built to last.

As visitors flow through museums, they break and lose items. Designs need to be flexible, allowing replacement of components rather than entire exhibits to assist with ongoing renovation.

"HANDS-ON" DESIGN—*PLEASE TOUCH THAT!*

Figure 27.5 (Kevin Burke)
Stepping Stones Museum for Children, Norwalk, CT.

Younger children learn through play. The best hands-on experiences are open-ended and provide direct contact with elements that children manipulate, move, and control.

However, hands-on exhibits often incorporate knobs, push buttons, hand-cranks, and other controls. These present greater design challenges.

CONTROLS

Children know to spin or turn a wheel when they see it. Young children like to explore and will grab wheels to see what they do and what they might control! Exhibit designs should enable children to see the connection between controls and resulting actions.

The size of the control wheels should be appropriate for the task (e.g., larger diameters for more power). Larger mechanisms are easy for everyone. When in doubt, err on the side of larger controls. Controls such as wheels, knobs, and levers, which are too small, require fine motor control that young children and children with motor impairments may find difficult to manage.

Figure 27.6 (Kevin Burke)
Museum of Life & Science, Durham, NC.
Controls should be as simple as possible. Ideally, each hands-on component includes only one control mechanism.

Safety is critical. Handles and cranks may potentially transfer force back to the user. Safety mechanisms must be part of the design (e.g., one-way clutches). Avoid wheels and handles with spokes, which can be unsafe when spinning.

Figure 27.7 (Kevin Burke)
Health World Children's Museum, Barrington, Illinois.
Provide knurling, indenting, or other grip-enhancing treatments to controls (such as at the outer perimeter of a wheel) to increase children's ability to grip without sliding.

MANIPULATIVES

Many hands-on activities for children involve direct interaction with physical elements. They manipulate balls, building blocks, and parts that they combine in a variety of ways.

These are known as ***manipulatives***. Manipulatives are small items that children can easily maneuver with their small hands.

Design exhibits that include manipulatives in a way that promotes keeping pieces where they belong. Parts bins or containers in the activity area help, as will hidden storage for easy restocking. Adult visitors often help with this task, but museum staff must periodically pick up, especially on busy days. Parts on the floor pose tripping hazards, especially when they scatter to places where people do not expect to see them.

Figure 27.8 (Kevin Burke)
Stepping Stones Museum for Children, Norwalk, CT.

Less complex tasks are better for multiple-age users. Activities that require more controls or several steps with different controls are too complex for many children. One exception to this rule is when two or more users participate together, such as in playing a game.

Parts and pieces

What is the "right" number of pieces? Too many pieces can be a management problem; too few can frustrate children, especially on busy days when there are not enough pieces or parts to go around.

Trial and error usually determines the perfect balance, as the right number depends on the number of visitors that typically play at the exhibit. Communicate regularly with front-line floor staff about their experiences on the space to evaluate the design and restocking.

Figure 27.9 (Kevin Burke)
Stepping Stones Museum for Children, Norwalk, CT.

Replenishment. Choose materials and components that are widely available. For example, design a ball activity around a golf ball, squash ball, or tennis ball, rather than a special ball that the staff must order.

Always choose pieces that are too large to fit into a child's mouth, avoiding potential choking hazards.

Design Guidelines for Controls and Manipulatives

- Create simple designs
- Use controls that children intuitively understand, such as wheels
- Design control sizes to reflect the activity (larger wheels when tasks require more effort)
- Design controls large enough for everyone
- Design controls that are easy to grasp; children's fingers should not slip in an effort to move them
- Incorporate safety features
- Design for easy storage, easy replacement, and ease of upkeep
- Use contrasting colors for pieces to facilitate seeing parts on the floor
- Use readily available components
- Ensure that the pieces are easy to clean
- Avoid very small pieces that can fit in a child's mouth

DESIGNING THE ENVIRONMENT

Start with an exhibition plan

An exhibition plan considers the overall relationship of floor spaces and the exhibits within them, with an eye to the rhythms and flows of audiences, exhibit adjacencies, hot and cool spots, and shared service areas. Managers and designers should jointly develop and review the plan.

