Arts, Research, Innovation and Society

Gerald Bast · Elias G. Carayannis
David F.J. Campbell *Editors*

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Foreword

Creativity in general and the arts in particular are increasingly recognized as drivers of cultural, economic, political, social and scientific innovation and development. In art and research (see Bast 2013; Ritterman, Bast and Mittelstraß 2011), some of the principal questions explored by the **ARIS** project (**Arts, Research, Innovation and Society**) are outlined:

1. Could and should artists be researchers?
2. How are the systems of the arts and the sciences connected and/or disconnected?
3. What is the position and status of the arts in defining the terms "progress" and "development"?

Other key questions that the **ARIS** project focuses on are as follows (these are clearly indicative and not all-inclusive or exclusive of additional issues, themes and questions that may arise in the context of the **ARIS** theory, policy and practice discourse):

1. What is the impact of the arts in societal development?
2. How are the arts interrelated with the mechanisms of generating social, scientific and economic innovation?
3. What is, could be and should be the nature, dynamics and role of the arts in shaping the research and innovation theories, policies and practices such as the New Growth Theory?
4. In the same context, what could and should be a new understanding of the support for funding of the arts as a stand-alone pillar with its own merit, value and potential along with research and innovation of smart, sustainable and inclusive growth that is socially embedded and cohesive development and progress?
5. What are the socio-economic, socio-political and socio-technical implications for society from the answers to any and all of these questions?

    5.1 For instance, what are the particular implications for sectors such as politics, education, health, manufacturing and others?

5.2 How can the New Growth Theory be understood in the context of creative economies, societies and democracies?
5.3 Are there limits to growth in the traditional economy, and what is the role of artistic research and arts-based innovations in redefining growth, development and progress?
5.4 What are the roles, interdependencies and dynamics of arts versus research versus innovation versus society as catalysts, drivers and accelerators of smart, sustainable and inclusive growth?
5.5 What is the relationship of arts to "quality of democracy" in theory and practice?

In particular and based on this context, creativity, invention, innovation and entrepreneurship (CI2E, see also Springer's *Encyclopedia of CI2E*, edited by Carayannis 2013) are key drivers of smart, sustainable and inclusive growth that are both enhanced and constrained by financial as well as social and environmental considerations and trade-offs. In this context, **Arts, Research, Innovation and Society** (**ARIS**) are four vantage points from which one could derive and develop insights as to how best to drive cultural, economic, political, social and scientific development and progress.

The Springer **ARIS** series explores (at the macro, meso and micro levels and in terms of qualitative as well as quantitative studies) theories, policies and practices about the contributions of artistic research and innovations towards defining new forms of knowledge, knowledge production (see Mode 3 Knowledge Production Systems by Carayannis and Campbell 2006, 2009, 2012) as well as knowledge diffusion, absorption and use. Artistic research, artistic innovations and arts-based innovations have been major transformers as well as disruptors of the ways in which societies, economies and political systems perform. Ramifications here refer to the epistemic socio-economic, socio-political and socio-technical base and aesthetic considerations on the one hand and to strategies, policies and practices on the other, including sustainable enterprise excellence considerations in the context of knowledge economies, societies and democracies (see also Quadruple and Quintuple Helix Innovation Systems Concepts by Carayannis and Campbell 2009, 2010).

The series features research monographs, edited volumes, proceedings, briefs and textbooks and may also include handbooks and reference works and in-print as well as online rich media encapsulations of ideas and insights, representing cutting-edge research and the synthesis of a body of work in the field.

Please contact *all* three editors at the emails provided for further information and proposals submission guidance.

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Ritterman J, Bast G, Mittelstraß J (eds) (2011) Art and research: can artists be researchers? Kunst und Forschung: Können Künstler Forscher sein? Edition Angewandte. Springer, Vienna. (http://link.springer.com/bookseries/7882 and http://link.springer.com/book/10.1007/978-3-7091-0753-9)

Contents

Chapter 1
Introduction to: Arts, Research, Innovation, and Society (ARIS)

Gerald Bast, Elias G. Carayannis, and David F.J. Campbell

Abstract Creativity in general and the arts in particular are increasingly recognized as drivers of cultural, economic, political, social, and scientific innovation and development. The title of this first book and the title of the whole book series are identical. This should underline the character and intent of the first book, which is to explore in an open approach the possible, promising, creative, and innovative themes that align with ARIS (Arts, Research, Innovation, and Society). The first volume of the book series consists of fourteen individual chapter contributions, plus the introduction and conclusion. In reference to the structure and form of the chapters, the chapters were not standardized, with the only exception that abstracts and key words were provided to all chapters. Experimenting with content as well as form (structure) will reveal the goal of the ARIS series, namely to explore and to pioneer new grounds at the evolving frontier of knowledge, learning and research across the disciplines. New knowledge should be created and produced in interdisciplinary and in fact trans-disciplinary arrangements and networks ("agglomerations of knowledge"). ARIS aims to provide further input for the international and global discourse on those themes, topics and issues that define the intellectual core of the ARIS project.

Keywords ARIS • Arts • Innovation • Research • Society

In the following, we introduce to the first book volume to the **ARIS** series: **Arts, Research, Innovation, and Society**. The title of the first book and title of the series are identical. This should underline the character and intent of this first book, which is to explore in an open approach the possible, promising, creative, and innovative themes that align with ARIS. *The thematic horizon of **ARIS** is encompassed by ARISE (Arts, Research, Innovation, Society, and Education;* see presentation by Elias Carayannis, invited lecture, Die Angewandte, May 2013). The first volume of

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the book series consists of fourteen individual chapter contributions, plus the introduction and conclusion. The final conclusion (Chap. 16) to our first book is more tentative by enclosing different propositions for further discussion. With the objective to allow for creativity and diversity in content, the creativity and diversity of the chapter contributions were also encouraged in terms of structure. In reference to the structure and form of the chapters, the chapters were not standardized, with the only exception that abstracts and key words were provided to all chapters. Experimenting with content as well as form (structure) will reveal the goal of the ARIS series, namely to explore and to pioneer new grounds at the evolving frontier of knowledge, learning and research across the disciplines. New knowledge should be created and produced in interdisciplinary and in fact trans-disciplinary arrangements and networks ("agglomerations of knowledge"). ARIS aims to provide further input for the international and global discourse on those themes, topics and issues that define the intellectual core of the ARIS project. The curiosity of thinking *"beyond the box"* (TM trade mark by Elias Carayannis, invited lecture on systems design and systems thinking, Die Angewandte, December 2013) acts as one of the drivers for ARIS.

Arts, Research, Innovation, and Society (ARIS): Several themes (and research questions) are crucial for the governance of the underlying self-understanding of the unfolding ARIS project and ARIS book series. Now without asserting to present or to represent here the complete spectrum of (possible) topics, the following three themes clearly are essential:

1. *Arts, innovation and creativity:* Innovation is important for economic activities. However, innovation is as a concept much broader than the economy and by this innovation clearly transcends the boundaries of the economic system. For our thinking it is important to liberate innovation from narrowly streamlined economic considerations and constraints. Innovation, understood comprehensively, will always acknowledge the context of society. Innovation combines the traits of change, "being new", "being knowledge-based", and with a progressive momentum. Innovation provides for the change in human history (and in the human future) with a potential for improvement, betterment and learning. There is economic innovation, but there is also social innovation, political innovation, innovation in democracy, innovation in knowledge production and "innovation in innovation", and innovation in the arts. *Innovation depends on the input of creativity, and creativity is encouraged by diversity, heterogeneity, and pluralism*. This appears to be necessary, so that innovation can evolve and so that there is a sustainable evolution of innovation.
2. *Arts, arts and the sciences, interdisciplinary and transdisciplinary knowledge production and research:* There exist several, also competing definitions of arts. In a traditional understanding, aesthetics (the beautiful, but also the ugly) plays an important role. A newer understanding of arts also emphasizes the additional aspect to also interpret the arts as a manifestation of knowledge production. Knowledge production (knowledge creation) in the arts represents a form of research, *creating artistic research,* and by this moving the arts closer to

research, also research in the sciences. Artistic research enables various and multifold linkages, inter-linkages and overlaps between research in the arts and research in the sciences. *Therefore, artistic research contributes to the creation, formation, and development of interdisciplinary and transdisciplinary designs, architectures and networks ("clusters of clouds") of research (knowledge production) and innovation (knowledge application) that integrate the whole spectrum of disciplines in the sciences and arts.* Interdisciplinarity is more than multidisciplinarity. Transdisciplinarity may be defined as interdisciplinarity in application or the context of application. Art represents a strategy that also aids the sciences in efforts of realizing a greater amount of interdisciplinarity and transdisciplinarity in their research activities. The arts support unconventional synapses-building between different fields of knowledge and approaches to knowledge production. By this the arts allow for greater creativity and a wider spectrum of new, unconventional, disruptive and innovative approaches to knowledge production and research, which are also essential for the sciences and research in the sciences. Here, the arts act as a driver for the progress of research in the sciences. *This demonstrates the "epistemic" qualities and potentials of arts for the further and continued evolution of research, also of research in the sciences.* Artistic research transforms the self-understanding of universities and other higher education institutions of the arts. Artistic research connects arts universities to processes of research and re-defines arts universities as being crucial institutions for innovation systems (in the multi-level architecture of national, global and local).

3. *Arts, economic growth, quality of democracy and the context of society:* The comprehension of economic performance often is being guided by conventional models that focus on (short-term) quantitative growth measures. This narrows economic development down to specific paths, routes and trajectories of possible development. However, for the purpose of long-term economic progress it appears necessary to emphasize more clearly the criteria of sustainable development that bring economic growth in balance with social, democratic and ecological considerations. Too much of a focus on short-term economic efficiency may in fact destroy economic development. The interest in a "longer perspective" for economic prosperity requires the realization of a broader basis of sustainable development that re-contextualizes economic progress into the frame of a co-evolution of economy, society and democracy. Economic innovation must be accompanied by innovations in society and democracy. *Here the perspective of **ARIS** is essential for exploring new routes to new models of economic growth and economic progress. Arts, artistic research and arts-based innovation aid in creating a new vision, for how the economy, society and democracy may be interlinked in moving and for moving toward the frontiers and horizons of today and of tomorrow.* Arts are essential for promoting diversity, heterogeneity, pluralism and creativity, which feed into interdisciplinary and transdisciplinary knowledge production (research) and knowledge application (innovation). Economy and economic development must realize more clearly the qualities of arts and of artistic research and artistic innovation.

There is no sufficient innovation for the economy without an innovation in society (and democracy) that is not being determined by economic considerations. Quality of democracy encourages a "democracy of knowledge" that supports pluralism in knowledge production and innovation. **ARIS** (**Arts, Research, Innovation, and Society**) reads as the blueprint and vision for a new master-plan for strategy and policy-making for the economy, but also for society and democracy.

Creativity in general and the arts in particular are increasingly recognized as drivers of cultural, economic, political, social, and scientific innovation and development. In the following chapter contributions, the opportunities, potentials and further ramifications of **ARIS** (**Arts, Research, Innovation, and Society**) are being explored in greater detail. This marks the beginning of an exciting intellectual journey.

Chapter 2
Fighting Creative Illiteracy

Creative Skills Constitute the New Cultural Techniques of Twenty-First Century Innovation Societies

Gerald Bast

Abstract Illiteracy with regard to art and creativity damages a society to the same extent as illiteracy regarding the written word. Today, specialization, productivity and efficiency have become the predominant aspirations, not just with regard to industrial production, but also with growing intensity and speed in the sciences. Universities have been forced to look first at evaluation figures instead of values and content. Quantification and rankings based on quantitative indicators are the main topics in higher education policy. However, history shows clearly how the power of science and the arts can multiply when the two enter into a constructive exchange in awareness of both their own strengths and identity, but also of the synergetic potential for social effects above and beyond citation indices and artistic market rankings. Innovation is increasingly becoming the new no.1 political slogan but is meant mainly as a cure for the economy.

Knowledge is not only growing in volume, but is also playing an ever-greater role in the development of our societies. In the meantime, the expansion of knowledge per se has become somewhat more of a problem rather than a solution. Without a sufficient number of functional knowledge synapses, irrespective of their height, the know-how towers remain isolated and self-referencing. Now the task is to further expand the canon of cultural techniques by the addition of creative skills.

In the post-industrial societies creativity should replace shareholder value as the guiding societal value. Creative literacy has to be spread throughout the entire society. Quantification bust be banished as an inappropriate scale for assessing universities. The educational system and social life must be infiltrated and penetrated with the arts. Teaching, learning, research and dissemination of art and science need to be reconnected again. An innovation society has to focus on educating specialists in de-fragmentation.

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Keywords Art • Creativity • Creative literacy • Creative skills • Cultural technique • Education • Knowledge • Innovation • Renaissance • Science • Society • University • Values

In his breath-taking book "The Swerve: How the world became modern", Steven Greenblatt tells the story of how the recovery of an ancient poem, Titus Lucretius Carus' manuscript "De rerum natura", developed into one of the sparks that ignited the Renaissance:

> When it occurred, nearly six hundred years ago, the key moment was muffled and almost invisible, tucked away behind walls in a remote place. . . .. A short, genial, cannily alert man in his late thirties reached out one day, took a very old manuscript off a library shelf, saw with excitement what he had discovered, and ordered that it be copied. That was all; but it was enough. . . . The finding of a lost book does not ordinarily figure as a thrilling event, but behind that one moment was the arrest and imprisonment of a pope, the burning of heretics, and a great culture-wide explosion of interest in pagan antiquity. When it returned to full circulation after a millennium, much of what the work said about a universe formed out of the clash of atoms in an infinite void seemed absurd. But those very things that first were deemed both impious and nonsensical turned out to be the basis for the contemporary rational understanding of the entire world. What is at stake is not only the startling recognition of key elements of modernity in antiquity . . ..[1]

Greenblatt stresses that naturally one single event in isolation could not have been responsible for such a massive and revolutionary change to the world like that produced by the Renaissance. Nonetheless, the poem from Lucretius Carus did play a key part in the history of the development of the Renaissance, a history that was to change both humankind's consciousness and its role in the world. Furthermore, he finds it particularly astonishing that of all people it was a poet, who through his work and specific type of poetic thinking and formulation was able to at least *partly* influence the course of history in such a lasting manner. "*More surprising, perhaps, is the sense, driven home by every page of "On the Nature of Things", that the scientific vision of the world – a vision of atoms randomly moving in an infinite universe – was in its origins imbued with a poet's sense of wonder."* This "sense of wonder" is indeed a central element in the creative skills, which from all sides and especially from the worlds of politics, business and industry, are invoked as being an indispensible qualification for the creative and innovation society of the twenty-first century.

However, when one considers the parameters and the active players in the age of the Renaissance, then the role of the arts in this multi-causal constellation ceases to be such a revelation. The interweaving and interlocking of secular and clerical power politics, trading interests, science and the arts was of major significance, even though it is not always possible to say when and which of these spheres of influence represented the predominant social yardstick at any one time. Whatever the case, they all had a social effect, particularly in concert, and this also applies to the arts. There is such a thing as the power of art and it derives from the capacity of

[1] Steven Greenblatt, The Swerve: How the world became modern, p. 8 ff., Norton & Company, New York, 2011.

creative persons to conjure up astonishment and thus facilitate changes of both thought and action.

In the light of art's current position which demonstrates marginalization with regard to broad social relevance and interest, but displays a disproportionate focus on economic effects, it would appear to be especially remarkable that art, or what is recognized as art by the ruling, economics-dominated system, possesses less social influence in democratically organized societies than in their autocratic, secular or clerical counterparts.

In his book "Die Kraft der Kunst", Christoph Menke addresses this apparent contradiction: *"In the modern world, there has never been more art and art has never been more visible, present and socially influential than at the moment. At the same time, art has never before represented such an integral part of the social process as it does today, but only as one of the many forms of communication that define art; as a goods item, an opinion, an insight, a judgement, an action . . . Never before and never to such an extent was the aesthetic simultaneously merely a resource in the economic utilization process, whether directly as a productive force, or indirectly as a means of recuperation from productive endeavours. Therefore, the social omnipresence of art goes hand in hand with the steady loss of what we can call its aesthetic strength."* [2] However, in reality this contradiction is actually only ostensive. Because it makes a difference if art has the role of a commodity which can be replaced by an alternative commodity, or if art is a carrier of values, identities and meanings. To take part in the production, use and transmission of values within a society by and through the arts it is necessary that the languages of the arts[3] can be read. Illiteracy with regard to art and creativity damages a society to the same extent as illiteracy regarding the written word.

When Max Horkheimer and Theodor W. Adorno were writing about the "illiterate principals" in our society they obviously referred to this kind of illiteracy: the inability to creative and therefore innovative thinking and acting. And they also describe the impacts and consequences this illiteracy causes.

> In former times, like Kant and Hume, they signed letters with "Your humble servant" while undermining the foundations of throne and altar. Today, they are on first name terms with the heads of government and with regard to every artistic movement are subservient to the judgement of their illiterate superiors![4]

2.1 What Has Happened to Our Societies?

Why does the idea that a poem or another work of art might be able to change the world, as was the case with Lucretius Carus' "De rerum natura", currently appear to be so scurrilous? In actual fact, it was not the poem as such that produced such a

[2] Christoph Menke, Die Kraft der Kunst, p. 11, Suhrkamp Verlag, Berlin, 2013.

[3] Goodman, Nelson. Languages of Art. Hackett Publishing Company, 1976.

[4] Max Horkheimer, Theodor W. Adorno: Dialektik der Aufklärung, p. 119, Frankfurt/M. 1989 W.

significant shift in the course of world history, as this effect was only possible due to the interplay between scientific, political and economic forces. Nonetheless, the arts were always present as a type of connective and reinforcing element in this power triangle.

In 2011, the following could be read in the "Stanford Social Innovation Review": *"Welcome to a nation unable to solve its problems, incapable of civil discourse, bogged down in a morass of multicultural conflict, and lagging behind the global innovation marketplace. Just look forward a generation or two, and this will be America if we do not address the dearth of investment in art and imaginative capacity."*[5]

Today, and not only in the USA, specialization, productivity and efficiency have become the predominant aspirations, not just with regard to industrial production, but also with growing intensity and speed in the sciences. As "The Economist" recently wrote:

> *"The obligation to "publish or perish" has come to rule over academic life."*[6] The journal went on to add: *"Too many of the findings that fill the academic ether are the result of shoddy experiments or poor analysis. A rule of thumb among biotechnology venture capitalists is that half of published research cannot be replicated. Even that may be optimistic." Speed kills quality and thus severely damages both the standards and the image of academic institutions. The pressure for greater productivity and the exclusive personal classification of research results is increasingly leading to professional specialization, the formation of niches and the systematic avoidance of communications and exchanges of information, as these might result in a competitive disadvantage.*

Universities have become used, or have been forced, to look first at evaluation figures instead of values and content. Quantification and rankings based on quantitative indicators are the main topics in higher education policy. Universities advertise their recent standings in national and international university rankings. If they lose ground in these ratings, or if they are unranked, they become subject to major difficulties in terms of institutional identity and economic stability.[7] As the existing rankings seem to give preferential treatment to universities from the USA and Asia, the European Union is now about to design a similar ranking system[8] and thus introduce the same concepts and mechanisms for the future development of its universities. These will result in the quantifying of intellectual performance and thus the necessary neglect of those areas that owing to their self-understanding and/or specific subject-related knowledge production processes can only submit partially, if at all, to quantification.

The dominant, global ranking systems for universities (Shanghai and THE rankings) were and are subject to the suspicion of promoting hegemonial interests in an (education-related) political regard, as their influence on educational policy at

[5] Eric Friedenwald-Fishman, Stanford Social Innovation Review, May 26, 2011.

[6] How science goes wrong, The Economist, October 19, 2013.

[7] http://articles.washingtonpost.com/2012-11-14/local/35505709_1_class-rankings-college-rankings-incoming-freshmen

[8] http://ec.europa.eu/education/higher-education/doc/multirank_en.pdf

governmental and university level has (in combination with other factors) altered the understanding of the nature and task of university education worldwide.[9]

The logic of production processes, the functionality of which demands the measurability of working procedures and results as a prerequisite, is steadily infiltrating educational policy theory and practice. Indeed, the European Union has defined "The role of the Universities in the Europe of Knowledge" [10] entirely in this spirit by linking it clearly with a contribution to Europe's economic policy success and thus burying Humboldt's educational ideals as a paradigmatic consequence.

The universities of art and academies have not been spared entirely from this educational trend towards the quantification of performance and hence the orientation of their teaching and learning processes towards efficiency criteria, but they have been affected to a lesser extent than their scientific counterparts. This may have something to do with Eliot Eisner's pithy, analytical statement that: *"The arts . . . have little room on their agenda for efficiency, at least as a high-level value. Efficiency is largely a virtue for the tasks we don't like to do; few of us like to eat a great meal efficiently, or to participate in a wonderful conversation efficiently, or indeed to make love efficiently."* [11]

In recent decades, we have increasingly tended to believe in the slogan: "If the economy is doing well, we all are doing well." We have become accustomed to the argument that economic growth is the father of all things such as new and cheaper services and products, social welfare, personal happiness, democracy, world peace, and last, but by no means least, victories in elections. And we all remember the successful slogan, "It's the economy, stupid!" with which, consciously or not, Bill Clinton's war room (what a term!) transferred and transformed Heraclitus' notion that, "*War* is the father of all things!" to the twentieth century.

Buckminster Fuller noted that until 1900 human knowledge doubled approximately every century.[12] However, by the end of World War II knowledge was doubling every 25 years and today human knowledge is doubling roughly every 13 months.

Increasing research specialization represents both the cause and effect of this knowledge explosion. As a result, in the academic world we are facing massive

[9] Simon Marginson, University Mission and Identity for a Post-Public Era, in: Higher Education Research & Development, Volume 26, Issue 1, 2007, Special Issue: Higher Education Governance, p 117–132, Routledge, 2007.

[10] "Europe needs excellence in its universities, to optimize the processes which underpins the knowledge-society and meet the target, set out by the European Council in Lisbon, of becoming the most competitive and dynamic knowledge-based economy in the world." Communication from the Commission – The role of the universities in the Europe of knowledge/COM/2003/0058 final, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52003 DC0058:EN:HTML

[11] Eisner, Elliot W., The Arts and the Creation of Mind, xiii, Yale University Press, Yale, New Haven, 2002.

[12] Buckminster Fuller, R., *Critical path*. Macmillan, 1981.

subject fragmentation. Universities have become an environment in which highly specialized experts compete to obtain points for their citation index and we are all aware of the strategy of splitting research results in order to increase the number of publications. Separation, demarcation and fragmentation constitute the story that scientific history seeks to tell us. And although the terms transdisciplinarity and interdisciplinarity now occur with greater frequency in a growing number of publications, and even more often during pleasant discussions, effective research collaboration between different disciplines remains an exception. It certainly does not fit comfortably into the current academic system, which is driven to a large extent by competition between institutions, disciplines and individuals.

The consequence of this development is an increasing trend towards self-referencing in the sciences. This has nothing to do with the separation of basic and applied research and is certainly not a per se criticism of the former. Nonetheless, the continuing discussion,[13, 14, 15] regarding the crisis in the humanities is clearly a symptom of the fact that faced by accelerating knowledge progress and ever more complex theoretical and practical topics, fragmented science is becoming steadily less able to formulate complex questions, complete profound analyses and develop differentiated theses and suggestions that accommodate all objective interconnections.

Instead it can be stated that the relevance of scientific work even for the theoretical discourse within the scientific community is declining in step with increasing specialization and the formation of scientific niches. Visionary concepts based on long-term or even utopian approaches, which generally demand that existing limits be ignored and prohibit the erection of new micro-disciplinary barriers, are therefore becoming rarities.

Lorraine Daston, the respected science historian, has stated that paradigm-breaking innovation arises mostly at the overlapping edges of different disciplines[16] and in fact there are only a few significant examples of systematic, interdisciplinary group formation. The best of these is life sciences, where experts in molecular biology, biotechnology, robotics, biomedicine, biophysics, biomechanics, genetics, neuroscience and other disciplines have decided to work together in various combinations. This strategy has led to an incomparable success story, as at present life sciences probably constitute the world's most powerful field of research from the viewpoint of potential capacity for the shaping of our civilization's future. The

[13] Levine, Peter, Nietzsche and the Modern Crisis of the Humanities, State University of new York Press, Albany, 1995.

[14] Stanley Fish, The Crisis of the Humanities Officially Arrives, The New York Times, October 11, 2010, http://www3.qcc.cuny.edu/Wikifiles/file/The Crisis of the Humanities Officially Arrives, NYTimes.com-1.pdf.

[15] Gutting, Garry, The Real Humanities Crisis, The New York Times, November 30, 2013, http://opinionator.blogs.nytimes.com/2013/11/30/the-real-humanities-crisis/?_php=true&_type=blogs&_r=0

[16] Daston, Lorraine, keynote speech at the European Forum, Alpbach, 2012.

next best example is provided by experimental physics, where theoretical physics, quantum mechanics and quantum optics join forces.

2.2 Art Meets Science Meets Arts

I believe that it is no coincidence when researchers from both these areas state that they need visualization for the enhancement of their theoretical models and that they profit from communications with artists. Anton Zeilinger, a leading expert in experimental physics, even went so far as to demonstrate his teleportation experiment, which is based on quantum mechanics and optics, at the dOKUMENTA (13) in Kassel, the world's most important exhibition of contemporary art.[17] In a response to these signs of the times, in 2011 the University of Applied Arts Vienna established an "Art & Science" master's degree program and graduates from this university presented a widely acclaimed experiment at the international Vienna Art Fair (VIENNAFAIR), using DNA for the storage and recall of visual information.[18]

It is also imperative to note that the *"invisible hand of the market"*[19] is even preparing to seize command in the art system. The art market is booming with parties and selling as the main purpose of the numerous art fairs, from Miami to Basel, from Dubai to Hong Kong and from Beijing to Sao Paulo. Artworks are assuming the role of shares, art collectors are slipping into the role of equity dealers and the artists themselves are occasionally taking the role of traders, as Damien Hirst demonstrated with an auction in New York on September 15, 2008. By bypassing his dealers, Hirst brought more than 200 of his own works to Sotheby's and earned USD198 million through this single auction. Ironically enough, Lehman Brothers collapsed on the very same day.

In fact, reports about art can be reliably expected when auctions bring record results such as USD 58 million for Jeff Koons' Balloon Dog, USD105 million for Andy Warhol's Silver Car Crash and USD142 million for Francis Bacon's Freud Tryprichon. And all this money in 2013 alone.

Naturally, art is also a significant economic factor away from the auction rooms, especially in the tourism area. However, as far as public consciousness is concerned such sensational headlines often serve to conceal the social value of art above and beyond its financial importance. *"The economic importance of the arts is increasingly appreciated, but to consider only the financial impact of cultural activities is to produce a distorted picture of their actual value to society."*[20]

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[17] dOCUMENTA (13), The Guidebook, Catalogue 3/3, p 134f, Hatje Cantz Verlag, 2012,

[18] http://pavillon35.polycinease.com/the-phage-λ-simulacrum-viennafair-2013/

[19] Smith, Adam, An Inquiry into the Nature and Causes of the Wealth of Nations, 1776.

[20] Matarasso, François, Use or Ornament? The Social Impact of Participation in the Arts, first published 1997, first published in electronic form 2003, Comedia, The Round, Bournes Green, Stroud, Glos GL6 7NL, ISBN 1 873667 57 4.

Art can also help to swim against the tide, *"bear witness, . . . express trauma and catharsis,"* and assume the form of collective memory and the sadness born of loss due to conflict.[21] Niklas Luhman points out that: *"It has always been the task of art to deliver descriptions of the world, or offer it forms that do not coincide with those that already exist*."[22]

Einstein stated that: *"Imagination is more important than knowledge."* And who had the imagination to foresee moon flight? It was neither John F. Kennedy, nor the NASA. It was Jules Verne, in his book "De la Terre à la Lune", written a century earlier.

The neuroscientist Wolf Singer points out that when developing new theories scientists use criteria that go far beyond logical conclusions and that these criteria lead to the language of the arts: *"In the case of a scientific theory, one knows that it is correct long before it is proven because it is aesthetically pleasing. Or put another way, not because it is inherently consistent, but simply because it "feels right" . In this connection one employs criteria that go far beyond what one can call logical conclusions."* The neuroscientist is convinced that: *"Everything that uses non-rational language such as the fine arts, music and the dance, communicates a form of knowledge that cannot be transported by rational language."* [. . .] However, the language of art must be learned for this purpose.[23]

The breakthrough from the geocentric to the heliocentric model arrived with the invention of the central perspective in Renaissance painting, which was somehow necessary in order to find a way of viewing the world from a fixed central point in space.

The paintings of Seurat (Figs. 2.1 and 2.2) can also be seen as pixelled pictures, a technique or technology that would be used some 60 years later for television.

And isn't it kind of amazing, that Van Gogh's painting of a starry night seems to show patterns of earth magnetism? (Fig. 2.3)

In his paintings, Picasso disassembled the visual and intellectual interrelationship between material, form, time and space with the result that a person or object disintegrates, or we see them from different viewpoints at the same time. Picasso's paintings predate Einstein's theory of relativity by a few years, as well as Heisenberg's discovery that the more precisely a particle's position is measured, the less precisely one is able to determine its momentum.

Uncertainty was thus the paradigm-breaking topic at the end of the nineteenth and the beginning of the twentieth century in both the arts and the sciences.

The twentieth century transformed the planet, or at least large parts of it, from a world of certainty into one of questions and doubt. And as far as influencing this view of the world was concerned, the arts played a role that was least equal to that

[21] Christoph-Bakargiev, Carolyn, in dOCUMENTA (13), Das Buch der Bücher, Catalogue 1/3, Hatje Cantz Verlag, 2012, p 301 f.

[22] Luhmann, Niklas, Interview in: Texte zur Kunst, Vol. I, Herbst 1991, No.4, p. 126.

[23] Singer, Wolf, Ein neues Menschenbild. Gespräche über Hirnforschung, Frankfurt/M., 2003, p. 103 ff.

Figs. 2.1 and 2.2 George-Pierre Seurat, The Channel at Gravelines, 1890 (Imagecredits G. Bast 2014)

Fig. 2.3 Vincent van Gogh, The Starry Night, 1889 (Imagecredit G. Bast 2014)

of the sciences. In fact, when one studies the parallelisms between artistic and scientific history, the fundamental upheavals in music, the visual arts and design, and the paradigmatic shifts in physics, psychology and medicine in the early twentieth century make particularly plain the interactions between what are apparently separate spheres.

Of course this does not at all mean, that Giotto and Brunelleschi were more important than Copernicus. Of course not, that George Braque, Pablo Picasso and Arnold Schoenberg were the pioneers of quantum physics. But it is precisely the quantum physics which has shown us that there is more than just direct and linear connections between time and place, between cause and effect. It is not least about something that you can rewrite with a holistic aesthetic and intellectual climate in a

society, a cultural climate, which artists and their way of looking at the world significantly impacted.

In any case this shows clearly how the power of science and the arts can multiply when the two enter into a constructive exchange in awareness of both their own strengths and identity, but also of the synergetic potential for social effects above and beyond citation indices and artistic market rankings. These random examples prove beyond doubt that the arts can contribute to creating an atmosphere or zeitgeist that is able to fertilize science and technology in a variety of ways.

Indeed, art and science, two sisters of the human spirit that in the course of history have become separated, are now showing an increasing tendency to enter into an active interrelationship, whereby the initiative would appear to emanate primarily from the artistic rather than the scientific side. In the arts, a fascination for the tapping into new possibilities for artistic work predominates, while in the sciences certain reservations remain. These relate to the anxiety that too great a rapprochement with the arts could have a negative effect upon the "seriousness" of the scientific community. This relates closely to the view that science stems from the brain and art from the gut. And that science has something to do with precision and planning, and art with coincidence and intuition.

In fact the history of both the arts and sciences is a saga of errors and accidents, and at the very latest, since Heisenberg we know that the world of the natural sciences does not function according to the conventional concepts of exactitude and precision. Leonardo da Vinci, who in his time influenced the worlds of science, technology and the arts, is alleged to have stated with regard to his painting and not his activities as a scientist and inventor: *"I paint with my brain and not with the brush."* Furthermore, Edward Wilson, one of the founders of socio-biology writes: *"A good scientist must work like a bookkeeper and think like an artist."*

Nonetheless, one fundamental difference does exist between art and science. *"Change and renewal in the sciences always bring the contradiction and substitution of existing knowledge, or at least its expansion and supplementation. In other words, they fill knowledge gaps. Thus the difference between science and art is that aesthetic progress does not invalidate what has gone before. The discoveries of Copernicus rendered those of Ptolemy obsolete, but Picasso neither refuted Van Gogh nor reduced his significance."*[24]

Therefore, in the arts change automatically implies expansion, while innovation in the sciences means both supplementation and replacement in the sense of the state of the art (still the current term for the respective latest technology!).

[24] Bast, Gerald Können Künstler Forscher sein? Can Artists be Researchers? In: Kunst und Forschung. Art and Research. Ritterman, Janet; Bast, Gerald; Mittelstraß, Jürgen, (Eds.) Edition Angewandte, Springer Vienna, New York, 2011.

2.3 Innovation and Arts

Innovation is increasingly becoming the new no.1 political slogan. Innovation as a panacea for saving the world's ills, but perhaps first and foremost, as a cure for its economy. Whatever the truth, political slogans must always be subjected to careful analysis. And in this case, the task is to uncover the actual meaning of the word innovation within the aforementioned context.

From Schumpeter to current definitions, innovation is seen as meaning the introduction and dissemination of new and improved products, processes, systems and devices for commercial use. Only a small few classify achievements relating to our social existence such as law, music, literature, painting, dancing, democracy, human rights, schools, universities, hospitals, museums and theatres as belonging to the innovation system.

Government documents show clearly the current direction: *"With an ageing population and strong competitive pressures from globalization, Europe' s future economic growth and jobs will increasingly have to come from innovation in products, services and business models. This is why innovation has been placed at the heart of the Europe 2020 Strategy for growth and jobs*." (EU Commission)[25] And on the White House website one can read: *"President Obama's Strategy for American Innovation seeks to harness the ingenuity of the American people to ensure economic growth that is rapid, broad-based, and sustained. This economic growth will bring greater income, higher quality jobs, and improved quality of life to all Americans*."[26] Innovation is therefore seen primarily in terms of a direct economic interdependency.

Prior to the Industrial Revolution in the mid-eighteenth century, no one could have imagined that within a few decades, first Europe and subsequently the USA and parts of Asia would go through a profound and lasting economic and social transformation affecting both working and living conditions. Inventions based on the use of mechanical processes altered radically both the means of production and travel, and large sections of the population lost both their occupations and income. Traditional trades and skills, like those of the weavers disappeared, while new professions arose along with increasing social inequality.

Similarly, the digital revolution of the twentieth century has not only reshaped production processes and communications, but also changed fundamentally our perception of the world. For those members of the global population with access to digital information technology conventional, fact-based knowledge is no longer the master key to power, but instead the processing and linkage of information. At the same time, the global differences relating to the availability of digital information have resulted in a previously unknown imbalance in the distribution of power. In addition, owing to the exponential acceleration in the speed of quantitative

[25] http://ec.europa.eu/research/horizon2020/pdf/press/horizon2020-societal-challenges-infokit.pdf

[26] http://www.whitehouse.gov/issues/economy/innovation

knowledge production (see above) not only is the gap between those with and those without knowledge, and between those with or without access to the linkage of data becoming ever larger, but also this inequality is gaining in permanence. Social differences are solidifying and are being "inherited". It is becoming increasingly difficult for anyone that once falls behind to ever make up the resultant leeway.

In addition to "innovation society", the terms "knowledge society" and "knowledge economy" are in increasing use. Knowledge is not only growing in volume, but is also playing, or rather could play, an ever-greater role in the development of our societies but additional knowledge alone is insufficient. In the meantime, the expansion of knowledge per se has become somewhat more of a problem rather than a solution. Our brains have myriads of nerve cells, but their simple multiplication does not enhance our memory capacity. Instead, of decisive importance are the synapses, the links between the nerve cells. It is these that enable the potential of raw information to be employed productively. For example, when the brain of a pedestrian crossing a road receives optical information from the eyes that a car is approaching, this alone is insufficient to establish the existence of a potential danger and initiate measures that would appear to be worthwhile and in the pedestrian's interest. Moreover, although as a result of the structure of its nerve cells the eye is capable of transmitting the image of the car, this remains useless irrespective of the degree of resolution. It is also of no help when such information remains isolated in the visual centre of the brain. In fact, what is vital for the survival of the pedestrian is the ability to assess the speed of the vehicle, estimate the extent to which it poses a fundamental danger (a capacity that small children do not yet possess) and allow this potential danger to find expression in other regions of the brain. The pedestrian then decides as to whether an accelerated stride is required, or if a leisurely pace will suffice owing to the fact that a marked crossing is being used in a country that in this situation allocates pedestrians rather than drivers the statutory right of way. This is a simple example, but nevertheless the possibilities are immensely complex. Of decisive importance are the quality and reaction speed of the links, the synapses, between the individual cell regions.

2.4 The Limits of a Knowledge Society

The knowledge society presents a similar behavioural pattern. The links formed by the lines of communication between the various branches of knowledge determine the degree of effectiveness of know-how within society. Without a sufficient number of functional knowledge synapses, irrespective of their height, the know-how towers remain isolated and self-referencing (Fig. 2.4).

In the 1950s Marino Auriti wanted to build a huge tower of knowledge, the Encyclopaedic Palace of the World, where all the world's knowledge should be stored. It never was built not only it became clear that even at that time the tower already would have been to small. Today for a lot of disciplines such a tower would

Fig. 2.4 Marino Auriti, The Encyclopaedic Palace of the World, ca 1950s (Imagecredit G. Bast 2013)

be too small even for a single scientific discipline. Auriti's model, shown at the Biennale di Venezia in 2013, reminds of Breughel's Tower of Babylon (Fig. 2.5).

The Tower of Babel did not fail owing to structural presumption or even more to being an expression of human hubris, but rather an underestimation of the complexity of the task in hand and the resultant communications requirement. It was the "Babylonian linguistic confusion", or in other words the babble caused by the inability of a large number of experts to communicate, that caused the Tower-of-Babylon-project to collapse.

Cultural techniques are basic structures where a society is built on. Like organisms need the cell structure to take form and grow, any society needs members with mastery of cultural techniques. Social life, politics, economy, they all need this basic structure. To date, reading, writing and calculating continue to be regarded as the most important "cultural techniques" for the functioning of society in general and the economy in particular. They occupy a central position in education. Indeed, the empowering of as many sections of the population as possible with an ability to employ these tools without difficulty was a major prerequisite for the industrial society. And not least, the introduction of general compulsory education in various

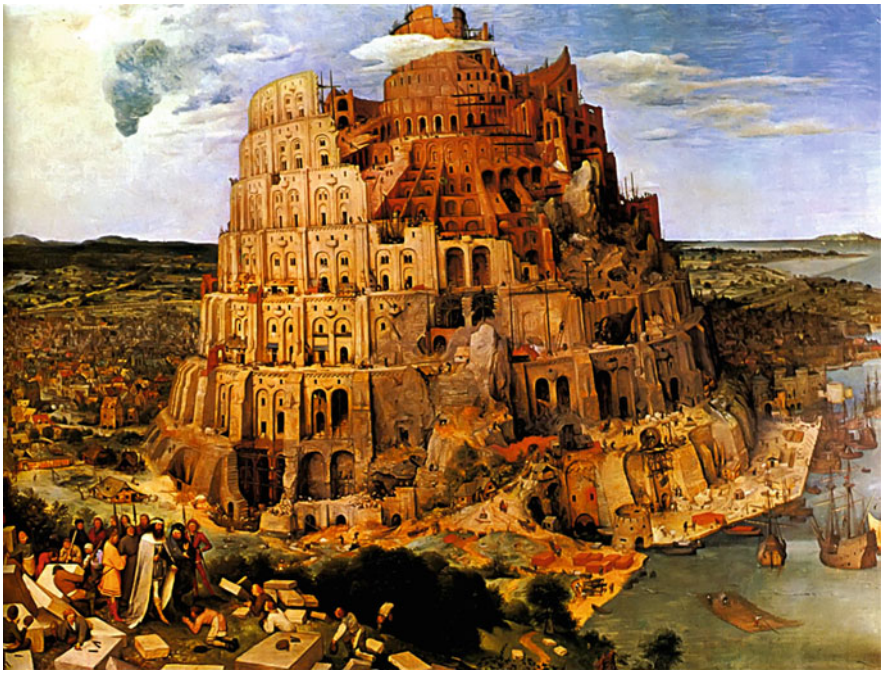

Fig. 2.5 Pieter Brueghel the Elder, The Tower of Babylon, 1563 (Imagecredit: Creative Commons, via Free Christ Images, http://www.flickr.com/photos/tico_bassie/4120114329/lightbox)

countries, which coincided roughly with the development of industrial societies from the second half of the eighteenth century onwards, had the objective of making a basic version of these "cultural tools" available on a broad basis.

At the close of the twentieth century and the onset of the digital revolution, the canon of the cultural techniques originating from the industrial age was supplemented by the ability to communicate digitally. Those lacking skills in this respect were and are regarded as digital illiterates with social exclusion and a shortage of employment opportunities in the labour market as a consequence.

Today, on the eve of a "creative revolution"[27] that is essential for the society and economy of the twenty-first century, the task is to further expand the canon of cultural techniques by the addition of creative skills:

- Imaginative and associative abilities
- The recognition of coherences that are not immediately apparent
- Problem-solving and critical thinking

[27] Compare Bast, Gerald, Preparing a "Creative Revolution" – Arts and Universities of the Arts in the Creative Knowledge Economy, in: Carayannis, Elias G (Ed.), Encyclopedia of Creativity, Invention, Innovation and Entrepreneurship, p 1471–1476, Springer Reference New York, Heidelberg, Dordrecht, London, 2013.

- Thinking in terms of alternatives
- The questioning of the status quo
- Communications and teamwork
- Recognition of the fact that there are various perspectives
- Recognition of the fact that there are forms of communication other than the verbal and the promotion of an ability to employ them

It is here that art comes into play for as early as 1995, the UNESCO pointed out that: *"If ever there was a need to stimulate creative imagination and initiative on the part of individuals, communities and whole societies the time is now. The notion of creativity can no longer be restricted to the arts. It must be applied across the full spectrum of human problem-solving."* [28]

The US Secretary of Education, Arne Duncan, justified the demand for an increase in art teaching as follows: *"Education in the arts is more important than ever. In the global economy, creativity is essential. Today's workers need more than just skills and knowledge to be productive and innovative participants in the workforce. Through the combination of knowledge and creativity, they have transformed the way we communicate, specialize and do business."*[29]

Owing to the underlying principles of art, persons with an artistic affinity, or in other words, people who in whatever form engage with the arts, possess far greater chances of underpinning the acquisition and consolidation of the characteristics and abilities that are collated under the term "creative skills", than those sections of the population that remain oblivious to the arts.

The reason is obvious for while science attempts to explain the present world, art attempts to create new ones. *"Works of art do not represent "reality", "the real world" or "everyday life", even if these terms are assumed to bear a specific or meaningful reference. Rather, art creates new realities and worlds. People receive and conceive in the light of narratives, pictures and images. This is why art is central to politics, just as it is central to social relationships and beliefs about nature. . . . Because they create something different from conventional perceptions, works of art are the medium through which fresh meanings emerge."*[30]

The issue is therefore the power of imagination, which the production and analysis of art demand from both artists and recipients. The ability to transform imagination and information in both an intellectual and an emotional sense is also involved because: *"Successful works of art enhance, destroy or transform assump-*

[28] World Commission on Culture and Development, 1 From web summary of WCCD Our Creative Diversity. UNESCO 1995. See: http://portal.unesco.org/culture/en/ev.php-URL_ID=15019&URL_DO=DO_TOPIC&URL_SEC- TION=201.html

[29] Re-Investing in Arts Education, p. viii, President's Committee on the Arts and the Humanities 2011, http://www.pcah.gov/sites/default/files/PCAH_Reinvesting_4web_0.pdf

[30] Edelman, Murray, From Art to Politics: How Artistic Creations Shape Political Conceptions, The University of Chicago Press, Chicago and London, 1995, p. 7.

tions, perceptions and categories, yielding new perspectives and changed insights,. .... they can transfigure experience and conception."[31]

For Chus Martínez, the head of the curating department of the dOCUMENTA (13), the essence of art, or better said, of art research, is not found on the basis of art, but by thinking *through* it. *"Today, art is located in a space, which is uniquely fertile for the interrelationships of fields of knowledge that otherwise would never overlap. The situation is similar to that which Gaston Bachelard sought to describe in his introduction to "The Poetics of Space" . Such space appears where the logic of causality gives way and another principle, that of the echo, takes effect."* [32] Art and subsequently creative skills are thus vital catalysts which can assist the operationalization of the ever-faster growing plethora of specific knowledge beyond the narrow limits of the specialist scientific community.

The current knowledge explosion does not automatically mean progress with regard to understanding. It requires associative strengths and inner networking. And the manner in which art demands and promotes associative thinking is clearly demonstrated by a work from Yoko Ono:

Swim as far as you can in your dream. Away from
your home
your mate
your children
your pets
your belongings
your work place
your colleagues.
See if you drown, or survive. [33]

When one reads the above, inner images immediately start to form and chains of association begin to grow. Not least because art locations, irrespective of whether these be places for art reception or institutes for art education, are competence centres for the development and application of associative powers. It is precisely because working with the power of awaking associations is an artistic domain that plays a key role in the creation of a system of synapses between the monolithic towers of knowledge in our fragmented scientific landscapes.

2.5 The Renaissance of Renaissance

The task is to overcome the current monopolization of innovation by the technological sector. That innovation possesses and has always possessed an affinity with art and culture is something that has become erased from the public consciousness.

[31] Edelman, 52.

[32] Martínez, Chus, in dOCUMENTA (13), Das Buch der Bücher, Catalogue 1/3, Hatje Cantz Verlag, 2012, p. 60.

[33] Yoko Ono, Connection Piece VI, in: A Corn, OR Books, New York and London, 2013.

This remains clear with regard to the Renaissance and it is no accident that today there are currents that bear the title "Renaissance 2.0".

Singapore's national strategy for example is entitled "Renaissance City" and this recourse to the term "Renaissance" is not representative of a historizing or even romanticizing attitude, but rather the expression of a future-oriented strategy of implementing art and culture as a motor for social and economic development.

"Renaissance Singapore will be creative, vibrant and imbued with a keen sense of aesthetics. Our industries are supported by a creative culture that keeps them competitive in the global economy. The Renaissance Singaporean has an adventurous spirit, an inquiring and creative mind and a strong passion for life. Culture and the arts animate our city and our society consists of active citizens, who build on our Asian heritage to strengthen the Singapore heartbeat through expressing their Singapore stories in culture and the arts."[34]

And Singapore is not the only but an excellent example for giving a city or region a new vision and thus a new identity by relying on the power of the arts – apart from economic effects. In 2006 the Government of Seoul released the "Vision 2015, Cultural City Seoul", a 10-year masterplan to transform Seoul into a culturally rich city.

Chinese authorities announced in 2006 that 100 new museums would open before the Olympics, and that by 2015, it planned to have 1,000 new museums throughout the country such that every significant city in China would have a modern museum.

The vision of the West Kowloon Cultural District project is to "develop an integrated arts and cultural district with world-class arts and cultural facilities, distinguished talents, iconic architectures, and quality programs with a must-visit appeal to local and overseas visitors, capable of making Hong Kong an international cultural metropolis".[35]

Abu Dhabi is despite various economic challenges about to realize a major cultural investment, which will include a cultural centre with institutions designed by the biggest names in architecture and art – Louvre Abu Dhabi by Jean Nouvel, Guggenheim Abu Dhabi by Frank Gehry, Saadiyat Performing Arts Centre by Zaha Hadid, Maritime Museum by Tadao Ando, and Sheikh Zayed National Museum by Norman Foster, a biennial exhibition space, arts schools and an art college. This obviousely on the long run not only will have impact on Abu Dhabi's global economic competitiveness but also has the potential to change a society, which is so far not at all influenced by the ideas of intellectual and cultural enlightenment.

In Glasgow government turned the image and the social as well as economic life of this city by realizing the vision "to make the development of our creative drive, our imagination, the next major enterprise for our society. Arts for all can be a reality, a democratic right, and an achievement of the twenty-first century".[36]

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[34] http://www.nac.gov.sg/docs/resources/2_finalren.pdf

[35] http://www.legco.gov.hk/yr07-08/english/bills/brief/b23_brf.pdf

[36] Glasgow's Cultural Strategy, 2006, http://www.glasgowlife.org.uk/policy-research/cultural-strategy/documents/glasgowsculturalstrategymaindoc.pdf

Looking at the city of Detroit, once being a national pride, now a bankrupt city with a broken identity and full of social and economic problems it seems that a cultural strategy for Detroit would be the only realistic chance to recover again.

Although these examples do have a clear economic aspect it would be short-sighted and it therefore would not work limiting the strategy to only supporting creative economy. For changing the identity of a whole social and economic environment which means changing a society entirely, it does make little sense to set up an oasis for creative economy within the economic sector. What is need is culturalizing the society instead of commercializing culture. What is needed is to increase creative literacy within the society.

2.6 So What?[37]

1. **Spread creative literacy throughout the entire society**

   In the post-industrial societies necessarily heading towards creative innovation societies, creativity should replace shareholder value as the guiding societal value. Therefore creative skills need to become the central cultural techniques. Creative literacy and the ability to reading the languages of the arts need to be spread throughout the entire society for economic reasons on one hand and for widening the societal participation in the system of the arts on the other hand.

   Peter Weibel argues, that the artist is merely a player, who in the social field of culture disseminates the following hypothesis: "Respected critics, gallery owners, curators, collectors, please view this work which I have produced as art. For it is not so much the artists who specify when a work of art is an artwork, or is an artwork of relevance that possesses certain characteristics, but to a far greater extent the institutions and personages of artistic society."[38] For Weibel art constitutes a social construction and the artist is simply a player in the cultural field. The artists are the first observers, namely observers of the products of others, e.g. artists and scientists. The social instances and institutions of the artistic community represent the second observer tier and they observe the artists. The result of this recursivity is art. Observers are also a product of the social construction of culture. They influence the artwork and vice versa, and in turn are influenced by other observers. Therefore, the observer is caught in a loop. Art is the result of this observer loop, feedback mechanisms and opinions. Thus observers are a link in a chain of cultural feedback.[39]

[37] Miles Davis asked this paradigmatic question with his music, re-inventing his interpretation of what music can be nor for the last time in his life.

[38] Weibel, Peter, Kunst und Demokratie, s. 45, in: Patrick Werkner, Frank Höpfel (Hg.), Kunst und Staat, Huther & Roth, Vienna 2007.

[39] Weibel, Peter Kunst und Demokratie, p. 47f,

Following this approach the key for the role of art within a society is the grade of the involvement in this feedback chain. Bourdieu has pointed out that access to the arts demands access to a receptive code, the existence of which has the function of consciously dividing social systems, as art and art consumption: *"Are so brilliantly suited to the fulfilment of the function of legitimizing social differences."*[40] The power of the arts within a society is limited if the access to the reception codes for the arts is limited. Widening the access to these reception codes is – or should be – a question of education in order to increase the power of the arts for larger parts of our societies.

The visualization of the role of art as a communicator of values, a public commitment to the production and reception of art as a value per se, and the integration of artistic creativity as a factor of equal standing in interdisciplinary innovation are necessary points on the agenda for the prosperity and development of democratic societies

2. **Banish quantification as an inappropriate scale for assessing universities**

We live in a culture of answers. And in order to be able to measure and evaluate answers simply and quickly, the questions must be as straightforward as possible and leave no room for differentiated responses or anything resembling discursive, process-oriented formulation. By contrast, the complexity of our societies and the challenges that they face demand a culture of questions and assessment. The recognition of the interesting and important questions, the selective evaluation of differing interdependencies and approaches to solutions is far more meaningful than quick, simple and ostensibly valid answers. Nonetheless, the culture of the correct and the incorrect is becoming increasingly dominant, even in the universities, as is clearly exemplified by the advance of multiple choice tests, which are not only to be found in the economic sciences, but also medicine and even parts of the humanities. Universities and indeed entire education systems are being evaluated, compared and rated on the basis of answers adjudged to be right or wrong, knowledge and skills called up in isolation, and bibliometrical as well as other statistical data. PISA as evaluation system for secondary education and various rating and ranking systems for higher education dominate and change the understanding of the mission as well as the development of educational systems and institutions. Only what can be quantified is relevant.

In this regard, art and the universities of art occupy a special position, for in spite of various intrusions (e.g. lists of the "most important" artists) they have been able to largely avoid the global ranking trend. On the whole, universities of art remain a bulwark of reflective thought and action. Perhaps this relates to the fact that as opposed to the sciences, art does not suggest to itself or its environment that: "We can explain the world." Art has a completely different approach

[40] Bourdieu, Pierre, *Die feinen Unterschiede. Kritik der gesellschaftlichen Urteilskraft*, Frankfurt/M. 1982, p. 27.

and neither the task nor the ambition to elucidate the world, but instead to challenge the real and create new realities.

Indeed it is not only contemporary art's innovative forms and media that demand the creation of new meeting-places and types of encounter between artists and recipients, and between art and society.

3. **Educate specialists in defragmentation**

No doubt: innovation, based on science and technology will be dominating future developments even more and even faster than in the past. But science and technology will also more than ever need creativity and the arts as the mother tongue of creativity to make the big leaps rather than the small steps towards the future of our civilization. And not only this: Art has the power to innovate, to strengthen societies only by being art itself. There was no time in human history without art. And this was not just because art is beautiful, no art was and is necessary if we don't want to be frozen in the ices of utilitarism and technocracy.

Our socio-political, economic and scientific systems are in a situation of rapidly growing complexity and fragmentation. Of course we need specialists in the sciences, specialists for certain challenges in our societies, but we also need experts to build bridges between the towers of highly specialized knowledge in high-breeded academic and societal niches. This is a difficult task and occasionally one has the impression that there is more to it than merely establishing communications between the sciences and arts by means of the translation of their respective languages. The far greater problem presents itself when the question arises as to whether or not the means with which the other party expresses itself actually constitutes a language at all, and whether communications between the artistic and scientific systems are possible, as basically both are hermetically sealed.

The key for meeting this challenge lies – as so often – in the education system. Not isolated specialized knowledge alone is the basis for innovative strength, but flexibility, the ability to think and act in interdisciplinary and intercultural contexts, bridging different spheres of thinking, crossing borders, questioning existing intellectual as well as behavioral habits, arriving at with new scenarios and producing amazement with its own work. This is the domain of the arts. Therefore interaction between arts, economy and technology systematically should be implemented on all levels of our education system.

After all: In our fragmented and even confusing world it is time to educate interdisciplinary innovation experts: Specialists in de-specialization. Which means utilizing the benefits of specialization by interconnecting people and ideas, seeing something together, which has not yet been seen together, recognizing the effects of contexts, uncovering correlations that are not arbitrary. We cannot waive specialized expertise. But in addition, the world urgently needs people with translational creative skills, people who are able to bridging the islands of specializations.

4. **(Re-)connect teaching, learning, research and dissemination of art and science**

   This connection is not provided by the current educational system, for although parts of the Central European university system champion the ideal of the linkage of research and teaching, it is rarely experienced in practice. The principle of learning through research is therefore diluted/relativated through a change of the term into research-led learning, which means that that those that teach should also carry out research, but that the process of learning and the learners on the one hand and research on the other are largely separated. Universities of the arts need to step into the field of artistic research and aesthetic innovation not leaving the field for the art market in defining the direction of the development of the arts.

   The term "museum" derives from the Greek word "museion" and these institutions found their most significant manifestation in the Museion of Alexandria. However, as opposed to many of the museums of today, Alexandria was not a temple for artistic and scientific worship, but rather a "laboratory" where art and science were further developed with the support of the knowledge stored in the library. Therefore, a museion was not a forum for artistic veneration, but cultural development and what today one would call interdisciplinary networking. In this sense museums have to be re-defined as rather educational institutions in the service of societal development and enlightenment by innovating and disseminating the arts than being parts of the tourism industry with primarily economic indicators for their performance. Not effectivity in economic terms must be on top of the evaluation scale but societal effectiveness. Systematic institutional collaborations between museums universities (of the arts) and other cultural institutions or groups are indispensable not only for increasing the power of research and defining the meaning of the arts but also for giving answers to changes in artistic methods and media. Without adopting the forms – and institutions – for disseminating artistic production into the society the effects of limited access to the reception codes and thus exclusion from participating in the system of the arts as observer will get larger – what on the other side again has effect on the artists and the meaning and content of artistic production. The arts – and especially "new" forms and media of the arts like media art, performance art, interactive digital art need to break the borders and spatial limitations of galleries, museums, theatres and concert halls and clubs. The concentration on these locations causes not only spatial limitations but also limitations in the impact of the arts. It need not be a rule that we are flooded from images wherever we go but the reception of art limited to defined "places of the arts"

5. **Infiltrate and penetrate the educational system and social life with the arts**

   In our society, which is characterized by the specialization and fragmentation of the industrial revolution, strict parallelism between science, economics and art continues to predominate. However, in actual fact our (knowledge) society demands the recognition of the interrelationships between the various disciplines. Therefore, our society has a need for bridges. Bridges that are supported

by artistic design knowledge and creativity as indispensible cornerstones of social and scientific development. And bridges that form a synergetic link between art, science, economics and society. Creative innovation labs should be employed to generate the required interdisciplinary synergies between science, economics, arts and the related access points for the creation of models and theories. For apart from analogous thinking and visualization competence, the ability to deal with uncertainty, complexity and diversity predestines artists to act as "role models". The language of art will thus supplement those of science and economics, in order to create fresh space for thought and action.

The interdisciplinary interaction based on experimental thought between students, teachers, researchers and businesspersons, as well as selective communications with a broad, interested public will open up fresh potential in a world characterized by a combination of rapidly accelerating disciplinary knowledge production, increasingly complex problems and rising demands with regard to approaches to change and solutions.

Referring to many studies on science history as well as brain research and statements of education experts John Eger, Professor at San Diego State University comes to the conclusion that "It is now increasingly apparent that arts and art-infused, interdisciplinary and project-based initiatives will be the hallmarks of the most successful schools and universities and, in turn, the most-successful and vibrant twenty-first-century communities and regions."[41] The University of Applied Arts Vienna in Austria already started several interdisciplinary and trans-disciplinary undergraduate and graduate programs and research initiatives, like Transmedia Arts, Trans-Disciplinary Arts, Art & Science, Social Design-Arts as Urban Innovation and a Innovation Lab with focus on the communication and interaction between the arts, science, technology, politics and economics. While some Art Schools in Europe and the USA stepped into this field of interdisciplinary curricula within the Arts, the paradigmatic change of traditions by combining artistic disciplines with humanities, science and technology still is missing. The reason for this can be found in the current system of evaluating and valuing the performance of a university, department or school: as long as acceptance and success within a single discipline is the main performance indicator, interdisciplinary activities will neither be in the main focus of university leaders nor of researchers and teachers.

Maybe this target should be aimed by following the pattern of the twentieth century when the educational system and social life were infiltrated by economic and technical content. The driving force for penetrating curricula with economic and technical content were economic interests which were implemented by politicians who saw that the needs of industry require more economic and technical skills and knowledge. Interestingly enough, the education system played little part in the penetration of society by digital communication skills. To a far greater degree "digital literacy" was fostered initially by the games

[41] Eger, John M., Arts Education and the Innovation Economy, San Diego State University).

industry and then subsequently by the industry-supported spread of mobile telecommunications and the triumphal progress of the so-called digital, social networks based on youth culture trends.

2.7 Mind the Focus

While we are now faced with the fictionalization of reality (money, assets and liabilities are largely fictitious financial constructions), the arts works with the idea of realization of fictions. For the arts values and visions are not disruptive factors for the operating system, but necessary working basis which – after the ages of renaissance and enlightenment – no longer function as dogmas but can be fought, weight against each other but also can be linked together.

Yes, the arts are a bulwark against the aggression of the banal in our increasingly meaningless desert of hectic economism. With the arts, also understood as a creative and communicative tool for social innovation, the value of values beyond a pure economism can be brought into societal consciousness again. And yes, this is in the interest of the arts as well as in the interest of the economy which both need to mind the focus of their work mode (Figs. 2.6 and 2.7).

So, where are the visionary politicians and lobbyists who are working on penetrating the twenty-first century education system and the whole society with the arts, realizing that the innovation society and innovation economy is the only alternative for the post industrial society and economy? The traditional

Figs. 2.6 and 2.7 Mind the focus (Imagecredits: G. Bast 2014)

understanding of literacy and illiteracy is mainly deriving from the needs of industrial societies and industrial economies. This does not fit to the needs of a creative innovation society. What now is queried and evaluated by PISA or university ranking systems is disregarding new the acquisition and application of skills and knowledge in the creative innovation age.

The Arts – contemporary arts – must come into to the centre of our societies – again. Not instead, but in addition to museums, galleries and opera houses. Not by refraining from artistic autonomy but by reading autonomy in a contemporary context of democratic societies. Not by replacing the classical standards of literacy but by additionally placing value on creative skills and translational knowledge. It is time to regain the societal confidence in the power of the arts! It is time to change the focus of values from mere economic growth towards creative growth based on visions for future societies.

Chapter 3
Art and Artistic Research in Quadruple and Quintuple Helix Innovation Systems

Elias G. Carayannis and David F.J. Campbell

Abstract The traditional understanding of arts emphasizes the aesthetic dimension of arts. Art and arts can also be understood (and re-invented) as a manifestation of knowledge, knowledge production and knowledge creation. Furthermore, knowledge production and knowledge creation extend to knowledge application and knowledge use. The here presented approach to arts introduces knowledge as an additional dimension for defining and understanding arts. This additional dimension does not replace, but extends the aesthetic dimension of arts, by this making the arts clearly multi-dimensional. Through knowledge creation, knowledge production, knowledge application, and knowledge use, research in the arts and arts-based innovation are being interconnected with research in the sciences and sciences-based innovation. Arts and artistic research add to the interdisciplinary and transdisciplinary spectrum of research organizations and of research networks, and can assist the sciences in building interdisciplinary arrangements. Arts and artistic research are now being regarded as drivers for forming and pluralizing interdisciplinary and transdisciplinary configurations and networks with research in the sciences and the application and use of knowledge and innovation in context of society, democracy, but also the economy.

The concepts of the *Quadruple Helix and Quintuple Helix innovation systems* are explicitly sensitive for the roles of arts and of artistic research for innovation. Within context of that line of thinking, arts, artistic research and arts-based innovation are essential for the further evolution and progress of innovation systems. Universities of the arts and other higher education institutions of the arts represent crucial organizations for innovation systems (national and multi-level innovation

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systems). Innovation may not be narrowed down to economic concerns and economic activities. Innovation is more than only economics. “Arts, research, innovation, and society” (ARIS) contribute to creating the basis for new models of economic growth, where “growth in quality” challenges the traditional focus on “quantitative growth” of selected economic benchmarks. “Arts, research, innovation, and society” (ARIS) furthermore interrelates and cross-links with Quality of Democracy. ARIS indicates opportunities for a creative design or creative-design-processes in the further co-evolution of knowledge economy, knowledge society and knowledge democracy.

Keywords AAA (art and artistic research) • AAA (arts, artistic research and arts-based innovation) • ARIS (arts, research, innovation, and society) • Art in the arts • Artistic research • Arts-based innovation • Arts-based research • Society-nature interactions • Socio-ecological transition • Multi-level innovation systems • Innovation ecosystem • Twenty-first century Fractal Research and Education and Innovation Ecosystem (FREIE) • Networks and network governance • Public-private partnerships for research and technological development (PPP RTD) • Democracy of knowledge • Republic of science • Co-evolution • Linear and non-linear innovation • Cross-employment and multi-employment

3.1 Introduction: Artistic Research and the Research Question of Our Analysis

This contribution does not focus on the *arts as such*. The focus is on “artistic research” and how artistic research relates to research, knowledge production (knowledge creation), innovation, and innovation systems. Artistic research may also have the potential to help us to better understand the arts themselves. By this, artistic research qualifies as an epistemic approach (“epistemic tool”) that navigates to core meanings of arts and of “art in the arts”. *Artistic research, however, also bridges, cross-connects and links the arts with knowledge production (research) and knowledge application (innovation) in the sciences or research and innovation that are based on the sciences.*[1] *Therefore, at least potentially, artistic research is also interdisciplinary in character*. Artistic research adds to the development and formation of designs and architectures of interdisciplinary research platforms and research as well as innovation networks, where different disciplines in the sciences are interconnected with the disciplines in the arts through research and innovation activities. In fact, interdisciplinary ambitions in the sciences are reinforced and

[1] Within context of our analysis, the plural term “sciences” always includes the natural sciences, life sciences, but also the social sciences and humanities (human sciences). For us, the *sciences* address the whole and complete disciplinary spectrum. Therefore, “sciences” is not equivalent to science. When we use the shorter expression “scientific research”, we actually always mean the research in all of the sciences.

excelled by bringing artistic research into play. Artistic research, but also the arts in more general, help in creatively strengthening and unfolding the interdisciplinary drive in the sciences. In one understanding, interdisciplinarity does not happen "automatically" in the organizational context of the sciences, but requires an involvement of structures and processes that encourage a further development of interdisciplinarity (within the institutional framework of universities or of other higher education institutions). For example, academic careers often follow a disciplinary logic: therefore, inserting and introducing interdisciplinarity to organizations and networks, requires to innovate and to re-invent the academic career logic. The organizational framing of transdisciplinarity creates even further challenges (on interdisciplinarity and transdisciplinarity, see for example Arnold 2013a, b). *There exists and is the opportunity of configuring and re-configuring scientific research (research in the sciences) and artistic research, interwoven in arrangements of interdisciplinarity and transdisciplinarity. In fact, artistic research has all the potential to increase interdisciplinarity and transdisciplinarity also in research in the sciences, when scientific research and artistic research are being interlinked.*

Our analysis is being driven by the following core research question: *How does artistic research relate to research in the sciences and how does artistic research relate to innovation and innovation systems?* Our inclination is to engage further in formulating, developing and designing propositions in reference to our research question. These propositions are more tentative in character, additional "research about research" is necessary and may impact future research agendas. The analysis of our research question will be based on Carayannis and Campbell (2013) and will departure in iterations conceptually from there. We are motivated to inquire connections of artistic research to innovation and innovation systems by relying on and by applying consequently the concepts of the Quadruple and Quintuple Helix innovation systems. In fact, we believe that the Quadruple and Quintuple Helixes are designed (and driven) in a way and are carried by an understanding that emphasizes the importance of arts, arts universities and artistic research for creativity, knowledge production and innovation. Triple Helix represents a basic model of the innovation core (see Fig. 3.4) and was developed by Etzkowitz and Leydesdorff (Etzkowitz and Leydesdorff 2000; Leydesdorff 2012). Quadruple Helix (Carayannis and Campbell 2009) and Quintuple Helix (Carayannis and Campbell 2010) bring in additional perspectives and by this already "contextualize the context". When we develop the importance and meaning of artistic research for research and innovation, we will follow in particular the conceptual logic of the models of the Quadruple and Quintuple Helix innovation systems. These models will serve as reference for artistic research. The Quadruple Helix and the Quintuple Helix express and emphasize why arts and artistic research are important for knowledge production and innovation.

Our following analysis is structured in the following sections. In Section Two, we explore further the cross-connections and inter-connection between arts and artistic research. This is based on an understanding of arts as a manifestation of knowledge. Section Three embeds artistic research in context of the concepts of Quadruple and Quintuple Helix innovation systems. We demonstrate, how concepts

of innovation and innovation systems have evolved, and how knowledge production, innovation and structures of organizations are intertwined in co-evolution. Finally, in Section Four, the conclusion to our analysis, we speculate on possible future scenarios of co-development of *arts, research, innovation, and society* (ARIS). ARIS has all the potentials of becoming crucial for the further progress of innovation and innovation systems that drives knowledge economy, knowledge society and knowledge democracy.

3.2 Arts and Artistic Research

What is art or what are the arts? This creates a challenge in the quest for finding or identifying answers. However, for our analysis presented here, a possible definition of arts is not of primary concern, because we will focus with greater emphasis on artistic research and its ramifications for knowledge production and innovation. Therefore, we reflect more briefly on the issue of what art is or what arts may be considered to be. *There exists not only one definition, but a pluralism of different definitions of arts* (e.g., see Campbell 2013b). We must recognize and should acknowledge a variety of different definitions of arts, also with competing, sometimes even conflicting meanings. *There are contradictions between the available definitions of arts. Also, definitions of arts have changed over time, and continuously will do so, and are furthermore context-dependent*. Are the arts older than the sciences? Art (as a concept and practice) exists now for several hundred, better several thousand years (at least), so there was a sufficiently long time for a serious evolution of arts. Art (as a concept and practice) probably is even older than the sciences (modern sciences).[2] *A pragmatic simplification could suggest that art is what artists are doing (and artists do very different things). Consequently, "established art" is being represented by the established artists*. But there exists no universal criterion or general standard who may qualify (or not) being an artist. We know that several of the most influential (and innovative) artists only had an impact later in their life, if not even for later generations. In these cases, the not-established (non-established) artists were even more important.

A "traditional" understanding of arts frequently associates the arts with an "aesthetic" dimension, which could be more abstract or more concrete. More concrete means to indicate a "perceived beauty", also an emotionally perceived beauty. Emotions imply that then beauty causes or is connected to emotions in the human "observer" (also producer) of arts, when art is being perceived (created). The emotional spectrum can be comprehensive and diversified, but also

[2] Of course, depending on how the sciences or knowledge production in the sciences are defined or is being defined, we may arrive here at different conclusion. Perhaps, the sciences (or pre-forms of the sciences) are just as old as the arts (pre-forms of arts). *Reasoning and aesthetic sensitivity represent universal categories of humanity*.

controversial. Looking at art from a historical perspective, the aesthetic dimension of arts often was thought to express the beauty or perfect beauty (perfect order) of the world (the universe), of society, but also of individual people (for example, see the review and discussion in Öcal 2013, pp. 11–27).[3] This expression of beauty or perfection (*beautiful perfection*) could have religious connotations, but was not necessarily linked to religious connotations. In several contexts also cross-references were drawn between the beautiful, the perfect and the good. Was this the case (the construction of meaning), then the beautiful was furthermore the morally or ethically good. The "beautiful order" expressed the "morally good order". *By associating art closely to an aesthetic dimension, arts can also fulfill "aesthetic functions", or also those aesthetic functions, which society or specific communities want to assign to arts*. Acknowledging modern (post-modern) reactions against traditional (too traditional) aesthetical concepts and conceptions of beauty, the aesthetic dimension may also be sub-clustered into a complex world of very different sub-dimensions. Can the absence of beauty also be expressed in the aesthetical dimension? Is there the "beauty of the non-beauty" or the "beauty of the ugly", does the ugly also fulfill aesthetic functions? Does the aesthetic dimension capture equally the presence, but also the absence of beauty? Can beauty (aesthetics) be measured without referring to a specific context? In a terminology of *measurement of beauty,* beauty could be represented on a dimension (a scale or multi-dimensional scale) of aesthetics that expresses the presence (presence and/or absence) of beauty, allowing for gradual degrees of beauty or also the expression of "positive beauty" and "negative beauty".

In addition to aesthetics, what are the possible alternative dimensions for conceptualizing and "measuring" the arts that complement and expand the aesthetic dimension of arts? *Beyond aesthetics, how can we conceptualize arts further?* In fact, we are interested in also promoting an understanding of arts which drives arts *further and beyond an only-aesthetic-understanding of arts,* which does not deny the aesthetic dimension (dimensions), but intends to complement the aesthetic dimension of arts. Therefore, we want to suggest as a new reference point for debate:

> Art and arts can also be understood (and re-invented) as a manifestation of knowledge, knowledge production and knowledge creation. Furthermore, knowledge production and knowledge creation extend to knowledge application and knowledge use.

The here presented approach to arts introduces knowledge as an additional dimension for defining and understanding arts. This additional dimension does not replace, but extends the aesthetic dimension of arts, by this making the arts clearly multi-dimensional (see Fig. 3.1). Consequences of this are (when we follow the logic of that particular knowledge-definition of arts) that the arts cannot be understood comprehensively and sufficiently only on the basis of aesthetics alone. Of course we could speculate, whether the knowledge involvement of arts implies a

[3] In her Master thesis, Derya Öcal also reflects on the question, *What is Art? Was ist Kunst?*

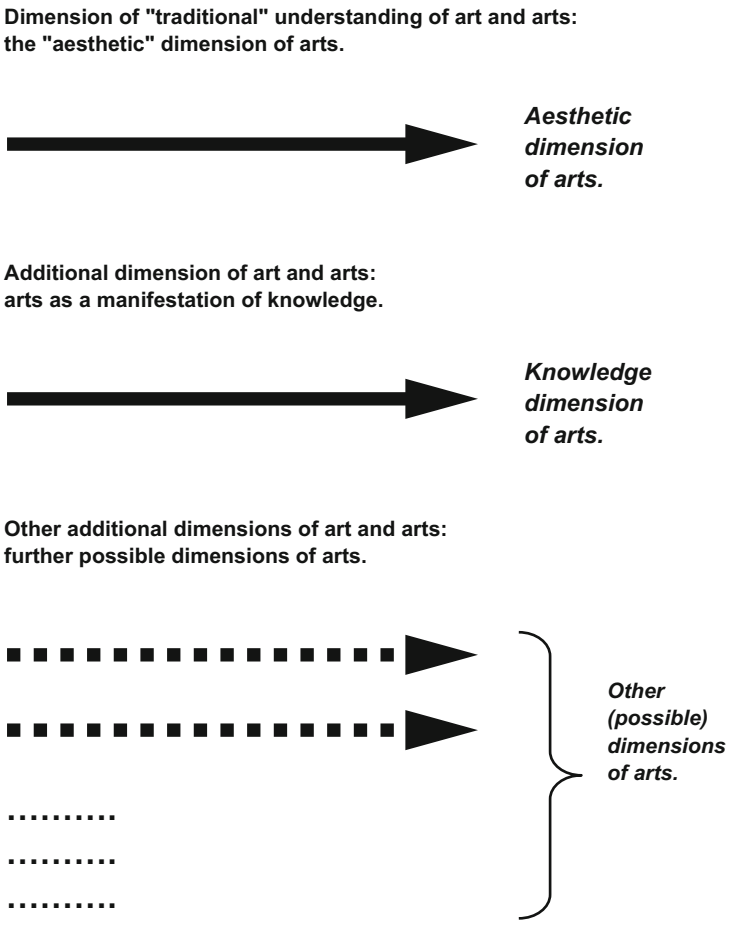

Fig. 3.1 Dimensions of conceptualization and measurement of art and arts (Source: Authors' own conceptualization)

knowledge for which aesthetic considerations play frequently an important role (forms of beauty or non-beauty). *Aesthetics may interact with different forms of reasoning or intelligence, such as intuition or emotional intelligence. Research and progress in the sciences clearly are also driven by and benefit obviously from intuition or emotional intelligence.* Clearly, there is furthermore more of a need to continuously reflect which dimensions (in addition to aesthetics and knowledge) may also be of further relevance for art and arts.

By introducing this additional-knowledge-dimension-of-arts, complementing the dimension of aesthetics, it is being acknowledged that also forms of arts-based research and arts-based innovation are existing and can emerge further. In fact,

"artistic research" represents one crucial expression of arts as a manifestation of knowledge. What are the differences between arts-based research and artistic research? Boundaries here are obviously fluid and depend on specific positions of perspective. Connotations of artistic research imply that the research is not only arts-based, but that research and arts are actually being intertwined and inter-linked with each other more directly (on "artistic research", see furthermore Damianisch 2013; Mateus-Berr 2013). Artistic research is more immediately and straightforwardly connected to the arts than arts-based research, at least being seen from a conceptual understanding. Of course, also artistic research and arts-based research overlap. *In fact, opportunities of interdisciplinary and transdisciplinary combinations of artistic research, arts-based research and academic research (in the sciences), extended by configurations of arts-based innovation and sciences-based innovation, are arising and can be utilized by institutions, organizations, communities and networks*. "In a short-cut, *transdisciplinarity may be defined as the application of interdisciplinarity* (transdisciplinarity = application of interdisciplinarity?)" (Campbell and Carayannis 2013a, p. 34). Of course, we have to admit that there also can be the transdisciplinarity of a "disciplinarity in application". Transdisciplinarity usually (always) refers to forms of application. Often (but not always) interdisciplinarity is more application-friendly than disciplinarity (see again Arnold 2013b).

The proposition (that knowledge, knowledge production and knowledge creation qualify as an-additional-dimension-for-art-and-arts) has the implication that the arts and our understanding of arts are being opened to knowledge and the "tree of ramifications" of knowledge. In fact, this bridges the arts with research and innovation. The arts are interconnected with research-and-innovation-in-the-arts and with research-and-innovation-in-the-sciences. *"Art as a manifestation of knowledge" draws interdisciplinary and transdisciplinary configurations in connectivity, where knowledge production and innovation in the arts are extended to knowledge production and innovation beyond the arts*. Furthermore, we can argue that in context of-a-knowledge-understanding-of-the-arts the "artistic research" actually is important for comprehending arts and also for developing the arts further. (There is no comprehensive understanding of the arts without artistic research?) Artistic research also touches on epistemic implications for the arts. Already in the introduction we asserted: "By this, artistic research qualifies as an epistemic approach ('epistemic tool') that navigates to core meanings of arts and of 'art in the arts'". *Is aesthetics more than only-beauty,* or what is the beauty of epistemology?

Having introduced knowledge, knowledge production and knowledge creation as a second dimension for art and arts, in addition to the dimension of aesthetics, we want to speculate on some of the implications and ramifications of this intellectual endeavor. The following propositions we want to suggest for further discussion:

1. *Art as a manifestation of knowledge:* Our proposition is that art and arts can also be understood as a manifestation of knowledge. This knowledge-based

definition refers to knowledge production and knowledge creation (research)[4] as well as to the application and use of knowledge (innovation). We introduced knowledge as a second (additional) dimension for defining arts that complements the first (and more traditional) dimension of arts, which is aesthetics. In our opinion, knowledge does not replace, but complements aesthetics for a broader understanding of arts. Dimensions in addition to aesthetics and knowledge appear also to be possible and valid for arts. (In context of our analysis here, however, we do not engage further in speculating on dimensions of arts beyond aesthetics and knowledge.)

2. *Arts, artistic research, interdisciplinary and transdisciplinary combinations of research in the arts and research in the sciences, innovation and innovation systems:* Artistic research represents one outflow in consequence of approaching arts as a manifestation of knowledge. In fact, it could be argued that artistic research helps in better understanding arts in all the possible ramifications. To turn the argument: without artistic research, our pictures of arts are incomplete, probably also too fragmented. Without artistic research, our visions of arts are insufficient. *Based on this paradigm of knowledge, arts-as-a-manifestation-of-knowledge and artistic-research clearly enable to cross-connect and interconnect the arts with knowledge*. Discourses in knowledge are being bridged with discourses in the arts. Research and innovation can spread from the domain of knowledge to the domain of arts. Arts and artistic research are now being regarded as drivers for forming and pluralizing interdisciplinary and transdisciplinary configurations and networks with research in the sciences and the application and use of knowledge and innovation in context of society, democracy, but also the economy. Arts and artistic research aid and add in widening our horizons of knowledge production and knowledge creation within the sciences. *With arts and artistic research, the domain (domains) of intelligence can be more fully leveraged for knowledge creation, which is also important for knowledge production in the sciences. What are forms or sources of knowledge production (intelligence) beyond language or the use of (written) texts?* Arts may also be utilized as an unconventional strategy for preparing grounds for *The New* "beyond horizon", for encouraging and experimenting with unconventional configurations of "interdisciplinarity in transdisciplinarity". *Arts-as-a-manifestation-of-knowledge and artistic research re-define the arts in a way, making it then obvious, why the arts are crucial (at least potentially) for innovation and whole innovation systems* (national systems of innovation or multi-level innovation systems; Carayannis and Campbell 2006, 2012, pp. 32–35). One radical proposition would be that without strong and continuously evolving cross-references to arts, every comprehensive innovation system (national or multi-

[4] In context of our analysis here, we use knowledge production and knowledge creation as interchangeable concepts. We could speculate, whether "knowledge creation" fits better for purposes of describing processes (knowledge-based processes) in the arts and in artistic research than the term "knowledge production".

level architectured innovation system) is only premature, operating below possible capabilities. "The arts excel as innovation systems." Arts and artistic research also contribute to *Quality of Democracy* and innovation capabilities in democracies and in processes of further democratization (Campbell and Carayannis 2013a).

3. *Epistemic implications of arts and artistic research:* Arts-as-a-manifestation-of-knowledge and artistic-research also emphasize the epistemic implications of arts.[5] This is not being seen as being in conflict with the aesthetic dimension of arts, since beauty or non-beauty are per se neutral with regard to epistemic potentials. Epistemic ramifications of arts and artistic research are manifold, diverse and heterogeneous. For example, artistic research engages the arts in interdisciplinary and transdisciplinary networks of research in the sciences (or in networks of research in the sciences and the arts). Arts and artistic research help us thinking and imagining beyond the "written text". Imagination and science fiction are references for the powers of fantasy, and may inspire processes and scenarios of knowledge creation and knowledge production, long before a particular knowledge application or technology implementation is realistic ("thinking in possibilities before possible uses"). "Fiction or science fiction may serve as stimulators for creative ideas, with the potential of being later transformed, at least partially (and of course not always), into new knowledge creation and production. *We can also call this the creativity of knowledge creation*" (Carayannis and Campbell 2010, p. 48). *Arts and artistic research can be used for designing "virtual worlds" that could not exist "outside in the world" or that contradict the "outside world", leading to paradoxical phenomena and furthermore to questions of what reality is or "What really exists?"*. One example is the Dutch graphic artist M.C. Escher (Maurits Cornelis Escher), who lived from 1898 until 1972.[6] Escher engaged in drawing "impossible constructions" [7] that actually represent "logical contradictions" (seen from a certain perspective of perception). Two famous drawings of his are "Ascending and Descending" (1960)[8] and "Waterfall" (1961).[9] We could speculate, whether the arts help us in seeing "impossible worlds". *Is there a contradiction between the picture (image) and a conventional logical explanation, which reality is truer (or is already this wording a contradiction in itself)?* These briefly discussed examples illustrate only tentatively and fragmentarily (in a partial

[5] Epistemology or an "epistemic base" may apply as a concept to very different fields. For example, also policy and policies can be discussed under aspects of "epistemic governance" (Campbell and Carayannis 2013b, c). In fact, to utilize an epistemic base in unusual contexts has all the qualities of a potentially innovative approach or approaching.

[6] See: http://en.wikipedia.org/wiki/M._C._Escher

[7] For an overview see: http://www.mcescher.com/gallery/

[8] See: http://www.mcescher.com/gallery/impossible-constructions/ascending-and-descending/ and http://en.wikipedia.org/wiki/Ascending_and_Descending

[9] See: http://www.mcescher.com/gallery/impossible-constructions/waterfall/ and http://en.wikipedia.org/wiki/Waterfall_(M._C._Escher)

manner) the whole spectrum of epistemic implications of arts and artistic research that appear to be possible. Further research and further artistic work is necessary.

3.3 Innovation Systems in Conceptual Evolution: Mode 3 Knowledge Production in Quadruple and Quintuple Helix Innovation Systems

Universities, or higher education institutions (HEIs) in more general, have three main functions: teaching and education, research (research and experimental development, R&D) and the so-called "third mission" activities, for example innovation (Carayannis and Campbell 2013b, p. 5). In reference to "arts universities" now the question and challenge arises, whether, to which extent and in which way the arts universities differ from the (more traditional) universities in the sciences. Arts universities obviously place an emphasis on the arts, and the arts are not identical with the sciences. However, also arts universities frequently make references to the sciences, thus also arts universities can express competences in teaching and in carrying out research in the sciences. *The other major challenge of arts universities is to engage in "artistic research" and "arts-based innovation". By this, arts universities (and other higher education institutions in the arts) are also being linked to and are being inter-linked with national innovation systems and multi-level innovation systems.* This widens the whole interdisciplinary and transdisciplinary spectrum of higher education systems. *"Artistic research" furthermore complements the "teaching of arts" at arts universities* (see also the propositions formulated by Bast 2013). Hybrid and innovative combinations of universities of arts and universities of the sciences are possible and indicate organizational opportunities for promoting creativity.

University research, in a traditional understanding and in reference to universities in the sciences, focuses on basic research, often framed within a matrix of academic disciplines, and without a particular interest in the practical use of knowledge and innovation. This model of university-based knowledge production also is being called "Mode 1" of knowledge production (Gibbons et al. 1994). Mode 1 is also compatible with the linear model of innovation, which is often being referred to Vannevar Bush (1945). The linear model of innovation asserts that first there is basic research in university context: gradually, this university research will diffuse out into society and the economy. It is then the economy and the firms that pick up the lines of university research, and develop these further into knowledge application and innovation, for the purpose of creating economic and commercial success in the markets outside of the higher education system. Within the frame of linear innovation, there is a sequential "first-then" relationship between basic research (knowledge production) and innovation (knowledge application).

The Mode-1-based understanding of knowledge production has been challenged by the new concept of "Mode 2" of knowledge production, which was developed

and proposed by Michael Gibbons et al. (1994, pp. 3–8, 167). Mode 2 emphasizes a knowledge application and a knowledge-based problem-solving that involves and encourages the following principles: "knowledge produced in the context of application"; "transdisciplinarity"; "heterogeneity and organizational diversity"; "social accountability and reflexivity"; and "quality control" (see furthermore Nowotny et al. 2001, 2003, 2006). Key in this setting is the focus on a knowledge production in contexts of application. Mode 2 expresses and encourages clear references to innovation and innovation models. The linear model of innovation also has become challenged by non-linear models of innovation, which are interested in drawing more direct connections between knowledge production and knowledge application, where basic research and innovation are being coupled together not in a first-then, but in an "as well as" and "parallel" (parallelized) relationship (Campbell and Carayannis 2012). Mode 2 appears also to be compatible with non-linear innovation and its ramifications.

The Triple Helix model of knowledge, innovation, and university-industry-government relations, which was introduced and developed by Henry Etzkowitz and Loet Leydesdorff (2000, pp. 111–112), asserts a basic core model for knowledge production and innovation, where three "helices" intertwine, by this creating a national innovation system. The three helices are identified by the following systems or sectors: academia (universities), industry (business) and state (government). Etzkowitz and Leydesdorff refer to "university-industry-government relations" and networks, putting a particular emphasis on "tri-lateral networks and hybrid organizations", where those helices overlap in a hybrid fashion. Etzkowitz and Leydesdorff (2000, p. 118) also explain, how, in their view, the Triple Helix model relates to Mode 2: the "Triple Helix overlay provides a model at the level of social structure for the explanation of Mode 2 as an historically emerging structure for the production of scientific knowledge, and its relation to Mode 1". More recently, Leydesdorff (2012) also introduced the notion of "N-Tuple of Helices".

Mode 1 and Mode 2 may be characterized as "knowledge paradigms" that underlie the knowledge production (to a certain extent also the knowledge application) of higher education institutions and university systems. Success or quality, in accordance with Mode 1, may be defined as: "*academic excellence, which is a comprehensive explanation of the world (and of society) on the basis of 'basic principles' or 'first principles', as is being judged by knowledge producer communities (academic communities structured according to a disciplinarily framed peer review system)*". Consequently, success and quality, in accordance with Mode 2, can be defined as: "*problem-solving, which is a useful (efficient, effective) problem-solving for the world (and for society), as is being judged by knowledge producer and knowledge user communities*" (Campbell and Carayannis 2013b, p. 32). A "Mode 3" university, higher education institution or higher education system would represent a type of organization or system that seeks creative ways of combining and integrating different principles of knowledge production and knowledge application (for example, Mode 1 and Mode 2), by this encouraging diversity and heterogeneity, by this also creating creative and innovative organizational contexts for research and innovation. Mode 3 encourages the formation of "creative knowledge environments" (Hemlin et al. 2004). "Mode 3 universities", Mode

3 higher education institutions and systems, are prepared to perform "basic research in the context of application" (Campbell and Carayannis 2013b, p. 34). This has furthermore qualities of non-linear innovation. Governance of higher education and governance in higher education must also be sensitive, whether a higher education institution operates on the basis of Mode 1, Mode 2, or a combination of these in Mode 3. The concept of "epistemic governance" emphasizes that the underlying knowledge paradigms of knowledge production and knowledge application are being addressed by quality assurance and quality enhancement strategies, policies and measures (Campbell and Carayannis 2013b, c).

Emphasizing again a more systemic perspective for the Mode 3 knowledge production, a focused conceptual definition may be as follows (Carayannis and Campbell 2012, p. 49): Mode 3 "... allows and emphasizes the co-existence and co-evolution of different knowledge and innovation paradigms. In fact, a key hypothesis is: *The competitiveness and superiority of a knowledge system or the degree of advanced development of a knowledge system are highly determined by their adaptive capacity to combine and integrate different knowledge and innovation modes via co-evolution, co-specialization and co-opetition knowledge stock and flow dynamics"* (see Carayannis and Campbell 2009; on "Co-Opetition", see Brandenburger and Nalebuff 1997). Analogies are being drawn and a co-evolution is being suggested between diversity and heterogeneity in advanced knowledge society and knowledge economy, and political pluralism in democracy (knowledge democracy), and the quality of a democracy. The "Democracy of Knowledge" refers to this overlapping relationship. As is being asserted: "The *Democracy of Knowledge*, as a concept and metaphor, highlights and underscores parallel processes between political pluralism in advanced democracy, and knowledge and innovation heterogeneity and diversity in advanced economy and society. Here, we may observe a hybrid overlapping between the *knowledge economy, knowledge society and knowledge democracy*" (Carayannis and Campbell 2012, p. 55). The "Democracy of Knowledge", therefore, is further-reaching then the earlier idea of the "Republic of Science" (Michael Polanyi 1962).

The main focus of the Triple Helix innovation model concentrates on university-industry-government relations (Etzkowitz and Leydesdorff 2000). In that respect, Triple Helix represents a basic model or a core model for knowledge production and innovation application. The models of the Quadruple Helix and Quintuple Helix innovation systems are designed to comprehend already and to refer to an extended complexity in knowledge production and knowledge application (innovation), thus, the analytical architecture of these models is broader conceptualized. To use metaphoric terms, the Quadruple Helix embeds and contextualizes the Triple Helix, while the Quintuple Helix embeds and contextualizes the Quadruple Helix (and Triple Helix). The Quadruple Helix adds as a fourth helix the "media-based and culture-based public", the "civil society" and "arts, artistic research and arts-based innovation" (Carayannis and Campbell 2009, 2012, p. 14; see also Danilda et al. 2009). The Quintuple Helix innovation model even is more comprehensive in its analytical and explanatory stretch and approach, adding furthermore the fifth helix (and perspective) of the "natural environments of society" (Carayannis and Campbell 2010, p. 62) (see Figs. 3.2 and 3.3).

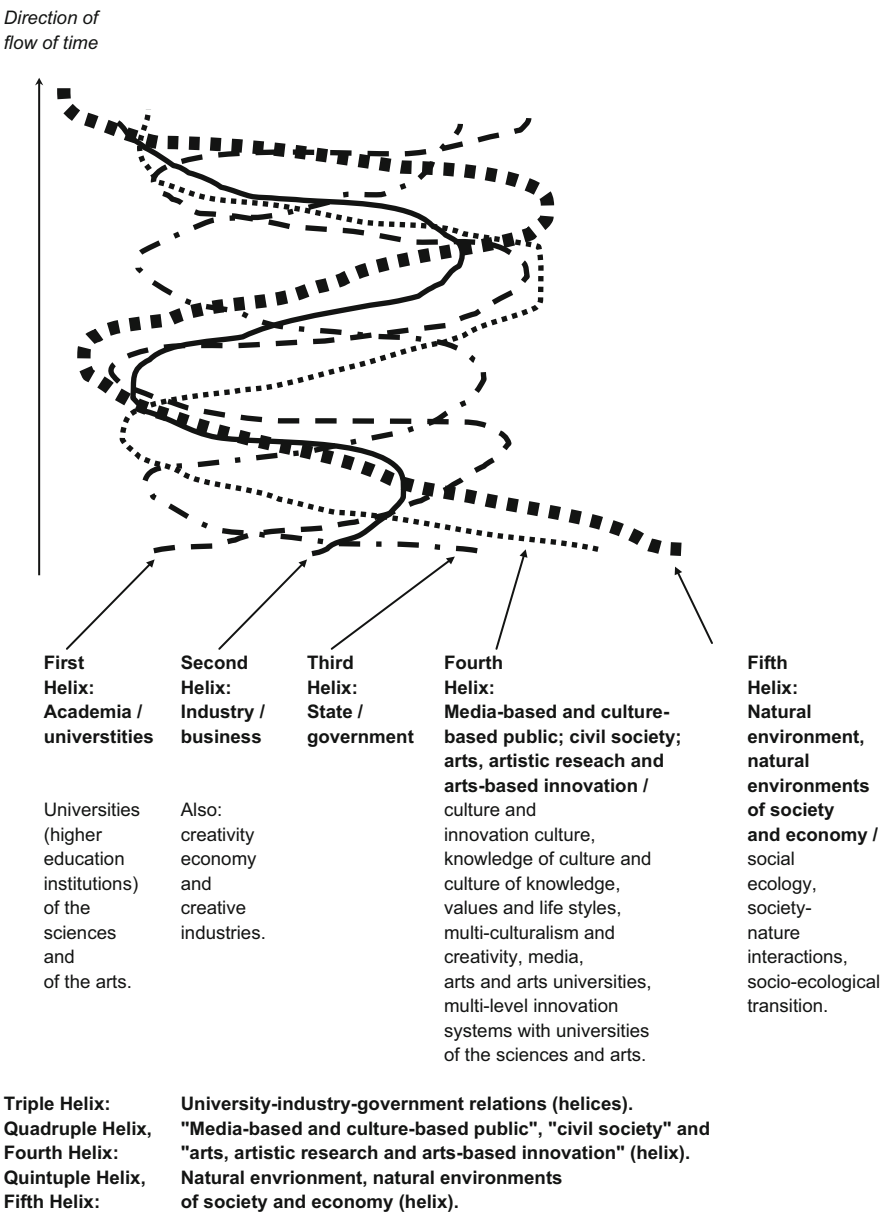

Fig. 3.2 The Quadruple and Quintuple Helix innovation systems (Source: Authors' own conceptualization based on Etzkowitz and Leydesdorff (2000, p. 112), Carayannis and Campbell (2009, p. 207; 2012, p. 14; 2013) and Danilda et al. (2009))

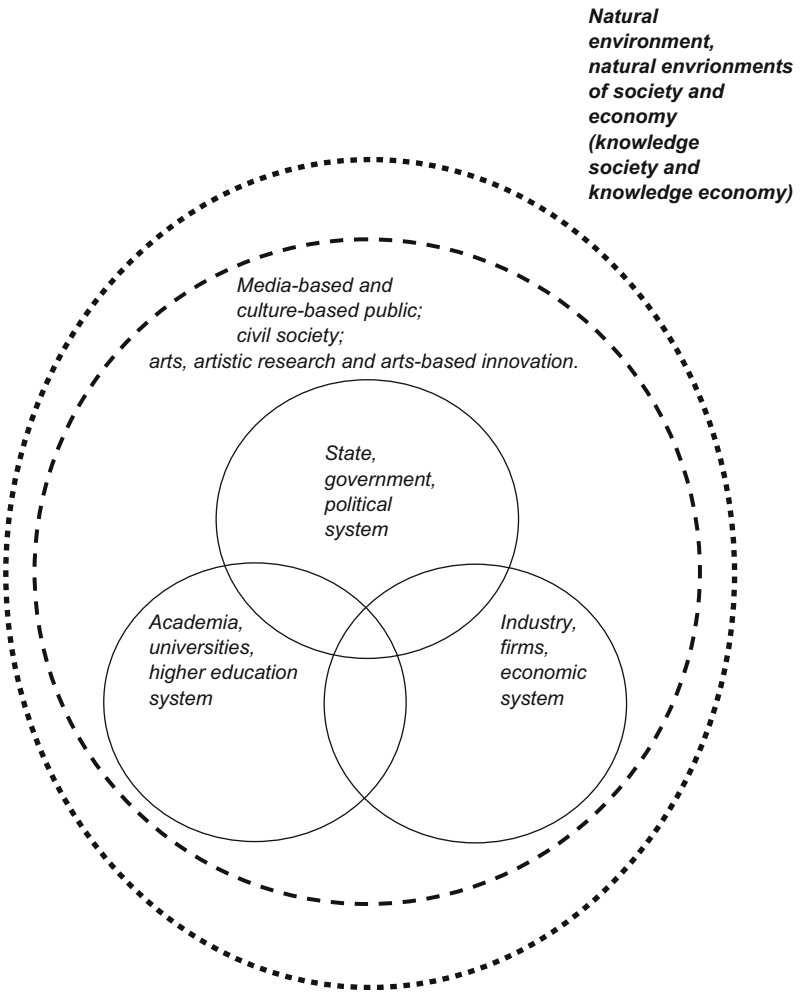

Fig. 3.3 The Quintuple Helix (five-helix model) innovation system (Source: Authors' own conceptualization based on Carayannis and Campbell (2010, p. 62; 2013))

The Triple Helix is explicit in acknowledging the importance of higher education for innovation. However, it could be argued that the Triple Helix sees knowledge production and innovation in relation to economy, thus the Triple Helix models the economy and economic activity. In that sense, the Triple Helix frames the knowledge economy. The Quadruple Helix brings in the additional perspective of society and of knowledge society. The Quadruple-Helix-innovation-system understanding emphasizes that sustainable development of and in economy

(knowledge economy) requires that there is a co-evolution of knowledge economy and knowledge society. The Quadruple Helix even encourages *the perspectives of the knowledge society and of the knowledge democracy* for supporting, promoting and advancing knowledge production (research) and knowledge application (innovation). Furthermore, the Quadruple Helix is also explicit that not only universities (higher education institutions) of the sciences, but also universities (higher education institutions) of the arts should be regarded as decisive and determining institutions for advancing next-stage innovation systems: the inter-disciplinary and trans-disciplinary connecting of sciences and arts creates crucial and creative combinations for promoting and supporting innovation. Here, in fact, lies one of the keys for future success. The concept and term of "social ecology" refers to "society-nature interactions" between "human society" and the "material world" (see, for example, Fischer-Kowalski and Haberl 2007). The European Commission (2009) identified the necessary socio-ecological transition of economy and society as one of the great next-phase challenges, but also as an opportunity, for the further progress and advancement of knowledge economy and knowledge society. The Quintuple Helix refers to this socio-ecological transition of society, economy and democracy, the Quintuple Helix innovation system is therefore ecologically sensitive. Quintuple Helix bases its understanding of knowledge production (research) and knowledge application (innovation) on social ecology (see Fig. 3.4). Environmental issues (such as global warming) represent issues of concern and of survival for humanity and human civilization. But the Quintuple Helix translates environmental and ecological issues of concern also in potential opportunities, by identifying them as possible drivers for future knowledge production and innovation (Carayannis et al. 2012). This, finally, defines also opportunities for the knowledge economy. "*The Quintuple Helix supports here the formation of a win-win situation between ecology, knowledge and innovation, creating synergies between economy, society and democracy*" (Carayannis et al. 2012, p. 1).