COMFORT

Children are the target audience, but adults bring the children. Since parents and caregivers can spend long stretches of time watching their children play, they will need seating and resting areas. Comfort becomes even more important during "worst-case" conditions—busy weekends with crowds of visitors.

"Comfort" refers to more than adequate seating and reasonable table and counter heights. *Sightlines* should allow parents to keep an eye on

Figure 27.10 (Kevin Burke)
The Kids Room, Maryland Science Center.

children throughout a gallery and easily view displays while sitting on the floor. Clear, well-placed building *signage* makes it easy to find one's way around. Family-friendly restrooms should be close by and large enough to accommodate busy-day traffic (see Chapter 26 on Wayfinding).

SOUND

Acoustic overload can make even visually attractive environments unappealing, especially for adults. The greatest source of sound in children's museums is the gleeful but shrill chorus of voices of children at play.

Environmental control is critical. Typically, well-padded carpeting and acoustic ceiling tiles dampen ambient sound. Some museums also choose to use sound-absorbing panels on walls, especially above the "touch" zone (the area children can reach). Well-made panels of this type are expensive, but can significantly reduce sound. Installing damping and insulation between floors, in walls, and in exhibit sound booths is less expensive during initial construction. It is more difficult and costly to retrofit.

Children and adults enjoy creating sound. Percussive activities (drums, xylophones, etc.) are particularly popular—but *loud;* so include them with caution. Sound may carry and make hearing difficult in other exhibits.

Figure 27.11a and Figure 27.11b (Kevin Burke)
"Making America's Music" Traveling Exhibition, Boston Children's Museum.
Specially designed spaces with acoustic protection can mitigate sound problems. Alternatives to true percussion instruments include electronic versions that allow designers to specify noise, by reducing or controlling the speaker systems.

LIGHTING

Overall light levels. Museum visitors prefer lighter and brighter spaces. Visitors often comment when an environment feels bright and cheery or seems too dark. Rarely do they verbalize appreciation of the subdued lighting of a darker space or remark that a well-lit space is too bright. They mention uncomfortable lighting, such as from direct natural light or glare that interferes with seeing exhibits.

Avoid stark changes in lighting. Passing from dark to brightly lit spaces requires time to visually adapt—a transition space should connect the two. Going directly from dark into a bright space causes discomfort. Use the magic of darkness sparingly and thoughtfully as a theatrical exhibition tool.

Light sources. Low-voltage fixtures or lamps tend to "hotspot," making it particularly difficult to read labels. They can create uncomfortably high contrast between disparate colors and finishes, as well as severe shadows.

Budget-conscious museums often ask designers to specify low-voltage fixtures. However, it takes many low-voltage fixtures to achieve appropriate illumination and cost savings are unlikely. If possible, a lighting-design professional should create the lighting plan, especially if it includes low-voltage fixtures.

Designers must aim fixtures to prevent glare or shadows. Both can make interacting with an exhibit component difficult or virtually impossible. As exhibits change over time, the lighting plan needs ongoing review. Fixtures will need replacing and refocusing. Reflection from a glass or plastic case is a classic glare problem, often extremely difficult to resolve because of the very broad range of viewing angles of adults and children. The best way to study and resolve this important design issue is with quick mock-ups in the design studio.

Fluorescent lighting, while not especially popular with museum designers, is often effective in children's spaces, especially when full spectrum lamps and incandescent fixtures accent lighting. This approach provides a good level of ambient illumination at a reasonable cost with minimal shadows and glare.

Color. Color brings appeal and excitement into children's spaces. Primary colors need not be the basis for color choices. Use a color palette with appeal for adults as well as children, so everyone will want to spend more time there.

Figure 27.12a and Figure 27.12b (Kevin Burke)
Stepping Stones Museum for Children, Norwalk, Connecticut.
A range of vibrant colors and thoughtful placement of objects can make an area attractive and stimulating for both children and adults.