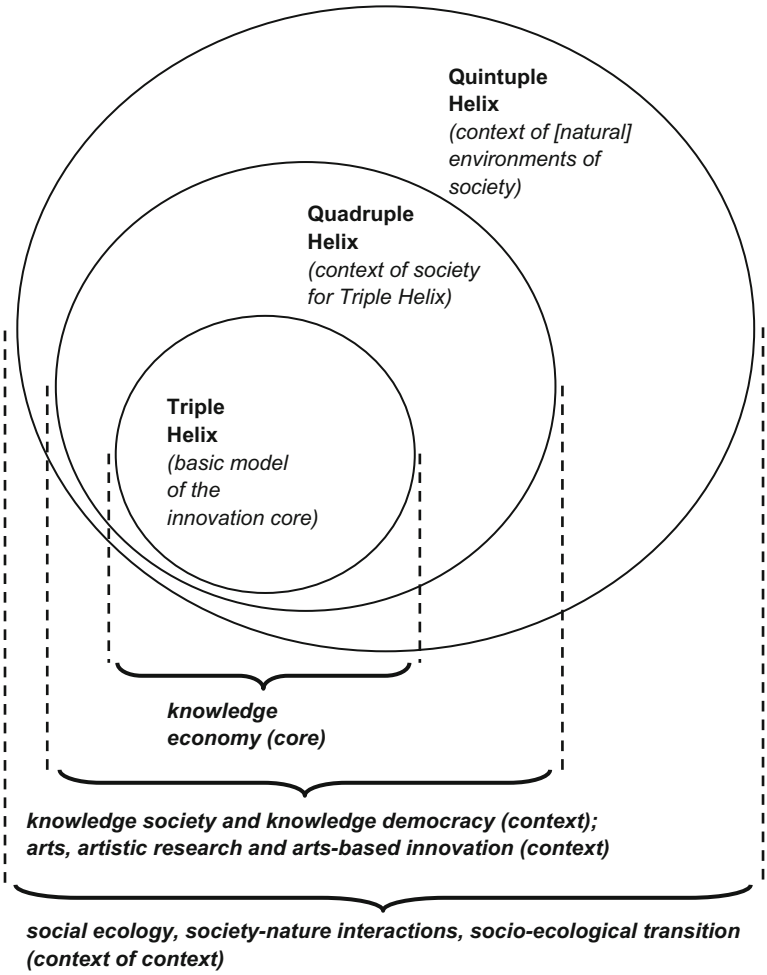

Fig. 3.4 The Quadruple and Quintuple Helix innovation systems in relation to society, economy, democracy, and social ecology (Source: Authors' own conceptualization based on Carayannis, Barth and Campbell (2012, p. 4) and Carayannis and Campbell (2013))

Conclusion: The Program of Arts, Research, Innovation, and Society (ARIS)

The terms and concepts of Mode 3 knowledge production and Quadruple Helix innovation systems were first introduced to international academic debate by Carayannis and Campbell (2006 and 2009), and were later developed further (Carayannis and Campbell 2012). The same applies to the Quintuple Helix (Carayannis and Campbell 2010). From the beginning, the "media-based and culture-based public" as well as universities and other higher education institutions of the arts were being regarded as crucial attributes and components of the Quadruple and Quintuple Helix innovation systems, *implying that arts are essential for the progress and evolution of innovation systems* (see again Figs. 3.2 and 3.3). *In our analysis here, we developed more specifically the Quadruple and Quintuple Helix innovation systems in terms and in favor of arts, artistic research and arts-based innovation. We wanted to demonstrate the full momentum and flexibility of the Quadruple and Quintuple Helix for conceptually addressing and integrating art and arts.*

More generally speaking, further ramifications of Mode 3 knowledge production in Quadruple Helix and Quintuple Helix innovation systems are:

1. *Multi-level innovation systems, the global and the local (GloCal):* Lundvall was pivotal for introducing the concept of the "national innovation system". Lundvall (1992, pp. 1, 3) explicitly acknowledges that national innovation systems are challenged in permanence (but are also extended) by regional as well as global innovation systems. Here, Kuhlmann (2001, pp. 960–961) could be paraphrased and the assertion that as long as nation-states and nation state-based political systems exist, it is plausible to use the concept of the national innovation system. More comprehensive in its analytical architecture than the national innovation system, is the concept of the "multi-level innovation system" (Carayannis and Campbell 2012, pp. 32–35). In a spatial understanding, multi-level innovation systems compare the national with the sub-national (regional, local), but also with the trans-national and global levels (see, for example, Kaiser and Prange 2004; furthermore, see Pfeffer 2012). However, it is also important to extend multi-level-innovation-systems to the challenges and potential benefits and opportunities of a non-spatial meaning, understanding and "mapping": "Therefore, multi-level systems of knowledge as well as multi-level systems of innovation are based on spatial and non-spatial axes. A further advantage of this multi-level systems architecture is that it results in a more accurate and closer-to-reality description of processes of globalization and *gloCalization*" (Carayannis and Campbell 2012, p. 35).

(continued)

2. *Linear and non-linear innovation:* Knowledge application and innovation are being challenged and driven out of an interest of combining and integrating linear and non-linear innovation. Key to here are a diversity, heterogeneity and pluralism of different knowledge and innovation modes, and their linking-together via an architecture of co-evolving networks. Firms, universities and other organizations can engage (at the same time) in varying and multiple technology life cycles at different levels of maturity. Another way, how to think non-linear innovation, is being suggested by the concept of cross-employment (Campbell 2011, 2013a). As a form and type of multi-employment, cross-employment emphasizes that the same individual person may be employed by two (or more) organizations at the same time, where one organization could be located closer to knowledge production, and the other to knowledge application (innovation): are those organizations also rooted in different sectors, then cross-employment acts also as a trans-sectoral networking (Campbell and Carayannis 2013b, pp. 65, 68). *Cross-employment can furthermore bridge different sectors and disciplines in the sciences with different disciplines in the arts*. What results is a "Mode 3 Innovation Ecosystem": "This parallel as well as sequentially time-lagged unfolding of technology life cycles also expresses characteristics of Mode 2 and of nonlinear innovation, because organizations (firms and universities) often must develop strategies of simultaneously cross-linking different technology life cycles. Universities and firms (commercial and academic firms) must balance the nontriviality of a fluid pluralism of technology life cycles" (Carayannis and Campbell 2012, p. 37; see furthermore Dubina et al. 2012). The relationship between networks, "cooperation and competition" ("Co-Opetition"), represents a challenge and sensitive issue, and allows for different creative answers in organizational representation and manifestation.
3. *Twenty-first century Fractal Research, Education and Innovation Ecosystem (FREIE):* Here, the understanding of FREIE is: "This is *a multilayered, multimodal, multinodal, and multilateral system*, encompassing mutually complementary and reinforcing innovation networks and knowledge clusters consisting of human and intellectual capital, shaped by social capital and underpinned by financial capital" (Carayannis and Campbell 2012, p. 3).
4. *Linear and non-linear innovation, and the causality of "if-then" and of "if-if" relations:* The hybrid overlapping of linear innovation and of non-linear innovation displays also possible ramifications and draws associations to models of causality and their re-modeling. "We can speculate, whether this parallel integration of linearity and nonlinearity not also encourages a new approach of paralleling in our theorizing and viewing of causality: *in epistemic (epistemological) terms, the so-called if-then*

(continued)

relationships could be complemented by (a thinking in) 'if-if' relations" (Carayannis and Campbell 2012, p. 24; see also Campbell 2009, p. 123).

At the beginning of our analysis (in the introduction) we formulated the following research question: *How does artistic research relate to research in the sciences and how does artistic research relate to innovation and innovation systems?* We were inclined to develop the interrelation and inter-linkage between arts, research and innovation on basis of the concepts of the Quadruple and Quintuple Helix innovation systems. We wanted to address *art and artistic research* (AAA) in context of the Quadruple Helix and Quintuple Helix. *"Arts, research, innovation, and society"* (ARIS) *may be regarded as a program with implications for theory, policy and practice*. In the following, we develop further a few more propositions with regard to ARIS. These propositions should be regarded as input for discussion and discourse:

1. *"Arts as a manifestation of knowledge":* By defining "arts as a manifestation of knowledge" (in complementary extension of a more "traditional" understanding of the aesthetic dimension of arts), the artistic research and arts-based innovation then inter-flow directly with art and arts. Artistic research helps explaining the arts. Artistic research also contributes to the epistemic potential of the arts and in arts. Universities and other higher education institutions of the arts are challenged to respond to artistic research and to implement strategies for developing artistic research, which also informs and drives university teaching. Through knowledge creation, knowledge production, knowledge application, and knowledge use, research in the arts and arts-based innovation are being interconnected with research in the sciences and sciences-based innovation. Arts and artistic research add to the interdisciplinary and transdisciplinary spectrum of research organizations and of research networks, and can assist the sciences (also science) in building interdisciplinary arrangements. Interdisciplinarity often qualifies as a good basis for transdisciplinarity. Arts and artistic research foster heterogeneous processes of diversification and pluralization within knowledge production and innovation. Arts and artistic research promote creativity, which is key for knowledge creation, knowledge production and innovation.
2. *Art and artistic research*[10] *in Quadruple and Quintuple Helix innovation systems:* The concepts of the Quadruple Helix and Quintuple Helix innovation systems are explicitly sensitive for the roles of arts and of artistic research for innovation. Within context of that line of thinking, *arts,*

(continued)

[10] In context of our analysis here, *art and artistic research* (also *arts, artistic research and arts-based innovation*) refers to a conceptual "Triple A" of the qualities of arts-based knowledge production and arts-based innovation.

artistic research and arts-based innovation (AAA) are essential for the further evolution and progress of innovation systems. Universities and other higher education institutions of the arts represent crucial organizations for innovation systems (national and multi-level innovation systems). In multi-level innovation systems, the global, national and local innovation systems co-evolve in parallel and in being mutually intertwined.

3. *"Arts, research, innovation, and society"* (ARIS) *and the quality in economy and the quality of democracy:* Innovation may not be narrowed down to economic concerns and economic activities. Innovation is more than only economics. "Arts, research, innovation, and society" (ARIS) contribute to creating the basis for new models of economic growth, where "growth in quality" challenges the traditional focus on "quantitative growth" of selected economic benchmarks or indicators. Arts, artistic research and arts-based innovation are key for advanced economies as well as the emerging markets. "Arts, research, innovation, and society" (ARIS) furthermore interrelates and cross-links with Quality of Democracy. ARIS indicates opportunities for a creative design or processes of creatively designing the further co-evolution of knowledge economy, knowledge society and knowledge democracy.
4. *Arts, artistic research, arts-based innovation and "Creative Knowledge Environments":* "Creative Knowledge Environments" (Hemlin et al. 2004) are interested in contributing to capabilities of knowledge creation, knowledge production and innovation in organizations and in networks. Cross-employment (Campbell 2013a) defines one strategy for doing so (also for non-linear innovation). Arts, artistic research and arts-based innovation furthermore represent approaches that add to the formation of "Creative Knowledge Environments". Arts, artistic research and arts-based innovation and innovations are at least "potentially" relevant to all organizations and networks that are engaged in research (knowledge creation and knowledge production) and innovation (knowledge application and knowledge use). This clearly demonstrates the possibilities and opportunities of arts, artistic research and arts-based innovation for the sustainable development and the "innovative re-invention" of organizations and networks that are involved in and perform in knowledge production. *There is a need for more creative organizational design*. In aggregation, this is also of relevance for whole innovation systems.

In a free association with the work of M.C. Escher,[11] we finally want to close the analysis here with the following two words: *Ascending Waterfalls*. This is the beginning.

[11] See again our analysis in section "Arts and Artistic Research".

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Chapter 4
The Culture of Information and the Information of Culture

Elias G. Carayannis, Denisa Popescu, and Ali Pirzadeh

He who understands the situation is not well informed
Ablert Szent-Gyorgyi

Abstract The Culture of Information refers to a cultural structure that strips away information from its meaning and conduces information to be seen as a commodity. In this chapter one of the main propositions is that today's global society should be examined through the reality of information overload that makes it possible to filter and promote standardized set of values and beliefs activities, thus leading to a mass culture produced from commercialization of information and its increased ability to wire people through information.

Keywords Culture of information • Commodification • Mass culture • Information-as-object

This chapter discusses the implications of the emerging Culture of Information paradigm that characterizes the current information-based society. We emphasize the need to study the Culture of Information carefully as it can be a major source of failure in our current society with respect to its impact on the way each of us perceives and acts upon our domain, if not taken into account. The chapter begins by defining culture and information and their constituent elements. The chapter

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then goes on to describe the construct of the Culture of Information and discusses implications of information in the context of commercialization, commodification and loss of "meaning."

4.1 What Is Culture

The word culture often conveys various connotations and denotations to illustrate a variety of phenomena that includes many dimensions. This tendency is mainly due to the fact that there is the widespread belief that culture is the essence of socially transmitted thought, perception, tradition, practices, and, more importantly, conducts. This means that culture is part of human development as much as human is part of his cultural development. Historically, a culture is the mode of life that a particular people has developed and standardized. Structurally, it is a complex of physical, social, and intellectual components. In the scientific realm, "Culture is the form that biology takes"[1] and hence man (and his behaviors) has merely considered as a zoological species.[2]

These sorts of statements merely underline the obvious, and therefore do not explain what they intend to explain. They are so indeterminate that all sorts of fallacious cultural theories have been based upon them. Butler alluded to this obscure generalization and points out, "[t]he total proposition stated in these erroneous terms is itself error; culture, instead of being merely the servant of man, is in many ways his master."[3] In short, you will know human by the trail of his deeds. However, such statement does not set well with prominent figures in the field.

Pierre Bourdieu, a father like figure in culture of production, defined the 'realization' of culture as *becoming natural*, "Culture is thus achieved only by negating itself as such, that is, as artificial and artificially acquired, so as to become second nature, a habitus, a possession turned into being".[4] He later remind us that "culture is not what one is but what one has, or rather, what one has become; to remember the social conditions which render possible aesthetic experience and the existence of those beings..for whom it is possible".[5] Marshall McLuhan's evocative maxim *Culture Is Our Business* can be understood at two levels. First and most obviously, cultural industries manufacture, buy, sell, and distribute symbolic wares for money. Second, it can be interpreted that cultural artifacts are means to fabricate, support,

[1] Searle (1995).

[2] It is noteworthy to mentioned that a biological adaptation is an inborn form of behavior; but a culture is a learned form of behavior – a communally preferred form, which (like other inventions) has been adopted by a whole society.

[3] Butler (1952).

[4] Bourdieu (1993).

[5] Ibid.

reinforce, condone, justify, or extend the fundamental organization of the consumer society. "We make consumer culture" would be an accurate paraphrase of this second interpretation. "By this rendering, the production and distribution of cultural (symbolic) wares are understood to create and reinforce the psychic ground of, or more philosophically the ontology for, a culture of consumption."[6] McLuhan is also convinced the English Romantics are the pioneers to understand that the rise of mass commercial culture is a product of "the total galaxy of events that constitute literacy", and hence Gutenberg technology.

Harold Adams Innis, McLuhan's mentor maintained that "throughout the course of human history, cultures, cultural artifacts, and cultural processes have generally supported, and were supported by, their society's predominant mode of economic and political organization. Within each civilization or society, according to Innis, there is and always has been a symbiosis between economy/polity on the one hand and the dominant culture/mode of communication on the other. If and when these grow out of synch, Innis maintained, transformation, transition, or even revolution follows."[7] Culture is political, is the key axiom of *cultural materialism* Raymond Williams's term for analytic work which sees texts as inseparable from the conditions of their production and reception in history; as involved, necessarily, in the making of meanings which are always, finally, political meanings.

Dewey insists, "The solution of the crisis in culture is identical with the recovery of composed, effective, and creative individuality. The harmony of individual mind with the realities of a civilization made outwardly corporate by an industry based on technology does not signify that individual mind will be passively molded by existing social condition as if the latter were fixed and static."[8] He roots the contradictions of the present in the contradictions of the past; as he looks to the past, he finds that "our tradition, our heritage, is itself double. It contains in itself the ideal of equality of opportunities and of freedom for all, without regard to birth, and status, as a condition for the effective realization of that equality."[9] However, for another American thinker, Ruth Benedict, a "culture, like an individual, is a more or less consistent pattern of thought and action. Within each culture there come into being characteristic purposes not necessarily shared by other type of society."[10] One approaches cultural behavior much like One approaches individual behavior, "If we are interested in mental processes, we can satisfy ourselves only by relating the particular symbol to the total configuration of the individual ..... If we are interested in cultural processes, the only way in which we can know the significance of the selected detail of behaviour is against the background of the motives and emotions and values that are institutionalized in that culture. *The first essential*, *so it*

[6] Babe (2009).

[7] Ibid, pp. 4.

[8] Dewey et al. (1999).

[9] Ibid, pp. 8.

[10] Benedict (2006).

seems today, is to study the living culture, to know its habits of thought and the function of its institutions".[11]

In this study, **culture**, is perceived as the *collective programming of the mind, which distinguishes the members of one group or category of people from another*.[12] Culture, we argue, in most part is not innate (not inherited) but rather learned. 'Learned', in this context, means modified by the influence of collective programming and to a lesser extent through unique individual experiences, which also derive from one's social environment. Therefore, it should be distinguished from human nature (what all human beings have in common) and an individual's personality.

4.2 The Culture of Information Definitions

We define the Culture of Information as the cultural structure composed of institutional settings and organizations that drive people to consume and produce information rather than to be informed consumers and producers. The Culture of Information is a mass culture produced from information dissemination via broadcasting.[13] We further extend this definition of the Culture of Information to include the idea that it is a "plug-in" culture, where society cannot operate if it is unplugged and where information plays a vital role in feeding/promoting certain messages and standardizing behavior. Furthermore, at the other end of the spectrum, we argue that this culture, enabled by sophisticated information retrieval and semantics technologies, can provide value added to research and policy-making by enabling mining of large amounts of information to find relationships and trends that add to the knowledge base (e.g. mining of social and mainstream media coverage of conflict areas to complement traditional sources of information). The difference between these two ends (retrieve actionable information from large amounts of knowledge and promote standardized behavior according to pre-definded messages) resides in the context and ability of the culture to transform information into knowledge.

On the one hand, and in the context of the global system, information evolves not in a vacuum but rather as a portion of the whole system in which it is created and operates. In a sense, it is a **reactive process**, a response if you will, to changes in its surroundings and it may create an **artificial need to use information** that does not necessarily lead to knowledge creation. For example, the push for open mega data is creating rush to gather and publish data without any coherency in terms of methodology and use by decision-makers. Moreover, what political and economic leaders need may not be what is made available to them. Supply and demand are not always congruent. Large amounts of information (one millions books published per day) may lead to information losing its knowledge content as it is

[11] Ibid, pp. 49. Emphasis added.

[12] See Hofstede (1984).

[13] See Carayannis and Pirzadeh (2014).

commoditized. Therefore, intellectual curiosity, which is the principle of science and research, may suffer as a result. This also creates an environment that allows some Amazon-like agents to exercise power that may in fact promote certain behaviors in a standardized way. We will discuss some of these implications in the next section.

On the other hand, the benefits afforded by the availability and quality of key information are well recognized. For example, the ability to connect to information sources created an opportunity to obtain information at an unprecedented rate and scope, providing new platforms that equipped individuals with new ways to accumulate, obtain, and use information. As "value" is hidden in diverse and large amounts of internal and external information, and as a result finding the useful information also implies a search process, which is extended at the margins of "the known" environment with the aim of identifying emerging issues and events within a certain context. This creates an information-driven environment that is characterized by a rapid evolution of data-driven decision-making toward the vastly more complex concept of computationally-intensive "big data analytics".[14]

4.3 Implications of Culture of Information

Examining "information" runs into immediate difficulties as soon as one considers its definition. A common sense suggests that gaining information implies enhancing our understanding and curtailing uncertainty, and hence information implies "becoming informed". Therefore, it seems ironic that the term conveys ambiguity and is used in different ways. Faced with various meaning of information, in this study we chose a pragmatic approach and survey the landscape to identify categories in which the term has been conventionally used. In what follows, we have distinguished three principle uses of the word information.

First, information has been viewed as *process that informed*, and hence it is given a intrinsic "informative power". In this respect, information is associated with knowing/learning something new. An example of such informative process, one can points to the development of *selective advantage* in evolutionary biology – the organism that able to inform its offspring and therefore possesses the new information has an edge over those that do not. However, information in this sense does not mean the raw information observed by a man sensory mechanism such as sight, taste, etc., but rather implies information that have been processed and given a context.[15] Let us clarify the point we are to make by a narrative and an example.

[14] Lavalle et al. (2011).

[15] For example, a red traffic light is data. The meaning that we attach to this data is "Stop". When you drive up to a red light and stop, you do so because your brain sees the data and process it. For more details see http://www.ictweb.org/as_ict/as_knowledge_information_data.html

Our narrative starts in Spring of 1948 in New York City where a group of electrical engineers, physicists, mathematicians, what will later be referred to as computer scientists, coined an expression that they thought would change our civilization; a leapfrog that would change forever the way we live our lives.[16] The abbreviation of this expression is IS, which was introduced in a session called 'Formation of "I" in language'. However, and unlike today's usage of 'I', which refers to the noun information, they used the verb informing, and so IS denotes *Informing System*. One major implication of such a shift is the fact that the verb informing suggests a process instead of a product, which is implied by the noun. Being a process means that there must be a knower, whether a human or a device operated by a human, in the act of observing something. Information, declared Fairthorne in 1954, "is an attribute of the receiver's knowledge and interpretation of the signal, nor of the sender's, nor some omniscient observer's nor of the signal itself."[17]

Nevertheless, informing system poses an inclination that knowing does start by registering and processing the raw information observed by man sensory system. Therefore, sighting a yellow object, as a particular object that is yellow, is merely limited to perceiving an optical pattern and detection of some wavelength of the light coming from it. At most, this approach makes a distinction between all yellow and non-yellow objects. Another way of saying the same thing is that we have limited our perception in term of a category, which incorporate all other objects already identifies as yellow, so that yellow-roses and sodium both joined in a cured yellow classification!

It is noteworthy to mention that focusing of *a process* draws attention away from people who are the significant user of information. This is an ironic development particularly in an era that is labeled as the age of information, in which abundance of information entails more people to assimilate, observed, and understand it.

The second manner in which information used is to denote the *knowledge* that provides a framework for evaluating and incorporating new experiences and insights. In short, knowledge makes information valuable. The reaffirmation of this observation can be found in what is known as the 'Lamarckian hypothesis', which asserts that traits acquired during the lifetime of an organism can be transmitted genetically to the organism's offspring. This hypothesis is generally interpreted as 'learned knowledge [information] can guide evolution directly by being passed on genetically to the next generation.'[18] However, knowledge usually

[16] See Wikipedia under 'Macy Conferences'.

[17] Fairthorne (1954).

[18] Melanie Mitchell, *An introduction to Genetic Algorithms*, MIT Press, 1998, p. 67. However, Mitchell explained further that while the Lamarckian hypothesis is rejected by almost all biologists, she still believed 'learning (or more generally, phenotypic plasticity) can indeed have a significant effects on evolution, though in less ways than Lamarck suggested' (ibid.). She then provided an example to explained her position, 'an organism that has the capacity to learn that a particular plant is poisonous will be more likely to survive (by learning not to eat the plant) than organisms that are unable to learn this information, and thus will be more likely to produce offspring that also have this leaning capacity. Evolutionary variation will have a change to work on

involves a *knower* in a sense that it associated with someone. Brown and Duguid point out that it is common to ask, "Where is that information" but quite unusual to request, "Where's that knowledge". Moreover, information most commonly appears as an autonomous matter. It can be easily circulate, manipulate, misinterpret, quantify, takes different forms, misplaced and found, and so forth. In contrast, knowledge needs to be discover and not gather, acquiring knowledge entails reasoning, cannot be the object of direct observation and it is unlike understanding, as Richard Mason observed, "Whether or not a viable theory of knowledge is, or ever has been, possible, an account of understanding modeled on similar ambitions would be misguided."[19] An ample illustration of this contrast is a distinction between the light of faith and the light of natural science, or between an understanding behind *that* God exists and knowledge of *what* God is.

Finally, information is professed as *object*, and as such, it conveys the obvious; information becomes a tangible thing i.e., sign, signal, data, text. In this sense information can be precisely measured, transferred and artificially stored. This is where contemporary institutions, museums of object, objectivity and rational thoughts, are most suited to utilize information. Claude Shannon's paper "A Mathematical Theory of Communication"[20] exemplified this understanding of information. Shannon conceived information as a quantifiable value, an object, in communications.[21] The sheer advantage of measuring information is related to an observation that without a measurement of sorts information cannot be defined. However, this objectification approach conveys nothing about the intrinsic meaning of information, the context, and motivation and social issues related to information.

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this line of offspring, allowing for the possibility that the trait – avoiding the poisonous plant – will be discovered genetically rather than learned anew each generation. Having the desired behavior encoded genetically would give an organism a selective advantage over organisms that were merely able to learn the desired behavior during their lifetimes, because learning behavior is generally less reliable process than developing a genetically coded behavior; too many unexpected things could get in the way of learning during an organism's lifetime. Moreover, genetically encoded information can be available immediately after birth, whereas leaning takes time and sometimes requires potentially fatal trial and error. In short, the capacity to acquire a certain desired trait allows the learning organism to survive preferentially, thus giving genetic variation the possibility of independently discovering the desired trait. Without such learning, the likelihood of survival – and thus the opportunity for genetic discovery – decreases.' (Ibid., p. 67).

[19] Mason (2003).

[20] C. Shannon, and W. Weaver, *The mathematical theory of communication*. Original work published in 1948. It should be noted that Shannon and Weaver's The Mathematical Theory of Communication is not actually a co-authored book. The book consists of two essays: Weaver's "Recent Contributions to the Mathematical Theory of Communication" and Shannon's, earlier paper, with the new title "The Mathematical Theory of Communication." In fact as Lai Ma observed, "Most readings of information theory are based on Warren Weaver's exposition of Shannon's theory." (see Lai Ma, "Meanings of Information: The Assumptions and Research Consequences of Three Foundational LIS Theories", *Journal of the American Society for Information Science and Technology*, 2012, vol. 63, no. 4, pp. 717).

[21] The reader should note that the Shannon–Weaver Model will be analyzed in more detail in a later section.

This is the main reason why his model has commonly been recognized as a foundational text in communication/information theory.[22]

Conceiving information-as-object allows Shannon's procedure to translate information into the binary code that is measurable through string of zeroes and ones. As such, information can be sought by calculation, mechanical procedure known these days as an algorithm, which enables us to breakdown long-lasting limits of accessibility, including locating, storing, transmitting, etc. According to James Gleick, it is here that information processing was born, along with information storage and information retrieval.[23] Conversion of information into digits has been proven a brilliant way to measure, transfer and share information with ease that never experienced by human civilization. This digitalization of information had indeed remove significant barriers of *accessibility* and allow a free entry for significant portion of people around the world into the access-free world that recognizes no borders, so access can now be obtain at a margin. It is a significant step forward that has flattened the playing field, particularly for those outside the affluent OECD club.

However, as information simplifies and quantified its semantic aspects become irrelevant. In short, its meaning, unavoidably, is removed. This distilling process, a rite of purification, is considered an integral part of mathematization of notions that are perceived difficult to fit into a frame (quantified) such as force, time, energy, etc. Marshall McLuhan in his classic book, *Understanding Media*, underlined this point when he observed, "The electric light is pure information. It is a medium without a message."[24] In effect, information without meaning/massage makes no distinction between sense and nonsense. For instance, if one applied the information theory to the following sentences: "Today is a good day" and "oozxzaxxzzdgetoozoo-pooosszzznwnsjdge", the rules of theory dictates that the latter contains greater information than the former. This is the information that runs our world today: the fuel and the vital principle that saturates our ability to understand of our surroundings, along with the operation of our economic system. The mechanism that has been set in place swapped all other sources that traditional were used to be informed. Today, significant fabric of our live is a node in an interwoven information network, receiving and processing and digesting through coding and decoding. The evolutionary theorist Richard Dawkins observed that what described living things of twenty-first century is information that instruct, "If you want a metaphor, don't think of fires and sparks and breathe. Think, instead, of a billion discrete,

[22] In 1983, Shaw and Davis already stated that "[M]uch theoretical work in information science is based on the Shannon-Weaver model of communication" (D. Shaw and C. H. Davis, "Entropy and information: A multidisciplinary overview", *Journal of the American Society for Information Science*, 1983, vol.34, no. 1, p. 71). More recently, Kalbach (2009) claims that Shannon and Weaver are the "fathers of modern information and communication theory" and that the concept of uncertainty in their work "underlies most aspects of our lives" (J. Kalbach, "On uncertainty in information architecture", *Journal of Information Architecture*, 2009, vol. 1, no. 1, p. 48).

[23] Gleick (2011).

[24] McLuhan (1998a).

digital characters carved in tablets of crystal. If you want to understand life, don't think about vibrant, throbbing gels and oozes, think about information technology."[25] This is a total transformation of every branch of existing beliefs on to culture of information, in which mechanical apparatus landed on human mind. This is not a critical statement, but rather mere observation of what has been prevailed in recent decades.[26]

In this study, we argue that stripping information of its meaning inadvertently creates an adverse effect. It compels users of information to follow suit and perceive "meaning" as inconsequential because a use of meaningless information can only result in meaningless interpretation.[27] Information emptied of meaning is like billboard lights that do not spell out any visual messages or brand names (to use McLuhan's analogy). Just as it is doubtful that such billboard lights would have any impact on the preferences of a population, it is highly unlikely that such information would have an informative effect on its user. It glows and flows effortlessly without making any mark.

We further argue that a procedure by which information is translated into binary codes, the derivation process by which information received in different structures is transformed to a common digital format, is standardization of information. The implication of this renovation implies that inferences that are made by patrons/receivers of such information are also standardized in a sense that these interpretations would inevitably resemble the information they are based on, drained and emptied of any possible meaning. This is a plausible argument since *one can use information more than what the information reveals*. McLuhan captured the essence of this argument when he said, "Man the food-gatherer reappears incongruously as information-gatherer. In this role, electronic man is no less a nomad than his paleolithic ancestors."[28]

In real life, an excellent example of a similar argument is related to the fact that English speaking populations or those with English proficiency have access to more documents than other groups simply because there are more documents inscribed in English than in any other language.[29] The point is that documents in English, just

[25] Dawkins (1996).

[26] There are those who considered comparing humans with a machine takes away our enchanted and magical attributes, I do not subscribed to such characterization. On the personal note, such comparison does not make me feel less special. What a wonderful thing that collection of matters, formed by billion years of evolutionary process, have been able to create van Gogh's *Starry Night* or Bach prelude.

[27] This observation also applies in a biological system, where information that is unfilled and does not provide a selective advantage is often lost.

[28] McLuhan (1998b).

[29] An argument has been put forward that the present set-up should be changed because it dictates a single-language dimension. I beg to differ with the approach rather than the logic of the argument. The fact is that English is the dominant language because, as mentioned above, more documents are either written in or translated into English. This is not going to change even if the dominant language on the Internet changes, say, from English to Chinese, because information that is available on the Internet is inscribed in English.

like information in binary code, are standardized, and hence would standardize users.[30] Another example that illustrates a similar point is related to a common algorithm used in Internet searches. This is a mechanism designed to seek and coordinate similar patterns of a user's previous logs, map them together to understand the user's pattern of interests and then provide information accordingly. In this respect, the user will not have access to information he/she did not search for and instead what becomes available is information based on similar patterns. Standardized procedure once again leads to standardization in users according to the encoding mechanism: an algorithm, mechanical rules to follow, no thought necessary.

The effects described above may come as a surprise to some, but they shouldn't. Mind you that these effects can often be traced back throughout the history of our civilization. Indeed, what we have learned from history is that every invention and new medium transforms the nature of human thought. At first, we are wondrous, and then bewildered; while a new medium triggers a wholesale and irreversible change in the human psyche. For instance, think back to when Samuel Morse and his protégé Alfred Vail thought of mapping the entire language onto a single dimension system – composed of the click (or dots), the space in between and the line or dash – in which signs were used as surrogates for letters. Morse and Vail introduced bare signs and made them stand in for all spoken words and written languages.

In retrospect, since each new medium has its own characteristics, one should be mindful of its fallout and its possible affect on society as a whole. Therefore, users of information which has been emptied of meaning ought to exercise extreme caution in interpreting what such information might convey. For one thing, such information is intrinsically inept at expressing meaning since it does not possess it. Second, this circumstance compels us to change a formulated objective away from the initial intention and assume the second-best solution. This is not an unusable proposition, particularly for those who are involved in various research studies and regularly use common statistical packages. Finally, it is imperative that in described circumstance, a distinction is made between what such information conveys, a "quantified observable," and what it does not, a "fact." Both imply a certain interpretation of the raw information (i.e., data) assumed in the experience. But the former, like most physical objects, is localized in space and time, whereas fact entails a much larger context to prevail. In another way, while observable data can be registered by the senses and then processed, a fact is not an object of direct perception. A fact is assimilated by means of a pre-existing conceptual framework. An example may clarify the point. Perceiving a withered branch as an optical pattern is a quantified observable. However, recognizing a branch as withered

[30] Here the definition of language is similar to that defined by Saussure, as *an organism*, which is governed by a code and that this code is written according to rules (grammar). See F. de Saussure, *SAUSSURE'S FIRST COURSE OF LECTURES ON GENERAL LINGUISTICS (1907)*, translated by George Wolf, Pergamon, 1996.

implies a pre-existing framework, knowledge if you will, of a living branch, and realizing that it may dry up without enough water. In an information process, the facts, as such, are even more difficult to identify. Often, what is called a fact in such a process is a single frame, selected arbitrarily from a complex sequence, which is similar to a transverse cut from a complex continuum. Since the difficulty one would face reconstructing a meaningful inference from this single frame is obvious, such selection would often (without being acknowledged) lead to erroneous interpretation that obscuring the relationship between what is being abstracted and what is left out. This alone should invalidate many interpretations that are derived from information processing. Sadly, this is not the case.

Another significant implication of information-as-object, or objectification of information, is that information can now be conceived as a commodity. This is an indication of the near-complete penetration of capitalistic modes into our modern lives. And soon, the economic view of information prevailed. To view information in this light is to assign it an exchange value and then examine it according to its enduring cost and benefits. Arrow underlined this new labeling when he observed, "Information is an economic good, in a sense that it is costly and valuable."[31] However, the incompatibility of information as a commodity relative to most conventional commodities becomes apparent once certain economic attributes are applied. For instance, constant returns are impossible with information when it is used as a commodity input. This is because, "Two tons of steel can be used as an input to produce more than one ton of steel in a given productive activity. But repeating a given piece of information adds nothing. On the other hand, the same piece of information can be used over and over again, by the same or a different producer."[32] This also implies that property rights to information take on a different form relative to conventional inputs.

Information is also used in various decisions regarding economics. However, the value of information diminishes rapidly when the chance of being wrong and the cost of being wrong are taken into consideration, as the recent financial crisis has illustrated. This is mostly due to the fact that various quantitative decision analysis methods overwhelmingly use information as bulk, mainly for two reasons. First, expert judgment in identifying valuable information for improving decisions is extremely difficult, if not impossible. Despite the exponential increase in information, there is a failure to identify which information is valuable. This is related more to the quality of information rather than the quantity available. This inability to identify valuable information is labeled in related fields as "false discoveries." We argue that the trouble with recognizing meaningful and relevant information is not that it's like trying to find a needle in a massive haystack, but rather (as stated earlier) that all bits of straws are processed and standardized in a uniform manner, and hence they all share similar content. Second, the prevailing excess supply of information dictates its own demand, as the law of market, introduced by French

[31] Arrow (1996).

[32] Ibid, pp. 120.

economist Jean-Baptiste Say, signifies. In short, information is overwhelming here, and so it is used. In order to recognize the magnitude of the supply explosion of information, it would be helpful to consider, "the scale of the data [information] we can store, analyze, and use as a basis for discovery and decision support has increased by a factor of over a trillion in less than 50 years."[33] To put such growth in perspective, one only needs to consider that it took 17 years for Charles Darwin to collect one of the data sets for his monograph *Original of the Species*.[34] In consideration of the astronomical growth of information, the baffling issue for the authors of this study is why, for the last three decades, the total number of new PhDs in science and technology awarded in the United State essentially remains unchanged? In fact, if one compares PhDs awarded during the specific periods of 1970–74 and 1995–99, the number declined by almost 7 % points.[35] While, pinpointing the cause or causes of such developments is difficult, the authors of this study, nevertheless, suggest that such stagnation and decline should be viewed as alarming sings of similar peculiarities in near future if we continue on the same senseless path.

Another side of perceiving information as a commodity object is how a notion such as exchange value subsumes greater portions of the everyday life of modern men. Indeed, there is little doubt as to how the reality of the prevailing system is penetrating deeper into the fabric of our lives, mediating through and by the perception endorsed by a commodity-producing culture and its protagonists. This is a breeding ground, no doubt, for the climate to conform and dissolve in the comfort of conventional wisdom, to retreat into ones' secure private space ready to engage in collegial conversation. For some, this is a strategic withdrawal, an anesthetic removal from ones' conscious sphere. For others this is a professional shift from an abandoned tradition to a celebrated one. Some disciplines are more susceptive to such metamorphosis than others. This is perhaps is due to the various nature of inquires they set themselves to be engaged or intensiveness of the members of a discipline in terms of what is it they are supposed to be doing. For instance, in a field like physics, humanity could recover pretty much everything it needed to know about the material world, observed one of the twentieth century's greatest physicists Rosetta Stone, in this simple statement, "All things are made of atoms, little particles that move around in prenuptial motion, attracting each other when they are a little distance apart, but repelling upon being squeezed into one another."[36] Other disciplines like economics lack such absoluteness, a principle of sorts to build its stand from the ground up. So, conventional economists, those in positions, learned by evolutionary necessity to develop a numbing sensation toward what the conventional wisdom disapproves. Indeed, no matter how persistence or

[33] Grossman (2012).

[34] Ibid. pp.171.

[35] See Lori Thurgood, Mary J. Golladay, and Susan T. Hill, *U.S. Doctorates in the twentieth Century*, National Science Foundation, June 2006. The report is available on Internet.

[36] Bizony (2007).

urgent the issue at hand is, they will not be distracted. In short, conventional economists developed a mastery of cherry picking and disregarding the cake. Mirowski and Sent brilliantly captured a similar point as they wrote, "It is a commonplace observation that economists love the Individual: it is just real people that they cannot be bothered about. A wag once added that economists also profess to love Science; it is just real scientists that make them nervous."[37] To break from the traditional as explained above, we start digging further into the notion of commodity.

It is not unusual to see an analysis that describes a commodity as an object outside of oneself, a thing that merely exist to satisfy, through its qualities, human wants of one sort or another. Of course, a commodity is a useful thing, but mostly as a thing and not as a relationship of production in the sense that Marx and Engel explained. The said that relationships of production denoted "the sum total relationships that people *must* enter into, in order to survive, to produce and reproduce their means of life."[38] Therefore, we learned that individual participation is not voluntary; people have no choice but to enter into these social relationships, which constitute a permanent structure that resembles the modern economic structure. Ernst Bloch underlined a comparable sentiment when arguing that in today's ever expanding commodity-producing society, the only value that working men possesses is ". . . the labor power [they have] to sell, and that in general such a society represents the transformation of all human beings into commodities."[39] So, the question of "What is the implication of a commodity-producing society?" will be addressed next.

Contemporary analysts have commonly used commodification, commercialization and commoditization somewhat interchangeably.[40] Recently, however, the blending approach has been challenged by a number of scholars. In the following, we offer several examples that diverge from the common approach and are relevant to the content of this study. Sheila Slaughter and Gary Rhoads examined the notion of commercialization of knowledge and argue that in recent years, a peculiar bipartisan political coalition is forming to support commercial competitiveness as a rationale for a significant portion of prevailing research and development.[41] According to the authors ". . . the Bayh-Dole Act of 1980 signaled the inclusion of universities in profit taking". It allows universities and small businesses to retain little invention made by federal R&D funds. In the words of the U.S. Congress, "It is the policy and objective of the Congress . . . to promote collaboration between

[37] Mirowski and Sent (2002).

[38] See http://en.wikipedia.org/wiki/Relations_of_production

[39] Bloch (1971).

[40] The reader should note that this study argues that these terms could not have prevailed without today's culture of information where billboard lights constantly endorse visual messages, pervasiveness of "talking heads" exponentially rising and our young are thought how to drained deeper and deeper into virtual obsoleteness.

[41] Slaughter and Rhoads (2002).

commercial concerns and nonprofit organizations, *including universities* [emphasis added]. Before the Bayh-Dole Act, universities could secure patents on federally funded research only when the deferral government, through a long and cumbersome application process, granted special approval."[42] Nevertheless, the authors critique the notion of oligopolistic capitalism and argue that it has shaken the foundation of academic science in today's world.

In fairness, however, one must point out that the primary goal of the Bayh-Dole Act, as it is written, intended to produce the greatest public benefit. This can be readily observed in the Preamble to the Act, which includes: "to promote the utilization of inventions . . . [for inventions to be] used in a manner to promote free competition and enterprise without unduly encumbering future research and discovery," to "promote commercialization and public availability of inventions" and to "protect the public against nonuse or unreasonable use of inventions." In this respect, the key justification of the Bayh-Dole Act is that academic patenting and licensing are essential to achieve commercial development of academic knowledge.[43] The weakness that we detect is that the wisdom behind the Act fails to recognize that: (1) educational institutions are not subsidiaries of commercial interests, and hence designating such roles to these institutions is neither good nor can it be considered as policy; and (2) goals and objectives of commercial developments are incompatible with that of the public. What is good for GM is not necessarily good for the country; finally, (3) such a frame of mind of policy-makers does not really assuring approach to disproved what Tocqueville claimed in 1837, "The observer who is desirous of forming an opinion on the state of instruction amongst the Anglo-Americans must consider the same object from two different points of view. If he only singles out the learned, he will be astonished to find how rare they are; but if he counts the ignorant, the American people will appear to be the most enlightened community in the world. The whole population, as I observed in another place, is situated between these two extremes."[44]

David Noble also sees the process of commercialization prevailing in higher education that aligning with the interest of business and industry to the extent that the use of technology in education is a deliberate transformation for the purpose of commercial transaction and the loss of academic integrity and freedom.[45] For Noble, instruction has become "a set of deliverable commodities" with the end goal not being knowledge, but profits. Philip Mirowski and Esther Mirjam Sent also

[42] Ibid. pp. 85.

[43] Unfortunately, at the present, these sort of erroneous arguments continue to play a major role in policy-making, both at the level of universities and at the level of governments. The urge to links commercial interest and public welfare seems to join for years to come.

[44] Alexis De Tocqueville, *Democracy In America*, Project Gutenberg HTML File, Volume I, Chapter 35, pp. 533.

[45] Noble (2001).

alluded to a similar observation and argued sarcastically that most scientists in the "bad old days" used to operate without "sufficient guidance from their ultimate patrons, the corporation pillars of the economy."[46] However, as commercialization reached scientific research, they maintained that "scientists have been ushered" into an appreciation of the compelling logic of commodification. Finally Paul Forman (2002: 102) observed, "As the commercialization of knowledge increases, we would expect to see the creation of interdisciplinary academic organizations that more nearly match the research direction of the manufacturing and service corporations that rely on commodified knowledge."[47]

To end the discussion on commercialization, we make an observation and present an argument. First, commercialization of information should be perceived as an innovative process of transforming a string of binary possibilities into commercial opportunities. It is an "information-intensive process" that either develops new commercial applications (e.g., human genetic information is used for commercial purposes), or creates a new industry as a platform for commercial purposes (such as the Human Genome Project (HGP)).

Second, it is plausible to argue that commercialization, as a process, deprives certain cultures of reaping the benefits of contemporary innovation. This observation, however, does not endorse a common perception that some cultures, particularly those with a strong traditional value-structure, are inherently against innovations or technology. Rather, it favors the notion that in the interconnected world of the twenty-first century, most cultures have little choice but to embrace innovations per se according to their own traditions and value-laden views. All cultures, in one way or another, are constantly involved in some sort of innovation according to the context of their own experiences without following certain norms and rules in the same manner that an open source platform operates. The ample confirmation of observation is that no one would have thought a few years back that a wave of political change in Africa, ineptly characterized as Arab Spring, would be facilitated by social networking, but it was. However, as the information culture settled in and commercialization extended from citizenship[48] to virginity,[49] cultures that have deep-rooted traditions and hence have the least potential to adapt will be threatened by innovation, particularly that of the Internet. These are the cultures that most likely would fail to secure the various benefits of innovation and

[46] Mirowski and Sent (2008).

[47] Forman (2002).

[48] In Hungry, Lawmakers from Hungart's populist ruling party have proposed to grant foreign nationals residency in exchange for purchasing of government bonds (see Margit Feher, "Hungary Offer Wealthy Foreigners Residency for Help on Debt", *Wall Street Journal*, Oct 31, 2012, p. A11).

[49] A 20-year-old Brazilian woman auctioning off her virginity online (http://www.huffingtonpost.com/2012/10/24/catarina-migliorini-sells-virginity-780k_n_2010260.html#slide=1682650); and

lift themselves up and compete at the global level. The point is not to eliminate the commercialization process or to remove all incentives for marketing goods and services, but rather to create proper countervailing pressure to end the domination of the hegemony of commercialization so that these nations would have breathing room and a chance to adjust to the overwhelming nature of information commercialization.

Commodification typically refers to the converting of things into economic circulations and market processes. As information is introduced into markets and becomes commercialized, it also endures/retains a value that can only be realized in a transaction, and as such it is commodified.[50] In review on this notion, William and Windebank observed that "Across the social sciences, it is frequently assumed that the commoditized economy is stretching its tentacles ever outward to colonize more spheres of life. However, although commodification, whereby *goods and services . . . are [increasingly] produced by capitalist firms for a profit under conditions of market exchange* is widely propounded to be an ongoing, albeit inherently uneven process, little concerted effort has been made to assess either the extent or unevenness of its penetration."[51]

A similar trend can be seen when one considers the diverse forms of commodification, where beyond typical generalization, almost no attempt is made to map the extent of how commodification penetrates our lives. Nevertheless, it is safe to say that the commodification process, along with commercialization, has a significant adverse impact on the general accessibility of information (i.e., news items and data) and knowledge (i.e., books and educational materials). For instance, information/knowledge is removed from a public domain by defining it as private goods, in which "all" have no access (i.e., the appropriation of traditional knowledge through patents, news organizations' claims over news archives, a Google strategy that does not allow a buyer to claim full-ownership of the purchased item, etc.) One may refute this observation and argue that; in fact commodification and commercialization are the reasons that a significant portion of the population around the world can now have direct access to information/knowledge. While such a contention has merit of its own, the question is why, if the claim is true, impaired with conduct that has been proven to cause inefficiency and is counterproductive to the very principle that aimed to establish free access? Monopolization of commodities and services comes in different forms, one of which is the act of converting the public good into the private good, and then claiming ownership of it. Furthermore, the intended objective of free access is nullified if access to already *available*/*produced information*/*knowledge* is either limited or denied altogether, particularly in cases where the item under consideration has already been produced

[50] Having said that, the definition is wide open to various interpretation. For instance, American author Bell Hooks refers to cultural commodification as "eating the other". By this she means that cultural expressions, revolutionary or post-modern, can be sold to the dominant culture (see Bell, Hooks, Black Looks: Race and Representation, South End Press, 1992).

[51] Williams and Windebank (2003).

and there are no production costs nor storage expenses (as a result of technology). It is then clear that the debate is not about the merit of commodification and its impact on our lives, but is rather far less ideological and more practical. The objection raised here is about stretching commodification far beyond common sense and rationality. Indeed, privatizing existing information/knowledge and limiting public access to it does not uphold any principles, either in disciplines like economics or in philosophical stand of democratic and unplanned society. The absurdity of private ownership of public information becomes more apparent when one takes into account that today one could easily assemble a personal digital library at almost no cost. What this means, observed Robert Grossman, is "for the first time in human history, an individual can carry the Bible, the works of Shakespeare, classic Greek literature, and thousands of other works of literature and art on a memory stick about the size of your key chain that can easily fit into your pocket or get lost in your purse."[52]

In this light, one can't help but wonder about the principle make-up of our lives in the twenty-first century and remember what Horace Mann stated in 1846, "All moralists agree, nay, all moralists maintain, that a man is responsible for his omission as for his commissions; that he is as guilty of the wrong which he could have prevented, but did not, as for that which his own hand has perpetrated. They, then, who knowingly withhold sustenance from a newborn child, and he dies, are guilty of infanticide. And, by the same reasoning, they who refuse to enlighten the intellect of the rising generation are guilty of degrading the human race. They who refuse to train up children in the way they should go are training up incendiaries and madman to destroy property and life, and to invade and pollute the sanctuaries of society."[53]

Some time ago, Bertrand Russell noted that "[e]very living thing is a sort of imperialist, seeking to transfer as much as possible of its environment into itself and its seed. . .. We may regard the whole of evolution as flowing from this *chemical imperialism* of living matter."[54] George Miller gave Russell's observation a real-life flavor when he calculated that "three hundred trout are required to support one man for a year. The trout, in turn, must consume 90,000 frogs, which must consume 27 million grasshoppers, which live off of 1,000 t of grass."[55] Jeremy Rifkin helps us to improve our understanding by stating, "The process of maintaining a non-equilibrium state, away from death, is costly in energy terms."[56] Finally, Jack Manno, put the nail in the coffin when he posed the following question; "Can we live simply so others can simply live?" He then made the following observation; "the economy organized by humans to serve individual aspirations for *material well-being* has ended up, through the unintended consequences of

[52] Robert L. Grossman (2012, pp. 173).

[53] Mann and Pecant (1891).

[54] Russell (2009).

[55] Miller (1972).

[56] Rifkin (2009).

certain system features, threatening the very life support systems upon which all human well-being depends."[57] To maintain material well-being, Manno suggests we must take a close look at commoditization, which according to him, "carries more of the sense of an active verb, *to commoditize* rather than the passive, *to be commodified*."[58] In this respect, he argues that the prevailing environmental and social crisis is the direct result of the economic dynamics of commoditization, "What *is* wrong, irrational, and avoidable is deliberately ignoring the unintended negative environmental and social consequences of runaway economic growth and commoditization."[59] Is anyone responsible for these consequences? The short answer to this question is not really. The brilliant property of commoditization lies in its dynamics, in which no one can be held responsible. "It is virtually agentless; there are no people whose job it is to commoditize, although there are scores of individuals whose jobs are to serve the commoditization process; advertisers in particular, designers, scientists, engineers, marketers, and investment specialists of all kinds. They (we) are operating, however, out of our best understanding of our self-interest, doing work that the economy rewards."[60] However, a more thorough answer points to the prevailing tendencies, mostly induced, of people to satisfy their appetites with commercial goods that can be bought and sold. We characterized such tendencies as mostly "induced" because in today's world, the proclaimed achievement is the fact that for every possible human desire/need there is a good available to be purchased. To extend that, we now witness a call for "regulating the sale of human organs".[61] More importantly, we encourage, and hence invite, these sorts of inclinations by tolerating and observing them as a normal part of today's triumph of humanity.

The fact of the matter in our world today is that there is a gap between the difficult act of acceptance and an easy-pretense of denial that is troubling us as we face rising challenges that have been caused by our own doing. What is preventing us from turning our collective attention to protect air, water, soil and us from us, or simply pause our destructive "way of life" and look around? In part, the answer has to do with the prevailing values and the mindset of the Culture of Information. When quantification is chosen instead of semantic, there is little option but to promote task-oriented instead critical-thinking education. Consequently, more attention will be given to commodities than to the community they are meant to

[57] Manno (2000).

[58] Jack P. Manno, 2000, pp. 28, footnote 23.

[59] Ibid. pp. 30.

[60] Ibid. pp. 31.

[61] See "Sale of human organs should be legalized", Independent Newspaper, November 09, 2013 (can be access at http://www.independent.co.uk/life-style/health-and-families/health-news/sale-of-human-organs-should-be-legalised-say-surgeons-2176110.html.); S. M. Rothman and D. J. Rothman, "The Hidden Cost of Organ Sale", *American Journal of Transplantation*; February 13, 2006, pp. 1524–29; and S. H. D, "Regulating the Sale of Human Organs", *Virginia Law Review*, Vol. 71, no6, September 1985, pp. 1015–1038.

serve. It's imperative to produce rather than to build. It's more efficient to destroy or threaten to do so than to sustain and resolve.[62]

The reader should note that these are all quick fixes. Some require no examination since their legitimacies as well as self-righteousness are embedded within their core principles. Others are often packed and ready to be purchased and used. A quick fix, as such, entails to be packaged because it is made to be own so it produces the expression of one's ownership of mastery of problem at hand. We argue here that a packaged quick fix is an integral part of a Culture of Information and commoditization. Our lives are filled with packaged things that are designed to fix things. Today, we have various toolkits that are designed to solve problems. These toolkits range from an institutional development toolkit for a country's policy-makers to an information and communication technology (ICT) everyday learning toolkit for teachers. Needless to say, these already predetermined fix-ups are designed to address what are perceived as predicaments, for instance, leveraging broadband technologies to enable social and economic development; addressing shortcomings of educational institutions through technological tools which provide "better simulations and models, global learning about diversity, more efficient testing and assessment;" a suggestion that the implementation of Total Quality Management "as a ready-made off-the-shelf-quick-fix package"[63] would considerably improve the operation of libraries (and other service organizations); the examples can go on and on and on. However, the point we would like to emphasize is that these examples are all patented, packaged, ready to be distributed, and sold. The essence of commoditization theory can be captured by the fact that there is always a ready-made package waiting to be called upon to offer a pleasing "breakthrough" for the modern world.

Something noteworthy has also occurred as a result of what has been emphasized above. The cultivation of sustainability has been scarifies by lust for a quick fix, and hence information emptied of meaning proceeds knowledge. Engagement in a commodity exchange for soil additives, chemical fertilizer and insecticides is far more profitable than employing a farmer's knowledge, knowledge which has been accumulated through years of hard work and learning-by-doing, of how to protect the land from soil erosion and recycle the nutrients of the soil.[64] The distinction between information and knowledge is the difference between sight and vision.

[62] One may sees the above explanations as a simplification of very complex and interdependent issues, which we have no quarrel with. But, retaining simplification does not invalidate the content in which the argument is made, which we believed is the case here. In fact, the propensity to favor simplicity facilitates to detangle an intricate structure and reveal what needed to be observed. Having said that, it is obvious that the issues at hand retain complex structure, but to described or illustrating one's perception, of a cause(s) does not necessarily entails a polygonal account. Truth is embedded with the amazing power of illumination and resonation.

[63] It may seem as a bit unreal title. However, a Google search for the exact title would provides more than 2000 results.

[64] Here we used the same examples that Manno used when he made a similar observation (see Jack P. Manno, 2000, pp. 12).

Information often acts as an eye-glass which intends to improve the sight but not the insight where knowledge rest, where as an instrument increasing the power of reason far more than any optical instrument has ever aided the power of vision.

Concluding Remarks

This chapter should be viewed as constructive criticism of the emerging Culture of Information. In this study, we argue that the current Culture of Information is built upon the construct of *information-as-object* that not only strips away information from its meaning but also conduces information to be seen as a commodity. The large amounts of information available make it possible to filter and promote standardized messages, as an individual does not have the cognitive capacity and technical ability to search among billions of records. Moreover, the technical cognitive difficulties in finding relevant information leads to commercialization of information where so-called high-quality information goods are being "privatized," and creates an industry of its own that in the name of "relevancy" and "quality" promotes certain messages and behaviors. In summary, we are not trying to eliminate the Culture of Information, but because it touches so much of our lives, we fear that ignoring its effects may lead to irreversible damage.

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Chapter 5
Art, Research and Society: New Ecology: The Affective Power

Vivienne Wang

Abstract We are coming to a very interesting place in history where new ecology of art, scientific and technological innovation, and society, is emerging. It will fundamentally change the dynamics and thus evolving pathways of the development of our society, and demand corresponding changes of the ways we perceive, understand and interact with this emerging ecology. Reexamining the relationships of art, techno-scientific research and society is thus to help both artists, scientists, policy makers and the public understand the emerging ecological system to fully utilize the great opportunity and better cope with the new challenges.

Keywords Double engines of society • Emerging ecology • Cross-fertilizing of arts and techno-scientific research

> It's in Apple's DNA that technology alone is not enough. That it is technology married with liberal arts, married with the humanities, that yields us the result that makes our hearts sing.
> ~Steve Jobs

The arts and the science are two large engines of a society (Wilson 2002). Science underpins almost every aspect of our lives, while art enriches almost every corner of the world. We are all surrounded by the technological and artistic products. However, the relationships between art and scientific and technological research as well as their relationships with the society which has great implications to our life and livelihood have not been clearly articulated and fairly recognized. In addition, such relationships have been changing along with the human development tracks that we have not truly understood the dynamics and trends. The reality is, without a comprehensive and yet in-depth understanding of these relationships, we cannot fully benefit from the positive synergies of the interactions and have to pay the price for these unwanted results and land on a undesirable destination from time to time. This paper is to contribute to our understanding of the relationships of art, research and society based on pieces of information from multi-disciplines and pioneer studies in this field.

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5.1 Art, Research and Society: Why Brought It Up Again and Now?

The interaction between the art, scientific and technological research and innovation and their relationships with society has been a recurring theme in the past (Garfield 1989). Why has such old theme been brought up to the academic fields, policies institutions and the public now again? Simply speaking, it is because we are at "an interesting place in history" (Wilson 2002).

In this interesting place of the historical track, a new ecology is emerging. In such ecology, the boundaries between the techno-scientific research and art are being moved in an unanticipated way and speed. The new technologies open up a new world- in which information exchanges are crossing all fields and geographic areas. The explosion of this new ecology has not been pre-planned. Today, so-called media labs, for example, are this type of the ecology with hybrid art, science and technology in our society. In fact, more and more researchers challenge the separations of art and science such as Harrell and Harrell (2011). The new focuses are not only on the roles of art and science, but also on the expansion of the zone and integration of art and science in the information society and knowledge economy.

Both arts and techno-scientific research contribute to the improvement and understanding of the human being and the world. It is also clear that arts and techno-scientific research are different in their aims, methods, products, processes and even their values to the society. From Renaissance to the emerging of information society, there are two critical landmarks Harrell and Harrell (2011). The first landmark was the turning place where art and research started their separation. The second one, on the opposite side, is where art and techno-scientific research start to get increasingly integrated (Fig. 5.1). The pre-historical cave painting can represent what may be the first use of both art and science (Garfield 1989). From ancient Greece time, to the Renaissance, the art and science continued to inseparably develop and interact (Combie 1986). Such interaction between art and science was not limited to Europe, the same can be found in eighteenth –century American (Garfield 1989).

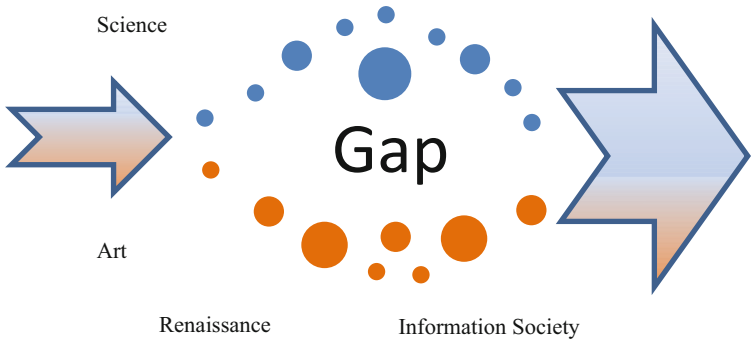


Fig. 5.1 Changes in distance between science and art

From the time of the Renaissance, the science and technology start getting separated and the distance between the science and art has been grown, as specialization and the advancement of technology became more and more important to the both production and people's life. The scientific discoveries and technological innovations were not immediately used as tools in the art work.

However, such distance has gradually narrowed down when the scientific discoveries and technological innovations are widely used as ways for the art work, and the art work further brings new view and understanding to the techno-scientific researches to address their bottlenecks.

The coming of the information society is the other turn point where art and techno-scientific research and innovation start to become integrated. In the information society today, there are many factors contributing to the gradually integrated art and science. A few key driving forces behind the change are listed below:

First, the information sharing, including both arts and scientific and technologic knowledge, is spreading in a speed that has never happened before. The digitalization, ICT applications, globalization have made the arts and scientific and technologic knowledge, techniques and products much more accessible, comprehensible and easy-to-apply for all researchers and users at both fields. They are no longer perceived as two opposite ends, as Fig. 5.1 indicated. These changes enable art and science to fertilize each other in a more substantive way than ever before.

Second, the technological developments, for example, the internets and big data applications, have made integration and cooperation activities between art and science more traceable and visible. This trend further fuels the increased interests and efforts in revealing these complicated relations among art, science and society, which would not happen otherwise.

Third, the findings about the roles and inter-relationships of art, science have much more profound impacts on society than in earlier decades. The Art and Science can be seen as the double engines of the development and sustainability of a society (Fig. 5.2). At the same time, as Carayannis and Wang (2004), and Wang and Carayannis (2011) suggested, the key factors of a given society have large impacts on the capacities and speed of both technological and artistic innovations. These factors include: the intuitional and cultural dimensions, knowledge base and learning/technological transfer mechanisms, pleasantness for living, and the actors and networks of a society. This is consistent with what Carayannis had defined as the "pull" and "push" factors.

- The institutional and cultural dimensions: e.g. the availability, accessibilities and quality of legal, administrative, financial services, the cultural traditions, diversification and openness;
- Knowledge base and learning/technological transfer mechanisms: e.g. the presences of scientific and research capacities as well as the technological and artistic advancement, as least in its key sectors and within these innovative entities, such as the government- university-private sector consortiums;

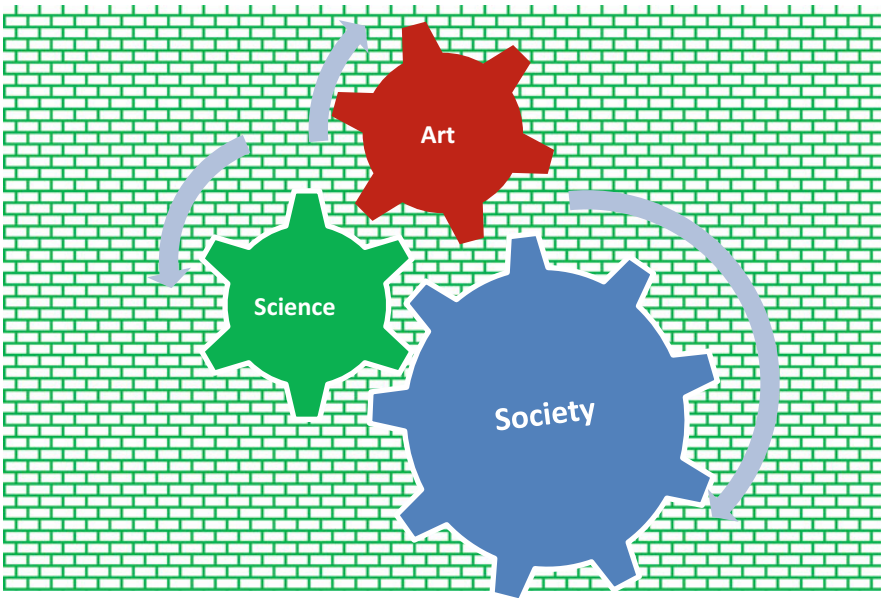


Fig. 5.2 Double engines of a society

- Pleasantness for living: the cohesiveness, physical environments, artistic work, and social and educational service and entertainment facilities; and,
- Actors and networks: the leading sectors and their actors, the local clusters, the networking within and outside the community. The number and quality of artists are as important as that of the scientists in a community. Their relationship, communications and the ways of their interaction and cooperation have impacts both on the quality of the society and innovative productivities.

Reexamining the relationships of art, techno-scientific research and society is thus both necessary and critical to help both artists, scientists, policy makers and the public understand the emerging ecological system to fully utilize the great opportunity and better cope with the new challenges.

5.2 Does Art Matter

While the claims for existence of the interaction among art, science and society can be widely acceptable. Then, does art matter? In many cases, the roles of art are still in the forms of some blur concepts, isolated examples. Arts, to varying degrees, are undervalued, in part, because some attributes of art are still not fully uncovered.

Thus, despite a general acceptance of the notion that art and science are not the two ends of the world, the relationship between arts and other social, economic and

technological elements are still not clear. This paper takes a holistic approach to shed light on affective power of art.

The most noticeable strength of art is that art can create immediate experiences for the viewers, regardless the forms of experiences and whether or not that is real-world or imaginary experiences. In addition, the arts enable human beings to discover the "truth", "ideas" and even "unknown world". They provoke associates of these of the "known" with these of the "unknown" across subjects and more critically, the boundaries of time and space, material and immaterial regimes. Arts trigger and stimulate unordinary parts of power of human's brains, which usually will not pop out normally.

Arts can weave artistic, philosophical, technological and scientific concepts and ideas to advance the frontier of our imaginations. They even use these scientific observations and artistic experiments to create new possibilities and products-innovations. These innovations that are embedded in the arts of all formats have not been fully explored in a measurable and tangible way. The foundation for our society and its prosperity and breakthroughs is built on the creations of arts, science, innovation, technology that drive social-economic development, no matter we have realized it or not.

There are some categorical illusions that in part prevent us from understanding the role of art in our society, e.g. education, health, social development, as well as science and technological innovations. Scientific and technological research and innovation has long been treated as the driving force of economic development and social changes. It is such a special area where art is not considered, to a certain degree, as essential or even relevant.

However, there are researches have revealed the values of arts from different angels that enable us to see how art is becoming part of the core contributor, what affective power the art has in a profound way. These findings provide important clues about roles and impacts of art on society, such as the economic benefits of art and the impacts of art on the social arenas include cohesion, health and well-being, inclusiveness, community identity and education.

5.2.1 On Economy

Arts are found to have a role of promoting economic prosperity (e.g. Azmier 2002; Perryman 2001; Walesh and Henton 2001; Singer 2000; Bryan 1998). There are also both "pull" and "push" effects at different stages of economic development.

On the pull side, as recognized by Guetzkow (2002).

- The arts attract visitors, e.g. as 'export' industry: community with unique art events will have indirect multiplier effects on the local economy, for examples service sector, local artists markets. At the same time, the fresh ideas, demands and even the presence of foreign consumers and products can trigger other related industries to emerge and grow. Florida (2002) claims that unique places

with strong local identity and rich transition arts and culture attract high-end visitors.

- The arts attract residents and businesses: The presence of high quality and good scale of art works can attract highly skilled, high-wage residents, and high-end businesses. High concentrations of high-skilled workers and high-end business can further produce agglomeration effects and multiplier effects on attracting investments and service industries, research centers and high-tech activities and events. Florida (2002) concludes that high-skilled and talented people as the core of the modern economy are attracted to cities where culture is rich and local identity is strong. The Silicon Valley, for example, it is a center of artistic creativity before it became a center of technological creativity.

On the push side, the impacts of art and its patterns of change have not been fully recognized. An interview with an Art professor at China Art Institute provides some interesting findings.

- The great communities usually come with the presence of great artists and art works. However, when living costs go too high, the artists may move out of the community and potentially create another new growing community. The left of the great artists will potentially slow down the creativity economy of the community first. And it may also affect the other economic sectors.
- The more the visitors from modern cities and developed countries, the more likely that the young generations in the community choose to pursuit educational and employment opportunities outside the community. Certain artistic techniques and skills may also spread and even emigrate out together with these emigrants.

One of these specific examples is the creative industry. The growing of the creative industry is becoming self-evident of the impacts of art on economy. The creative industries are not only becoming more and more vital to economic development and innovation. Its indirect impacts on the economy as a whole also can no longer be neglected. Higgs et al. (2008) claimed that "the creative industries are ones of the most important contributors to the UK economy".

5.2.2 On Social Development

The arts provide a catalyst for the creation of social capital and cohesion for attainment of important development goals (e.g. Whilte and Rentscher 2005; Barraket 2005; Merli 2002; Goss 2000; Matarasso 1997; Williams 1995; Matarasso 1997). Matarasso(1997) argued that "the real purpose of the arts is not to create wealth but for building and improving the stability, confidence and creativity of the society". From several aspects, where the impacts of Art on the society have been revealed:

- The arts improve social cohesion by "developing networks and understanding, and building local capacity for organization and self-determination" (Matarasso 1997). The statement is from the participation perspectives, so that the arts work can provide participants with an opportunity to think about their rights and social responsibilities.
- The arts help residents in appreciation of local cultures and valuing their traditions. It can also help develop social identity and belonging. Some far-reaching benefits also include change of values and raise positive expectations for the future: about themselves and the society.
- The arts improve social capital though producing skills of labor force, including both productive skills as well as organizational and coordinative capacities. The arts can also inject power of innovation through strategic thinking, creativity and innovative components of the art works.

Barraket (2005) stated that arts initiatives appear to have significant impacts on social inclusion, in terms of delivering the intended results.

5.2.3 On Education

Arts-integrated school curricula supposedly improve academic performance and student discipline, same apply to adult study (e.g. Whitman 2013; OECD 2013a; Root-Bernstein and Root-Bernstein 2012; DeMoss and Morris 2011; Root-Bernstein 1997a; Fiske 1999a; Remer 1990). DeMoss and Morris (2011) stated that "learning in and with the arts has been linked with increased student achievement".

- The arts can have direct impacts on learning related subjects (Winner et al. 2013). The children who listen to Mozart (and other similar stimuli) show improved performance on visual-spatial reasoning tests – whether such effects are short-term or Long-term in nature was not concluded yet (Chabris 1999; Hetland 2000).
- The arts have indirect impacts on learning other subjects. Several studies have indicated that students involved in arts education or activities also do better in other subjects, and schools that used arts-integrated curriculum have improved student performance (e.g. Winner and Hetland 2000; Fiske 1999; Weitz 1996; Albert 1995; Remer 1990; Jackson 1979);
- The arts can improve students' skills in observation, concentration, harmonization and creativity. Based on DeMoss and Morris (2011)'s studies through 90 interviews of 30 students, and OECD (2013a)'s assessment, the integrated art education can,
  - Improve learning environments, in which students expand their learning from traditional boundaries and methodologies and deepen their understanding.
  - Engage in contents through transforming learn experiences about the content of learning towards positive and constructive directions, thus the engagement in the learning process.

- Broaden learning portfolio by extending the boundaries for learning from the traditional classrooms and far beyond.
- Foster skills such as critical and creative thinking, motivation, self-confidence, and the ability to communicate and cooperate effectively

Art skills are related to the student future success in their career path, and even of the careers in science and technology. "Many other studies parallel ours. One found that neither mathematical nor verbal reasoning tests are useful indicators for future careers in science and technology, but high visual imaging ability is. Another found that high aptitude in arts and music are much more predictive of career success in any field than the results of grades, IQ, achievement or any other standardized measures. Business executives who head major technology firms often are very talented artists, musicians and photographers" (Root-Bernstein 1997b)

5.2.4 On Health

The arts improve people's physical and psychological well-being (e.g. Staricoff 2004; Ball and Keating 2002; Baklien 2000; Turner and Senior 2000; Bygren et al. 1996).

5.2.4.1 The Arts Improve Physical Health

Stuckey and Nobel (2010)'s studies of health effects of music engagement, visual arts therapy, movement-based creative expression and expressive writing, found clear indications that artistic engagement has significantly positive effects on health. Some other researches also find that engaging in creative activity or attending some kind of artistic event benefits people's physical health (Ball and Keating 2002; Thoits and Hewitt 2001; Angus 1999; Baklien 2000; Bygren et al. 1996).

This could be due in part to the ability of arts to relieve stress, widen and strengthen social bonds through participation and cooperation that improves health (Baklien 2000; Ball and Keating 2002). Bygren et al. (1996) further explained: "we know that the organism responds with changes in the humoral nervous system–for example, verbal expression of traumatic experiences through writing or talking improves physical health, enhances immune function, and is associated with fewer medical visits."

5.2.4.2 The Arts Improve Psychological Well-Being

Attending art events can stimulate and relieve stress and hence leading to improved happiness. The previous researches have distinguished the art project participation

into two categories: passive and active participation. Active participation in the arts can further lead to improved self-respect and sense of being-recognized. In fact, to some extents, the creation and improvement of some arts works provide an opportunity to the participants for the feeling of confidence and increased positive recognition. However, how much a participant can expect to gain in psychological well-being and whether such effects can be perceived in different socio-economic and cultural settings has not been concluded yet.

5.2.5 On Community

The art revitalization effects to the communities and neighborhoods have been studied in recent years (e.g. Walesh and Henton 2001; Stanziola 1999; Costello 1998). Building on Guetzkow (2002)'s summary, we can further elaborate the arts as a vehicle and venue to,

- Draw people together and interact in art creation and construction, and further spur participation in other constructive community/social activity;
- Foster and enhance trust among participants, and expend trust among communities;
- Serve as a symbol of recognition and even pride of communities, and increase sense of home of residents;
- Provide an experience or aspiration for technical and interpersonal capacities, and apply such skills to other projects and events; and,
- Increase the scope of individual and community social networks, and extend such networks to other fields and geographic connections.

Guetzkow (2002) has provided a summary of levels and types of artistic inputs and types of impacts (Table 5.1).

McCunn (2013) further argues that "arts are absolutely vital to any city that wants to thrive in the information age and artists are important to a healthy community". The rapid development in information and communication technologies, has make the art and science connected even deeper and in wider areas of work. One example is Wilson (2002)'s Information Arts, where he studied various initiatives in his Intersections of Art, Science, and Technology. It covers a relatively comprehensive survey of international artists actively engaging in scientific inquiry and new technological experiments. Alliances of science and art have provided many major benefits, and greater potential. Some of these potential may be still unknown to us. Arts, in addition to its impacts on social, economic, health, educational arenas, have profound impacts on techno-scientific research, and deserve a section to explore the relationships between arts and the techno-scientific research.

Table 5.1 Mechanisms of arts and impact[a]

	Individual			Community		
	Material/health	Cognitive/psych.	Interpersonal	Economic	Cultural	Social
Direct involvement	Builds inter-personal ties and promotes volunteering, which improves health	Increases sense of individual efficacy and self-esteem	Builds individual social networks	Wages to paid employees	Increases sense of collective identity and efficacy	Builds social capital by getting people involved, by connecting organizations to each other and by giving participants experience in organizing and working with local government and nonprofits
	Increases opportunities for self-expression and enjoyment	Improves individuals' sense of belonging or attachment to a community	Enhances ability to work with others and communicate ideas			
	Reduces delinquency in high-risk youth	Improves human capital: skills and creative abilities				
Audience participation	Increases opportunities for enjoyment	Increases cultural capital	Increases tolerance of others	People (esp. tourists/visitors) spend money on attending the arts and on local businesses. Further, local spending by these arts venues and patronized businesses has indirect multiplier effects	Builds community identity and pride Leads to positive community norms, such as diversity, tolerance and free expression	People come together who might not otherwise come into contact with each other
	Relieves stress	Enhances visuo-spatial reasoning (Mozart effect)				
		Improves school performance				

Presence of artists and arts organization and institutions	Increases individual opportunity and propensity to be involved in the arts			Increases propensity of comm.-unity members to participate in the arts	Improves community image and status	Promotes neighborhood cultural diversity
				Increases attractiveness of area to tourists, businesses, people (esp. high-skill workers) and investments		Reduces neighborhood crime and delinquency
				Fosters a "creative milieu" that spurs economic growth in creative industries		
				Greater likelihood of revitalization		

[a]This grid further develops a typology proposed by Kevin McCarthy (2002)

5.3 What of Art and Science Have to Do with Each Other?

While, with some exception, there are considerable evidences that arts have positive benefits to economic and social development, education, health and community. The inter-links among art and research, technological innovation are, to some extents, weakly evidenced and partially understood. What kinds of relationships are among art, scientific research and technological innovation? How do arts and techno-scientific research inform and fertilize each other? To contribute to the discussion of the relationship of arts, research and society, the common attributes and complementary roles are discussed in this session.

5.3.1 What Are Art and Techno-scientific Research in Common?

The exploring of the answer to this question, in fact, has led to a bigger question-how can we know our world that we live? The answers from different angles, interestingly, can have one similar answer: through the lens of both science and art. Neither of them alone can draw a complete picture. Each can only explain part of the world. Furthermore, no matter it is from scientific perspective or artistic perspective, one has to rely on the other to make an explanation of its own fields. Wilson (2010) refers such phenomena of science and art as "twin pillars of creativity and innovation".

The big question can be understood without having to distinguish the definitions of art, science and technology. However, when we look into a particular field, logically, the next question is: what is science, technology and art respectively? We seem to understand the relationship of science, technology and art. The boundaries of such understanding by different studies, practical areas can vary dramatically. It is hard to come with or agree on one set of definitions, and the boundaries over time are changing. Different definitions may well fit into each theoretical stream or practical field. However, there are some generality across all theories and applying areas. Simply put, scientific research can be understood as "knowing-why", technological research as "knowing how". Then art can be defined as "knowing what". Smith (1980) observed that art works reveal "subtle properties of matter" that are still uncovered by science. In other words, scientific research is to "find", technology is to "make" and art is to "express". For the discussion of the relationships to science and technology, we can say that techno-scientific research to roughly represent the exploring, explaining and making use of the scientific and technological knowledge activities.

Root-Bernstein (2003) claimed that "art and science are on a continuum in which artists work with possible worlds whereas scientists are constrained to working in this world". He also found that at least one thing in common as he has described that "despite the very real differences between the products created by artists, writers,

and scientists, people in all fields use a similar set of pre-verbal, pre-logical forms of creative thinking."

In fact, the arts and techno-scientific research both look for new possibilities and the ways to move beyond what are already known to the artists and scientists, even though their approaches and processes can be quite different. Therefore arts and techno-scientific research have in common and can exchange these basic notions about the nature of world where we live and the nature of the human being. Both arts and techno-scientific research can have in common and exchange understanding about the key dimensions of the universe: time, space and life as well as their relationships. Garfield (1989) identified the following essential components that are common to both arts and techno-scientific research:

1. Both art and techno-scientific research are an exploring process and synthetic thinking in their endeavors (Copley 1987). One of the examples have been used is of Albert Einstein, a most famous scientist, who are regarded as having used visual thinking as essential process of his scientific work.
2. Creativity is another common component. Both artists and scientists are engaging in creative activities that are driven by a sense of mission or curiosity compelling them to move beyond what are given and what they have already known.
3. Both techno-scientific and artistic researches depend heavily on their abilities and means that they can possibly use for interpretation of nature or the natural world. Artists are observing, understanding, interpreting and decoding the nature using specific media, while scientists are doing the same but using different way of thinking and means of doing.

It is clear that both techno-scientific research and arts have their core objectives in common: to prospect, observe, interpret and render the nature of the world. Such core objectives are pursued and carried out may in quietly different ways, and to varying degrees, complementing to each other, and even integrating together.

Innovation as Carayannis (2004)[1] stated, is science of art and art of science. However, as Root-Bernstein (2003) described "science and engineering is often portrayed as if it were distinct from that in the fine arts" and "science and engineering are supposed to be objective, intellectual, analytical, and reproducible so that it is clear when an effective solution has been achieved to a problem. The arts, literature, and music, by contrast, are portrayed as being subjective, sensual, empathic, and unique, so that it is often unclear whether a specific problem is being addressed, let alone whether a solution is achieved."

Eskridge (2003) by looking into history of connection between art and science, such as the Egyptian pyramids, also concluded that "history proves that the two disciplines cannot exist without each other, enduring in constantly changing and evolving relationships.", Then, when arts and techno-scientific research are integrated, are both more powerful?

[1] Carayannis, E.G. 2004, in his lecture to Doctor students, at George Washington Business School.

5.3.2 *The Affective Power of Art on Techno- scientific Research*

As early as 1967, OAM described art as "an adventure or a journey with no predetermined destination". In other words, the art, itself, challenges our boundaries of knowledge and habits of thinking. These revolutionary natures are embedded in two ways: the astonishing art works and extraordinary stride of creative thinking. The arts in such cases open a fresh new window for scientific and technological researchers to look at the subject matters in a way that would not occur otherwise. Arts enable new things and new ways of thinking to happen that may not be possible in techno-scientific perspectives. As OAM has claimed, "art can sometime change the way we look at the world, which beyond aesthetic pleasure". Creativity plays an important role in scientific and technical research and innovation. The inspiration, stimulation and new-ground –finding effects of arts are both necessary and critical to research and innovation. Such affective power is intrinsic, essential, but intangible. It, often, is underestimated and overlooked.

Wislon (2002) elaborated the possibilities of art as research. He pointed out that artists develop new kinds of knowledge and applications ignored by mainstream scientific and corporate search. However, the arts push scientific inquiry in unanticipated directions.

In reality, a conductive and productive innovation system is constantly evolving between art and techno-scientific research, along with other key factors (Shavinina 2003). In nowadays, innovation is becoming increasingly a shared activity operating in various networks (Carayannis and Wang 2008). These networks are rich in trust and strong in social capital. Geographic proximity of high art-tech clusters is among preferred choices for innovation and research investments. The degree of trust between actors in the innovation system determines scope and results of collaborative learning (Bakhshi et al. 2008). Wilson (2002) argued that arts play very special role in the evolution and development of technology, based on his research across the fields of biology, physics, material science, astronomy, cognitive science, engineering, medicine, architecture, and social and information science.

Root-Bernstein (2003) explained the reasons that support the claims of Arts' affective power. The arts' power in providing "insights beyond the methodological capabilities of the sciences comes from the fact that the artistic innovations often precede and make possible subsequent scientific ones."

Some examples from Root-Bernstein' research are listed below:

- The Russian rocket pioneer Konstantin Tsiolkovsky was inspired to begin inventing by the works of Jules Verne (NASA 2012)
- Leo Szilard is best known for his pioneering work in nuclear physics Adams (2013). Many of his ideas were inspired by novel of H. G. Wells (1914), titled The World Set Free.
- Alexander Graham Bell's first invention, multiplex telegraphy, resulted from his avocation as a pianist (Mackay 1997)

- A musical device also inspired one of the first heart pacemakers (Jeffrey 1997)
- Marvin Cohen, a professor of physics at the University of California, Berkeley, collaborated with choreographer David Wood to explore forms of dynamic symmetry that inform the theory of super-conductivity (Root-Bernstein and Root-Bernstein 2008)

Root-Bernstein's own study in 2003, which included a group of four Nobel laureates, 11 members of the National Academy of Sciences (USA), many typical university professors, as well as several individuals who left academia for industry, concluded that "participation in the arts as an adult is also highly predictive of success as a scientist". Root-Bernstein also realized that these results do not exclude possibilities that the most successful scientists have innate talents to be excellent in doing anything, with trans-disciplinary skills.

The findings are consistent with Cranefield (1966) claim that the range and nature of the subjects that techno-scientific research address are correlated with their artistic avocations.

Similarly, Smith of MIT spent a lifetime studying oriental arts and crafts which provided useful insights into metallurgy. Smith (1978) concluded "I have slowly come to realize that the analytic, quantitative approach I had been taught to regard as the only respectable one for a scientist is insufficient . . .. The richest aspects of any large and complicated system arise from factors that cannot be measured easily, if at all. For these, the artist's approach, uncertain though it inevitably is, seems to find and convey more meaning".

In sum, the affective power of arts on techno-scientific research can be seen in the following ways.

- Arts have influence on thoughts: Art can radically influencing perceptions and thought. New perceptions and thoughts can empower and enrich techno-scientific research. Root-Bernstein (1997c) argued that artistic inventions "have outstripped the methods of contemporary science and technology". In fact, scientists "draw on their dual backgrounds in science and art". Root-Bernstein and Root-Bernstein (2003) cited the claims made by Henri Poincaré, a great mathematician of the early twentieth century, that "**It is by logic that we prove, but by intuition that we discover**". He further argued that arts "foster sciences and technology by elaborating possible worlds that can be evaluated for the insights they provide to the real world".
- The arts can invent or discover phenomena, observations, and rules that are unknown to the sciences, which generate new questions and pose new problem for seeking solutions.
- Arts have influence on techno-scientific abilities. Root-Bernstein (2003) pointed out that arts, in addition to invent or discover phenomena and observations unknown to the sciences, enable scientists to "imagine possibilities—possible problems, possible tools, possible solutions—through synthetic and sensual forms of thinking".

- Arts can even directly provide scientists nontraditional approaches and tools that to be used by scientists to solve techno-scientific problems and explain techno-scientific phenomena.
- Arts impact techno-scientific research through its impacts on society. It is critical to understand that techno-scientific research and innovations cannot productively and sustainably flourish without a conduit society. A conduit society, as Carayannis and Wang (2004) pointed out, has people, culture as well as technological elements presented in a both competitive and complementary way. Arts play critical roles in forming, enhancing and sustaining such a conduit society. Innovations, so often involve social, economic, cultural and technical factors in its processes.
- Arts are necessary in communicating the techno-scientific findings and applications. The higher the technology is, the more in needs to apply sophisticated art means and tools to communicate the advanced theories and explain the high-tech products.

5.3.3 Science and Technology on Art

Techno-scientific research has direct impacts on all aspects of life from the food, medicine, to communications and entertainment. All these changes come to influence our culture frontier and the arts.

The scientific findings and new technological tools can change the picture and perception of the world that we live and our interaction with the nature. All these changes can enlarge the scope, alter the perspectives and push frontiers of the artists and their artistic works. Such changes can further enable the artists to explore the new possibilities.

In recent years, there is an increased level of artists using technological concepts, techniques, tools and methods and their participation into the techno-scientific research. What is called high-tech art, is a typical example of how techno-scientific advancement can fertilize arts. The technological methods, materials and tools of high-tech arts are changing, following emerging of new techno-scientific innovation.

Wislon's (2002) described the pattern of sequence as: technological invention, artistic experimentation, and then commercial assimilation. Scientific findings enable artists to look into uncovered world and test their assumptions. Technological innovation provides new means and tools for artists to conduct their own investigations and innovation. The newly developed concepts will provoke and trigger artist to represent the new view and go even further beyond.

Technological and scientific research empowers people to create arts in new and very different ways. There are artistic products that are borne from the most advanced scientific research and technological innovation. Scientific findings and technological development has been used by artists in various ways.

Computers and information technologies have been used by artists, for example, that have the effects of:

- Expanding conventional scope of art works- arts use technological and scientific possibilities to create new forms of arts;
- Amplifying art effects through multiple media- arts use technological and scientific tools to produce new ways of communicating feeling and seeing;
- Enabling new areas of artistic research- arts use technological and scientific advancement to advance the artistic frontiers; and,
- Emerging new ways of art-science integration- arts and science finds more and more ways of work together. Art will be enriched when the science and art inform each other.

Moulon (2012) stated that artists always use "the techniques and technologies of their times". He further claimed that "exchanges between the world of art and the world of science take place more often than one might think".

The way the techno-scientific impacts on art are generally easy to identify and describe, the way that art influence science is more subtle. Ede (2005) argues that science is affecting the creation and interpretation of contemporary art, and artistic insights are as important as those in science. Root-Bernstein (2003) also argued that "arts, although are seen as subjective, emotional, nonintellectual works, it help make science and invention possible".

Wilson (2002) summarized the similarities and differences between Art and Science as below:

Difference between art and science	
Art	Science
Seeks aesthetic response	Seeks knowledge and understanding
Emotion and intuition	Reason
Idiosyncratic	Normative
Visual or sonic communication	Narrative text communication
Evocative	Explanatory
Values break with tradition	Values systematic building on tradition and adherence to standards
Similarities between Art and Science	
Both value the careful observation of their environments to gather information through the senses	
Both value creativity	
Both propose to introduce change, innovation, or improvement over what exists	
Both use abstract models to understand the world	
Both aspire to create works that have universal relevance	

Thus, arts supply scientists with new ways of perceiving the world and post new questions and clues for exploring the nature of the world. Arts also complement scientific and technological means of reasoning and analysis. On the other side, techno-scientific research help artist to look at the new world and use the techno-

scientific tools to create artistic work. This cross-fertilization process yielded an increasing number of integrated approaches, in which both techno-scientific and artistic methods are used. In some cases, art methods may even be superior to scientific ones (Root-Bernstein 2003)

5.4 What Will Be the Next?

Today, the technological, arts and social development have led to a new trend of the convergence of art and science. Such convergence provides new opportunity as catalyst for both artistic and techno-scientific research, enterprise, and creative experimentation and development. This ushers a new stage in historical evolution of the interaction among science, art and society (Fig. 5.1).

The innovations and breakthroughs in science and technology introduced a gold era for integrated arts and techno-scientific research and development together for the following main reasons.

- The rising of cultural industry: The distance between any two places on the globe has shortened. Exploring and cultural diversity and unique cultural traditions become a strong economic sector that links the art in all media, local economy and society on the global networks.
- The zone of interaction between art and science is expending, as a results of the increased the availability products/application and capacities of research and simulations. The technologies have made the new materials and applications to create new art works; the new art works can serve as new concepts and tools in scientific and technological products and their development processes.

Work with both science and art is no longer a choice by interests, but an inevitable pathway of a society. This can be explained by following theoretical grounds.

- First, the economic theories such as comparative and competitiveness indicated that the underlying driving forces of development are innovation. To achieve comparative or competitive advantage, the speeds of innovations, quality of innovation and usefulness and acceptance of the innovation by customers, as well as the unit costs and scale of products based on the innovation economy play the key role. Taking comparative advantage in utilizing the artistic and scientific and technological advancements, as well as a strong social capital and cohesive and yet innovative society and community, it is viable way to achieve or sustain any economic competitive advantage.
- The speculation based on the reality that the ICT and globalization has make reversed-engineer and technological spill-over faster and easier than ever before. Customization and standardization, two critical factors, in market competitions, cannot be achieved without integration art and science in the local setting, under the global market background.

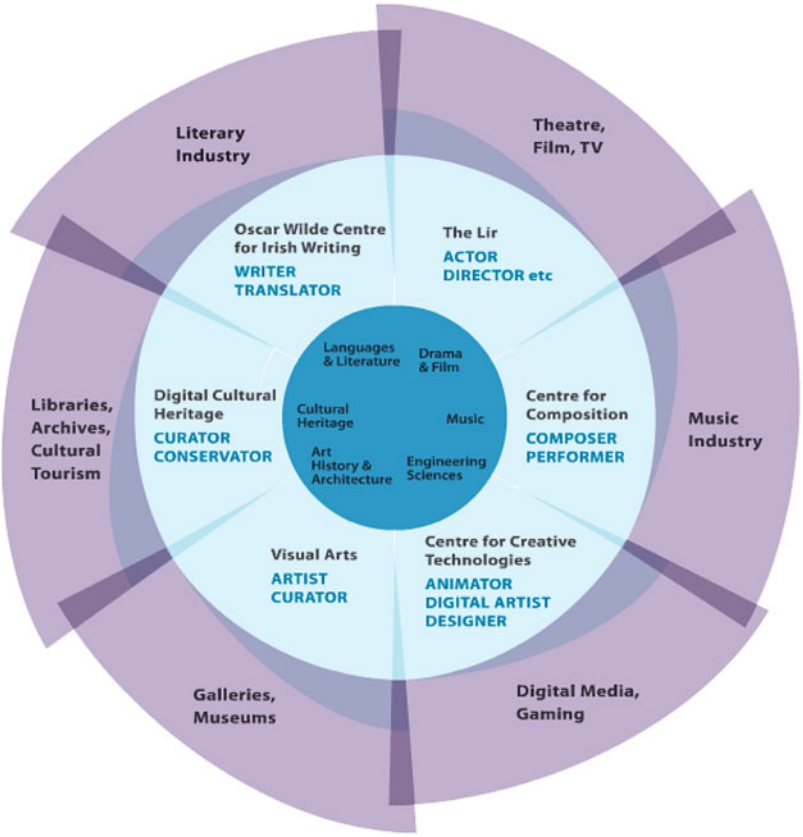
- Behavior theories and networking effects also play their roles in the process of integration of art and science. For any technological advancement, there are artists who are finding their ways in applying the advancement in their art work, and even push the boundaries further forward. The artistic advancement or breakthrough will spread faster than ever among both the artist circles and the scientific experts and technicians. The new artistically skills eventually can be used widely. The speed of obsoleting is also faster that pushes both artists and scientists to advance their work in a faster speed.
- The networking effect is itself an integration of art and science. There is a large number of initiatives and scientific research projects where the artists and scientists are work as one team (Wilson 2002). Such networks not only bring together the people from art and techno-scientific fields together, but also change the way of how the research and innovations are identified, initiated and organized and applied. Such networking effects can ripple beyond the network itself and geographic boundaries.

In recent year, more and more artists use scientific knowledge and technological applications to achieve the artistic goals. In addition to use the results of scientific and technological research conducted by others, artists have already been an important part of the efforts to create new techno-scientific knowledge and products. Mutual benefits and cross-fertilization are the positive impacts of the integration. At the same time, scientific and technological researchers have become more active in networking, incorporating art elements and even acquiring artistic knowledge and skills.

The creative industries are "not merely another sector but is also a driving force behind various economic and social processes" and their "broader added value of the creative industries manifests itself in the contribution by creatively actively professionals to innovation and competitiveness in the broader economy" (European Union 2011).

The chart below describe the concept of an initiative for a long term strategy for developing a Creative Arts, Technologies and Culture Network at the heart of Dublin city catalyzed by Trinity College. The concept chart reflects a major shift from traditional approach of art and techno-scientific research separation, to new media and technologies, and integration of both into a network of art, research and society. It provides a platform that will "form a springboard for new ideas, for new forms of connectivity within the disciplines and across the arts and Sciences, and between the university and the city."

The creative economies, as illustrated in the example below, can further connect relevant disciplines, sectors, new technological applications, scientific findings with the creative Arts and Culture for new forms of learning, scholarship, practice and enterprise that will "produce graduates with deep knowledge and innovative practitioner skills and are engineers/scientists skilled in the Arts, or artists and humanists skilled in technology." (Trinity College Dublin, 2013)



Adopted from Trinity College Dublin, the concept of the Creative Arts, Technologies and Culture Initiative: http://www.tcd.ie/catc/concept/

FLORIDA (2002) also stated that "given that creativity has emerged as the single most important source of economic growth, the best route to continued prosperity is by investing in our stock of creativity in all its forms, across the board". This requires "increasing investments in the multidimensional and varied forms of creativity—arts, music, culture, design and related fields—because all are linked and flourish together".