SEATING

Adults often tire during their visit. While they may spend time on the floor with their children, they also need seats with good support.

Bench seating with pads and backrests let parents sit while they watch their children. Benches can be comfortable and easy to maintain. They promote social interaction among adults and permit visitors to move them to meet their viewing needs.

You can never have too much seating.

Benches that are not against a wall should have backs. Strength of construction and stability are important as people with mobility impairments use the backs or arms of the benches to help themselves when they sit down or get up.

Figure 27.13a (Kevin Burke)
HealthWorks! Kids Museum, South Bend, Indiana.

Figure 27.13b (Kevin Burke)
Health World Children's Museum, Barrington, IL.

Tabletop and computer activities often need stools or chairs for children and adults. Not all furniture should be child sized (and children come in a variety of sizes themselves).

SIGHTLINES AND ACCESS

Parents and caregivers like to see their children at all times. This requires minimizing interior partitions and other large visual obstructions. Multilevel climbing activities should return children to their starting point (or very near) and keep them within easy view at all times.

Signs should clearly indicate where exhibit exits and entrances are. If this is not possible, either make them large enough for adults to accompany their children or anticipate the need for additional staffing to guide parents on busy days and respond to their concerns.

Figure 27.14a and Figure 27.14b (Kevin Burke)
Stepping Stones Museum for Children, Norwalk, CT.

Climbing structures should be readily accessible by adults in case of an emergency or accident. Crawl-through activities and tunnels should be relatively short and not too dark.

Figure 27.14c (Kevin Burke)
The Kids Room, Maryland Science Center.
A clearly marked entry invites visitors to come in and explore.

AIR QUALITY

Well-designed air-handling systems keep facilities comfortable with an even temperature and fresh-smelling air. As with all other aspects of facility design, design the heating, ventilation, and air conditioning (HVAC) for peak load conditions.

Water exhibits require special HVAC design. They can become breeding grounds for fungus and bacteria that pose a health risk and create an unpleasant smell that can easily permeate the area or entire museum. The HVAC system can prevent these problems.

Theater spaces may also need air supply and return if accommodating more than 20 people at a time. This is especially true when they are largely enclosed and have their own ceilings.

Figure 27.15 (Kevin Burke)
Stepping Stones Museum for Children, Norwalk, CT.

The Exhibition Plan

The *exhibition plan* is a periodic review of the overall relationship of floor spaces and the exhibitions with an eye to the rhythms and flows of audiences, exhibition adjacencies, hot and cool spots, and shared service areas. Managers and designers should jointly develop and review the plan.

SAFETY

Safety is the most important aspect of design.

Staff who perform the morning walkthroughs should check for potential safety hazards such as broken elements with sharp edges, drumsticks without a rubber tip, or cabinet doors left open.

Strategically placed checklists help staff identify problems. Broken or dangerous elements should undergo quick on-site repair or removal. Having a repair room near the exhibit floor is a wonderful safety asset.

General design guidelines for the environment

1. Design for everyone's comfort
   a. Consider abilities and limitations of children and adults
   b. Provide elements of each exhibit that appeal to all ages
2. Design for ease of movement
   a. Open spaces permit easy movement and visibility of children
   b. Frequent, clear signs show the way
3. Design so that people can hear each other and the sounds of the exhibit
   a. Design to keep ambient sound levels low—use sound dampening throughout
   b. Use spaces to "trap" sound
   c. Substitute mechanical for "real life" sounds when the latter are loud and carry
4. Design bright, light spaces
   a. Use transitional lighting between exhibits in which the light levels change
   b. Avoid glare
   c. Use dark spaces sparingly and only to create a "special effect"
5. Include places to refresh
   a. To rest and listen to a quiet story
   b. To eat
   c. Design for easy and quick access to restrooms
   d. Include comfortable seating with back support for adults
6. Plan for air quality

Figure 27.16 (Kevin Burke)
HealthWorks! Kids Museum, South Bend, Indiana.
Safe climbing components can include low walls with handholds that challenge children to move horizontally from one end to another along a ledge only a few inches above the ground. Walls should offer no possibility of climbing vertically without careful supervision.