Such integration is not without challenges. One of the difficulties is the communications, since artists and scientists may, in so many cases, have different concepts, speak different languages and use different tools. "In order for them to collaborate effectively, to perceive in each-others' problems and methods opportunities for insight, we must have a large cadre of artist-scientists and scientist-artists" (Root-Bernstein 2003) or the ones who can effectively make them work together, these are people who can bridge.

To address the truly important problems of the world effectively, arts and techno-scientific research are both necessary. Thus, the future of innovation will reside in the place where minds of techno-scientific and artistic can be met.

To bridge the arts and techno-scientific research, the capabilities in coding the tactic knowledge have particular critical roles. Techno-scientific research and arts should be tightly interwoven, with each driving the other.

Richard Buckminster Fuller (1939) expressed that the more advanced science gets, the closer it is to art. The more advanced art gets, the closer it is to science

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> It's in Apple's DNA that technology alone is not enough. That it's technology married with liberal arts, married with the humanities, that yields us the result that makes our hearts sing.
> ~Steve Jobs

OECD (2013b) also claims that artists' innovation in our societies, along with scientists and entrepreneurs, and thus "it is not surprising that many see arts education as a means of developing skills critical for innovation."

5.5 How We Know?

Even if everyone agrees that an interdisciplinary approach is the key. However, for something to be exciting and transformative, something trans-disciplinary has to occur.

While the literature on the relationships of art, science and society have been studied as recurrent theme in the major scientific fields, from prehistory to the modern eras. There is no systematic approach or method to capture the essential contributions of art to science, science to art, or synergy among art and science. Cases in assessing the impacts on arts on social, economic, health, community

dimensions can be found worldwide, but mainly in the North American, Europe and Australia.

Technological and scientific research is spreading their influence into every corner of life. The intersection of art and science gets a more and more attention these days (Frank 2012). Robust data, sound evidence and more robust means of establishing the value of the arts are needed. White and Rentscher (2005) analyzed the existing research of 104 articles using English language. Their research challenges traditional ways of studying culture and question the wisdom of trying to understand the art.

Understand the relationship of art and science shall be within a larger economic and framework. Integrated the methodological aspects among disciplines of art and science, are critical in modern society.

There is a great amount of research on innovation, including the disruptive innovations. Both in terms of the innovation process and management and the external factors, the art dimension, in large has been overlooked. It is in part because it is not suitable and no available information to test the role that art has played.

How to capture and measure the affecting power of arts is a new challenge facing the academic and research institutions as well. One of the tools is the "Big data", which provide a better way of communication among arts, research and society. The artificial-intelligence technologies have been applied in many fields, and web traffic and social network and other tools to interpret structured and unstructured data are fast gaining ground. The big data approach will become one of the tools that can better reveal the inter-dependency of art, science and the society.

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Chapter 6
Crossing Thresholds: Artistic Practice in Times of Research

Richard Jochum

Abstract This article will examine the role of the artist as a researcher in the context of a highly specialized and complex information and network society. Following structural changes in the relationship between art, research, and society at large, including higher education, and their impact on contemporary practitioners, it will establish art practice as a privileged spot to produce both unique knowledge and cultural agency. The metaphor of the threshold, interstice, or liminal space will serve as a descriptor for how the practice of an artist can be understood and used as a device for knowledge production. The article will be tied closely to my own artistic practice.

Keywords Transformed learning landscape • Arts-based research • Art and knowledge-society • Liminal spaces • Interstices • Threshold as a swing • dis-positiv • Collaborative silverware

6.1 Introduction

The goal of this article is to explore the ramifications of the professionalization of artistic practice leading up to a changed status of art practice as research. The underlying questions to be asked will be: What is the role of the artist in regards to the context of research? In which way can one consider art practice a privileged spot to produce knowledge and what type of knowledge is art-making able to produce, if at all? In order to shed light on these questions I will draw from arts-based research of my own making and introduce the 'threshold' as a metaphor to describe the role of an artist within a research landscape. I will discuss recent changes in the making of art, its relationship with artistic discourse, and how artists operate in a knowledge society. Within the paradigm of research, the artist can take on the role of the messenger, communicator, translator; bringing back and integrating knowledge that is otherwise discarded, underrepresented, forgotten, and irrelevant – the artist as a connector and cultural agent.

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6.2 A Transformed Learning Landscape

The studio program I enrolled in when I entered art school in the late 1990s was called 'sculpture'. Four years later, when I graduated, it was renamed 'expanded media art' and allowed students to work across the whole spectrum of contemporary practice. As freshmen, we were modeling figures from clay (*selfies*), imitating and representing the human figure. At the end, activities that would create a lot of dirt were unwelcome in the new environment of computer technology. Working with the human form seemed of low artistic merit and became, I believe, intimidating to some of the teachers. At the beginning there was still a master artist who was heading the program, based on a strong hierarchy and a curriculum that didn't permit a lot of freedom to pick electives outside of a prescribed module. When I graduated, the master-class had turned into an institute led by multiple professors who were now sharing resources and parts of the curriculum. Students were encouraged to make their own choices and to select courses outside of their program, and the hierarchy flattened, albeit slowly and with resistance from some faculty. When I started, the program took pride in an autonomous, fine-art spirit. As it progressed, it tapped into various aspects of professional development and included business training. In this way art education responded to the realities of a professionalized art world; the curricular adjustments made sure that students were prepared to write their own press releases. When I started, the school itself was an orphan unit of academia, a vocational school of arts and crafts, with a unique sense of freedom and self-determination at a price of feeling slightly inferior to other fields of academia. When I left, the art school had achieved full membership status in an academic, higher education system. At the beginning the highest degree was an MFA. At the end, the school had made attempts to implement doctorates in studio practice, although few had a clear idea about what such a curriculum should entail, either in content or with regard to research methodology, mentorship, and advising. One could go on with a list of changes that took place in the years around the millennium. And although this is a personal account, changes like these are typical of the radical developments in art education on the postsecondary level across the globe.

The aforementioned shifts have instigated an increasing amount of academic writing and considerable debate in the past twenty years.[1] The shifting role of art schools as they have undergone a change from academies to universities has left schools wondering about the place of the arts within higher education and their particular strengths and unique ability to contribute to the cultural production of meaning and knowledge, i.e. creative inquiry, material thinking, critical practices, imaginative exploration. These developments have also pressured them to step up

[1] Frayling (1993), McNiff (1998), Friedman (2000, 2003), Balkema and Slager (2004), Sullivan (2005), Holly et al. (2008), Liamputtong and Rumbold (2008), Hickman (2008), Varto (2009), Barone and Eisner (2011), Biggs and Karlsson (2011), Ritterman et al. (2011), Daichendt (2012), Jagodzinski and Wallin (2013), Nelson (2013), Rolling (2012, 2013); et al.

to the extraordinary demands of a professionalized system of higher education with its traditional divide into 'research,' 'teaching' and 'service.' The burden to continue and further develop the debate lies on the institutions as much as on the individuals seeking advancement in their professional careers. Both sides face difficulties. The institutions must struggle to expand notions of research, often defined by numbers of publications, to include professional practices and creative accomplishments. Artists, on the other hand, are already constrained by a demanding specialized practice, which is public, peer-reviewed, and competitive.

Transformations in art-making, art-learning, as well as real and imagined pressure from the academic system, have brought to the forefront a debate about the art school as a place to contribute to the production of knowledge and about art as a distinct way of knowing. 'Arts-based research' summarizes this often elusive debate with as many tangents as participants. While many of its proponents are concerned with establishing a proper place for art-making within the confines of academia, others direct their criticism at those confines. Their critique is targeted at the institutions themselves for bringing forth such debate. More specifically, it is aimed at what is seen as an institutional demand to coerce art practice into a narrow, scientifically modeled, traditional research paradigm that falls short of the width and breadth of that knowledge. At the same time, it undermines the potential power of art as an ability to question the real, imagine the possible, and enter the futile yet invigorating quandary inherent in the quest for truth. Particular resistance can also be found by some to allowing the arts to succumb to the instrumental rationality of the creative industries with their practical concern for commodification, design thinking, career-preparation, and professionalizing innovation in a competitive global economy. The debate will likely continue to grow. Is the production of knowledge – and teachability of creativity – an unrealistic expectation that homogenizes and endangers the particular merit of what art is able to bring to the table? Why should art be research, too? While some struggle to define what research can be, others claim 'what counts as research' may be just another 'wrong question' to ask.[2]

Rethinking the place of the arts within higher education and, more broadly, within 'research' could be a chance to expand the focus – which I believe is put insufficiently on the art itself – in order for the arts-based research to continue. This book series widens the agenda, further develops and deepens it. My contribution does not aim to add more bullet points to the argument over whether art practice should be seen as a form of research; instead, it aims to show the way in which their relationship is already, de facto and de jure, essentially intertwined. My position is that of an artist whose practice is conceptual, multi-media-based, and immersed in theory, teaching, and research. In making my case, I will start from my own practice and elaborate some of my own artistic strategies which reflect the interconnectedness of art practice and research. I will use these as a springboard to explore the

[2] "What Counts As Research?", Stenhouse (1981); "Are We Asking The Wrong Questions in Arts-Based Research?", O'Donoghue (2009).

larger changes in the area of art production itself and how these changes have given the arts and artists a special place in the field of knowledge production and dissemination.

6.3 Moving Thresholds

A threshold is a space that connects spaces; it covers the seam or juncture that occurs when two spaces join. Architecturally it can serve as a decoration or ornament. Functionally it allows people to seamlessly move from one space to the other making the crossing easy and inviting. It can also function as a barrier between spaces, preventing the elements of one of the spaces flooding the other. With its strategic placement as a passage or gate, it serves as both entrance and exit, invitation and exclusion. Folk tradition and popular culture mandate the groom carry his newly wed bride over the threshold in order to safely enter a life of their own. The lengthy, arresting conversation at a doorway is an experience common to many. The ambivalent position of the threshold is well expressed by the phrase 'sitting on the fence', an expression that recalls the medieval, Old High German figure of the *hagazusa*, the thing (*haga*) that sits on the fence (*zusa*). *Hagazusas*, witches, marked the difference between the woods and the village, between wilderness and civilization, between the alien and the familiar; jeopardizing the established rules and certainty of well-established facts and solid knowledge. With their ability to sit comfortably in between – frequently depicted on a broomstick – hags threatened traditional culture and religion and the conventional order of segregated spaces; their tragic demise is well known.[3]

If one were able to lift the threshold off the ground just a few inches and mount it on ropes, it would turn into a swing. The threshold as a swing would still allow passage, but it would be unstable and move with its passenger as it traverses from one space to the other. The person ready to cross would have to hold on, so as not to fall off.[4] *The Threshold as a Swing*, reconstructed from a wooden doorway and hanging from the ceiling two inches above ground was first created for an installation at the University of Applied Arts in Vienna and later for the Kinetic Arts and Sciences Center in New York, as a special exhibition involving kinetic works. Visitors who stepped on the suspended piece of wood, found the threshold moving. They were able to touch and experience an installation in action and get physically involved. Operating at the intersection between architecture and sculpture, the

[3] These spaces can be similar or very different. The threshold lies at the foundation of our definition of neighbor. Depending on the adjacent population and their hospitality, the threshold becomes a barrier or passage; a no-mans-land, a well-trafficked, or heavily controlled border.

[4] By turning the threshold into a swing, one sees its function amplified – as a connector, not a barrier, and no longer just a juncture, but an interstice, a space in its own right in between spaces.

installation provides the experience of a playground as well as an experience to reflect upon.

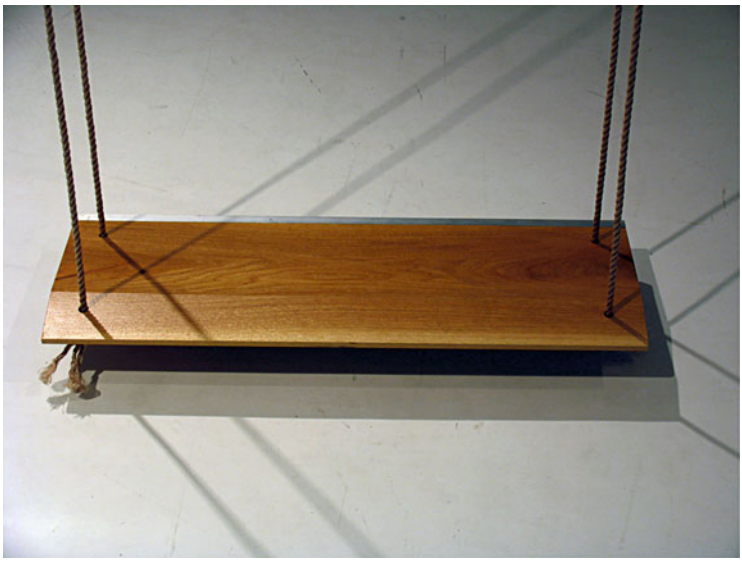
The Threshold as a Swing depicts a dangerous yet interesting place. It is a space that moves back and forth, crossing and traversing spaces that may or may not belong together. The threshold represents the liminal space, the interstice, a space-in-between-spaces, laden with instability, ambivalence, and crisis.[5] 'Sitting on the fence' means somebody hasn't made up his/her mind. He/she is caught up in limbo, still looking. That can be uncomfortable, especially for cultures that emphasize the importance of moving on or the necessity to specialize. Yet, it may also be powerful as it allows special insights and knowledge.[6] In its ability to encompass multifarious spaces art operates in the same way: like a moving threshold. The artist here acts as a connector of disciplines, technologies, and materials, while still feeling comfortable with a high degree of ambiguity. Art engages in the making – and interrogating – of connections: between art works, audiences, concepts, and desires, "conceiving and reconfiguring the political, ethical and social landscape of our time",[7] connecting segregated provinces of practice that have solidified into discourses and disciplines or 'spaces'. Art makes one explore and see what one usually does not risk exploring. It creates a space conjured up by the image, a space that we can enter due to imagination, an unstable space, a space in between, a space that can go 'either way' in its continuous transition. Freud called it the subconscious, Benedict Anderson the cultural imaginary, Homi Bhabha the liminal state.[8]

[5] Victor Turner has described how the experience of liminality in small-scale societies occurs only for short periods of time before it needs a stabilizing structure. Yet, during the period of the 'rite of passage', a new identity is formed and the system gets reconfigured.

[6] Following George Spencer Brown's Forms of Law, which starts out with the drawing of a distinction, constituting two spaces, Niklas Luhman has developed an epistemology of 'second order observations'.

[7] Meskimmon (2011, p. 5). And in this, the artist "is not just a transcriber of the world, but he is its rival" as André Malraux has pointed out.

[8] Hereby further developing a concept by Arnold van Gennep and Victor Turner. For Turner, liminality implies both instability and re-orientation.



The Threshold as a Swing, Emily Harvey Foundation, New York, 2005 (Image: Richard Jochum)

6.4 De-centered Encyclopedia

The Threshold as a Swing came out of a creative assignment on interstices to which we had to respond when I was a student at art school. It served as a particular, artistic solution to an aesthetic problem given by an artist-teacher.[9] The goal was not only that it permitted audiences to have an aesthetic experience ('exhibition value') but that it became a visual representation for artistic research ('research value'). *The Threshold as a Swing* symbolizes a mode of inquiry, curiosity, and repetition, central to arts-based research, as well as to the place of the researcher, connecting the known to the new. Research is often described as an activity based on methodical inquiry and intellectual curiosity. By going back and forth, ideas come to pass. The scanner maps a territory and completes a picture. Going back and forth creates a logbook of passages of which history keeps a record. Doing this repetitiously generates a track record of data and observations. It also determines future behavior. There are multiple ways to connect the image of the threshold to research, cybernetics for example. Re-searching is what research does, thereby creating sequences, iterations, variations, feedback, history; in short, similarities

[9] Like research, art practice can be seen as problem-driven.

and differences.[10] Repetition can be a strategy for discovery, a mandatory outcome for a lab report, or a means of disruption.

Within the field of research and knowledge production, art brings a special perspective. It stands outside the encyclopedic division of knowledge into disciplinary cells and represents ambiguity, paradoxical thinking, tacit knowledge (Plotnitsky 2002), and imagination. Unlike traditional research, art is not limited to the production of facts about our world. Instead, it aims at the creation of experience, which, in return, serves as the main avenue to its access. While its otherness has frequently been pointed out as a shortcoming for research purposes, one might see it as art's special advantage.[11] Artists bring – sometimes force – together areas of knowledge and experience – often playfully – that seemed disparate. This is why art is often sought out to study invention, creativity, and innovation. Design is a good example of the application of artistic thinking to the world of products.[12] Another example is the aesthetically driven photograph from cell-biology labs, which serves as a visual ambassador for scientific processes that are otherwise inaccessible to the public. Images, micrographs, or models and sketches become envoys and entice the public to stay engaged while representing a looking glass over the shoulder of scientists. Collaborations between scientists and artists have multiplied in recent years (Bly 2010). Specific examples can be found in the Australian artistic laboratory SymbioticA, which engages in research, learning, critique, and hands-on engagement with life-sciences while being located in a biological science department; the GenSpace in New York, run by artists and scientists conjunctively; the art-science-lab 'Incubator' at the University of Windsor; or the Swiss Artists-in-labs based in Zurich (and online),[13] to name a few.

The recent history and philosophy of science paints the picture of an encyclopedia that cannot be comprehensive, let alone completed. This becomes particularly interesting at a moment in history that sees knowledge explode. The epistemological and academic consequences of the in-determinability of our knowledge have been occasionally discussed yet insufficiently interpreted.[14] One can still find fantasies and cultural practices that perceive the completion of the encyclopedic project as either possible or desirable. This is visible even in the arts. The curator of the 55th Venice Biennale, Massimiliano Gioni, made such a provoking fantasy, *The Encyclopedic Palace*, an imaginary museum conceived by the Italian-American artist Marino Ariti in 1955, the center point of the Biennale. The museum, a project

[10] Nietzsche's perspectivism, Derrida's concept of iterability and Kierkegaard elaboration about repetition relate to this type of research. See Zalina A. Mardanova, http://www.inst.at/trans/16Nr/02_1/mardanova_bericht16.htm

[11] It needs to be said: the best scientific thinking has these features as well. Many leaps in knowledge have been made by people who do not think in traditionally constrained ways.

[12] A useful reference is Ken Friedman's paper, Friedman (2000).

[13] Citizen science does something similar and speaks of a widening and democratization of research in which laymen now compete with labs for funding. See http://www.scientificamerican.com/openinnovation/ and Rogers (2011).

[14] See Jochum (1998).

consisting of a planned 136-story building, encompassing several hundred meters in height and sixteen blocks of Washington, D.C., in width, was meant "to house all worldly knowledge, bringing together the greatest discoveries of the human race, from the wheel to the satellite".[15] The project never materialized. Instead, it became the starting point of an "inquiry into the many ways in which images have been used to organize knowledge and shape our experience"[16] by bringing together and into a dialogue through the core exhibition of the Biennale artifacts and art works from more than 150 international artists.

The fundamental incompleteness of knowledge and the interminability of the encyclopedic project[17] have consequences in the way research is conducted and put art in a privileged spot. In a knowledge-society without center, without oversight, researchers in general, and artists in particular, become messengers between the different cells of the encyclopedia – with the traversing threshold in between. Art as a field of practice that doesn't specialize in one medium, one cultural activity, one discipline alone, is well equipped to connect disciplinary spaces that seemed far away from one another or incompatible altogether. In their ability to move freely and unbound by disciplinary constraints, causality, logic, and purity of methods, artists – and travelers – show an exceptional mobility, even if some of the connections made may be founded on shaky grounds (naiveté, disrespect, lack of rigor). Within an information-society based on the division of labor, artists operate as generalists, i.e. merchants and distributors of knowledge, who at times bring together dislocated aspects of an otherwise highly specialized culture. Buckminster Fuller serves as a case in point.[18]

To bring it back to the underlying art work: the threshold turns into an image for the communication between spaces that are unlikely to talk with each other – the aesthetic object, the art work being the interlocutor, mediator, and instigator. Within a democratized paradigm of research, artists – albeit not only artists – take on the role of messengers, connectors, and translators. They also reintegrate knowledge that is otherwise underrepresented, forgotten, or made irrelevant. Research is an activity based on exploration and documentation, "founded in curiosity and a desire to understand".[19] Artists raise questions in unpredictable ways; "research asks questions in a systematic way."[20] Arts-based research is a special case of research because of the position of the arts within the encyclopedic division of knowledge. The epistemological function that art is able to inherit is a consequence of a research landscape, which not only continues to be incomplete but

[15] http://www.labiennale.org/en/art/exhibition/gioni/

[16] Ibid.

[17] . . . as well as the 'unattainability of truth', a fact that keeps feeding the quest.

[18] "The only ones who don't get trained for specialization are artists, they want to be whole," "It is the artists who keep the integrity of childhood alive until we reach the bridge between the arts and sciences." From a keynote address by Allegra Snyder-Buckminster.

[19] Stenhouse (1981), p. 103.

[20] Friedman (2003), p. 512.

in which knowledge transfer is essential to its success (Cook and Brown 1999). The capability of the arts to cross heterogeneous spaces, disciplines, theories, cultures, media, and technologies, facilitates cross-pollination and allows connections that otherwise fall short.[21] This is how one can connect the threshold to epistemology. On the cusp of the threshold, knowledge is produced, communicated, disseminated, and disrupted.

6.5 *dis-positiv*: The Artist, the Curator, and Their Discourse

Another installation that originated from the context of an art school (and directly relates to our theme) was a project called *dis-positiv,* a multimedia exhibition project that showcases not art works, images, or objects but art historians, critics, theorists, and curators. The project has had a number of successful realizations throughout Europe beginning in 1998; the most recent being *The Curator*,[22] which was shown in New York in 2013. In its main iteration it consisted of a large free-standing Plexiglass structure separating the exhibited art historians and writers on display – physically present in the exhibition space – from their onlookers. The Plexiglass display allowed the exhibited curators and critics to pursue their own work or, if they wished, to create a performance element that would represent a vision of their work.[23] Each of them was exhibited for two hours. By putting art critics on display as art objects themselves, the project turned the regular order of exhibition practice on its head. The curators, theorists, and art critics became embodiments of the discourses in art, challenging participants and audiences alike to look at some of the less obvious ways in which art is made and to think about how meaning is produced. It allowed a view behind the closed doors of exhibition practices and provoked audiences to think about the credibility of each person in their role as representatives of the discourse, as well as their creative talent to make either their work or themselves become visible. The performances were accompanied by a live-stream to a website as well as published magazines in which the exhibited critics were asked to create images and artists were invited to produce reflective texts. Both were encouraged to think about how they saw art practice and art discourse work hand-in-hand.

[21] "Artistic research is that interaction, where the two sides of practice and theory shape and shake each other." Mika Hannula, In: Balkema and Slager (2004, p. 76).

[22] Part of a recent project called *Richard*, curated by Marco Antonini, containing readymades.

[23] For example: one of the critics on display invited a colleague and together they produced a critique of the project projected onto a screen live in front of the audience. Another exhibit, a curator, invited fellow curators for a lavish meal and onlookers had to make do with the fact that the nice dinner was taking place inside the vitrine while they were standing outside, excluded.

dis-positiv, Magazin4, Bregenz, 2001 (Image: Klaus Hartinger)

The project had a variety of origins, one of which was the visit of two art historians to our sculpture class. A student colleague of mine, who was up for critique, showed three oversized angel figures cast in clay. The two art historians – a gallery director and a newspaper critic – asked what type of materials she was going to use to finish her work in order to present it as her master's thesis. She answered she would be using plaster due to financial constraints, yet would prefer to mold the project in bronze and place it in a church. The two art historians seemed baffled by her response. They questioned with visible concern, was she not aware that bronze as a material had been problematized and therefore had become obsolete for artists today, unless they could point to contextual necessities or produce additional explanation? Her response was unwavering. She stood her ground, reconfirmed her choices, and didn't seem to care. It was not the type of answer the two art historians were hoping for, and it made them conclude and share out loud that she may end up being a good artist, but with such an attitude it was doubtful she would become a great one.

Their judgment was remarkable not just because the critics were finding faults with an otherwise skillfully executed triptych of sculptures but also because of the finality of their pronouncement. What gave them the authority to make such strong judgments without further explaining their way of thinking? Why did the scrutiny of the art work not lead to a thorough examination of the foundation of such a critique? Who decided that the interrogation would start and stop with them? Studio critique is known to be potentially intimidating for those who receive it as well as for those who have to produce it. What deserves special attention is the authoritarian and sanctimonious place art critics, art historians, and art curators can occupy in the making of art; in short, the multiple ways in which the making of art is influenced by a so-called discourse, constituted and executed by its representatives. The visit of the two critics made obvious that it is not solely the artist who produces a work of art, but the art world with its gatekeepers and decision makers as well. Aesthetic theories from Hegel to Dickie to Danto undergird these conclusions (see Dickie 1969; Cahn 2002), best translated into: Every work of art is a work of art in the world of art. Every work of art is accompanied by a critical discourse which keeps in balance its underlying concepts, implicated theories, and aesthetic decisions, the artist's intentions notwithstanding.

Another incident contributed likewise to the coming about of *dis-positiv*. As part of the curriculum, a drawing instructor taught us handwriting. He was a good teacher who each week brought to class albums of various artists using calligraphy in their visual works. At his students' request, he shared his own catalogue with us on the last day of the course. Images of his work were accompanied by a text written by a well-known curator. Since we had to pass the book along and had no time to read it, I asked the instructor if he would summarize what the critic wrote. He replied with a smirk that he didn't know and started to laugh.[24] It was not the type of laughter that stems from embarrassment or from difficulties to recapitulate a complex text, rather complicity in the face of disregard and ignorance about the writing of an art critic. Now it is true that art-speak can be aloof and divorced from reality, which in itself serves a particular function,[25] but that didn't seem to be the case with this text. Something else was at play.

The visit of the two critics as well as the feigned simplemindedness of an artist sparked a reflection about the two seemingly opposing poles of the art world: the 'practitioners' on one hand and the 'theorists' on the other, art-making versus discourse. I assumed they belonged together but found myself surrounded by evidence that seemed to indicate otherwise. The disaffiliation and lack of knowledge about each other felt remarkable, given that the art world encompasses both sides – artists and critics. It reflected a gap that seemed akin to the type of chasm described by C.P. Snow. In his often-quoted Rede Lecture Snow spoke of two different cultures in the world of scientific research: the world of the humanities versus the world of the sciences.[26] As in the philosophy of science, the art world showed signs of a rift between studio practitioners and art world professionals, and within it a climate of mutual hostility and ignorance. The polarization between artists and art historians mimics the chasm between humanities and sciences or even between the sciences. Although it reflects to a large degree ordinary human power struggle, it is unfortunate because it continues a rift between the knowledge that lives in both spaces; knowledge that if shared has the potential to complete both sides.

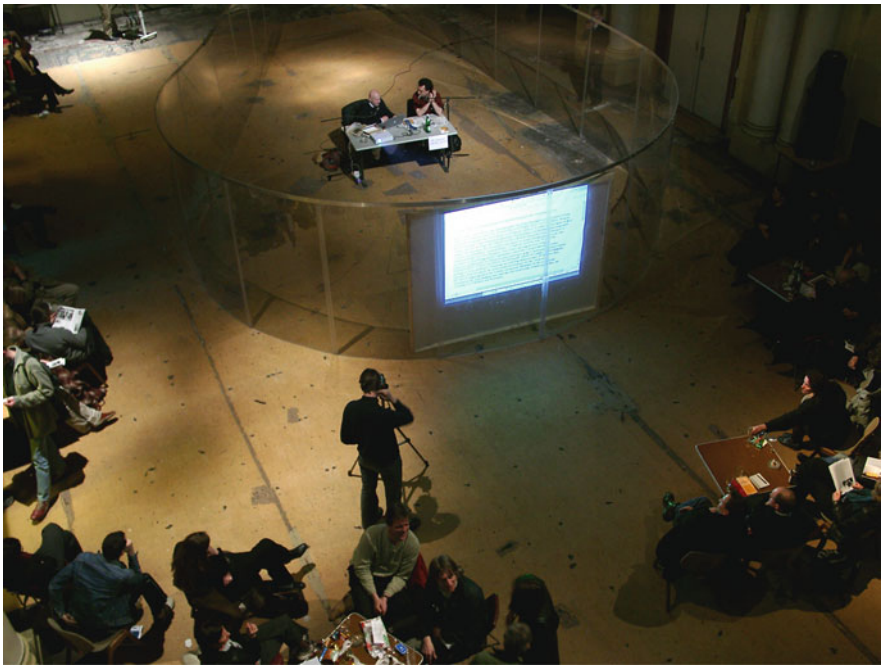
While the two incidents mentioned above seem arbitrary, there are copious other examples one could point to. The art critic who, for example, sees her work as a favor to the artist, thinking the critic's article will likely boost the artist's career without understanding that the critic, too, produces something valuable. Or the artist who looks up to the theorist and her ability to conceptualize his work without understanding that he – as the maker – already knows a lot about his own making.

[24] He seemed to have little interest what this critic wrote about his work, except for that it was a well-known one.

[25] See Groys 2008, p. 111: "The art commentator's role is entirely misconstrued if one expects him to be clear and comprehensible."

[26] "Literary intellectuals at one pole – at the other scientists, and as the most representative, the physical scientists. Between the two a gulf of mutual incomprehension – sometimes (particularly among the young) hostility and dislike, but most of all lack of understanding." Excerpt from Snow (1993, p. 64).

Or the artist who pretends to be friendly to curators or gallery directors in the hope of getting an exhibition, thus believing in the power of others instead of the power of her own work. In return, there is also the gallery director who avoids meeting with artists, fearful it would only take so long till he will be asked for favors. Or the art historian who cannot write about the still-living artist in fear of losing objectivity along the way. All of these instances have their legitimate place of concern. But they also suggest an atmosphere that is permeated by prejudices and shows signs of polarization. Together these attitudes and incidents show an art world that is divided into strongholds, with two cultures that keep eyeing, imitating, alienating each other while creating hindrances or barriers in the development of a collaborative spirit that is reflective of the mutually inclusive problems of our times. To innovation this leads not.



dis-positiv, Staatsbank, Berlin, 2003 (Image: Milena Schloesser)

6.6 The Artist as a Theorist

Like many works of art, *dis-positiv* had been instigated by singular incidents that might seem accidental. However, the conceptual framework that has been developed out of its implications reaches beyond the singular event. To persuade art critics, curators, and theorists to participate in a self-critical, potentially self-

deprecating project required locating the idea within contemporary discourse and art theory. As a work in progress *dis-positiv* was well positioned to conduct inquiries into the way representatives of the art world entertained their discursive practices and selection processes. What began as a small, whimsical idea turned into an epistemological device that allowed a closer look at the relationship between artists on the one side and critics, curators, and theorists on the other. By going back and forth between the two sides, separated by a glass structure and accompanied by performances, publications, and public statements, the project became a looking glass and immaterial threshold, dividing the two fields of production from each other in order to instigate exchanges as well as study their relationship. Suspending the usual exhibition setup – with viewers inspecting inanimate artifacts that cannot look back – provided the project with the opportunity to disrupt symbolically a ceaseless exhibition cycle in which artists supply commodities and conceptual merchandise for curators to select for display, and to allow the conceptualization and theorization of the distinct elements involved. Instead of the audience falling back into the accustomed role as onlookers, *dis-positiv* made people behind one side of the glass look at people behind another side of the glass. 'Who milks whom' was the telling title of an art work in response to the project and as part of *dis-positiv*.[27]

The project was conceived as an artistic statement, not as a curatorial project, which would have created a different order and most likely have changed the dynamic of the interactions. As an art project, it allowed turning the tables and having art critics and curators morph into 'art proxies' or embodiments of the discourse. Normally, it's the work of the artists that is on display. The latter know well that the pleasure of exposure can come with the discomfort of feeling exposed.

dis-positiv became a project about the relationship between art and discourse, theory and practice, how they feed each other and how one cannot separate them easily: as a matter of fact, it showed how important it can be to see them together and fundamentally linked. In a professionalized art world, and this has been the working hypothesis of the project, artists have become theorists, too. As an arts-based research project, *dis-positiv* was built on the premise that art practice and discourse – or, for that matter, research – have become inseparable.[28] The inseparability – of which the delicate relationship between art maker, critic, curator, and historian is a symptom – is founded on a number of tectonic shifts that art-making as well as the research landscape have gone through within the past fifty-plus years. These have reshaped the relationship between cultural formations in play, including arts and sciences (see Fuller 2006 and Kandel 2012). Based on observations regarding the art work itself, the making of art as well as its production

[27] Margot Meraner and Gerti Hopp, Bregenz, 2000.

[28] *dis-positiv* started as an artistic statement, which - by virtue of the context in which it operates - made it become a research project. The underlying questions were presented as: What does art produce beyond a discourse that confines the production of art? What does the discourse produce, other than more of its own?

environment, I will address these changes, which also form the background and inform the radical developments within art education at large that kicked off this article.

6.7 Tectonic Shifts

Art practice has gone – and is still going – through profound transformations in the past decades, some of which concern its materials, others which have changed its interactions, and some affecting the field. Both internal and external changes have led to a re-positioning of its role, one of which is characterized by the debate 'arts-based research.' I would argue that the current debate of art as a form of research can be understood against such a backdrop – as well as a response to a society under duress that sees hope in the rise of creative industries as a means to further advance production cycles and perpetuate innovation.

One of the big changes within art-making is the fusion of disciplines. This fusion is primarily an internal process. Sculpture, for example, used to be a discipline that made a strong commitment to certain materials – clay, metal, wood, etc. – and strove to produce and reproduce classical models with the human form as its template. This has changed altogether: sculpture now lies at the intersection of both fine art and performance and includes hybrid elements from disciplines as diverse as photography, painting, architecture, media art, etc.[29] This doesn't imply, however, that sculptors cannot work with traditional materials or figuratively any more. It means merely that today's artists are no longer limited to one particular material or traditionally defined field of practice, now sometimes called 'post-studio practice.'[30] Art schools reflect such changes by rapidly adapting their curricula or by generating new ones in an attempt to open traditional education to creative explorations beyond the boundaries of closed disciplines. As a result, today's artists are expected – and able – to master several traditional and non-traditional disciplines, a demand that has proved to be particularly challenging to institutions that specialize in the education of the artist.

With the fusion, and multiplication, of practices comes also a fusion of materials and media, which – in a mode of 'convergence' that is stretching the boundaries of media and concepts – creates hybrid forms. The hybridization of media reflects on the one hand a process that art has always gone through by conjuring up new forms. The new forms, though, are not disassociated from the old forms. Old and new media tend to interact with each other recursively, with the predecessor mirroring and recreating its successor. The history of photography in relationship to painting

[29] To run down a list of such changes, is nothing new; yet, institutionalized discourse often disregards the consequences this has for the practice and – subsequently – research.

[30] The widening debate about post-studio can be found, for example, in Jacob and Grabner (2010).

provides a case in point for this process, which has been described as 'remediation'.[31] The relationship between web design and print design is another example. 1990s web design initially resembled print design. That comes as no surprise, given that the designers of the web had previously worked in print. As web design matured, it influenced print design, which now often incorporates visual elements of the World Wide Web. It took both media time to build on their own strengths and develop specificity. Skeuomorphism is an example of the back and forth of visual languages and gained notoriety among designers with the success of the late Steve Jobs.

Although the hybridization of media may not be new, it has achieved a new level of pervasiveness with the digital revolution of the past twenty years. Hybrid art describes the increasing deluge of technology and digital media in the making of art as well as its presentation, all of which remain in flux. Notable examples for the continuous reorganization of the field are the current maker-movement, alternative learning spaces, and digital fabrication labs.

Hybridity doesn't stop with art forms. It permeates concepts as well, which in return create new fields of practice and subjects of study: conceptual art, social practice, community and participatory art, interactive arts, electronic arts, intermedia, trans-media, to name a few. Art schools respond by creating curricula around each of these fields. And while one can see transformations in the content of art education, delivery has changed as well and taken on collaborative and hybrid forms of their own. Some of these changes are less than ten years in the making, social media technology and online instruction being the most pertinent examples – and drivers – of them.

The fusion of disciplines and hybridization of media and concepts reflect the internal transformations of art practice, which have escalated with recent technological advances and since the appearance of conceptual art in the 1960s, and have slowly permeated and reshaped art making – and its conceptual underpinnings – as a whole.[32] At the same time, this internal fusion of disciplines, materials, media, and technology is seconded by external transformations in the field of art theory and criticism. Until recently, there was a large industry that contemplated and commented upon art and then processed its deliberations and mediated it to the public (through books, lectures, research articles, opening remarks, etc.) at a price of coming late, after the work is done, and being 'congenial'. Today, this 'congenial' approach by art theory, art criticism, and aesthetics has given way to a more cooperative one in which criticism and theory no longer play a peripheral role but rather both effect and interact with art as a practice. These two micro cultures, the 'making of' and, for lack of a better word, 'discourse' of art often clash in their prejudices as mentioned above, but they actually live in a very close symbiosis. Theory considers treating a painting qua painting as obsolete and treating an object

[31] Bolter and Grusin (1999); Weibel, In: Reed et al. (1996).

[32] Art education in the U.S., but in Europe as well, seems to have caught up with of these changes only recently.

qua object as historical. And so do the artists. In response to the historicizing – and discriminating,[33] sometimes idealizing or devaluing – tendency of the critic or theoretician (see the visit of the two art historians), the artist or practitioner has developed a series of self-reflective strategies, thus becoming his/her own critic, his/her own historian, his/her own theorist and even curator. As a result, twentieth century art, to an extensive degree, cannot be understood without aesthetic concepts and theory, (Alberro and Stimson 1999). Additionally, present-day artists provide not only works of art, but interpretation as well.[34] To summon the chutzpah of putting everyday items into a museum requires a theoretical statement or conceptual analysis of those items, or better, their transaction into the museum and context of display. Duchamp was an intellectual, as was Beuys, as are many contemporary artists.[35] The artist has become a (lightweight) theoretician.[36]

6.8 Every Work of Art Is a Work of Art In the World of Art

All works of art have an opening toward research. This is also because they are conceptually and contextually rich and communicate with each other. It is not enough for artists to use skills, special effects, and tricks in order to build a body of work that holds its own. The conceptual quality of art works is not only built into their 'style' or genre, the way conceptual art is a genre; it is built into the way they are made. Art works correlate to each other in the process of their fabrication, and with works that precede them. Artists are continually involved in an imaginary dialog with their predecessors and their work, as well as with their own work, which is often produced in series or sequences, one building up on the next. 'Intertextuality,' i.e. the dialog of a text with previously written texts, is a phenomenon attributed to academic writing.[37] Yet, it applies to art making as well and to images as they keep referencing one another.[38] Even play, often used to describe an

[33] Critics were inclined to judge art works within two extremes: either in terms of their morality: good versus bad; or their place within history: old and repetitive versus new. The advent of visual culture has flattened some of these extremes and introduced new categories, for example post-modern versus modern.

[34] Koons and Rosenblum (1992), Adamson and Goddard (2012).

[35] Some of these thoughts are taken from the original concept of dis-positiv from 1998, which incorporated hyperbolism in order to take intellectual command over a timely topic that needed to stand its ground as to entice the curators and philosophers to participate in their display.

[36] And the curator an *artist* of sorts.

[37] Bibliography and footnotes are expressions of this phenomenon.

[38] *dis-positiv*, the exhibition project was copied a few times, including by prominent artists such as Jochen Gerz, who misappropriated the credits. Plagiarism is taken very seriously in academia, but is rarely acknowledged in the arts, where appropriation has made itself a name as an artform of its own.

essential aspect of the artistic practice, is a highly conceptual interaction and dialog with materials that are being explored, taken apart, and put together again.

Art may be based on an 'open concept,' perennially elusive to discrete definitions, albeit defined by a functionally specialized world that has come of age, i.e. the art industry or art world.[39] For the work to grow from private to public and then to become art, it needs a conceptual framework that connects the art work to the art discourse.[40] In the past, this framework has been provided by art historians, critics, and theorists. But twentieth century art has seen a development, in which the artist him/herself takes increasing ownership of this process. In a microcosm where each work of art is determined by the world of art, artists become self-reflective to distill and provide necessary and probable connections to the discourse instead of holding out for discovery by art historians or curators. Waiting to be 'discovered' is unfathomable for many practitioners not only because it is unlikely to happen, but also because of a changed role of the arts in today's society. Twentieth century art has moved on from the Renaissance concept of the elevated artist-genius who produces visual forms for audiences to relish in and educates through his mastery only. Leaving the intricacies of patronage, autonomy and commodification on the side, the hierarchy has flattened and artists have become an equal part of the world in which they live in. They now engage in any material, not just the visual. The notion of an aloof artist who, disconnected from his audiences, retracts into his/her studio has given way to the image of an artist who engages in post-studio practices and includes, if not enlists, his/her audiences in the outcome. To embrace educational outreach is now often part of the practice. In order to do so artists learn to understand their own place as well as the whereabouts of their audience. The role of the artist as a master-artist and artist genius has been relinquished to a collaborative spirit in the making and placing of the work as well. This transformation is by no means complete, with some traditional understandings of art practice still in play. But the field as such has shifted, with the education of the artist to follow.

[39] As Morris Weitz was pointing out, see Cahn (2002). Or as Howard Becker said it aptly: "The title 'art' is a resource that is at once indispensable and unnecessary to the producers of the works in question. It is indispensable because, if you believe art is better, more beautiful, and more expressive than nonart, if you therefore intend to make art and want what you make recognized as art so that you can demand the resources and advantages available to art – then you cannot fulfill your plan if the current aesthetic system and those who explicate and apply it deny you the title. It is unnecessary because even if these people do tell you that what you are doing is not art, you can usually do the same work under a different name and with the support of a different cooperative world." Becker (1984, p. 133).

[40] This sometimes happens unprovoked and from outside, the Renaissance painter Matthias Grünewald being one example, Cindy Sherman's 'Untitled Film Stills' another. Or it happens because artists team up, following the lesson of Matthew Barney, and collaborate with writers, curators, critics, and theorists to build strategic partnerships or real collaborations. These cases are the exception and of little illustrative value for the tectonic changes that I am interested in pointing out.

6.9 Cultural Agency

The fusion of disciplines and hybridization of media and concepts is accompanied by changes to the field as a whole, which has become increasingly mobile and specialized. The specialization and, hand in hand with it, professionalization (Freidson 2001), which has taken hold of large aspects of the cultural production – be it education, science, law, economy, administration, and government – has reshuffled the art world, art production, art theory, and art education as well. New job descriptions and fields of expertise are evidence of it; the independent curator, the art critic, the exhibition designer, the reproduction photographer, the collection manager, the grant writer, etc. Art schools have long responded to the changing nature of their field by offering courses that support the reflective and professionalized nature of an artist's work, such as art history, aesthetics, visual culture, as well as writing and career training. In an art world that is saturated with new professions, artists take on new roles, become self-reflective and theorists, researchers, activists, or part-time curators themselves, not to replace jobs, but to correspond to the changed givens of a knowledge-society in which theory and practice have significantly closed in on each other.

In the expanded field of practice roles shift and expand. Artists have turned into cultural agents, artist-citizens, who, immersed in their culture, take ownership of their time and create works across the spectrum of disciplines, materials, concepts, and audiences. In their new roles from producers of objects to participatory agents of culture they are able to move fluidly from one space to the next, crossing thresholds, while building their identity on the go, moving back and forth. The need for agency stems from the aforementioned changes in the organization of the encyclopedia where every cell sees only parts but not the whole.[41] The encyclopedia reduplicates its incompleteness in each single cell.[42] This leaves each part responsible for the whole.[43] In a world of knowledge-production that is void of a governing instance, anybody who is not afraid to make connections and meaning can become a messenger, an advocate, bridging the cultural divides and establishing a third culture. Artists are well equipped and positioned to do so because of their high level of mobility, i.e. curiosity and imagination.

[41] ". . . Science has become blind in its capacity to monitor, foresee, even to conceive its social role, in its capacity to integrate, articulate, reflect on its own knowledge. If the human mind cannot effectively apprehend the enormous entirety of disciplinary knowledge, then something must change-either the human mind or disciplinary knowledge." Morin (2008, p. 32).

[42] Serres et al. (1983).

[43] Jochum (1998).

Collaborative Silverware, Dowd Gallery, Cortland, 2009 (Image: Richard Jochum)

Collaborative Silverware is an installation and performance piece for two performers, one table, two plates, elongated silverware, and food. The thirty-six inch spoons, forks, and knives prove themselves to be too long to feed oneself individually. Instead, the two performers will have to feed each other. The installation creates a space for exchange based on equality and collaboration and is set in motion by participants who are curious and hungry. The performance piece reflects a world that is essentially interdependent and increasingly reliant upon each other. That applies to the individual disciplines within the encyclopedic spectrum of artistic genres, hybrid as they may be, and it applies to the research landscape as well. The threshold served as a metaphor for the activity of the artist as he/she provokes and transports knowledge and meaning within the compartments of culture. *The Threshold as a Swing* is an interesting place not only because it makes one visit unfamiliar spaces, but also because it challenges one to refrain from polarizing judgment. Advancements and achievements in art and research are the outcome of collaborations between various parts of the spectrum with no rigid role assigned. *dis-positiv* was constructed around changes in the art world with its multiple agents while reflecting the new role of the artist as a practitioner and theorist, regardless of how much he/she is willing to take on or delegate parts of these roles. *dis-positiv* separated the two sides of the artistic process – art making and discourse – in order to make visible how fundamentally braided they have become. The two cultures not only belong together but mirror each other: the artist, who is now also a theorist of sorts, deeply immersed in meaning-making and conceptual thinking, even when just 'playing'; and the theorist, critic, or curator who needs to have a practitioner's view in order to elicit commentary, create exhibitions, or produce theories that are relevant in practice. This has to do with

the tectonic shifts in both art and research, which have given professional practice a new significance, as much as with the pressing social, economic, political, and cultural issues of our time, which reinforce the need and ability for collaboration.

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Chapter 7
A 3D "T-shaped" Design Education Framework

Yongqi Lou and Jin Ma

Abstract The radically changing social and economic context of innovation calls for a shift in design education. This article argues that cultivating "T-shaped people," characterized by the integration of both vertical and horizontal capabilities, should sit at the heart of design education that is geared toward innovation. Based on the prevailing Undergraduate-Master-PhD educational system, a 3D T-shaped educational framework is proposed. The curriculum planning practiced in the College of Design & Innovation (D&I) of Tongji University is adopted to illustrate several core considerations of this framework. These includes: breaking the rigid barriers between disciplines, developing new modes of design education by integrating and restructuring the knowledge arising from distinct areas and disciplines, and facing complex and diverse real world challenges. The authors attempt to use this framework as a hermeneutic tool to explore possible approaches to foster design innovation talents. This is further facilitated by relating individual 3D T-shaped models of distinct disciplines toward the idea of a Knowledge Cube.

Keywords 3D T-shaped • Design education • Vertical knowledge • Horizontal knowledge • Interdisciplinary

7.1 The Changes of Design

In this new era, design must and is currently being redefined. Social and economic changes impel designers to "think bigger." For the design discipline, the expanding roles and tools of design make it more possible than ever to connect and to integrate multi-disciplinary knowledge within the social and economic context (Buchanan 1992). Design is now more and more involved in solving strategic and holistic

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problems in the social and economic development and our daily life. Design thinking, combined with scientific and technological thinking, allows us to explore the new frontier of design and innovation and to link design to the future through achieving the balance of desirability, possibility, and feasibility (Brown 2009). Design has already become an important agent in creating sustainable, human-centered, and creative societies (Sotamaa 2008).

These emerging thoughts and the ensuing practices of design set higher requirements for design knowledge, in terms of its depth, breadth, and complexity. Through design, information (concepts) can be turned into results, which are either tangible (e.g. products) or intangible (e.g. services). The hallmark of design in this changing context includes: a reinforced interdisciplinary identity; education and training for innovative and T-shaped talents, explorations into new territories, changes in ways of learning, and the establishment of new values.

This trend is further shaping the business model of design. While design used to deliver one-way service to the client in the main, it is undergoing a transition toward providing holistic solutions that have greater social impact and business value. The conventional employment relationship between capital and design will become a more cooperative one to a certain degree. The horizon of design is moving beyond goal-oriented and individual efforts toward social innovation: to support sustainable ways of living and production on a common ethical basis (Lou et al. 2013).

In China, design has just been recognized as one of the primary disciplines in the higher education system. As a discipline, design is more than a professional category. To borrow Lee Shulman's (2004: 456) conception, a "discipline is in fact a powerful pun because it not only denotes a domain but also suggests a process: a community that disciplines is one that exercises quality, control, judgment, evaluation, and paradigmatic definition." In this sense, design aims to discover and create new knowledge and to contribute to the development of the economy and society, through such a process. Situated within the radically changing social, economic, and technological context, discussions on the fundamental issues centering on design as a discipline—research scope, theory system, and methodology—become inquiry of necessity. In this article, we focus on how to combine these lines of thinking with design education through a systematic framework.

7.2 Three Dimensions: Profession, Value and Approach

When people discuss design, basically three dimensions are implicitly intertwining in their considerations.

The first dimension is practice-based design. It is closely related to a wide range of professions, including architecture, product design, landscape design, graphic design, and many more. Design professions result from the social, technical, or economic division of labor. They have grown out of trade activities and now provide "intellectual and conceptual services in the interest of the client and the

public." Professions lay down the practical foundation of design: they establish a variety of basic domains of design by turning practical knowledge into reality.

The second dimension is value-based design. It is the theoretical and ethical foundation of design practice. Human-centered design, inclusive design, sustainable design, and open design, to name a few, are categorized on the basis that they address specific ethics and guidelines that drive design concepts and activities.

The third dimension is approach-based design. It mainly explores methodology, the process, methods and tools for design activity. Approach plays a dual role in design practice and cognition. Approach-based design provides implementation paths to the design discipline, while it may embody certain intrinsic values. Service design, parametric design, and system design, for example, fall into this category of design.

Clarification of these three dimensions can dispel lots of unnecessary confusions. For example, when we talk about various kinds of design, we need to know, in the first place, whether what we are talking about are on the same basis. However, interpenetration between these three dimensions always implicitly occurs. They are often employed to describe design in a highly integrated manner. The following sentence is a clear illustration of such relationship: "Using system design (approach) to achieve a sustainable (value) industrial design (profession)." The social and economic impacts of design can be indicated by the comprehensive performance of design in these three aspects. (See Fig. 7.1.)

From the perspective of design education, design's three dimensions are hinged on two different capabilities: the vertical and the horizontal. The former denotes the deep, operational and disciplinary knowledge and skills in a specific professional domain; the latter is the ability to integrate and to apply knowledge and skills to solve problems in different contexts. These two capabilities are the basic elements of the so-called "T-shaped people" (Leonard-Barton 1995, see Fig. 7.2). T-shaped people are "deep problem solvers in their home discipline but also capable of

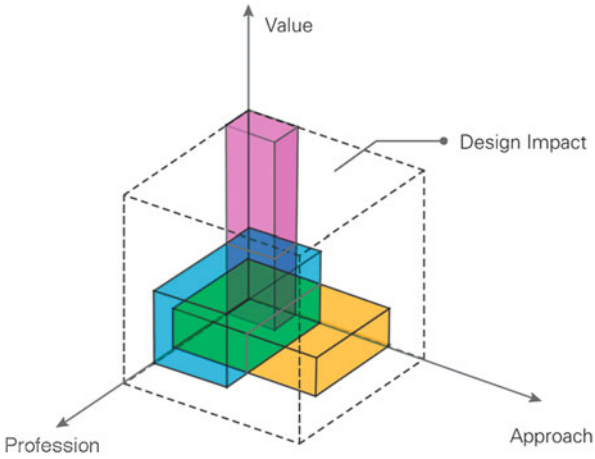

Fig. 7.1 Three dimensions of design and their impacts

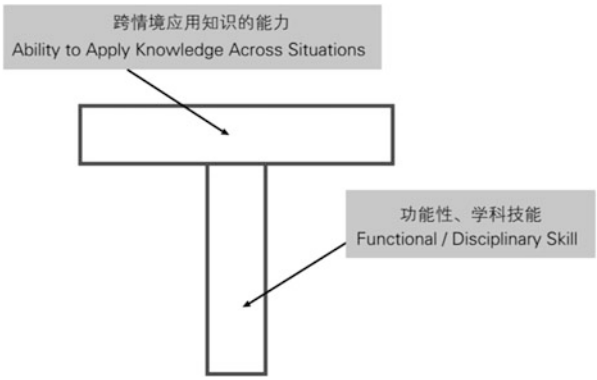

Fig. 7.2 Two basic capabilities of "T-shaped" people (Leonard-Barton 1995)

interacting with and understanding specialists from a wide range of disciplines and functional areas" (IfM and IBM 2008).

7.3 T-shape: The Combination of Vertical and Horizontal Knowledge

The notion of T-shaped people has been widely known to the practicing world, due to the impact of IDEO, one of the world's leading design firms. Tim Brown (2005), the CEO of IDEO, maintains:

> [T-shaped people] have a principal skill that describes the vertical leg of the T—they're mechanical engineers or industrial designers. But they are so empathetic that they can branch out into other skills, such as anthropology, and do them as well. They are able to explore insights from many different perspectives and recognize patterns of behavior that point to a universal human need.

Whereas T-shaped people is one of the most popular concepts discussed in design schools around the world, most conventional schools are still focusing on teaching *classical design*. They foster the professional practices based on past or existing technologies, standards, knowledge and skills, and oriented toward current ways of living and production. Such knowledge and skills are fabricated in curricula that typically emphasize a vertical pattern, where students are encouraged to advance knowledge and skills in depth but fail to deal with broad and complex issues requiring the horizontal part of T. An innovative person possesses the integrated capability in both directions.

We will use a thumbtack metaphor to describe the relationship of vertical and horizontal capabilities. With a big pushing-surface, one can easily push a thumbtack into the wall, even if the end of the nail is not sharp enough. Nevertheless, without a pushing-surface it is impossible to push a sharp-ended needle into the wall unless using other tools. Therefore, vertical and horizontal capabilities are complementary to one another.

When reviewing the world's most successful design and innovation education, several interesting phenomena capture our attention. First, the most highly regarded innovative design education programs are mainly found in the non-classical design schools including, for example, the Stanford D-School and the Design Factory of Aalto University. Second, there is an increasing awareness among some independent design institutes that sticking to segmented specialization will seriously affect their ability to innovate, and a movement to create strategic collaboration with comprehensive universities nearby is emerging. The collaboration between Royal College of Art and Imperial College London in the UK, and that between Rhode Island School of Design and Brown University in the USA, are successful examples of this case. Third, design education is embracing more and more influence from the world leading innovation firms, such as IDEO, FROG, and CONTINUUM. These innovative enterprises are introducing new perspectives to the classical design education society and helping reshape the educational pattern in both practice and research. For instance, IDEO approaches are taught and applied in design schools worldwide.

7.4 Connecting Vertical and Horizontal Knowledge

To educate T-shaped people with competitive advantages, the connection between vertical and horizontal knowledge becomes a crucial issue. The T-shape conception, however, addresses little on how the vertical part and the horizontal part connect. This is analogous to the thumbtack metaphor, too. Many of us have the experience that a thumbtack easily breaks due to the weak joint of the pushing face and the nail.

Some cutting-edge educational projects of innovation shed light on various solutions to this problem though. They focus either on fostering horizontal capability that can integrate multiple lines of vertical knowledge and skills (horizontal capability with depth), or on cultivating vertical knowledge and skills that also contain the vision to expand horizontally (vertical capability with broadness). On the one hand, students are well trained in their home discipline (the vertical leg of T); on the other hand they need to obtain broad vision and the ability to integrate knowledge with deep supporting vertical knowledge. To achieve the latter, students are encouraged to collaborate in interdisciplinary teams, working on challenging real-world problems.

Design thinking, which combines creation, business and engineering together, or what we call *DESIGN*, is the most influential pattern adopted in the innovation education society. The D-School in Stanford University, Alta Scuola Politecnica (a joint efforts of PoliMI and PoliTO) in Italy, the Design Factory of Aalto University in Finland, and the Sino-Finnish Center of Tongji University in China are a few successful endeavors based on this pattern. Design thinking exercises as an effective way of knowledge integration that enables design innovation education to meet human needs and goals such as sustainable development. Some of these

programs have even taken a step forward, i.e., to infuse entrepreneurship initiatives into design innovation education. Such an endeavor is innovative in every sense.

7.5 From Undergraduate to PhD: A 3D T-shaped Educational Framework

There is a growing body of discussion on T-shaped people, innovation mode and its impact on design education. However, efforts to develop innovation curricula that can truly meet the needs of this era and be effectively applied are still scanty worldwide (see Friedman 2012). We attempt to propose a 3D T-shaped educational framework and to explore possible approaches to cultivate design innovation talents. Our discussion is based on the prevailing Undergraduate-Master-PhD system (or equivalently, the Bologna Process in Europe). This framework is currently applied step by step in the College of Design & Innovation (D&I) of Tongji University. We will use the curriculum plan practiced in this college to explain the core conception of the 3D T framework. It is our hope that this framework may be useful for other design schools to plan their own curricula and disciplines.

A leading design school should shape its undergraduate, master, and PhD programs in light of distinct goals, cultivating different kinds of talents who are suitable for design, research, education, or management.

Undergraduate education focuses on vertical capability. It cultivates the vertical leg of T, whereas reserves sufficient room in the entire undergraduate curriculum for the horizontal stroke of T. Undergraduate curriculum thus aims to educate design professionals who have innovative thinking and broad knowledge. (See Figs. 7.3 and 7.4.) While students, as future "design professionals," have to grasp and intensively enhance their vertical knowledge and skills, "innovative thinking and broad knowledge" relies in accumulation of horizontal knowledge and formation of design methods, which can be facilitated by bridging design with the real world in particular. In this sense, students will obtain a broad vision of knowledge related to design; in the meanwhile they will learn to master specific domain

Fig. 7.3 Distinct emphases in undergraduate and master programs

Fig. 7.4 Undergraduate and Master programs in Tongji D&I

knowledge and skills from Year 1 on. Corresponding to different vertical capabilities, various programs are established. In D&I these programs are: industrial design, communication design, environmental design, and digital media design, with overlapping as well as distinct characteristics. Furthermore, establishing preliminary research courses, in addition to general education courses, facilitates students to expand their capabilities.

Master education focuses though on moving beyond vertical capability toward horizontal development, emphasizing fostering learning experience of interdisciplinary and integrated innovation, design methods, and international practice (See Figs. 7.3 and 7.4.). During this phase of education, the subject matters of design are expanding from the tangible world to the intangible world made up of, to name a few, services, relations, experiences, and systems. Recognition of social, technological, and economic issues and the management of these, are also an important part of the concerns in Master program planning. Two kinds of Master programs are offered in D&I. The first kind focuses on advanced vertical capability, i.e., vertical capability with breadth. This denotes learning and creating the more complex and comprehensive part of knowledge in specific areas such as industrial design, communication design, and environmental design. The second kind focuses on horizontal capability of integration, which transcends individual areas, but rather values the capacity to accommodate and to integrate knowledge arising from different domains. Such horizontal capability intensively mirrors design thinking. Programs of the first kind, e.g. in D&I, include: advanced product design, advanced communication and media design, and advanced environmental design. The second kind of programs consists of: interaction design, product service system design, design strategy & management, design history & theory, and potentially more. The Master education in design is supported by the vertical knowledge and skills that student has achieved in a specific domain, which can be a design area, or non-design at all.

PhD education emphasizes the depth of knowledge and theories. PhD programs are provided to the research students who are interested in design research and are able to raise questions that will not be addressed in domains other than design.

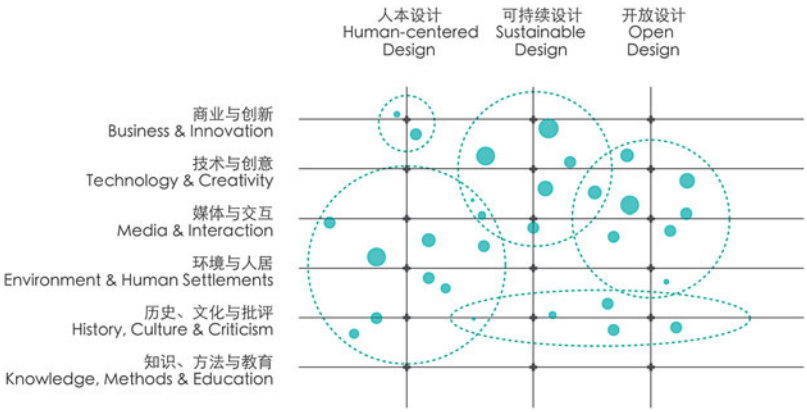

Fig. 7.5 Depth of knowledge: the Value-Theme matrix framework of D&I

In D&I, we propose a "Value-Theme" matrix framework to structure our PhD program (see Fig. 7.5). The value dimension contains: human-centered design, sustainable design, and open design. All these are value-based design. The theme dimension covers: business & innovation, technology & creativity, history, culture & criticism, and knowledge, methods & education. These are themes of research areas. Among the three values, human-centered design addresses the value based on profound understanding of and respect for humanity, which is one of the classical western design values. With the world's increasing awareness about the environmental issues in the past half century, sustainable design has been absorbed into the design agenda and has achieved a dominant position in recent design explorations. Open design is nevertheless an emerging trend that is accompanied with technological development, e.g. digital and internet-based ways of living and production in particular. We believe, *open* deals with both epistemology and methodology of design, and its impact will be way more far-reaching than what we have experienced. When these values and the aforementioned themes intersect, a framework that can structure PhD education and research areas is established. When located in this matrix, specific design studies will emerge and huddle around distinct cross points, and gradually form a group of research clusters comprised of inter-supporting studies. The accumulation of such research clusters exhibits the depth of university-based design research. In the meantime, the emerging studies, and then the new clusters, may enrich this framework and further expand it by adding new values or new themes. Using this framework, the school can also plan its PhD program based on understanding the existing and the prospective issues in regard to national welfare and people's livelihood. In this way, the school is not merely paying lip service to the society. The idea of the matrix is analogous to playing cards: the constituent elements of knowledge are "out there," waiting to be re-discovered and re-organized for the creation of new knowledge.

In order to enable design education to better meet social needs in real world challenges, D&I further proposes a set of Special Interest Groups, which attempt to integrate undergraduate, Master, and PhD education into a few research areas. The

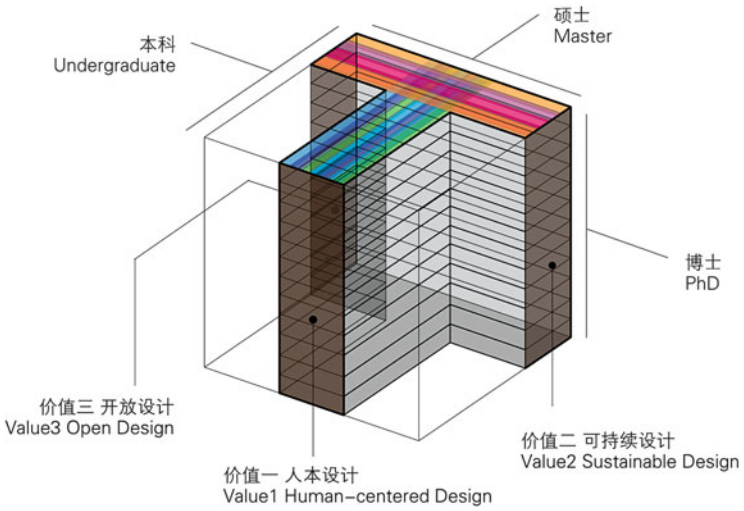

Fig. 7.6 A 3D T-shaped educational framework

Special Interest Groups are devoted to researching and improving the burning issues in today's China, using design as an agent. Their areas include, but not limited to, design for health care, design for urban–rural interaction, design for mobility and transportation, design for smart and sustainable living, and design for industrial transition. The practices conducted in these Special Interest Groups provide design education with an excellent context for problem-solving and knowledge-creation. Involved together in one group, undergraduate, Master, and PhD students can engage in working out problems at different levels. Take medical design for example: undergraduate students could be involved in surgical instrument design, or signage design for the hospital; Master students could participate in projects on product service system design; PhD students could explore how to improve, for example, the doctor-patient relationship through design agent, and propose criteria and principles for re-shaping the clinic process.

We have so far introduced every constituent part of the 3D T-shaped educational framework that structures programs ranging from undergraduate to PhD, and have explored the rich relations within and between these parts. This framework is illustrated in Fig. 7.6.

7.6 The Resilience of T-shape and the Knowledge Cube

Human beings have created and cumulated numerous bodies of vertical and horizontal knowledge. Modern universities organize knowledge and methods and turn them into specialties or disciplines. When internalized through education, knowledge and methods will become a certain capability, or expertise. When institutionalized, the adjacent specialties will be structured into a department or a school. As

the 3D T-shaped framework indicates, bodies of the institutionalized vertical knowledge (or programs/specialties/areas) exist in an interrelated manner. Each contains a unique area while overlapping with other ones. Paradigmatic definitions of an area demarcate the boundary of a body of knowledge pertaining to that area. Such boundaries, however, sometimes blur. This is not unusual in design education. For instance, what we used to call graphic design has expanded into communication design. It is also true of the relationships between the families of horizontal knowledge. The active overlapping part between interaction design and product service system design is an example of this. We call such flexibility and energy to change the resilience of the T-shaped model.

Different schools and colleges possess combinations of different vertical and horizontal knowledge, and therefore have distinct 3D T-shaped models of their own. Imagine we merge all sorts of 3D T-shaped models (distinct bodies of vertical and horizontal knowledge from different schools) into one as a whole, the 3D T model will grow into an approximation of a cube, provided that the number of schools and the diversity of them are big enough. It will be a highly abstract metaphor—a Knowledge Cube (See Fig. 7.7). This cube allows great freedom to integrate vertical and horizontal knowledge. A Master student, who obtained her/his vertical knowledge in a non-design discipline, may still find a preferable way to link such knowledge to design while advancing her/his horizontal knowledge. This is the essential power of knowledge integration in an interdisciplinary context of design. As a result, design encourages collaboration between students across a variety of disciplines. One of the most popular approaches is to recruit students from various backgrounds, for example, business and management, linguistics, psychologies, engineering, biology. Modern disciplines encourage the flow of knowledge. Design, however, is the arena where this idea is highly appreciated and practically exercised. This has to do with the interdisciplinary nature of design and the growing complexity of subject matters that design addresses.

In addition, a temporal dimension in the 3D T model merits a little clarification. For an individual learning experience, the 3D T-shaped knowledge model constructs the development of design expertise. Which knowledge and skills should be cultivated in the first place, which comes after that, this illustrates a trajectory of learning and growth. Correspondingly, this temporal dimension plays a role when a

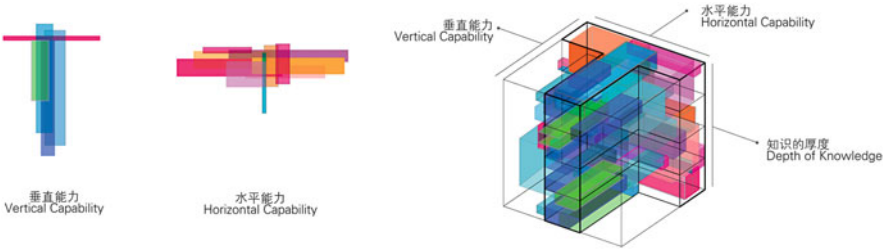

Fig. 7.7 Relationship between T-shapes and the Knowledge Cube

school is planning curricula for its undergraduate, Master, and PhD programs. Nonetheless, in the viewpoint of a design educational institution, the T model could be timeless. Design education provides a plan, in which the student grows. This plan namely constitutes the educational environment, including curriculum, experience, practice, research, and life. A school is the organizer of various knowledge, capabilities, space, and resources, who cultivates an ecosystem for each individual learner. Within such an ecosystem, every student may develop a unique growing trajectory. This conception goes in concert with Dewey's (2012: 13–14) observation of education:

> We never educate directly, but indirectly by means of the environment. Whether we permit chance environments to do the work, or whether we design environments for the purpose makes a great difference.

In this sense, we design environments for our students. The 3D T, positioned in a potential knowledge cube, is the structure of those environments.

An even bolder attempt will be to further blur the boundaries of every solid T within the cubical framework: not only enabling students from different disciplines and backgrounds to collaborate together, but encouraging undergraduate, Master, and PhD students to co-study to deal with real-world challenges under the condition of international, university-business collaboration. Situated in the inter-cultural, interdisciplinary, and cross-education-system environment, students will create knowledge, learn to grasp skills, manage projects, and conduct research. In this way, knowledge transfers between project teams, and between university and the society. The above mentioned Special Interest Group, for example, is among the most feasible places to practice this conception. The success of such an educational mode lies in a well integrated solid T. Practice allows undergraduates and post-graduates to obtain knowledge from more than a single discipline with a sufficiently broad perspective (Hobday et al. 2011). We see this as a viable experiment that is able to respond to Don Norman's (2010) criticism on general design education—trying to encounter complex and comprehensive challenges from the real world but failing to do so due to a lack of necessary knowledge and skills. In its essence, the experimental educational mode we envision here is, as Buchanan's (1992) elaboration on "wicked problems" indicates, using design thinking to break the rigid barriers between disciplines, and integrating knowledge and skills at different levels (varying from signs and symbols, objects, activities, to environments) to satisfy the needs and to realize the values arising from this changing world.

In collaboration with the Sino-Finnish-Centre (SFC) of Tongji, D&I offers interdisciplinary, innovative entrepreneurship projects to the students from the whole university, which is a step toward this direction. In 2013, for instance, collaborating with Panasonic, SFC hosted a successful Product Development Project (PDP) course named "InnovAIR." Participating students, from different countries and 5 disciplines, proposed a brilliant solution to the PM 2.5 air pollution problem. Aside from proposing design concepts, they accomplished the technological solutions and planned a highly feasible business model. Figure 7.8 captures a few moments while the students were making the functioning prototype.

Fig. 7.8 On-site scenes of the InnovAIR project, a PDP course offered by SFC

Concluding Remarks

The 3D T-shaped educational framework we proposed here identifies knowledge and skills at different levels and of different nature, and explores their interrelations and possible positions within the process of educating innovative design talents. Using the educational plan that has been practiced in D&I, we demonstrated a way of structuring knowledge and planning the learning process. This framework is in a sense a hermeneutic tool. It is open to more interpretations with regard to productive ways of combining the vertical and the horizontal and encouraging interdisciplinary discourses. This framework will hopefully inspire design educators, teachers, and students to make their contextualized educational plans. And moreover, establishing the relationship between the solid T and the knowledge cube allows us to break the boundary of thinking, i.e. to develop innovative design education patterns through integrating and re-organizing knowledge in various disciplines, in order to better address real world challenges.

As Buchanan (1992) rightly points out, design thinking as a new liberal art can be applied to any area of human experience. Once such open design thinking becomes a prevailing awareness, it will radically change the way design is practiced, not merely how design appears. To recognize and to adapt to such a transition is not the entire mission of design education. But rather, design education should take action to lead and to drive this transition.

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Chapter 8
The Heterodox Pedagogy: Hackerspaces and Collaborative Education in Design

Mitchell Joachim and Maria Aiolova

Abstract Design is frequently regarded as the act of generating something new, something that didn't entirely exist before. Scientific research, as it's typically defined, is for generating new knowledge based on long standing paradigms. Academic proponents of research through design maintain that the process should follow the established method of unique image and object production. This is essentially the same as the art and practice of design itself. On the opposite side of the spectrum, there is a movement to adopt the systematic research methodology that is used in science. Today, designers are still educated to be idiosyncratic and summarily reject most precedents and/or produce an obscure signal to the past. Conversely, within many scientific based endeavors, researchers work in robust collaborative environments. They incrementally build on prior experiments and publications. In science you learn to replicate preceding efforts and disrupt the limits by an order of magnitude. Designers never copy; almost everything is reset from scratch. Imagine an architect exactly replicating Frank Lloyd Wright's Guggenheim Museum with the modest addition of improved ramp sizes. That would be an irrefutable act of design failure or even plagiarism. Conversely, if a biologist replicates the work of another biologist in a lab and makes a reasonable measurable improvement, they are rewarded. Design is not simply a creative process; it is also another form of a focused scientific endeavor. Like science, design is experimental, but in a way that prominently recognizes invention. Our current research attempts to establish new forms of knowledge at the confluences of design and science activity.

Using a collaborative approach between these disciplines and the available cutting-edge technologies, designers can to offer unorthodox solutions to a number

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of current problems. Innovation, after all, doesn't happen in isolation. It needs a charged zone that connects exceptional cross-disciplinary activities. It also needs spaces of focused heterodoxy, often identified as hackerspaces. The open network of these spaces and their members presents a critical understanding of invention and access to knowledge through sharing. This pioneering community is spreading around the globe, where innovation flourishes in a host of unusual spaces. Although relatively young, this movement enables relationships between design and science that generates the unconventional inventions urgently needed in the age of climate crisis and natural resource scarcity.

Our goal is to invent an alternative design process to foster designs that are interdependent with the natural world. The study of biology and synthetic biology is essential to creating connections between designers and the environment. It can also open the possibilities of new solutions to the current environmental crisis. We created ONE Lab as an independent school for design and science that moves toward this necessity.

The whole idea of ONE Lab originated in the Metropolitan Exchange (MEx) Building. Often described as a hackerspace, the building is full of extremely diverse collection of companies and individuals, brought together by their inventiveness, efficiency, and competence. Terreform ONE was the first design practice to start a biological laboratory in the building, which further developed through collaboration with Genspace, another nonprofit organization devoted to access to biotechnology. More recently, we created New Lab at the Brooklyn Navy Yard, an extremely charged interdisciplinary zone for free interaction and cross-pollination of ideas.

This chapter is comprised of three parts that explore the different aspects of the alternative design process practiced by Terreform ONE. Part I, *BioMap City of 11 Billion People in 2110*, offers an example of our most recent investigation in the crossover of design and biology. Part II, *Hackerspaces and Synthetic Biological Design,* focuses on open collaborative spaces and their users to form a new understanding of invention in design. Part III, *The Future of Collaborative Education: Global Architecture and Design,* follows the evolution of ONE Lab into a global educational platform for collective learning.

Keywords Global architecture • Design research • Urbanism • Hacker spaces • Collaborative education • Study abroad • Synthetic biology • Ecology • Future cities • Terreform ONE

8.1 Part I: BioMap City of 11 Billion People in 2110: Bioinformatics Beyond Buckminster Fuller

> I have summarized my discovery of the option of humanity to become omnieconomically and sustainably successful on our planet while phasing out forever all use of fossil fuels and atomic energy generation other than the Sun. I have presented my plan for using our increasing technical ability to construct high-voltage, superconductive transmission lines

> and implement an around-the-world electrical energy grid integrating the daytime and nighttime hemispheres, thus swiftly increasing the operating capacity of the world's electrical energy system and, concomitantly, living standard in an unprecedented feat of international cooperation.
>
> Cosmosgraphy, 1993, Buckminster Fuller and Kiyoshi Kuromiya

The world population will reach 11 Billion by the end of this century. More than three quarters of us will live in cities, an unprecedented condition in human history. The numbers from different sources vary but they are all colossally sized. There is very little speculation, however, about the form and the impact of these Mega Cities. Most of the world has reached an agreement that human actions are a significant contributor to climate change. A new movement is under way, based on a quest for renewable energy and healthy living. Our intention is to research the innumerable consequences of these radical changes to the global cities, and explore how the world is adapting to address these changes (Fig. 8.1).

This investigation is based on a succession of interconnected ides of vital significance to the health of cities: political will and the lack thereof; the role of the automobile; expanding versus shrinking cities; the rise of a "Planet of Slums"; forms of racism, poverty, immigration, war, criminality and terrorism. Climate change and environmental deterioration are a crucial concern. The speeded consumption of energy, the unfettered pollution, and the resulting changes to the earth's climate can no longer be ignored (Fig. 8.2).

Globalization has had an overwhelming effect on the form and energy of cities. This influence can be felt in urban centers and farmland alike. While historical city centers may persist, in many cases they are now augmented with multiple interconnected centers. These centers are linked by a network of communication

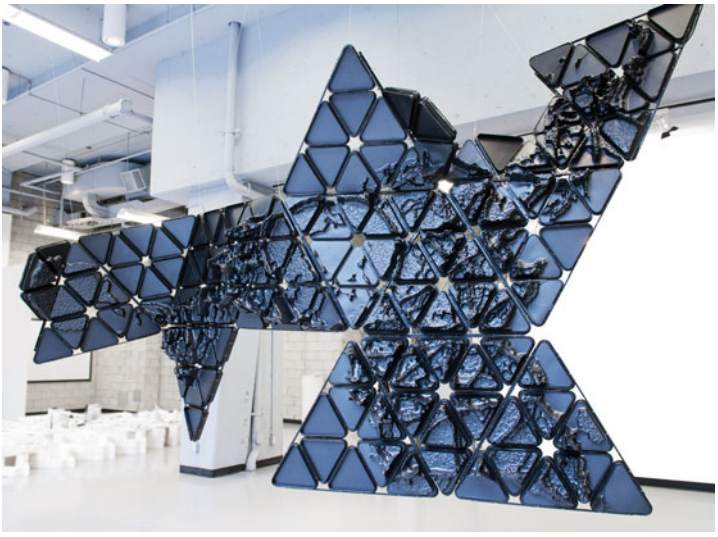

Fig. 8.1 Topological forms illustrate the shift in urban population density across continents as a biological habitat for 11 billion people

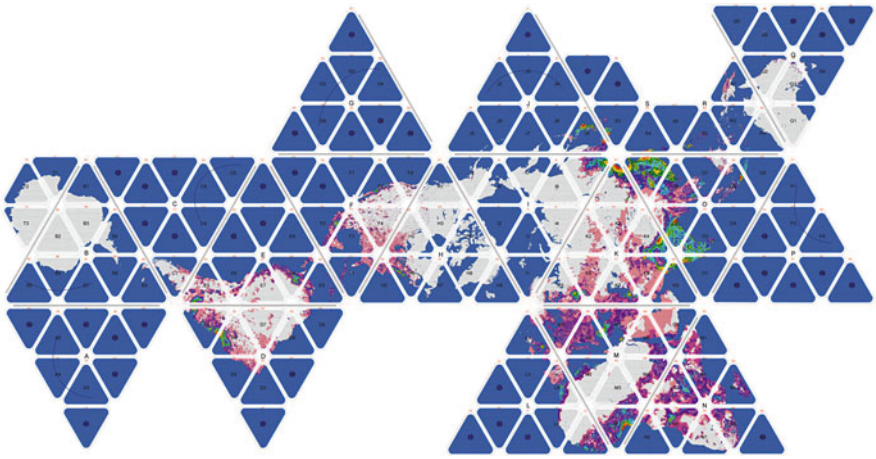

Fig. 8.2 Dymaxion map of global population density in 100 years

and transportation infrastructures to shape a multifactorial urban system that extends far into what was once countryside. The scale and networked quality of these mega-urban configurations will grow beyond reach and beyond control.

Seventy years ago, Buckminster Fuller unfolded the globe in a Dymaxion projection. This resulted in an icosahedral net of almost contiguous landmass comprising all of Earth's continents. It was also connected the flow of energy, and allowed solutions to global problems, matching human needs with resources. More recently, Rem Koolhaas proposed a similar exchange of energy, looping a ring of offshore wind farms in the North Sea and connecting them to vast photovoltaic arrays in Sub-Saharan Africa. Such a massive network would allow major flows of both energy and population on a global scale. In a fully connected world, competition will be replaced with cooperation (Fig. 8.3).

The BioMap City is a forecast of the world population distribution in the next 100 years. It has been modeled by combining all the world cities together as one continuous growth system. The current phenomena of volatile growth – the "Megacity" with populations of more than 20 million: Mexico City, Shanghai, Lagos, etc. – merge together into a continuous urban construct. As human population expands, we see it as one single macro city spread across the continents. Other cities, mainly in the developed world, exhibit the reverse trend, as they are shrinking (Manchester, Detroit, Leipzig, etc.) (Fig. 8.4).

We argue that most nations cannot view the effects of planetary population density through the lens of just one city or region. Instead we aim to reveal the long-range effects of massive human population in areas of present and future urban intensity. On the reverse side of the mapping installation are focal points of biological details in specific localized city forms. They zoom in on density zones that are dispersed throughout the globe. These points use the technique of "bacteriography" (bacteria photography) to shift scale and underscore the highest

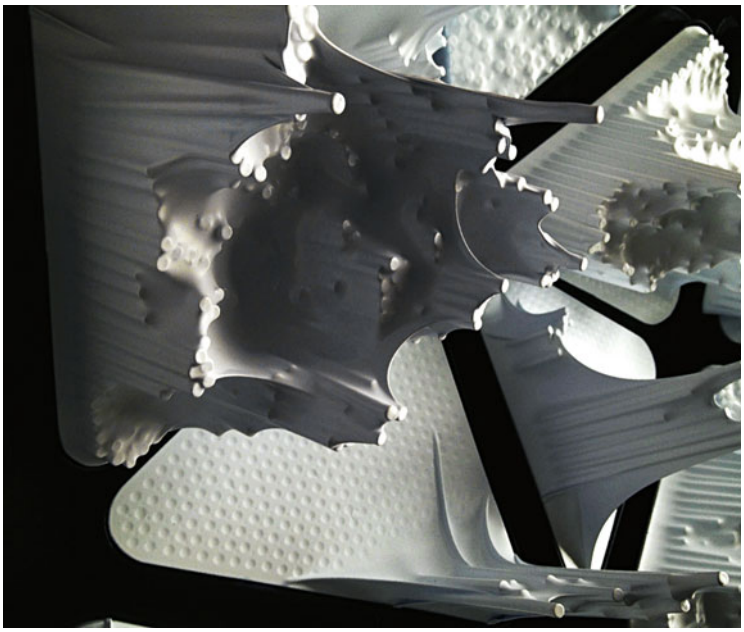

Fig. 8.3 Graph heights reveal population density

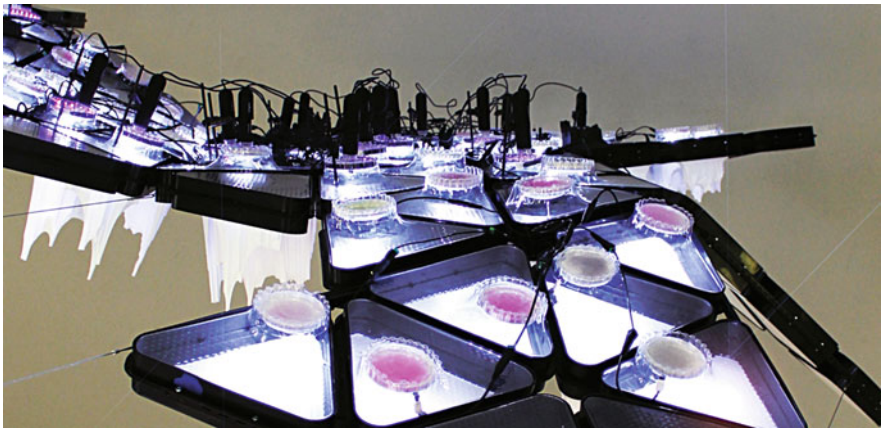

Fig. 8.4 Double sided mapping system – SIDE A: 100 petri dishes of bacteria w/ digital stencil control and microscopes. SIDE B: Extruded Population Graphs

Fig. 8.5 City grown from E. coli Bacteria w/ 400× Microscope

zones of growth. Our method creates a real-time parametric display using Gammaproteobacterium Escherichia coli Strain K12 in agar medium that has been genetically modified to express color under UV light. The strains used are harmless variants of E. coli, studied by college students all across Europe and the United States. They have been utilized in schools for decades without any safety issues and are considered non-pathogenic and innocuous (Figs. 8.5 and 8.6).

The BioCity forms have been transformed with DNA that encodes fluorescent proteins found in sea anemones and jellyfish. This enables those bacteria to emit

Fig. 8.6 Laboratory bench work with densities of E. coli

red, green, yellow and blue light under long wave UV bulbs. The fluorescent proteins are based on the discoveries of Shimomura, Chalfie and Tsien, who were honored with a Nobel Prize for their work in 2008. Ultimately, the bacterial photos grow to reveal variant patterns of biological transformation in urban regions (Fig. 8.7).

Rather than using computer code to mimic growth in nature, this method is the actual iterative vehicle of growth itself. Bacteria in this constrained form and under the right conditions, behave almost identically to urban population patterns. Moreover, the resolution of these bio-based city patterns will change with more nuanced biological inputs. In many cases, they are as good as computational versions because they are the source which algorithms are derived from in the first place. In time, the mapping installation may illustrate patterns yet unobserved in typical

Fig. 8.7 Twenty-five world cities with highest population in petri dishes with *red* and *green* E. coli

models. It is this emergent and unfettered map of population we wish to make into spectacle. By using bio lab based materials, we expect to narrow the gap between idealized mathematical interpretations and observable events in nature. This may lead to learning, in the words of Buckminster Fuller, "how to make the world work" for 11 Billion People, without causing ecological damage and disadvantage to any one (Fig. 8.8).

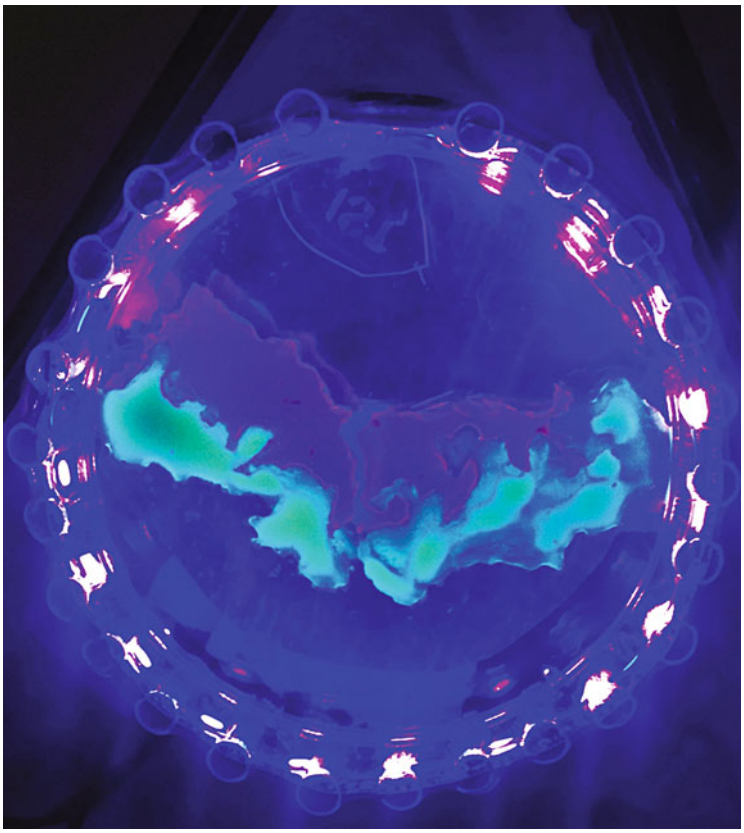

Fig. 8.8 Existing population expressed in *green*. Projected population expressed in *red*

8.2 Part II: Hackers Spaces and Synthetic Biological Design

The tide of environmental decline is a multilayered dilemma in qualitative architectural research. To some extent, architectural directives have struggled to reverse this environmental decay. That is not to say the desire and aspiration to positively contribute to an ecological society is omitted from the design discourse. In fact just the opposite, an immense consortium, both formal and informal, of architectural thinkers are absolutely devoted to the task of sustainability. For at least this past decade the dominant meta-theme of a majority of architectural research has been the promise of sustainability. Architects have reflexively launched themselves into the center of the environmental polemic as both its source and resolution. This eco-crisis demands robust solutions on a considerable scale to deal with an immanent collapse. At this point, the radicalization of sustainability is widespread. As a

principle it is the politicized mainstream agenda for most design procedures. How can you contend against platitudes like; 'save the planet'? The architectural responses range from fantastical feats of geo-engineering to low-flush toilets, all in service to assuage our fears. It's vital to concede that sustainability will happen in every shade of green. For if the mission fails, we will not be here to say otherwise. Therefore, we must shift beyond sustainability alone and its associative rhetoric. What are the latest comprehensive models within design research that can expedite a greener and grander shift? We need to prepare the next generation of innovators to be self-reliant in a world that requires regeneration. We also need to expand a discourse that continues an arc of humanitarian and technological assertions after sustainability is achieved.

8.2.1 Restructuring Investigative Goals

Passive cooling, zero emission paint, and harvested lumber do not foreground evocative design. During the last two decades, the prevalent challenge for the sustainable design movement in the United States has been to sluggishly modify the behavior of the developers, architects, and planners responsible for the sizable majority of new projects. From this outlook, it was uniform conventions – as opposed to salient ensembles – that was fought for by green advocates. We considered such standardized aspirations as limiting and myopic. This is not to disregard their gradual approach, but to question what it arouses visually. How can design complement our creative judgment and account for the environment? After implementing environmental standards, green architecture appears nondescript. What does it take to re-create a 'Bilbao effect' – an artifact as a stimulating catharsis – ecologically? The profession has to restructure its investigative goals, particularly assuming a balance and responsibility of giving aspirants a sufficiently bona fide command of environmental studies and adaptable technologies. It is through promoting formal research, as a conscious effort from the design community to impart the skills and receptivity considered essential for social environmental living. The proposition is to create a study to edify professionals on the sensibilities of green design, and to further prepare our architectural discernments for the next technological wave. What is the next surge of technology and where can it be situated? The very space we practice architecture requires an overlay. To flourish beyond the territory of sustainability alone, the area of the architecture design studio needs modification. Existing atelier layouts are suitable, but there is opportunity for a superimposed workspace. This zone is more like a micro-garage for invention than a table of a draftsperson. Here the emphasis is on discovery.

8.2.2 The Act of Making

In many instances, discovery comes through the act of making. A revamped studio environment ought to accommodate the next kind of designer that recognizes the advents of the maker culture. Individual makers have to some extent turned the architecture of the authoritarian workplace upside-down. Different then the dot-com era moguls that preceded them, these people define themselves modestly. In some cases they refuse to be lumped into a prescribed movement or category. However, they have been defined in various outlets as: inventors, makers, tinkerers, activists, nomads, occupiers, and hackers. Their varied translation of conventional architecture is unique.

By blurring traditional discipline boundaries and using accessible advanced technology, makers tend to manifest fresh insights to numerous difficult problems. They inhabit shared spaces of professional heterodoxy, more commonly referred to as hackerspaces. Many of their innovative quasi-professional methods and practices generate unique areas that connect unobvious cross-disciplinary activities. As an open community these spaces and their users critically inform an acute understanding of invention. It takes place in a loosely defined intersection that emphasizes open source knowledge through sharing. This network is perhaps a global movement, where innovation thrives in a filter of unconventional spaces. How do hackers and the architecture of their related spaces transform industry in the context of industrial ecology? That does not mean maker culture overtakes design practice. Instead, it serves as a smart programmatic overlay to fine-tune, nudge, and tweak the existing studio context. The aim is to create an exploratory spine woven throughout studio culture that comprehensively supports hands-on inventiveness.

The methods and tools deployed within this curricular spine are; desktop 3D printing/ additive manufacturing, biohacking, urban farm/food production, open source design, Do-It-Yourself (DIY) fabrication, Arduino electronics, crowdsourcing, scripting/ freeware, alternate energy strategies, and citizen science. All are intended to unleash the power of invention in architecture. Today, hackerspaces exist, prosper, and thoroughly support societal needs both locally and globally.

8.2.3 Clinical Material Explorations and Biodesign

The emergence of citizen biotech must be seen within the broader context of advanced technologies becoming ever more readily available to individuals and groups. With that availability, comes an enhanced opportunity to develop new design ideas. A brainstorming session between biologists and architects queried: What can synthetic biology do for design and vice versa. Thus Gen2Seat was initiated for the International Genetically Engineered Machines (iGEM) conference and elsewhere (Fig. 8.9).

Fig. 8.9 Genetic generation module (Gen2Seat)

Applying the tools of synthetic biology, alongside other biological disciplines, such as microbiology and medical tissue engineering, will allow us to create products that are a hundred percent organic, with minimal waste and energy expenditure. Our aim is to use grown materials to reshape the way people think about manufacturing products and genetic engineering.

Biodesign is a field of design that incorporates living organisms in the creation of new materials and products that can enhance our living. As designers we aim to create products in a way that pleases us aesthetically while being as efficient as possible. We have seen the consequences of not considering the environment when it comes to production and manufacturing. It's time for a paradigm shift in the way we create, think, and live. Biodesign is part of that shift. Inspired by the shape of human tailbones, Gen2Seat is customizable in height and volume, due to the different articulated sections that give it flexibility and ease in transportation. The filler is made up of mycelia substrate, a combination of woodchips, gypsum, oat bran, the combination of which is consumed by mycelia and then hardened into a tough, durable material. The external skin, analogous to the leather covering of a sofa, is bacterial cellulose. The mycelia substrate and bacterial cellulose fuse to become a hard biopolymer that is suitable for material applications, and a fully functional chair (Fig. 8.10).

The gram negative bacterium *Acetobacter xylinum* produces and extrudes cellulose, weaving thick mats of it that can be harvested from cultures. It represents a renewable source of cellulose that is potentially more 'green'. We set out to improve this material through synthetic biology by engineering Acetobacter to produce a hybrid copolymer with elements of both cellulose and chitin, the carbohydrate that makes up the hard shells of insects and the spores of yeast. We reasoned that this new polymer might be expected to have different characteristics than pure cellulose, such as improved tensile strength or increased impermeability to water. We biobricked key genes from the yeast *candida albicans* chitin synthesis pathway for expression in acetobacter, thus providing the cell with the raw material to manufacture the cellulose-chitin hybrid. Additionally, we biobricked a gene whose product, NAG1, might be used in an inducible system to control copolymer

Fig. 8.10 Gen2Seat

production in acetobacter. Consumer attitudes toward potential products made from this material were gauged via an extensive national survey, and by hands-on interaction between customer and a representative product – that we designed – using the new material (Fig. 8.11).

Our chair might be the first household product that can be grown rather than manufactured – waste-free and pollution-free – but it won't be the last. Gen2Seat will become a reality and a new product in an emerging techno-industrial revolution where products are designed not only with efficiency and profitability in mind, but also sustainability and disposability.

8.2.4 Adaptive Work Environments

Researching and invention requires hands-on experience. Think/do-tanks that by definition are highly adaptive and modest in scale are easy to locate. In many cities alternative spaces for experimentation have developed around the creative class. Examples include prominent sites in New York City such as The Kitchen, Eyebeam, Alpha One Labs, New York Resistors, Makerbot, General Assembly, Genspace, The Metropolitan Exchange and New Lab. These examples serve as a

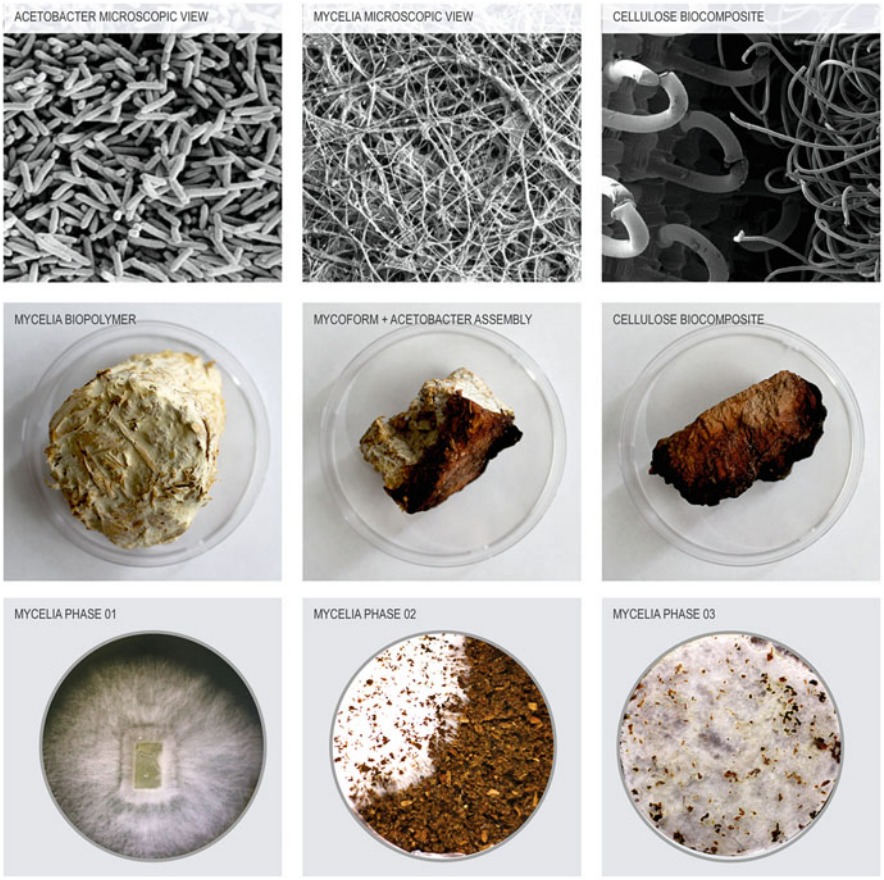

Fig. 8.11 Mycelia growth process

guide to integrate a maker culture in a design studio. It's a constructive way of learning and its intended to be congenial.