CLIMBING

Children will climb anything they can, especially if it appears that climbing is part of the intent of the design. While this is often not the design intent, it is the interpretation of the user. Many adults allow children to climb on virtually everything in a space for children, perhaps mistakenly assuming it is acceptable. This leaves the task of avoiding unsafe climbing to designers and museum staff.

Characteristics that seem to invite climbing include step-like elements, footholds, limb-like elements, or any form of ladder. Of course, if a smaller child cannot see an exhibit, they will immediately look for a way to raise themselves higher, such as on a ledge or bench. Children can misinterpret vertical panel edges with 6 in. (15 cm) horizontal bars spaced 12 in. (30.5 cm) apart from top to bottom, as a ladder.

Multilevel climbing structures introduce the potential for stepping on children's fingers as they climb ladders and other scaling structures. Finger injuries are one of the most frequent injuries in facilities for children (see below). Injuries of this nature increase dramatically if the activity is available to children of all ages.

Younger children (3- and 4-year-olds) move more slowly (i.e., cannot get out of the way fast enough) and are somewhat less aware of others than are the older children (7- and 8-year-olds). Many facilities, recognizing that such structures are available at playgrounds, opt to eliminate climbing activities, especially when there are limitations in space and staff.

INJURIES

FINGER INJURIES: Finger-pinching injuries are common among children visiting exhibits. Doors with hinges and pivoting control levers are particularly hazardous. Doors or other hinged elements can catch fingers between two closing surfaces or pinch them in a space on the hinge side. Large and pivoting control levers with hard stops can catch fingers between the lever and stopping element. Avoid designs that can pinch fingers.

Many children develop finger injuries when they get stuck in a hole. This can lead to more severe injuries should children lose their balance or be bumped by another child while a finger is stuck. To avoid this, all holes should be smaller—or considerably larger—than a child's finger, and back perforated metal panels (with round perforations) with solid materials. The backing should be so close that a small finger cannot come between the two.

EYE INJURIES: Eye injuries are painful and can be quite serious. To reduce the risk of eye injury, avoid activities that involve small projectiles and stick-like components. If such elements are needed (e.g., a conducting baton or drumstick), making them oversize in diameter, with large radius rounded-over ends, will help. In the case of a drumstick or xylophone mallet, cover the end with a soft rubber ball-type tip.

Figure 27.17a and Figure 27.17b (Kevin Burke)
"Making America's Music" Traveling Exhibit, Boston Children's Museum.
Virtual conducting and "musical fences" activities make good use of tethered, oversized batons.

ELECTRICITY: Obviously, electrical components need to comply with applicable electrical codes.

Guidelines include:

- Use low voltages in areas that users might touch.
- If control of a component involving higher voltages is necessary, design an interface that lets children use a low-voltage relay to turn on–off the higher-voltage device.
- House electrical components and wiring in enclosures that require keys or special tools for access.
- Place light bulbs high and out of children's reach to avoid burns and breakage.

Other hazards include:

1. Elements that can become an unintended "weapon" (e.g., bat-like elements).
2. Elements that can become hot enough to the touch to cause pain (e.g., light bulbs inside metal housings).
3. Cords or cables that entangle children or their limbs (strangling or tripping danger).
4. Small pieces that may pose a choking hazard (diameters of 1.75 in. [4.5 cm] or less).
5. Access to the underside or inside of cabinets.
6. Sharp edges on cabinets, structures, and all other devices.
7. "Soften" or "ease" all outside corners of cabinets and tables at a child's head height by padding or rounding.

GERMS AND HEALTH

Design for quick and easy cleaning. For horizontal surfaces and elements that get a lot of use, use materials and finishes that are easy to clean with readily available cleaning products such as germicidal all-purpose cleaners.

Avoid items that go on children's heads, due to their potential for spreading head lice. This includes items used in role-play activities (hats, helmets, etc.), as well as audio headphones. Displays that include these items need daily cleaning. Replace hats and helmets regularly.

Figure 27.18 (Kevin Burke)
Stepping Stones Museum for Children, Norwalk, Connecticut.
Water invites touch. People may reach out to feel the water, even in areas that are not designed with this intent.

Figure 27.19 (Kevin Burke)
Stepping Stones Museum for Children, Norwalk, Connecticut.
Children of all ages love playing in water. As these areas are breeding grounds for germs, they need regular maintenance and germ-eradicating filtration systems.

If it is not feasible to install a filtration system, change the water frequently. This requires the location of the water supply and drains to be near by and easy to access, so staff can change the water quickly and efficiently.

Water exhibits require floor drains, sloping floor grades, and special flooring material to allow for drainage and cleaning. Rotating floor staffs are often responsible for the important day-to-day cleaning and maintenance of water features. Provide ongoing training for this maintenance, along with written rules and procedures.

General safety design guidelines

1. **Design for safety first**
   a. Review each design plan and exhibit for safety concerns.
2. **Check, check, and recheck**
   a. Train staff to scan for safety issues.
   b. Provide safety checklists.
3. **Pay attention to special areas such as**
   a. Climbing structures;
   b. Hinged or pivoting components;
   c. Stick-like elements;
   d. Use of electricity; and
   e. Water play.

UNIVERSAL DESIGN

The term *universal design* aims to enable all people to use them, rather than designing for particular groups such as people with disabilities.

The guiding principle is that everyone truly benefits from inclusive design, those with disabilities, children, elderly, and able bodied. For instance, captions on a video exhibit, while providing the narrative for deaf viewers, also offer a reading experience for a child just learning to read or a viewer not fluent in English. This section is written with the idea of inclusiveness at the forefront.

LABELS

The primary readers of labels and signs are adults. However, labels provide an important link between adults and children. Parents depend on labels to tell them what the things are or what to do. In some cases, the labels explain what their children are doing and why. Labels help adults feel comfortable coaching their children and providing guidance. Parents quickly gain "expertise" while their children busily experiment.

Design for size and reach. People of all ages attend children's museums and science centers and the physical elements need to "fit" each user. Often the chosen design approach is "one-size-fits-all."

However, adjustable-height tables and chairs are not the solution. They require adjustment after each use. Most adults do not want to make the effort and children definitely do not want to wait until adjustments are made.

One-size-fits-all works because visitors typically spend only a few minutes at a given activity. The variety of activities also keeps people moving among various postures and places; doing things on the floor, standing, crawling, and sitting.

Design dimensions are a compromise solution. For design purposes, the average size user in a children's museum is a 5-year-old boy, in a science museum it is a 12-year-old boy.

Suggested reading:

Norris, B.J. and Wilson, J.K. (1995) *Childata: The Handbook of Child Measurements and Capabilities—Data for Design Safety.* Department of Trade and Industry, London. ISBN 0 9522571 1 4.

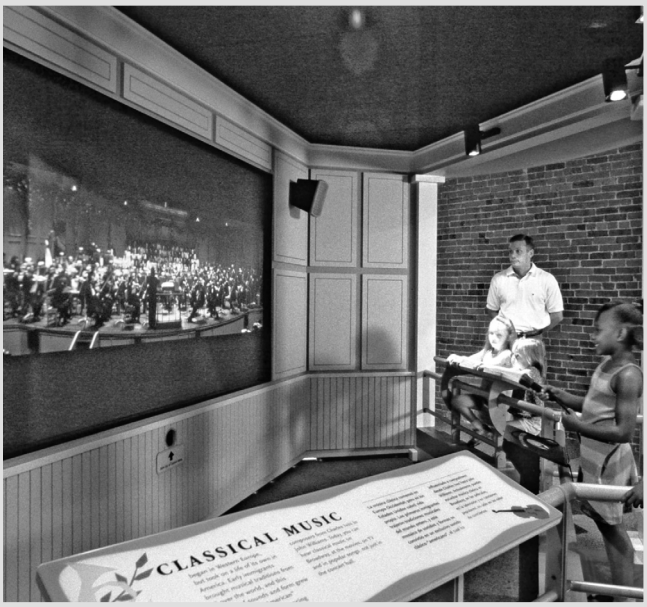

Figure 27.20 (Kevin Burke)
"Making America's Music" Traveling Exhibition, Boston Children's Museum.