Architectural design investigations should respond to the needs of today and the not-so-distant future, especially in ecology and technology. What does the livelihood of tomorrow's architect look like? How does their activities support a healthier planet? Architecture performs a vital role in the manifestation of creative workplaces towards invention and ecology. At some point of immanent fruition the designer is defined by his/her generation. It's time we recognize the innovative methods our inventive cohorts have assembled. The 'science garage' has long been the pinnacle of American invention. The challenge is to address and revamp predictable applications in research with the liberties of these collaborative environments. If we are to explore original strategies for innovation as it relates to environmental discourse, we have to embrace these free zones of connectivity and interactivity. Practitioners of architecture and supportive fields will greatly benefit

with an addition of a vigorous maker element –providing an egalitarian exploratory space in a studio that is unprogrammed and uncensored. This is a resilient direction that promotes a dialogue beyond sustainability. Permission to play with a purpose engages professionals with an understanding of consequences that extends outside our discipline set.

8.3 Part III. The Future of Collaborative Education: Global Architecture and Design

The proliferation of open global communities of designers, inventors, makers sharing spaces, resources and ideas presents a paradigm shift: the move from competition to collaboration; from ownership to membership. This shift presents an opportunity for collaborative design education.

MITx offers a portfolio of MIT courses for free to a virtual community of students around the world. The first MITx course, 6.002x (Circuits and Electronics), was launched in February 2012 in an experimental prototype form. 150,000 students from around the world, more than all of the living MIT alumni, registered for the course. Students from Tunisia, Egypt, Pakistan, India, China, Columbia, Mexico, Brazil and many other places are all collaborating and working together, forming international study groups, meeting in tea shops in Cairo, Guangzhou and Bogota, discussing technology, education, learning, humanity and sciences.[1]

On May 2, 2012, Harvard University joined MIT as a partner in edX. MIT's Director of the Computer Science and Artificial Intelligence Laboratory and the first edX President Anant Agarwal declared: "Online education is revolutionary and will change the world." The goal is to make these courses accessible to anybody in the world, from any background, interested in learning. The only prerequisite is a computer with an Internet connection. New technologies will profoundly alter the way knowledge is conveyed. Online education is disruptive; machine learning and cloud computing are making it possible.

edX and other MOOCs (Massive Open Online Courses) can truly democratize education. Educational systems will have to be radically transformed to reflect how people learn. In a global world, events far away affect people on the opposite side of the planet. New forms of education have to adapt to this global reach in both physical and virtual way.[2] One of the most successful students in the first MITx course, Circuits and Electronics, was in Mongolia. A recent New York Times article followed the story of a boy from this largely nomadic country who "aced an MITx course."[3] This was possible by combining the student's great talent with the determination of his teacher and the kindness of a Ph.D. candidate from

[1] edX http://www.edxonline.org/

[2] Summers, Lawrence, *What You (Really) Need to Know,* The New York Times, January 20, 2012.

[3] Pappano, Laura, The Boy Genius of Ulan Bator, The New York Times, September 13, 2013.

Stanford University who traveled to Mongolia to set up a real-time laboratory. The success of MOOCs was based on linking high academic quality uniform curriculum online with local faculty and lab experience.

The Bologna Process in Europe offers a great example of synchronization of higher education. It created a "European Higher Education Area" where faculty and students can move freely and have an acknowledgment of their credentials and credits. Forty countries have restructured their higher education systems in order to move toward the harmonization of university degrees with high academic quality.[4]

The studies in the disciplines of Architecture and Design can follow suit by creating a new curriculum. The objective is to evaluate the current trends of the discipline, recommend what should be taught, and develop a standardized program that can be offered in cities around the world. A high quality, harmonized program will focus not only on the history and culture of the host city, but also explore current and future social, economic and technological trends. Cities today offer an exceptional place for people, resources and thoughts to meet and sprout new ideas and innovation. To match this looming social growth, future architects and designers will need to produce a similarly worthy technological evolution. It is projected that future cities will advance into very resourceful technical environments for immense populations. The curriculum necessary to educate students in this field will need to include a range of technologies: alternate energy, personalized public transportation systems, urban farming, synthetic biology, reclamation infrastructure, additive manufacturing, crowdsourcing, and citizen science. In addition to the technological evolution, a design practice based on social activism has emerged and needs to be reinforced by collaborative studies of architecture and design. This practice engages very practical, hands-on designs and products that can be speedily deployed during disaster and famine.[5]

What is required to comprehend globalization today is a close study of specific places, cities and cultures. Even in a truly interconnected world, architecture will remain rooted to place. What travels are images, ideas, knowledge and the designers themselves. In order to generate a collaborative educational experience we need to create a curriculum that works with elements of history and tradition just as it takes full advantage of new technologies and the opportunities of global exchange.[6]

ONE Lab was founded as an urban non-profit group concerned with research and education in the synthesis of design and science. We began as an extraordinary think-and-do-tank of architects, engineers, artists, biologists, designers, urban ecologists, physicists and planners seeking alternatives to traditional forms of teaching and professional practice. Through this interaction, we discovered the need for an interdisciplinary pedagogical free zone, where students and practitioners can

[4] Bologna Process http://www.wg.aegee.org/ewg/bologna.htm

[5] Architecture for Humanity, *Design Like You Give a Damn* New York: Metropolis Books, 2006.

[6] Allen S (2012) 'The future that is now' Chapter. In: Ockman J (ed) Architecture school: three centuries of educating architects in North America. MIT Press, Cambridge, MA.

generously discuss and conduct experiments that have a positive effect on the global community.

ONE Lab is dedicated to cultivating change. The laboratory advances professionals towards an intellectual scheme that recalibrates the meaning of city. ONE Lab promotes the investigation and erudition needed for the first generation of Urbaneers. Each Urbaneer is an individual with a different set of versatile abilities that merge previously disparate occupations. They range from ecological architects and engineers to action based urban planners and developers. Almost any recombined professional activities can work, so long as they meet the constantly changing needs of urbanization. Ultimately, the job of city creation belongs to everyone – including a new force of highly trained specialists.[7]

ONE Lab, in partnership with CIEE, the world leader in international educational exchange, has developed a new interdisciplinary global platform focused on investigating the imaginative uses of technology in architecture and design. The Global Architecture and Design (Global AD) programs will offer a uniform curriculum by assembling a faculty of innovators and thought leaders from around the world. After 5 years of teaching in New York City, in Spring 2014, Global AD will be offered to advanced architecture and design students in Barcelona, Berlin, Prague. Using each city as a laboratory, the program rethinks what is essential about the city, in both its forms and its life. The investigations will be based on one illuminating hypothesis: in the future, cities will grow to be self-sufficient in their critical necessities through massive public works and infrastructural support. The Global AD program explores the effects of technological interventions that can have profound impacts on the planet as a whole.

Digital fabrication, 3D printing and synthetic biology have given designers new means of production where complexity becomes attainable and virtually free. By overcoming the restrictions imposed by the old manufacturing methods and processes, there technologies will open a broad field of research and experimentation in design. In this new context, the Global AD programs will incorporate some of these technologies as part of its academic agenda and work environment.

The Global Architecture and Design program will create a new platform for disseminated knowledge and collaborative action. Students will connect with their peers, faculty, and researchers in other Global AD cities. Through an online platform, the students will share knowledge, collaborate on projects, and debate common questions. At the same time, they will be in constant dialog with the students on the home campus through online blogs and chat-rooms, which will enable them to maintain connections and the sense of community.

Ultimately, the Global AD will become a modular program where students can combine a semester of modules offered in different cities. This will provide access to individualized study abroad with highly specialized content. The mixture of different knowledge sets in close proximity evokes dialogues between discipline groups in order to solve problems. It creates shared wealth of information and

[7] ONE Lab: New York School for Design and Science http://www.onelab.org/

knowledge platform and a mechanism where students can give back to the host community. Freely organized teams can produce solutions that span multiple fields of expertise around the world. Eventually, the Global Architecture and Design program has the potential to become a "Roaming University" with local faculty, local resources, local community and global students traveling from a place to a place. An "Open Badges" credit system can enable the students to accumulate a body of knowledge and build credentials online by data collection, recommendations, assessment, and ultimately a global competency certificate.

Project Credits

BIO CITY MAP OF 11 BILLION: World Population in 2110 Credit: Terreform ONE, Mitchell Joachim, Nurhan Gokturk, Melanie Fessel, Maria Aiolova, Oliver Medvedik.

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Gen2Seat: Genetic Generation Seat Credits: Terreform ONE + Genspace, Mitchell Joachim, Oliver Medvedik, Melanie Fessel, Maria Aiolova, Ellen Jorgenson, Shruti Grover, James Schwartz, Josue Ledema, Tania Doles, Philip Weller, Greg Pucillo, Shivina Harjani, Jesse Hull.

Chapter 9
The Noetic Turn: From Language-Based to Tool-Based Knowledge Trees

Peter Weibel

Abstract For thousands of years, knowledge was organized according to the metaphor of a tree. Therefore, we speak of trees of knowledge. These trees hide a hierarchy of knowledge, starting with the Greeks and their differentiation between *technê* and *epistêmês* and ending with Ludwig Wittgenstein "The limits of my language mean the limits of my world" (TLP, 5.6). The dominant ideology is, that language serves as the primary medium of knowledge. This essay argues that language was only the first medium to describe the world but we have developed new media, new tools to describe and to construct the world. Technology is seen as an extension of the medium of writing.

Keywords Noetic turn • Language-based knowledge tree • Tool-based knowledge tree • Technê • Epistêmês • Genealogy • Media • Encyclopaedia • Family tree of art • Rhizome

9.1 The Metaphor of the Tree

The tradition of seeing language as the medium of truth and awareness began with the Ancient Greeks. How language as a medium is directly connected with the awareness of being was formulated clearly by Parmenides of Elea in ca. 500 BC: "For it is the same thing that can be thought and that can be."[1] What Parmenides is advocating here is a purely formal system of propositions that do not refer to facts based on experience, to actions or deeds which can be verified or falsified empirically. His epistemology consists in propositions connected by logic that are distinguished from empirical facts. Parmenides' epistemology is thus one of the earliest models of a theory of knowledge based purely on thought and language. Since that time, theories based on logic and language have been at the forefront in knowledge and in knowledge trees in philosophy, theory of science, and theology,

[1] Parmenides (1892).

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and not empirical experimental systems. The popularized version of Parmenides' philosophy – "thinking and being are the same" – expresses this succinctly. As thought can only be expressed in the spoken and the written word, that is, in language (according to the general perception), a close connection between thinking and language was forged, and, as thinking and being are the same according to Parmenides, language and being were also linked up. This led to the crystallizing out of a hierarchy of branches of knowledge that was headed by language and mind-based media, and thus by disciplines such as theology, philosophy, rhetoric, grammar, and so on – the six *epistêmês* of Greek and post-Greek philosophy of fields of knowledge. *Technê,* the practice of manual, tool-based "arts" or "crafts," such as agriculture, architecture, painting, sculpture, and so on, were at the bottom of the fields of knowledge hierarchy.

These introductory remarks serve to outline some of the basic problems connected with noesis. Philosophy, as a language-based medium of knowledge, began to absolutize language as *the* medium of knowledge. "Language is being." The knowledge of the being operates via language, as we are taught by philosophy – from Parmenides to Heidegger. Theology follows suit with the statement that "In the beginning was the Word" (John 1:1). Obviously, language-based media explain the world using words, sentences, and linguistic expressions. That is why language-based media have headed up knowledge systems from the outset. Language became a model of the world; the world became a mirror image of language. The structure of the world reflected the structure of language and vice versa. Cosmogenesis, anthropogenesis: the origins of the world, the origins of humankind, were described and explained in metaphorical language. In the process mythical, religious, and rhetorical narratives were mixed and combined. Properties of language became the properties of objects and of the world. Inquiries into the origins of the world and living organisms, that is, into ultimate causes, automatically presupposed a model of sources or derivation. This model is most obvious in the concept of genealogy. Deriving from Ancient Greek *geneá*, family, and *lógos,* knowledge, *genealogía* – the family tree – is the study of families and their descent; in short, a history of blood relatives. Today we would define genealogy as the study of genetic relatedness. The Bible and other early texts devote pages upon pages to the ancestors, mothers, and fathers of the persons mentioned in the texts. However, this genealogical research was not confined to individuals, it also included peoples.

Almost without exception origin myths are genealogical tales, whether of the descent of individuals or entire ethnicities (Genesis 17:4–8; 20:12; 7:1–9). The history plays by William Shakespeare describe the genealogical wars between various royal houses of England or between the members of several generations of the same house in the late sixteenth century. As legitimation of their rule hereditary monarchies still only recognize two types of relationship or derivation: on the one hand from God, and on the other through the bloodline. These biological genealogies, from the Bible to monarchies, gradually became generalized. The theory of the descent of an individual became the theory of the descent of the

whole of humankind: the theory of evolution. Genealogy became a method whereby history could be explained. Ultimately, certain disciplines such as philosophy, theology, linguistics, and science were also subjected to the genealogical model. The biological, genealogical models became social and mental models. The image chosen for genealogy was the tree, the family tree. Through expanding the metaphor of the genealogical tree, from biology to epistemology, the family tree became the knowledge tree. From the outset, however, there was a curse on the tree metaphor; namely, the mixing of biology and sociology. The story of the expulsion of Adam and Eve from the Garden of Eden, perhaps the most famous example of the tree metaphor, in which the family tree becomes the tree of knowledge, clearly identifies the seed of this curse. This tree metaphor appears in the Bible as a transgression, as trauma, as gender trauma. Eva and Adam are banished from paradise ostensibly because they ate fruit from the tree of knowledge (Genesis 2:17; 3:24). Clearly their act had challenged the divine monopoly on knowledge and the pirates had to be immediately sent into exile forever. Henceforth knowledge was depicted as a tree, and this tree, or rather knowledge, is apparently dangerous, or forbidden.

We shall now look at how the tree as a metaphor for knowledge has evolved. From the family tree of lineages via the family trees of languages (Louis Meigret, *Le Traité de la Grammaire française*, 1550) we arrived at the tree of knowledge. Diagrams depicting hierarchically structured systems of knowledge that utilize the form of the tree metaphor indicate that their origins lie in genealogy, which is "situated within the articulation of the body and history."[2] Everywhere the tree is not only the form that genealogy takes, it is also the form that structures knowledge. From ancestral charts to family lineages, from family Bibles to family trees not only a genealogy of bodies emerged, but also a genealogy of rationality. Kant speaks of the "genealogical tree of pure understanding."[3] Genealogy, as the question about origins, not only looked for the progenitor of the human race, it also sought the origins of history, of knowledge, and of reason. With genealogy began the system of deriving, of deductive reasoning, of deductive logic; that is, the ordering of knowledge. Thus, time and again the origins of knowledge are likened to the metaphor of the tree (from Roland Barthes' "The development of the discourse then resembles the spreading of a tree"[4] to Robert Dumas' *Traité de l'arbre. Essai d'une philosophie occidentale*, 2002). In Noam Chomsky's generative grammar, in the generative structure of language and rhetoric, we also find branches connected at nodes like the branches of a tree. Similarly, we find the notion of ramification at the basis of all programming languages in the work of mathematician Axel Thue (Fig. 9.1).[5]

[2] Foucault (1977).

[3] Kant (1781).

[4] Barthes (1989).

[5] Thue (1914).

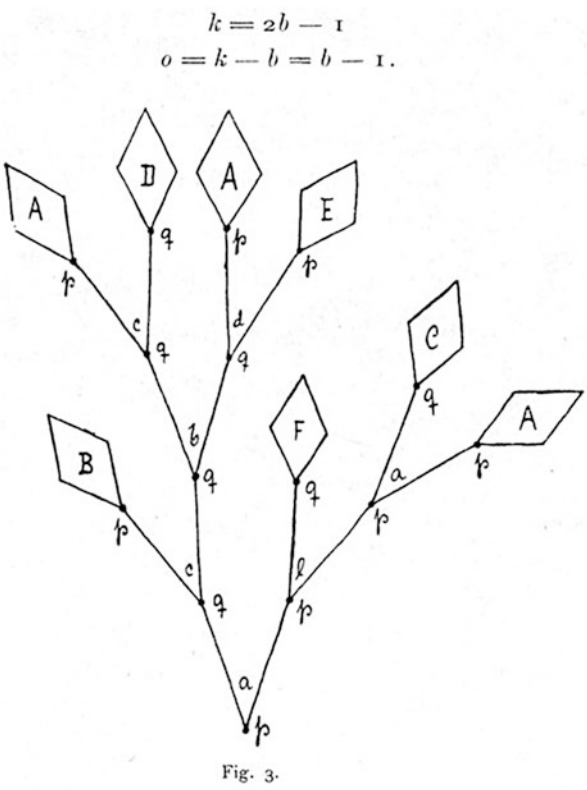

Fig. 9.1 Axel Thue, in: "Probleme über Veränderungen von Zeichenreihen nach gegebenen Regeln, [Problems concerning the transformation of symbol sequences according to given rules]," in: *Christiana Videnskabs-Selskabs Skrifter, I. Math.-naturv. Klasse*, Oslo, 1914, no. 10

After the invention of writing the world was described in this medium and with the increasing spread of literacy the world became an extension of writing. In essence this anticipated Marshall McLuhan's assertion that the media are "Extensions of Man" (the subtitle of *Understanding Media*, 1964). According to McLuhan, the wheel is an extension of the foot, the computer an extension of the nervous system, and so on. If writing was the very first medium, then its advent marked the beginning of the extension of human organs into space and time. It is therefore understandable that humans, ensnared in writing and language, had no option but to say "In the beginning was the Word" (John 1:1). This maxim formed the foundation of all language-based knowledge trees. Language was the first medium and, therefore, for millennia the world was described as language because language was the only medium available. However, the Bible already mentions a further medium of knowledge: "By their deeds you will know them" (Matthew 7:16) – the medium of actions. This opened the door to a different foundation for knowledge trees. Today, for example, particle physics is a medium of knowledge, and consequently, the universe did not begin with the word but with the Big Bang and the conversion of its energy into subatomic particles: "In the beginning was the 'particle zoo.'"

Thus the tree served as a model whereby knowledge could be ordered and classified and this developed into systematization and indexing of knowledge, the search for the interrelation of our knowledge, the causes of its emergence. Based on these considerations genealogies were created and from the genealogies, hierarchies. In his *The Conflict of the Faculties* (1798) Kant argues for the precedence of philosophy over law and medicine as a medium for establishing truth. Thus Kant prioritizes the language-based medium of knowledge, philosophy, as opposed to medicine, a tool-based medium of knowledge. In a similar way Leonardo da Vinci in *Trattato della Pittura* had claimed around 1500 the superiority of painting, as "cosa mentale," over sculpture, architecture, music, and poetry in the Renaissance *paragone* debate.

9.2 The Encyclopaedic Tree

The Encyclopédistes were the first who sought to produce a systematic treatment of the entire field of human knowledge and, moreover, according to Francis Bacon's three categories: Memory/History, Reason/Philosophy, and Imagination/Poetry. From this *système figuré* the "encyclopaedic tree" resulted (Fig. 9.2).

Its origins go back to the Middle Ages and Ramon Llull's *Arbor scientiae* (1296–1297), a work that sought to cover the sum of human knowledge – an *Encyclopedia generalis et ultima* (Fig. 9.3).

The will to an encyclopaedia invariably coincides with the will to systems, and the notion of a tree is the outcome; to be more precise, in Llull's case the idea of 16 trees, from *Arbor exemplificalis* to *Arbor quaestionalis* and finally *Arbor caelestialis*. Here Llull developed the method of deduction both for philosophy and theology (Fig. 9.4).

In his *Advancement of Learning* (1605) Francis Bacon abandoned the method of logical deduction. His trees of knowledge represent an empirical "induction," an inductive epistemology, which consists in extracting speculatively general properties from a random collection of facts. Bacon puts an end to the Renaissance belief in correspondences between the logic of thought and the order of things. Hence he creates tableau-like lists with prolific arborescent ramifications (Fig. 9.5).

In his book Bacon divided up "human learning" according to types of "human understanding" into the triad of memory, imagination, and reason. "But because the distributions and partitions of knowledge are not like several lines that meet in one angle, and so touch but in a point; but are like branches of a tree that meet in a stem which hath a dimension and quantity of entireness and continuance, before it comes to discontinue and break itself into arms and boughs; therefore it is good, before we enter into former distribution, to erect and constitute one universal science, by the

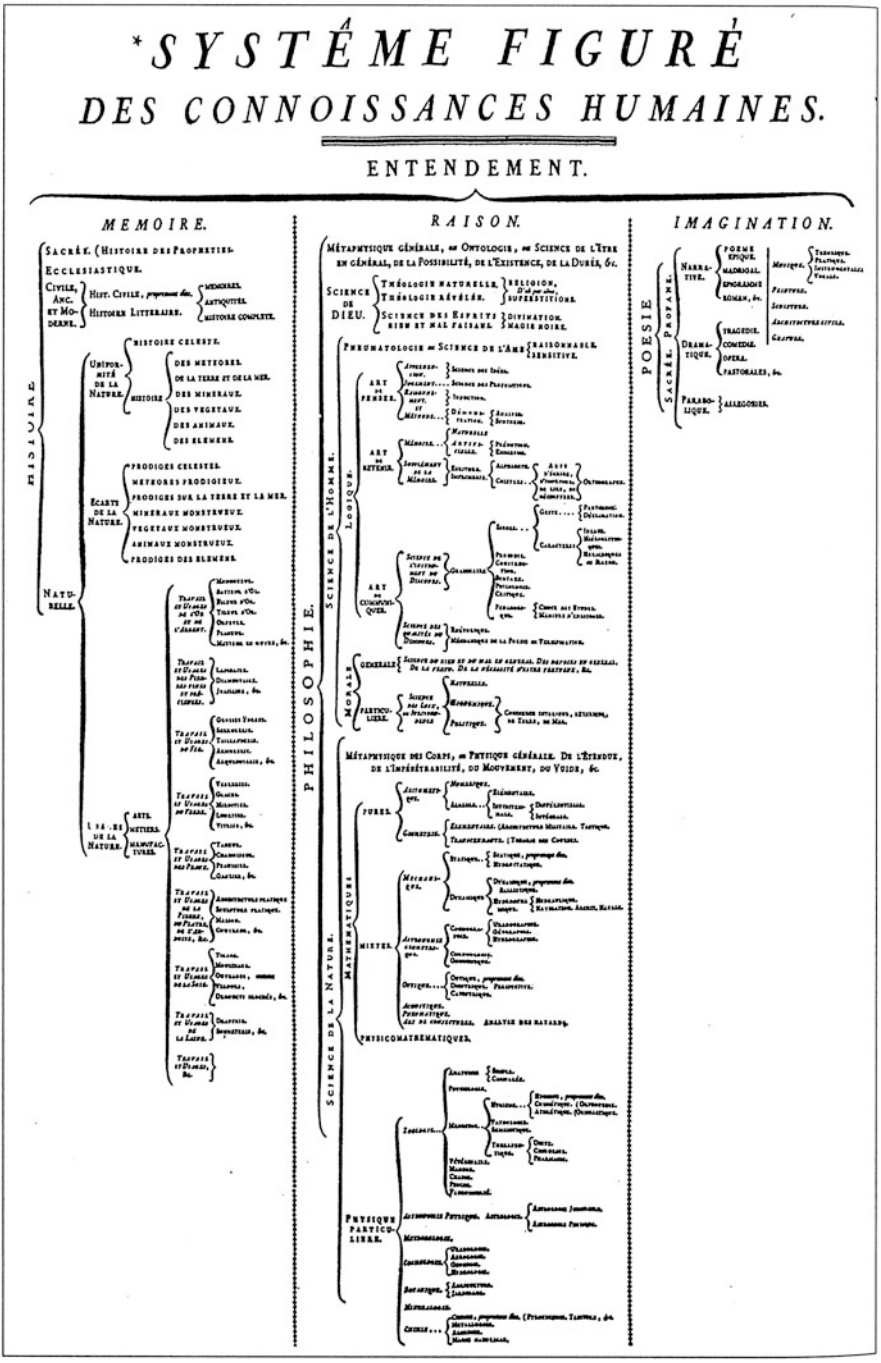

Fig. 9.2 *Système figuré des connoissances humaines, Encyclopédie*, 1751

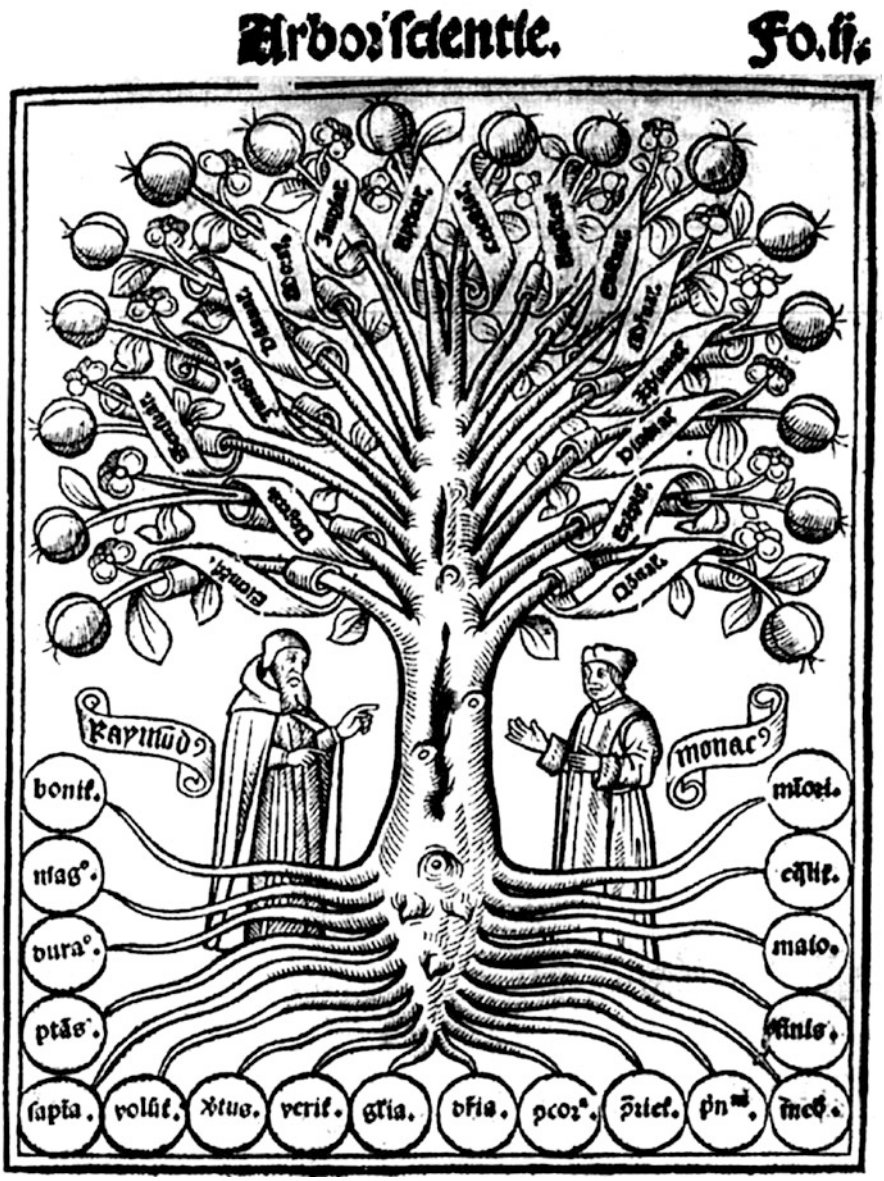

Fig. 9.3 Ramon Llull, frontispiece to the treatise *Arbor scientiae*, 1515, woodcut

name 'Philosophia Prima,' Primitive or Summary Philosophy, as the main and common way, before we come where the ways part and divide themselves."[6] On the other hand, in *Les Principes de la philosophie* (*Principia philosophiae*) (1644)

[6] Bacon (1605).

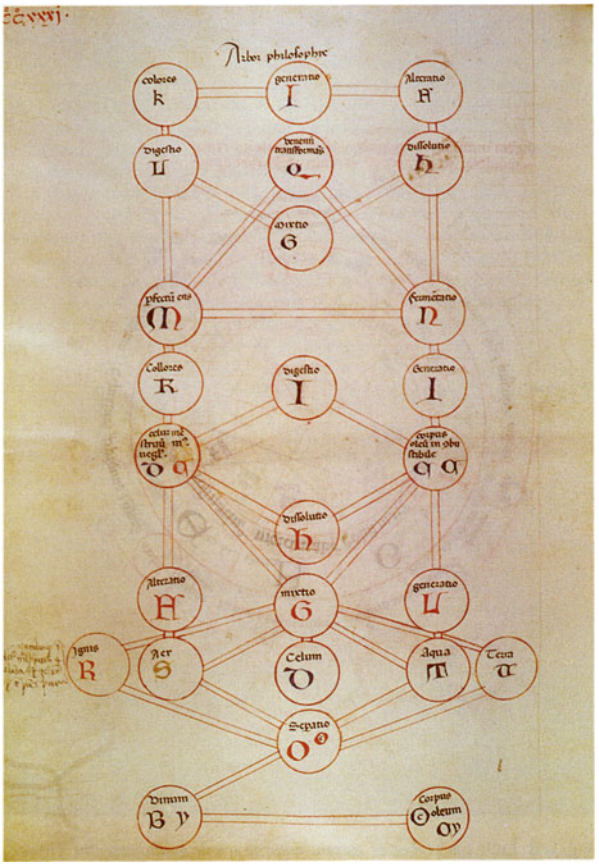

Fig. 9.4 Ramon Llull, *Arbor philosophiae*, fifteenth century, in: *Liber de secretis naturae seu de quinta essentia*, Florence, Biblioteca Nationale Centrale, Ms. BR 52, F. 181v

Descartes searched deductively for the origins of all knowledge and its principles, but retained the motif of the tree. "Thus, all Philosophy is like a tree, of which Metaphysics is the root, Physics the trunk, and all the other sciences the branches that grow out of this trunk, which are reduced to three principal, namely, Medicine, Mechanics, and Ethics. By the science of Morals, I understand the highest and most perfect which, presupposing an entire knowledge of the other sciences, is the last degree of wisdom. But as it is not from the roots or the trunks of trees that we gather the fruit, but only from the extremities of their branches, so the principal utility of philosophy depends on the separate uses of its parts, which we can only learn last of all."[7] In an illustration based on Descartes we see metaphysics represented as the root of all developments in knowledge. Mechanics, and likewise medicine, are merely subsciences.

[7] Descartes (1644).

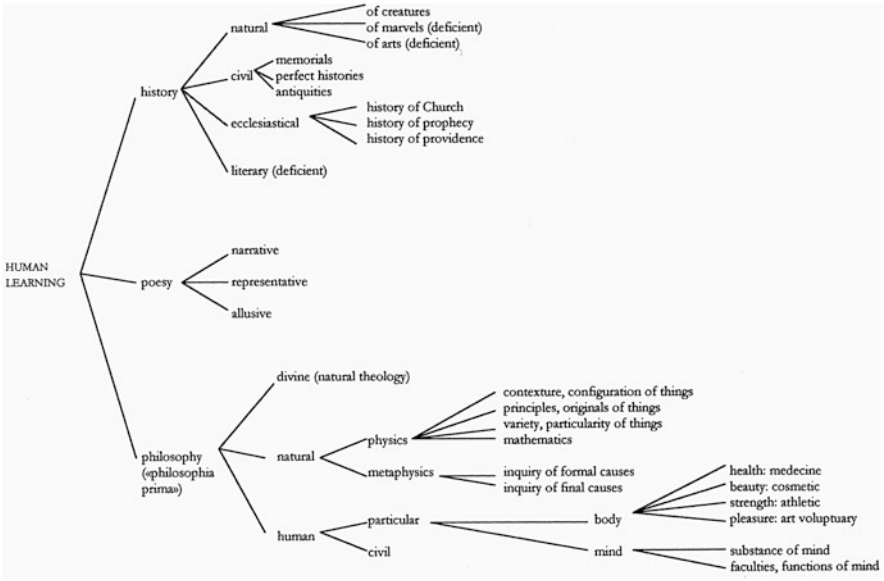

Fig. 9.5 Francis Bacon, *The Advancement of Learning: Divisions of learning*, 1605, graphical representation by Simone Roggenbuck, *Die Wiederkehr der Bilder. Arboreszenz und Raster in der interdisziplinären Geschichte der Sprachwissenschaft*, Gunter Narr Verlag, Tübingen, 2005, p. 128

The apex of the classification of knowledge was reached by the Encyclopaedia project, for example, by d'Alembert in his *Essai sur les éléments de philosophie* (1759) (Fig. 9.6).[8]

Notwithstanding, the tree metaphor also appears occasionally in this work. The Preliminary Discourse to the Encyclopédie starts programmatically with the *Arbre encyclopédique*. "[. . .] it remains for us only to make a genealogical or encyclopedic tree which will gather the various branches of knowledge together under a single point of view and will serve to indicate their origin and their relationships to one another."[9] However, Diderot and d'Alembert appear to have had their doubts about the correctness of the tree metaphor: "We will explain in a moment the use to which that tree may be put according to our claims, but the execution itself is not without difficulty. Although the philosophical history we have just given of the origins of our ideas is very useful in facilitating such a work, it should not be thought that the encyclopedic tree ought to be, or even can be, slavishly subject to that history. The general system of the sciences and the arts is a sort of labyrinth, a tortuous road which the intellect enters without quite knowing what direction to take."[10] Saint-Simon also constructed an encyclopedia in the form of a tree around 1810 (Fig. 9.7).

[8] D'Alembert (1759).

[9] Diderot and D'Alembert (1751).

[10] ibid.

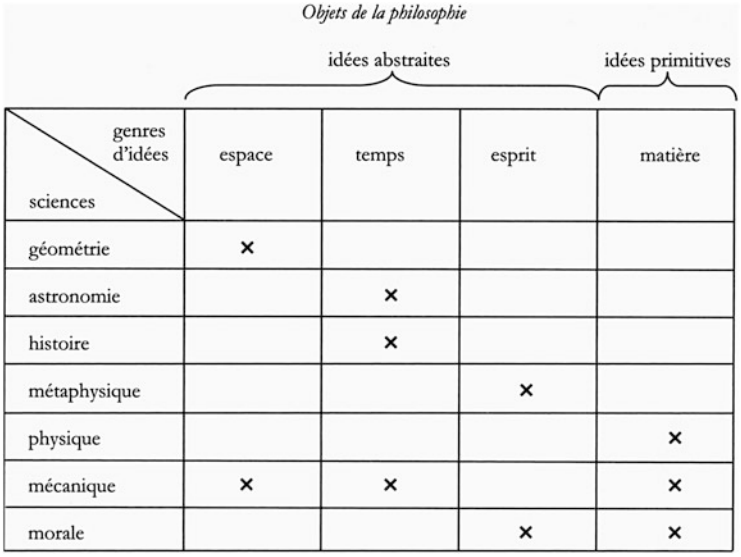

Fig. 9.6 Jean le Rond D'Alembert, *Objets de la philosophie*, 1759, graphical representation by Simone Roggenbuck, *Die Wiederkehr der Bilder. Arboreszenz und Raster in der interdisziplinären Geschichte der Sprachwissenschaft*, Gunter Narr Verlag, Tübingen, 2005, p. 145

From the branches of knowledge in the Middle Ages and the Renaissance we arrive at the depictions of knowledge in the age of Neoclassicism as grid-patterned tableaus. The overtaking of metaphysics by physics, the sidelining of theology's leading role, and the changeover from similarity to difference as a category of generating knowledge had metamorphosed the tree into a tableau; for example, Gottfried Wilhelm Leibniz in his *Nouveau Essais sur l'entendement humain* (1704/1765) divides the world into three "provinces of understanding." The idea of a common origin had given way to the concept of parallel worlds of truth.

9.3 Family Trees of Art

Art took over the tree-like genealogy from biology, linguistics, and epistemology. Contexts within art history were also depicted in the arborescent structure of a tree (Fig. 9.8).

Painters, too, elaborated their work genealogically, for example, Paul Signac,[11] Heinz Mack (Fig. 9.9), and Ad Reinhardt. Modern art, in particular, sought to represent itself as historical by developing genealogical trees. The most famous of these is the tree by Alfred H. Barr, founder of the Museum of Modern Art,

[11] Signac (1911).

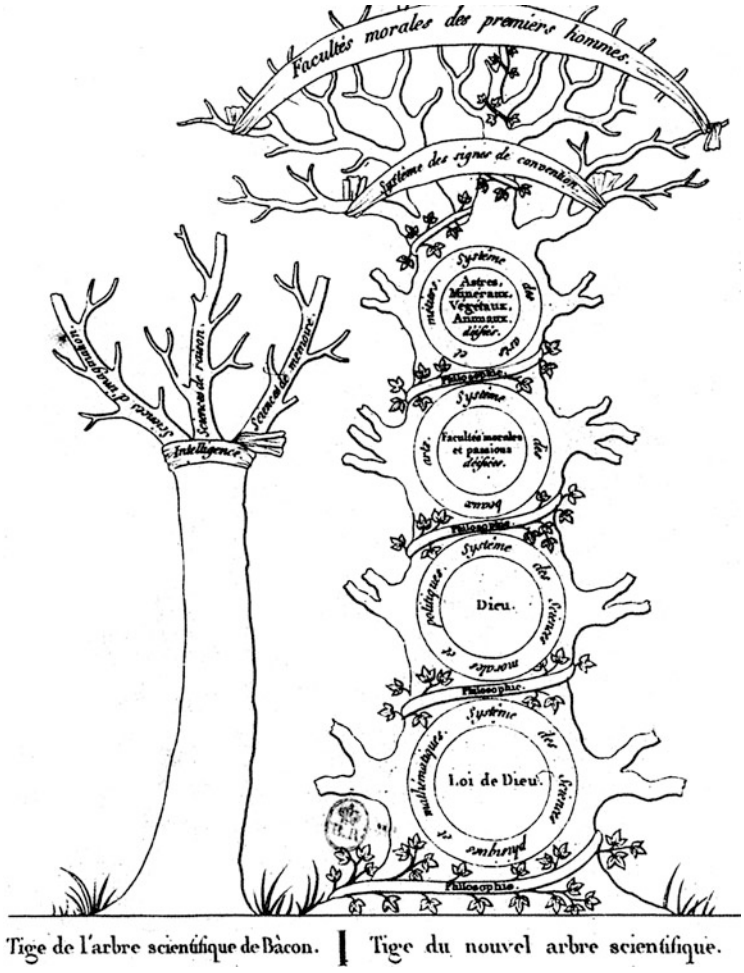

Fig. 9.7 Saint-Simon, *Esquisse d'une nouvelle encyclopédie, ou Introduction á la philosophie du dix-neuvième siecle; ouvrage dédié aux penseurs*, Paris, ca. 1810, p. 9

New York, which depicts the evolution of styles in art from 1890 to 1935 (Fig. 9.10).

The tree metaphor had become as important for the contemporary discipline of art history as it had been in the past for science. From the perspective of noesis art lags behind science. Contemporary art also includes further developments of the tree metaphor (see, for example, the works by George Maciunas (Fig. 9.11) and Ben Vautier).

From the knowledge tree of Savonarola (Fig. 9.12) to the art tree of Maciunas we can trace the transformation of knowledge. Whereas from Llull to the Encyclopédistes the tree had served as a metaphor to encompass the entire knowledge of humankind at the time (Roland Schaer, ed., *Tout le savoir du monde*, 1996),

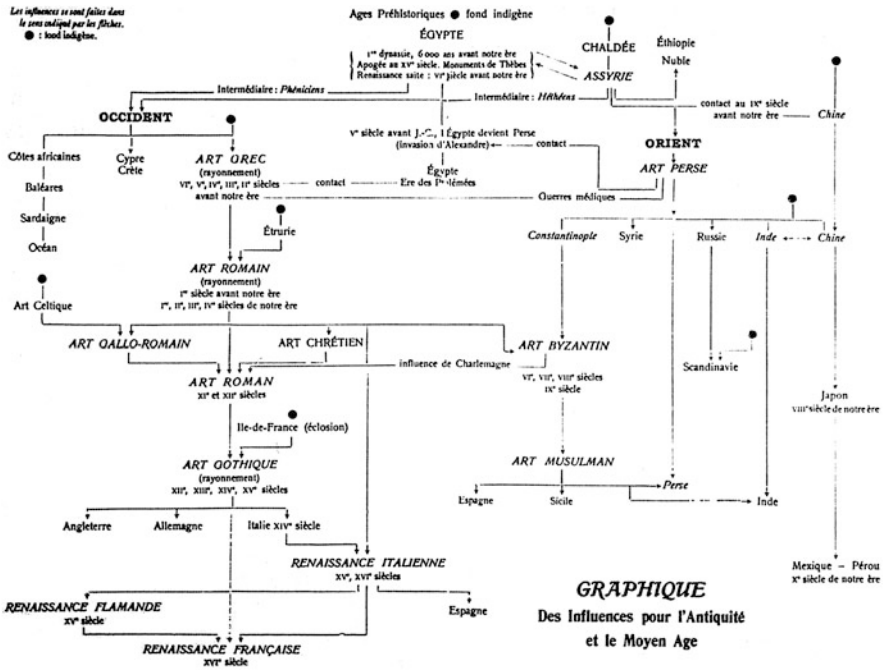

Fig. 9.8 *Diagram of the influences on Antiquity and the Middle Ages*, 1911, in: Joseph Gauthier, *Graphique d'histoire de l'art*, Paris, 1911, p. 242f

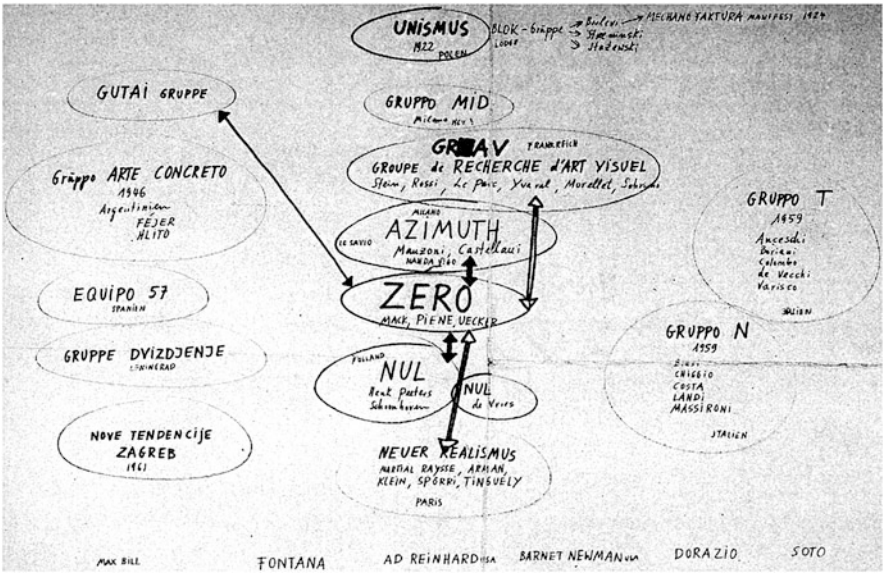

Fig. 9.9 Heinz Mack, *Kunsthistorisches Diagramm* [diagram of art history], 1970, felt pen on paper, 50 × 65 cm

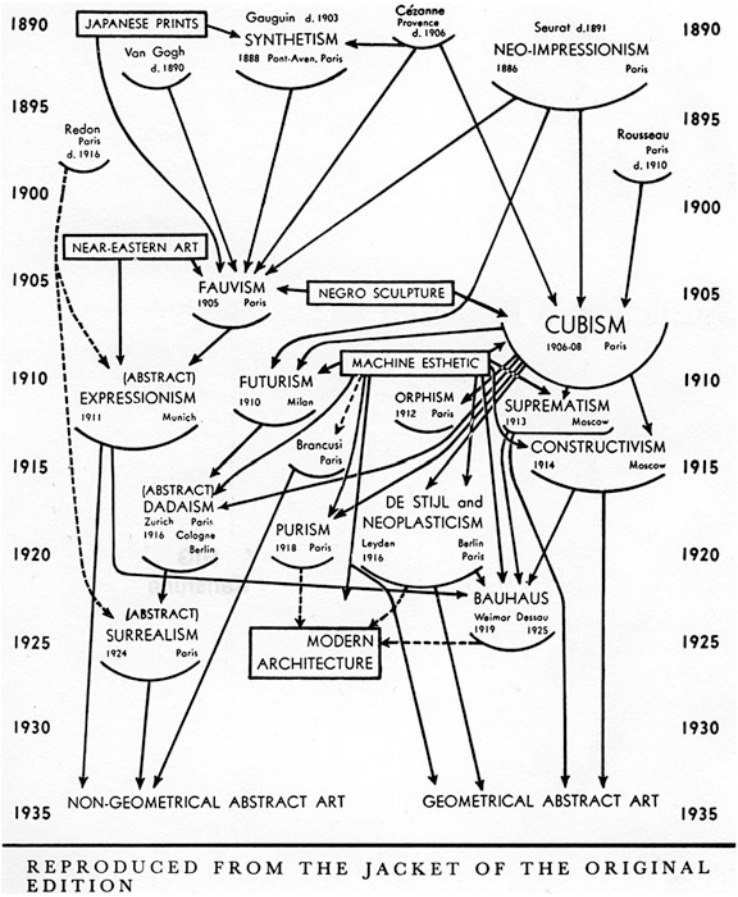

Fig. 9.10 Alfred H. Barr, *Diagram of Stylistic Evolution from 1890 until 1935,* 1936, exhibition catalog, The Museum of Modern Art New York

in art it merely served the art production of a particular epoch as legitimation on the basis of its derivation. In the same way that monarchies derive their claims to inheritance genealogically through blood relationships, artists seek legitimacy for their work *a posteriori* by citing their precursors. Here the tree does not start at the roots but at the leaves. The artists understand themselves as a new leaf on the tree of art and attempt to cobble together retrospectively a new tree from the history of art by seeking the roots of their art in precursors of their choice. It's not a tree of knowledge any more, not an *Arbor scientiae*, not a tree of wisdom; it's an *Arbor artis* – a purpose-built tree of self-justification. The genealogical theory of descent through bloodlines, of noble lineages, of the aristocracy, makes a covert comeback in art genealogies. The field of art is not depicted in taxonomies or tableaus, but in genealogies because in modernity justification, a foundation, is lacking *per se*. This is the reason why a pseudo-foundation is constructed by means of a dichotomous

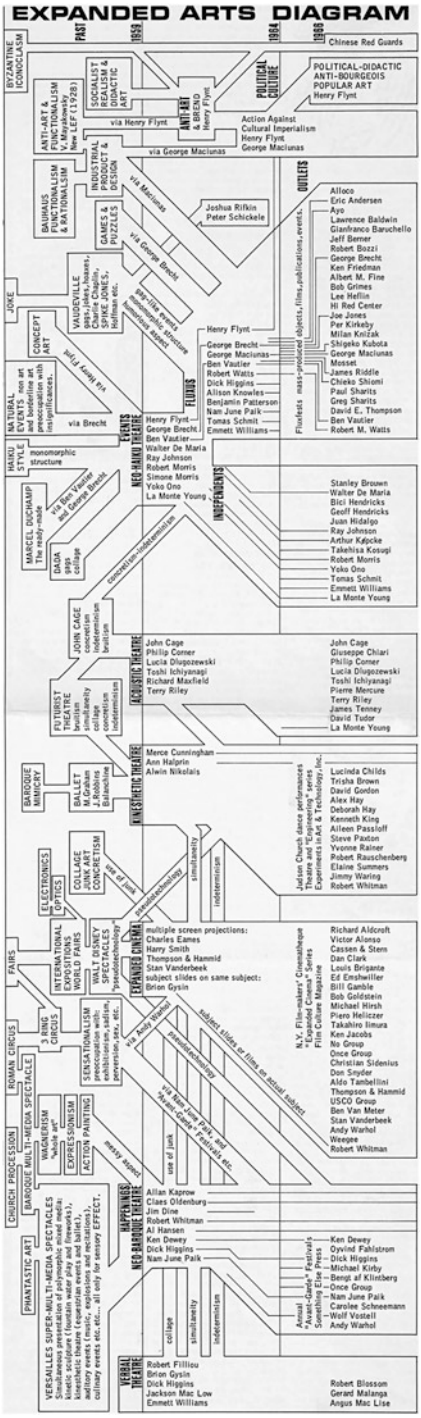

Fig. 9.11 George Maciunas, *Expanded Arts Diagram*, in: *Fluxfest Sale*, New York, 1966, The Gilbert and Lila Silverman Fluxus Collection, Detroit

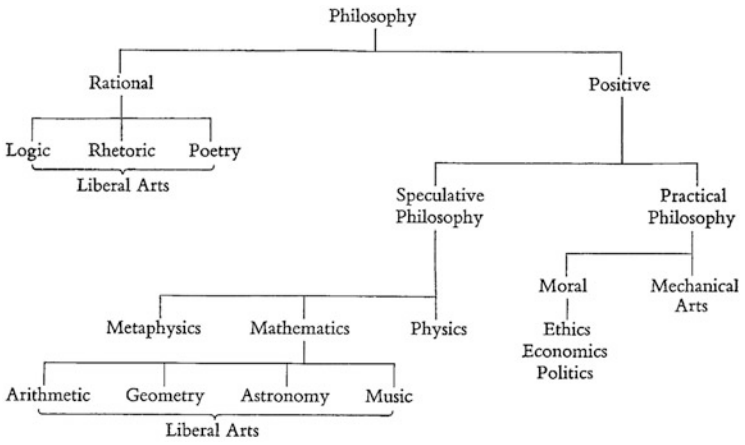

Fig. 9.12 Girolamo Savonarola, *Tree of Knowledge*, ca. 1492

tree of genealogy. Taxonomy (from Greek τάξις *táxis*, arrangement, and νόμος *nómia*, distribution) employs a standard procedure to define groups, or taxa, on the basis of shared characteristics. Taxonomies are of great importance for scientific advance because they simplify dealing with individuals and enable summary statements that, in some cases, can even lead to explanations of causal relations. Knowledge dwindles the less that is derived taxonomically, and the more that genealogical trees sprout in art. The family trees of art are pseudo-trees of knowledge. Their noetic gain is virtually zero. This is a reversion to pre-medieval times. It is not a coincidence that, before he described Modern art genealogically, Alfred H. Barr was a medievalist. The genealogical tree of art is not encyclopaedic, that is, as inclusive as possible, but the opposite: exclusive. Whoever is not a branch on the family tree of art, is not a part of art. Thus, through their pseudo-genealogy the trees of art serve the principle of exclusion. Precisely that which Karl Popper and the Evangelist wanted, namely, to establish criteria that would distinguish between science and pseudo-science, between doctrine and heterodoxy, Barr and his colleagues have watered down. Using their genealogy it is now very difficult to differentiate between art and pseudo-art, between statements and spurious statements. Their genealogical method of excluding some and not others effectively hampers any verification or falsification. In this way the door was thrown open to undesirable developments in art. It was precisely this that turned art into a copyshop where errors were copied over because defining criteria legitimized by scholarship were lacking. In place of such criteria genealogical criteria of exclusion were established. Everything that arises from the family trees created by art historians or artists characterized by Eurocentrism is art, and that which is art is *per se* good art. In this way the art of the twentieth century broke away from the tree of knowledge, which Leonardo had claimed for art in the first sentence of his *Trattato della pittura* (1270): “Se la pittura è scienza o no.”