Type should be large (at least 24 point font size) so it is easy to read by a wide range of adults and is accessible to children just starting to read. Ample spacing between lines, high contrast with the background and, using fonts from the serif family facilitate reading. Even lighting and avoidance of glare will help.

LIGHTING

Rapid transitions from dark to light spaces cause discomfort for people with normal vision. For those with visual impairments, this can be a truly painful experience. Light-adapting transitional passages can alleviate this problem.

Labels are difficult to read if the background color is too light or too dark and if the lighting is too bright or "hot." For people with visual impairments, these conditions make a label illegible.

In dark environments (not especially recommended for children), labels are more easily read if the background is dark and the type is a highly contrasting light color (i.e., white type on a black background). Backlit graphics are the hardest to read of all, especially for people with vision impairments.

WHEELCHAIRS

Designing for wheelchair users benefits all visitors because exhibit spaces tend to open up, providing ample room for everyone to move about comfortably, even on crowded weekends.

Two basic rules of thumb are:

1. provide room for two wheelchairs to pass at all points (minimum 1.82 m [6 ft])
2. provide wheelchair turnaround space (minimum 1.82 m [6 ft] radius).

Wheelchair users need to pull up to exhibits to perform activities. Yet, wheelchairs come in a wide variety of sizes and configurations. This makes it difficult to arrive at a table height and under-cabinet foot clearance that meets everyone's needs. Pulling up sideways is not an acceptable alternative, except in extreme conditions. Wheelchair users need to get their feet far enough under an exhibit structure to reach controls or other elements requiring manipulation.

Figure 27.21 (Kevin Burke)
Health World Children's Museum, Barrington, Illinois.

Most children in wheelchairs sit higher than children on stools. This means that the table height for children on stools (or even standing up) is not ideal for wheelchairs.

If a tabletop activity is one in which reach is not important, then pulling up to the table (or other exhibit structure) to the point where the wheelchair arms make contact with the table or structure may be acceptable (as opposed to the arms going under the tabletop for a closer position).

Many hands-on activities require reach and many children using wheelchairs also have upper body impairments that constrain their reach. Building multilevel play structures is one answer.

CAPTIONING AND DESCRIPTIVE AUDIO

Figure 27.22 (Kevin Burke)
HealthWorks! Kids Museum, South Bend, Indiana.

Descriptive audio and captioning to multimedia components benefit all visitors.

The standard practice in nearly all museums today is to caption film and video productions for hard of hearing and deaf visitors. It is preferable for captioning to be "open," meaning that it is on screen at all times, rather than "closed," in which case it appears only when someone pushes a button or activates this feature. Drawbacks of "closed" captioning include that it is difficult to see caption buttons or requires making your way to the front of a group of viewers to turn it on.

Descriptive audio provides an additional soundtrack intercut with a film's voice track that describes the action on screen for visitors with sight impairments. Descriptive audio requires additional hardware, either in the form of a portable device or, in a theater-type setting, mounted headphones. For this reason, it is less common than captioning.

Well over half of a typical children's museum audience are below the reading age. This means that most captions are for accompanying adults to read and interpret for children.

CONCLUSION

Although children's museums are "for children," the best designs are for "children of all ages."

Museums for children are, in fact, *family museums.* The best museums make children and adults alike feel welcome and ready to explore. Design of museums for children becomes more complex and more eloquent, the more inclusive they become, engaging and inspiring visitors of all ages.

FURTHER READING

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