9.4 New Trees of Knowledge

A maxim in the Bible is "By their deeds you will know them" (John 2:1–6; Matthew 7:16). Understanding and acting are linked here. This is one of the first instances of the idea that action can potentially be a noetic instrument, a tool of knowing. Truth is not revealed in words but in deeds. Deeds become a medium for differentiating, understanding, knowing. The act, the deed becomes a criterion of truth.

The author, or authors, of the Gospel apparently sought to measure the teachings of Jesus Christ by the degree to which his followers put these into practice in their own acts and deeds. If the teachings had no consequences for everyday life then they made no sense and were a false doctrine. The theory of the doctrine, or rather the doctrine of the theory is tested and verified by actions. This is what "By their deeds you will know them" means. Even religion invokes the scientific method of verification. The deeds verify the theory. Surprisingly, we find the Christian doctrine of the New Testament moving closer to the method or the scientific theory of critical rationalism. For acts and deeds can verify or falsify religious faith. It is not coincidental that the saying contains the word "know." According to the Evangelist, religion is a theory of knowledge, and the truth content of this theory of knowledge is verified by acts and deeds.

Now, who would have thought that the Christian religion is a version of critical rationalism, and Matthew and John are precursors of Karl R. Popper? Around 1920 Popper was exploring the question of whether there is a precise criterion for distinguishing between science and pseudo-science (to which astrology and psychoanalysis belonged in his view). In a similar way the Evangelist sought a criterion to distinguish between the true doctrine of Christ and false doctrines. How can a statement be disqualified as unscientific or heterodox? The problem of making distinctions, or demarcation, was solved empirically by the Evangelist by saying that the claim to truth of the teachings can be known by observing the deeds to which they give rise. Popper's concern was the propositions of metaphysical philosophy, which in his view made no scientific sense. For the members of the philosophical school of the Vienna Circle the problem of demarcation was bound up with the problem of induction. In induction, knowledge is what is extracted from observation data using inductive methods. According to this, a proposition is scientific if a condition for its truth can be advanced that is evaluable by empirical means (observations, measurements) in order that the statement may be verified. Popper entirely rejected this and held that induction has no place in the logic of science because, in his view, theories cannot be falsified or verified on principle – even incorrect theories can produce some conclusions that are correct. Hypotheses can only be disproved or falsified through empirical facts but never reinforced: "it must be possible for an empirical scientific system to be refuted by experience".[12] Thus statements cannot be falsified or verified. With the criterion of demarcation Popper sought to provide falsifiability with a rational and objective, that is,

[12] Popper (1935).

intersubjectively verifiable, instrument. The concern of the Evangelist was to make the failure of false doctrines recognizable in experiences and deeds; that is, he also wanted to provide an intersubjectively verifiable, rational, and objective instrument with which, paradoxically, faith might also be falsified. Clearly, not only scientific statements but also statements of faith can be falsified.

For taking hold of and felling in a different way the language-based tree of knowledge, the tree as a metaphor for genealogy, and thus the hierarchical genealogy *per se,* we are indebted to two important philosophers of the twentieth century – Gilles Deleuze and Félix Guattari. They updated extensively the metaphor of the tree, which since the Middle Ages had provided a dynamic means of arranging the fields of knowledge, in the course of critiquing, attacking, and negating it. In their negative design the idea of the genealogy-logic and the problem of demarcation also continue to play a dominant role. For in the modern digital society, which represents a new form of the knowledge society, the notion of organizing knowledge is of seminal importance. In their major work *A Thousand Plateaus* (1980) they outline a theory of the rhizome at the beginning of Volume 2. In that chapter they sacrifice the tree trunk, in other words the principle of hierarchy and of the genealogy, the definitive part of a tree (including in the metaphor of the family tree) that enables branching to occur, to trace ancestry and to legitimize descent. Deleuze and Guattari embed knowledge in a horizontal network: the subterranean roots of the tree.

Rhizome (from the Greek ῥίζωμα *rhizoma,* root) is a central concept in the philosophy of Deleuze and Guattari. It derives from the name of horizontally growing underground plant stems. In the work of Deleuze and Guattari it is a metaphor for a post-modern, or post-structuralist, model of organizing knowledge and describing the world, which replaces older, hierarchical structures as depicted by the tree metaphor. "A rhizome as subterranean stem is absolutely different from roots and radicles. Bulbs and tubers are rhizomes. Plants with roots or radicles may be rhizomorphic in other respects altogether: the question is whether plant life in its specificity is not entirely rhizomatic. [. . .] The rhizome itself assumes very diverse forms, from ramified surface extensions in all directions to concretion into bulbs and tubers."[13] The idea of the rhizome dispenses with both the genealogical and the taxonomical models. Here an organization of knowledge is put forward that is anti-descent and anti-genealogical. Eighty years after the invention of modernity, which developed and operated concealed behind the veils of genealogies, its heart is revealed.[14] Modernity is essentially an attempt to justify – if at all – each step and each phase of its development solely with breaks. The break with genealogy, the self-positing, the perpetual re-invention of the self without any legitimation, is the core of modernity. The rhizome, the abolition of the tree and the hierarchy, places its reliance on transverse and horizontal dissemination. This model of organizing knowledge, however, remains attached to the tree metaphor because it

[13] Deleuze and Guattari (2004).

[14] Baudelaire (1887).

continues to refer to roots. The tree may have been done away with, but roots still have only one raison d'être; namely, to bring forth a tree. Staying with this metaphor, the question arises: What are roots for without a tree? Obviously, no trees exist without roots, and there are no roots without trees. Notwithstanding, the rhizome model does have the advantage that it has opened a way to search for a different basis for knowledge trees, and thus it freed up the path leading to tool-based trees of knowledge.

The turn in the history of knowledge trees was in fact initiated by the Encyclopédistes of the Enlightenment by foregrounding visual representations of tools in their books. The twentieth century is actually the century of a tool revolution, not a revolution of styles and forms. The tool achieved such importance because the relationship between theory and empiricism was reversed. Theory itself became a tool. With the tool of theory, for example, with Maxwell's equations, in 1886–1888 Heinrich Hertz succeeded in demonstrating empirically the existence of the electromagnetic waves that Maxwell's theory had predicted. Tools became an instrument of noesis and theories became tools. Frank Lloyd Wright summarized this in his *Kahn Lectures* in 1931 with the formula "machinery – material – men." Using the tool of the machine humans produce new materials, and these materials, together with new machines, produce technical artifacts which are made by humans and not by nature. With the aid of tools humankind steps out of the ambit of nature. This is what led to a radical change in knowledge trees. Previously, language-based theories, from theology to philosophy, had stood at the apex of the knowledge trees, and tool-based sciences and arts lay at the base of the pyramid. Epistemology, theories of knowledge, were games with language – from Fritz Mauthner to Ludwig Wittgenstein, from Martin Heidegger to Jean-Paul Sartre, from Edmund Husserl to Niklas Luhmann. The Wittgenstein who wrote *Tractatus logico-philosophicus* (1921), who like Parmenides asserted the sameness of language and being ("A logical picture of facts is a thought"[15]; "A proposition is a picture of reality. A proposition is a model of reality as we imagine it."[16]; "Propositions *show* the logical form of reality."[17]), did a famous volte-face in his *Philosophical Investigations* (1953): under "language-game" Wittgenstein says he understands that "the *speaking* of language is part of an activity, or of a form of life."[18] Speaking becomes action. Each and every expression of language is embedded in a human practice. "I shall also call the whole, consisting of language and the actions into which it is woven, the 'language-game.'"[19] The whole of the form of life is thus an expression in language. Speech is a part of action. The exponents of language-based knowledge trees were visibly worried. They sensed that language as a model to explain the world was in crisis and so they wanted to make over language into a "speech

[15] Wittgenstein (1921).
[16] Ibid., 4.01.
[17] Ibid., 4.121.
[18] Wittgenstein (1953).
[19] ibid., § 7.

act,"[20] an activity, an action. For this reason, on the basis of this changeover of knowledge trees from the realm of words to the realm of things, they sought to build bridges. The books of the philosophers thus carried titles like *Word and Object* (Willard Van Orman Quine, 1960) or *Les mots et les choses* (Michel Foucault, 1966). The "ordinary language" philosopher John Langshaw Austin even claimed to be able to make things with words (*How to Do Things with Words*, 1962), so great was the desire to construct things with "linguistic tools," as letters and sentences were suddenly called. The language-driven disciplines wanted to be operational. That is why political philosophers, like Antonio Negri, called their work "operaism." They, too, wanted to be able to say that their texts were operations in the realm of things.

9.5 The Tool-Based Turn

The noetic turn from language-based to tool-based media in the twentieth century was most clearly signaled by Buckminster Fuller in his essay *Operating Manual for Spaceship Earth* (1968). Fuller says that the Earth is a spacecraft and humankind is its crew; the crew, however, do not have an operating manual and such a manual cannot possibly be provided by philosophers and politicians, but only by planners, architects, and engineers; that is, by toolmakers in the broadest sense. "So, planners, architects, and engineers take the initiative. Go to work, and above all cooperate and don't hold back on one another or try to gain at the expense of another. Any success in such lopsidedness will be increasingly short-lived. These are the synergetic rules that evolution is employing and trying to make clear to us. They are not man-made laws. They are the infinitely accommodative laws of the intellectual integrity governing universe."[21] The new noetic view turns the knowledge trees completely on their heads. Now it is the *Artes mecanicae*, *technê*, that stands at the top. The *epistêmês*, like rhetoric and grammar, are now at the bottom of the knowledge pyramid. The journey of the trees of knowledge from language model to model of evolution, which in the final stages spat out the family trees of art, turns around. No more is the medium of language the highest of them all; the technical arts and sciences are now the paramount medium of knowledge. Modern science has achieved its theoretical advances only on the basis of technological development. Without the ubiquitous apparatus in the laboratories of medical science and particle physics we would not have been able to create the world of today. The language-driven media have only described this modern technological world. The tool-based media have not only changed the modern world, they created it. Tool-based, not language-based noesis is the future: thus a radical reorientation is necessary. This was even described by Martin Heidegger in his essay on technology.[22]

[20] Searle (1969); Austin (1962).

[21] Fuller (1968).

[22] Heidegger (1953).

Félix Guattari also had an intuition of this. In his book *La révolution moléculaire* (1977) he went far beyond the customary mechanism and even spoke of the unconscious as a machine. A machine is to be understood as the material form of a formalization. Everything that can be formalized, for example, language, can be mechanized (Church–Turing thesis, 1936). Therefore mechanical tools are merely a continuation of the formalized mechanics of language tools (see Charles de Brosses, *Formation mécanique des langues,* 1765). The evolution from language-based to tool-based knowledge trees is, therefore, merely a logical step. But tool-based knowledge trees will rather look like rhizomatic, transversal or horizontal networks with feedback etc. than like trees. Tool-based media have expanded the world enormously. The triumphal progress of the computer demonstrates that vast areas of being, or ontology, from calculating to seeing and speaking, can be formalized, programmed, and stored. Formal operations, which can also be mechanized in machines and media, are advancing into all areas of our lives: from combinatorics of the genome to the mechanisms of molecules. After the mechanical formation of language comes the mechanical formation of life. To create the foundations of life in the twenty-first century is thus the new task of noesis. We have to take active steps to cope with the diversity of crises that can be subsumed under the term Anthropocene. That is why we need a changeover from language-based to tool-based. Should art be prepared at all to assume a noetic responsibility, it is only by moving closer to science that it will escape going down with the modernity of the twentieth century.

Translated from the German by Gloria Custance

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Chapter 10
United Micro Kingdoms: A Design Fiction (2013), Critical Design FAQ (2007)

Anthony Dunne and Fiona Raby

Abstract The United Micro Kingdoms (UmK) was a design experiment commissioned by the Design Museum, London, UK, from 1st May-31st August 2013.

Collections like the Wellcome Trust, Pitt Rivers, and London Museum hold everyday objects from past or distant societies. When we see a strange shoe or ritualistic object we wonder what kind of society must have produced it, how it was organised; what values, beliefs and dreams motivated its citizens; if it was wealthy or poor; democratic, feudal or totalitarian. We become conceptual window shoppers, trying things out in our minds, imagining how we would interact with them, use them, wear them, and how they would affect our interactions with others.

It requires a lot of imaginative effort from the viewer, but it leaves room for individual interpretation. If rather than looking back in time, we presented people with hypothetical products from alternative versions of our own society, or a near future, would people begin to relate to them in the same way—a sort of speculative material culture, fictional archeology or imaginary anthropology?

Keywords Speculative design • Design fiction • Speculative anthropology • Research 'through' Design

Picture credits: Dunne & Raby. Except for pages 179, 184 (bottom image), 186, 188, 190, 191 photographer Luke Hayes.

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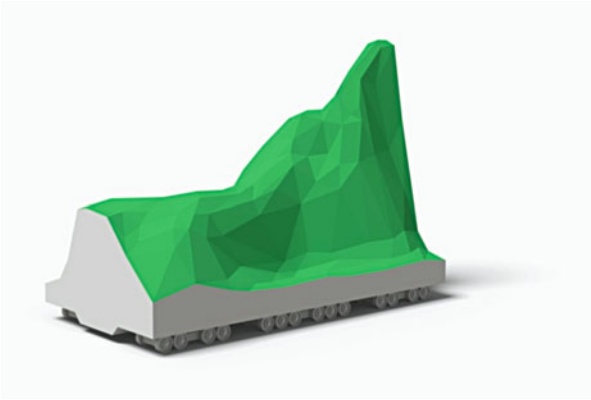


10.1 United Micro Kingdoms: A Design Fiction

We called them micro-kingdoms rather than micro-states or micro-nations suggesting they are more like fables or tales based on imagination rather than hard scenarios based on analysis and reason—somewhere between sci-fi and foresight.

Architects have long developed master plans for cities and regions but can designers contribute to these future propositions? Is it possible to talk about big ideas through small things? Would the viewer imagine the bigger world the designs belong to and move from the specific to the general?

This was our aim. To "tell worlds rather than stories," as Bruce Sterling aptly puts it.

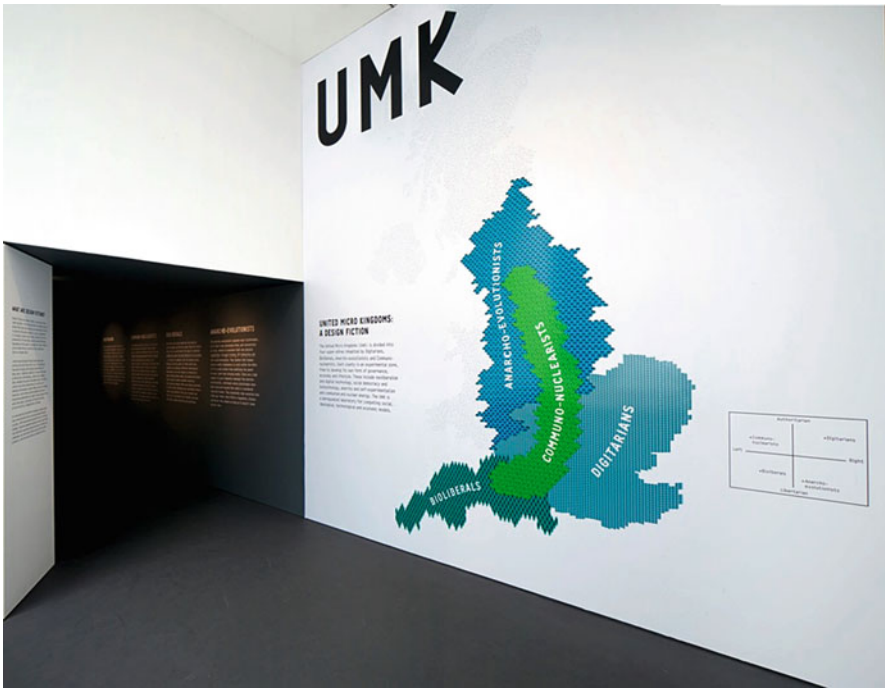
Proposals are closer to literature than social science, emphasizing imagination over practicality, they ask questions rather than provide answers. They are a playful reminder that Design is not ideologically neutral—objects and systems are inevitably shaped by the values and ideologies they sit within. To be effective, our proposals needed to contain contradictions and cognitive glitches. Rather than offering an easy way forward, they highlight dilemmas and trade-offs between imperfect alternatives. Not a solution, not a "better" way, just another way.

If our belief systems and ideas don't change, then reality won't change either.

10.2 The United Micro Kingdoms (UmK)

The United Micro Kingdoms (UmK) is divided into four super-shires inhabited by Digitarians, Bioliberals, Anarcho-evolutionists and Communo-nuclearists. Each county is an experimental zone, free to develop its own form of governance,

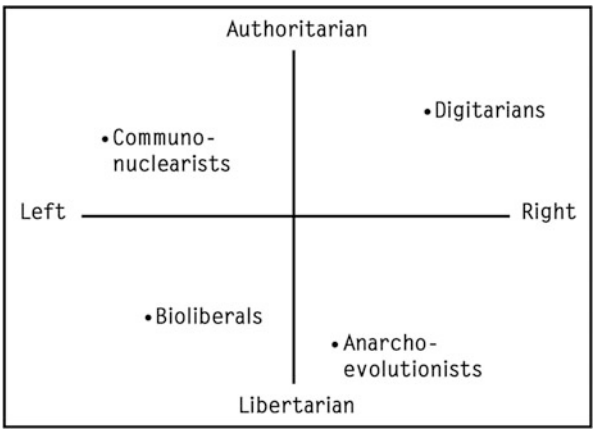
economy and lifestyle. These include neoliberalism and digital technology, social democracy and biotechnology, anarchy and self-experimentation and communism and nuclear energy. The UmK is a deregulated laboratory for competing social, ideological, technological and economic models.



The United Micro Kingdoms was a commission from Deyan Sudjic, Director of the Design Museum London, and was presented as an exhibition between 1st May-26th August 2013.

10.3 The Digitarians

Digitarians depend on digital technology and all its implicit totalitarianism—tagging, metrics, total surveillance, tracking, data logging and 100 % transparency. Their society is organised entirely by market forces; citizen and consumer are the same. For them, nature is there to be used up as necessary. They are governed by technocrats, or algorithms—no one is entirely sure, or even cares—as long as everything runs smoothly and people are presented with choices, even if illusionary. It is the most dystopian, yet familiar of all the micro kingdoms.



10.4 Digicars

The Digicar is a development of electric self-drive cars being pioneered today. The car has evolved from being a vehicle for navigating space and time, to being an interface for navigating tariffs and markets. Every square metre of road surface and every millisecond of access, at any moment, is monetized and optimised. Passengers are required to stand to minimise the vehicle's footprint, and are happier to communicate virtually with distant friends than fellow commuters.

Digicar types:

Single unit

Small footprint, forward facing, inclusive drop-off priority, maximum privacy

Two person unit

Forward facing, 2 level drop-off priority surcharge, enhanced privacy

Two person unit

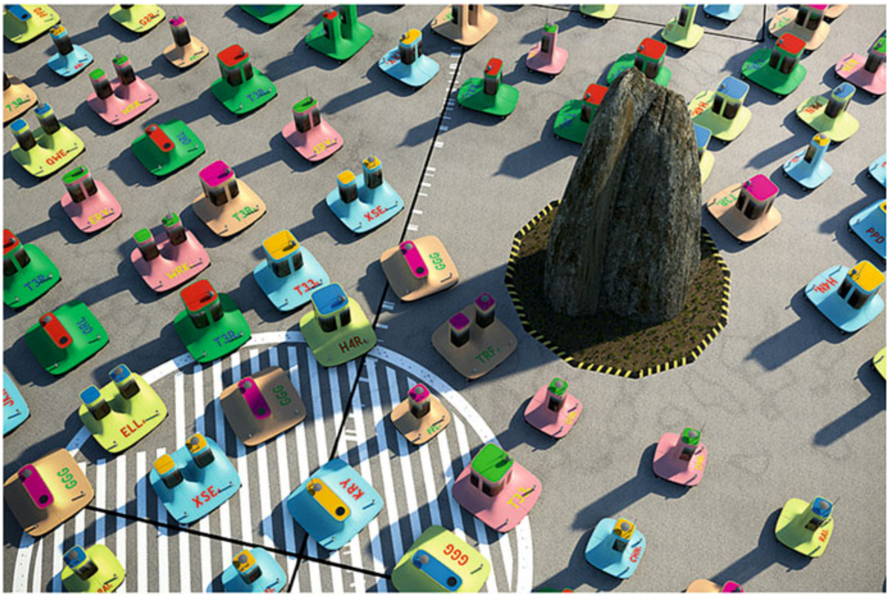
Side facing, 2 level drop-off priority surcharge, standard privacy

Four person unit

Front or back facing, 4 level drop-off priority surcharge, standard privacy

Sleeper unit

Maximum comfort, inclusive drop-off priority, maximum privacy



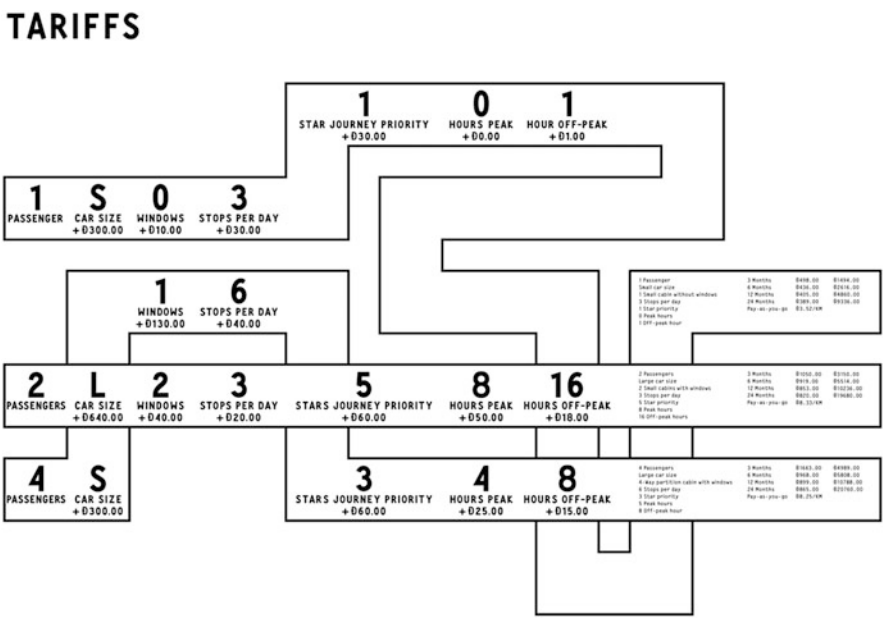
Today, self-drive cars are presented as social spaces for relaxing commutes, but Digicars are closer to economy airlines, offering the most basic, but humane experience. It is essentially an appliance, or computer, constantly calculating the best, most economic route.

Digiland is made of vast, never - ending planes of tarmac.

A cross between airport runways, sports fields and car parks, dense with markings that no human can decode. A landscape exclusively designed for machines.

10.5 Tariff Chart

Roads are owned by the state, but companies bulk-buy access and offer it to their customers in the same way that today's energy suppliers operate, or the way telecoms companies manage their mobile phone tariffs.



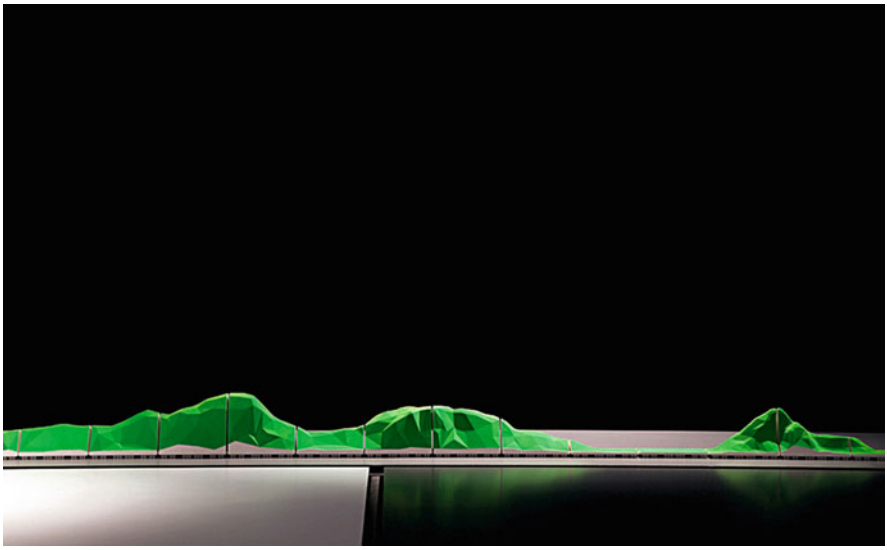
Power and speed are replaced by footprint and privacy – how much space you take up and whether it is shared or not. There are also priority tariffs, and options for sharing journeys whilst maintaining privacy. Tariffs are calculated according to a P5 Index: price, pace, proxemics, priority and privacy.

10.6 The Communo-nuclearists

The Communo-nuclearist society is a no-growth, limited population experiment. Using nuclear power to deliver near limitless energy, the state provides everything needed for their continued survival. Although they are energy rich it comes at a price—no one wants to live near them. Under constant threat of attack or accident, they live on a continually moving, 3 km, nuclear-powered mobile landscape. Consequently, they are organised as a highly disciplined mobile micro-state. Fully centralised, everything is planned and regulated. They are voluntary prisoners of pleasure, free from the pressures of daily survival, communists sharing in luxury not poverty. Like a popular night club there is a one-out one-in policy, but for life.

10.6.1 Train

The train is comprised of 75 carriages, each measuring 40 m in length by 20 m in width. Straddling two sets of 3 m wide tracks, it travels at 4 miles per hour, and never stops. Inhabitants live inside the mountain carriages which also contain labs, factories, hydroponic gardens, gyms, dorms, kitchens, nightclubs and everything else they need. On the mountains are swimming pools, fish farms, and bookable huts for periods of isolation. The environment surrounding the tracks, like a demilitarised zone has become a natural paradise, a wilderness to be enjoyed by nature-loving Communo-nuclearists from the safety of their train.



Carriages 2, 3: Nuclear Reactor
Carriage 5: Swimming Pool
Carriage 7, 8, 9, 10: Bookable Isolation Cabins
Carriage 23, 23: Wildlife Club Facilities and Bird Watching Tower
Carriage 26: Wild Flower and Garden Pool
Carriage 35, 36: Laboratories
Carriage 38, 39, 40: Living Quarters
Carriage 43, 44: Auditorium
Carriage 60: Fish Farm
Carriage 63: Hydroponic Farm
Carriage 69, 70: Living Quarters

10.7 The Bioliberals

Bioliberals are social democrats who embrace biotechnology and the new values that this entails. They live in a world where the hype of synthetic biology has come true and delivered on its promises—a society in symbiosis with the natural world. Biology is at the centre of their world-view, leading to a radically different technological landscape to our own. Nature is enhanced to meet growing human needs, but people also adjust their needs to match available resources. Each person produces their own energy according to their needs. Bioliberals are essentially farmers, cooks and gardeners. Not just of plants and food, but of products too. Gardens, kitchens and farms replace factories and workshops.

10.7.1 Bio-cars

Bioliberals regard the use of huge amounts of energy to overcome gravity and wind resistance to be counterproductive and primitive. Faster is no longer better. People travel in extremely light organically grown vehicles, each customised to its owner's dimensions and needs.

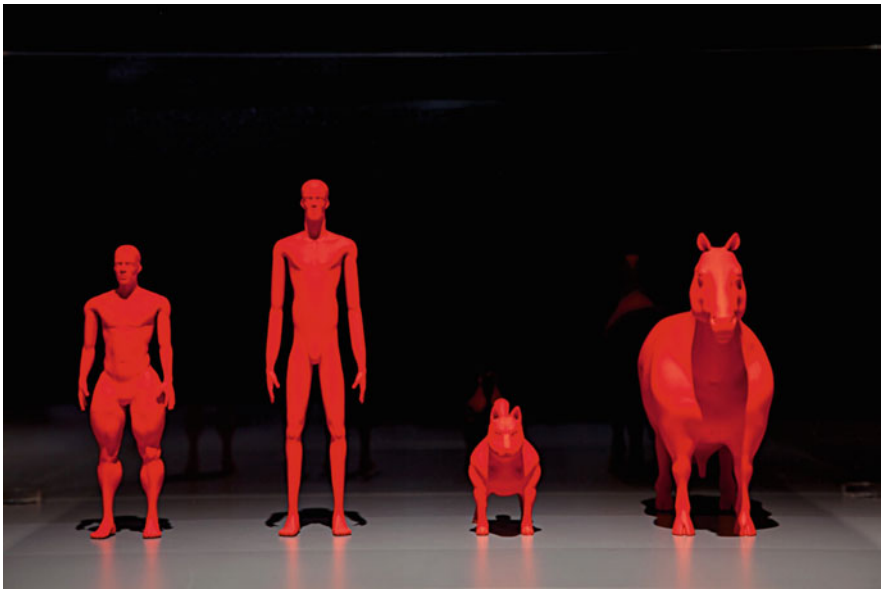
The bioliberal car combines two technologies: anaerobic digesters that produce gas, and fuel cells that use the gas to produce electricity. Bags of uncompressed gas cannot compete with the efficiency of fossil fuels, a fuel based on millions of years of preparation compared to one that takes hours or days. The resulting cars are bulky, messy, smelly, and made of artificial lab-grown skin, bone and muscle, not literally, but in abstracted forms. Wheels, for example, are powered individually using jelly-like artificial muscles.

10.8 The Anarcho-evolutionists

The Anarcho-evolutionists abandon most technologies, or at least stop developing them, and concentrate on using science to maximise their own physical capabilities through training, DIY biohacking and self-experimentation. They believe that humans should modify themselves to exist within the limits of the planet rather than modifying the planet to meet their ever growing needs. There are a high number of post-humanists amongst the Anarcho-evolutionists, individuals whose physiologies have been improved beyond that which is considered naturally human. They essentially take evolution into their own hands. Very little is regulated, citizens can do as they please as long as it doesn't harm anyone else.

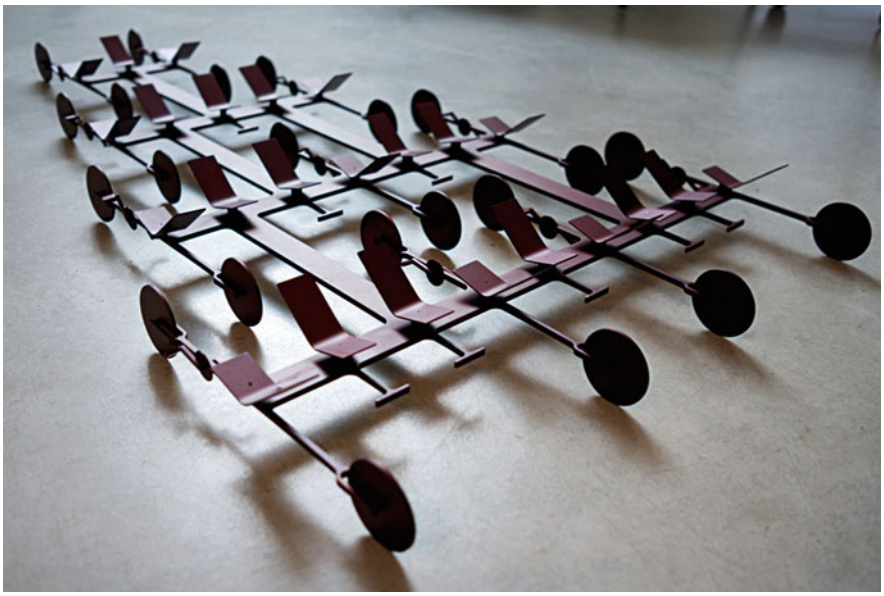
10.8.1 Cyclist, Balloonist, Pitsky and Hox

The family or clan is the most important social unit. Families evolve around particular forms of transport using a combination of genetic modification, training and the passing down of knowledge and skills from generation to generation. A distinctive physique is associated with each clan, and is a matter of pride. Cyclists have well developed thighs, while Balloonists are tall and willowy and so on. As well as modifying themselves, Anarcho-evolutionists have developed new forms of animal to satisfy their needs. The Hox is a mix of horse and ox, a hybrid animal bred to move heavy loads and pull carriages, while the Pitsky is a combination of pit bull terrier and husky, designed for pulling smaller loads and personal protection.



10.8.2 Very Large Bike (VLB)

The Anarcho-evolutionist's world is a world without cars. Their transport is either human, wind or (genetically modified) animal powered. The vehicles are designed around the principle of organisation without hierarchy and embody their social order and values. Sociability and co-operation are more important than speed and competitiveness.



The Anarcho-evolutionists travel in groups, each doing what they are best at, and each is responsible for a bit of the vehicle. The Very Large Bike (VLB) is designed for travelling long distances in groups, pooling effort and resources. Travelling on abandoned motorways, it is gently steered by leaning, each person knowing from experience and practice just how much is required of them. While the elderly, young and weak are not able to pedal and are carried along by the others, their role is that of expert singers and story tellers, providing entertainment and motivation to the others.

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Critical Design FAQ (Dunne & Raby 2007)

1. What is Critical Design?
   Critical Design uses speculative design proposals to challenge narrow assumptions, preconceptions and givens about the role products play in everyday life. It is more of an attitude than anything else, a position rather than a method. There are many people doing this who have never heard of the term critical design and who have their own way of describing what they do. Naming it Critical Design is simply a useful way of making this activity more visible and subject to discussion and debate.

   Its opposite is affirmative design: design that reinforces the status quo.
2. Where did it come from?
   Design as critique has existed before under several guises. Italian Radical Design of the 1970s was highly critical of prevailing social values and design ideologies, critical design builds on this attitude and extends it into today's world.

   During the 1990s there was a general move towards conceptual design which made it easier for noncommercial forms of design like critical design to exist, this happened mainly in the furniture world, product design is still conservative and closely linked to the mass market.

   The term Critical Design was first used in Anthony Dunne's book Hertzian Tales (1999) and later in Design Noir (2001). Since then many other people have developed their own variations.
3. Who does it?
   Dunne & Raby and their graduate students from Design Interactions, Royal College of Art (RCA) such as James Auger, Elio Caccavale and Noam Toran, are probably the most well known, (Revital Cohen/Tuur van Balen, Tobias Revell, Anab Jain are a new generation creating their own interpretation) but there are other designers working in a similar way who would not describe what they do as critical design: Krzysztof Wodiczko, Natalie Jeremijenko, Jurgen Bey, Marti Guixe . . .

4. What is it for?
   Mainly to make us think. But also raising awareness, exposing assumptions, provoking action, sparking debate, even entertaining in an intellectual sort of way, like literature or film.
5. Why is it happening now?
   The world we live in today is incredibly complex, our social relations, desires, fantasies, hopes and fears are very different from those at the beginning of the 20c. Yet many key ideas informing mainstream design stem form the early 20c.

   Society has moved on but design has not, Critical Design is one of many mutations design is undergoing in an effort to remain relevant to the complex technological, political, economic and social changes we are experiencing at the beginning of the 21c.
6. What role does humour play?
   Humour is important but often misused. Satire is the goal. But often only parody and pastiche are achieved. These reduce the effectiveness in a number of ways. They are lazy and borrow existing formats, and they signal too clearly that it is ironic and so relieve some burden from the viewer. The viewer should experience a dilemma, is it serious or not? Real or not? For Critical Design to be successful they need to make up their own mind.

   Also, it would be very easy to preach, a skilful use of satire and irony can engage the audience in a more constructive away by appealing to its imagination as well as engaging the intellect. Good political comedians achieve this well. Deadpan and black humour work best.
7. Is it a movement?
   No. It's not really a field that can be neatly defined. It's more about values and an attitude, a way of looking at design and imagining its possibilities beyond the narrow definitions of what is presented through media and in the shops.
8. What are its main relatives?
   Activism
   Cautionary Tales
   Conceptual Design
   Contestable Futures
   Design Fiction
   Interrogative Design
   Radical Design
   Satire
   Social Fiction
   Speculative Design
9. What are the biggest misconceptions?
   That it is negative and anti-everything.
   That it is only commentary and cannot change anything
   That it is jokey
   That it is not concerned with aesthetics
   That it is against mass-production
   That it is pessimistic
   That it is not real
   That it is art

10. But isn't it art?
    It is definitely not art. It might borrow heavily from art in terms of methods and approaches but that's it. We expect art to be shocking and extreme. Critical Design needs to be closer to the everyday, that's where its power to disturb comes from. Too weird and it will be dismissed as art, too normal and it will be effortlessly assimilated. If it is regarded as art it is easier to deal with, but if it remains as design it is more disturbing, it suggests that the everyday as we know it could be different, that things could change.
11. Isn't it a bit dark?
    Yes, but not for the sake of it. Dark, complex emotions are ignored in design, nearly every other area of culture accepts people are complex, contradictory and even neurotic, but not design, we view people as obedient and predictable users and consumers.

    One of Critical Design's roles is to question the limited range of emotional and psychological experiences offered through designed products. Design is assumed to only make things nice, it's as though all designers have taken an unspoken Hippocratic oath, this limits and prevents us from fully engaging with and designing for the complexities of human nature which of course is not always nice. It is more about the positive use of negativity, not negativity for its own sake, but to draw attention to a scary possibility in the form of a cautionary tale.
12. And its future?
    A danger for critical design is that it ends up as a form of sophisticated design entertainment: 90 % humour 10 % critique. It needs to avoid this situation by identifying and engaging with complex and challenging issues. Areas like Future Forecasting would benefit from its more gritty view of human nature and ability to make abstract issues tangible. It could also play a role in public debates about the social, cultural and ethical impact on everyday life of emerging and future technologies.

UMK Project References

The Communo-Nuclearists

A online discussion about the feasibility of a nuclear powered train: http://www.physicsforums.com/showthread.php?t=608920

Some information about SSTARs (small, sealed, transportable, autonomous reactors): http://en.wikipedia.org/wiki/Small,_sealed,_transportable,_autonomous_reactor

A lecture on the use of thorium in nuclear reactors which would be cleaner, safer, cheaper: http://www.youtube.com/watch?v=N2vzotsvvkw&feature=player_embedded

For other fictional train worlds see Christopher Priest's Inverted World (1974), http://en.wikipedia.org/wiki/Inverted_World, and China Miélville's Railsea (2012), http://en.wikipedia.org/wiki/Railsea

The Bioliberals

A research paper about an integrated biohydrogen refinery, inspiration for the Biocar system: http://eprints.bham.ac.uk/1181/1/Redwood_IBHR_Bioresource_Technol_2012.pdf

Wood-powered cars from the early twentieth century. http://www.lowtechmagazine.com/2010/01/wood-gas-cars.html

A video about a technology currently being developed at the Auckland Bioengineering Institute in New Zealand that uses jelly-like artificial muscles as motors in robots: http://www.popsci.com/technology/article/2011-03/video-jelly-artificial-muscles-create-rotary-motion-could-make-robots-more-flexible

Mercedes-Benz F-Cell Roadster Concept Car: http://autoworld.wordpress.com/2009/03/26/new-mercedes-benz-f-cell-roadster-concept-created-by-students-details-photos/

The Digitarians

For more about how the design of cars might change due to 'robocars', see Brad Templeton, "New Design Factors for Robot Cars":http://www.templetons.com/brad/robocars/design-change.html

The Anarcho-Evolutionists

Video of human-powered Helicopter: http://www.eaa.org/news/2011/2011-05-09_helo.asp

A paper about anarchism as a theory of organisation: http://www.panarchy.org/ward/organization.1966.html

Other

Sci-Fi Writer Bruce Sterling explains the concept of Design Fiction: http://www.slate.com/blogs/future_tense/2012/03/02/bruce_sterling_on_design_fictions_.html

Imagining Technology, a Nesta Working Paper by Jon Turney: http://www.nesta.org.uk/library/documents/Imagining_Technology.pdf

Sternberg Press' Solution Series of books re-imagining existing countries: http://www.sternberg-press.com/index.php?pageId=3&cat1=107

The political compass enables you to see where your views lie: http://www.politicalcompass.org/

For other fictional England, see: Rupert Thomson, Divided Kingdom (2006) http://en.wikipedia.org/wiki/Divided_Kingdom

Will Self, The Book of Dave (2006) http://en.wikipedia.org/wiki/The_Book_of_Dave, and Julian Barnes, England England [1988] (2005) http://en.wikipedia.org/wiki/England,_England

Chapter 11
What Is at Stake: qu'est-ce que l'enjeu? Paradoxes: Problematics: Perspectives in Artistic Research Today

Giaco Schiesser

Abstract The text summarizes and analyzes thirty years of international artistic research practice by sketching its paradoxes, problematics, voids and perspectives. And it puts forward a proposal with necessary strategies and the need to develop an epistemology for the future that allows artistic research to become a crucial practice far beyond the artistic research community and the art world only—a crucial practice for the whole society and its urgent demand for a new "aesthetics of existence".

Keywords Artistic research • Art • Epistemology • Aesthetics of existence • Sciences • Humanities • Society • Strategies • Experiment • Experience

11.1 Aesthetics of Existence

The point of departure for the reflections that follow is, in equal measure, the current situation of artistic research in Europe today[1] and the findings in current accounts of artistic research, a variety of which have been put forward recently.

A former version of this text was published under the title of "'A certain frustration ... '. Paradoxes, Voids, Perspectives in Artistic Research Today," in: Department of Art & Media/ZHdK, ed.: *Practices of Experimentation. Research and Teaching in the Arts Today*, Zurich: Scheidegger & Spiess 2012, pp. 96.

For the present publication the text was revised, updated and extended.

[1] Because there is no agreement on terminology, and none of the terms used—artistic research, practice-based research, research in/through/about the arts, art research etc.—are unproblematic, I will use the term *artistic research* in what follows to refer to the field that tries to cover all these terms, and because it has become the most used term in the international discussion. See, e.g. *Society for Artistic Research* (SAR), *Journal for Artistic Research* (JAR) or SHARE's – an international network of 39 institutions to foster the 3rd cycle (PhD in the arts)—*Handbook for Artistic Research Education* (Amsterdam: Valand Academy, 2013).

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My goal is to propose a set of interconnected strategies whose pursuit and distinction I consider central to any productive development of artistic research. What is at stake with artistic research today is not only, and not even in the first instance, art universities, the "Art System" or "the Arts". The unfolding of the potential of artistic research today—alongside and in differentiation to research in the natural sciences, technological sciences, and the humanities[2]—means an extraordinarily explosive power for society. Although a debate that broke out between Charles P. Snow and Frank R. Leavis in the 1950s concerning "the two cultures"[3] has become topical and even more acute today in particular,[4] it sorely lacks any integration of artistic research. "Sorely" because what is the stakes (l'enjeu) in the debate today—given the primacy of the life-sciences (especially neuro-science, nano-science and bio-genetics) not only scientifically, economically and politically but also mentally and in our perceiving of and dealing with every day life—is not just about interpretive authority in the sciences and research but rather much more urgently and profoundly about practices, procedures, content, forms and a renewed *discours de circonstance* (Gaston Bachelard) of a future «aesthetics of existence» (Michel Foucault) of the society as a whole.

What is at risk here is the significance and effectiveness of artistic research, which could (and should) have an impact far beyond the artistic research community or the art world, which at the moment is of interest neither to most researchers into the arts nor to politics or economics. In the case of artistic researchers, that is either because artistic research signifies a formal (and increasingly necessary) undertaking in their academic careers or because it maintains the traditional self-image prevalent in the arts that artistic research and art are "completely different"—a self-image that negates (abstractly) scientific research or, at its most extreme, always merely wishes to "subversively evade" or "interrupt" it, and which for that very reason remains bound to the primacy of the natural sciences. And in the case of politics and economics, it is because they are interested in artistic research exclusively and simplifying, since utilitarian as an increasingly necessary discipline to bring in the creative industries, which they imagine in an all too simplistic fashion.

Against this backdrop, it is urgently necessary to accelerate the development of the potential of artistic research in a socially complex, responsible, and far-reaching sense and to increase the quality of artistic research in breadth, diversity, and depth.

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[2] As I will explain later, many artists are not aware that the research criteria, methods, and procedures of these three sciences sometimes differ considerably. In what follows, I will use the term *sciences* and *humanities* to refer to these three types of "science" (*Natur-, Technik- und Geisteswissenschaften*, in German) in order to keep in mind how they differ from each other and from artistic research.

[3] Snow CP (1960) The two cultures, 2nd edn. Cambridge University Press, Cambridge, 1993.

[4] On the latest status of this debate, see "Naturalisierung," special issue of *Zeitschrift für Kulturphilosophie*, no. 1, 2011. See also Halfmann J, Rohbeck J (eds) (2007) Zwei Kulturen der Wissenschaft—revisited. Velbrück, Weilerswist.

11.2 The Current Situation of Artistic Research in Europe

The current situation of artistic research in Europe can be sketched in broad outlines as follows:

1. For around twenty-five years—since the middle of the 1980s—there has been systematic artistic research at art schools in the United Kingdom[5] and for about fifteen years in art schools in the Nordic countries (Norway, Sweden, Finland) and in Australia.[6] In all these countries artistic research has been and is closely connected to the establishment and development of PhD programs. In the course of the Bologna reform of European higher education over the last seven or eight years, other European countries have followed.[7] The upshot: Measured by the duration and quantity of artistic research thus far, the results of academically persuasive works—works that open up new horizons judged by the specificity of artistic research, and by their Eigensinn [willful obstinacy],[8] and generate new, other, or different knowledge—are still meager.
2. In relation to the amount of money they get, this is also true, mutatis mutandis, of a large number of sciences (e.g. neuro-science), with the significant difference that artistic research is subject financially, politically, and culturally to completely different pressure to legitimize itself. It first has to demonstrate the "meaning" of its subject matter and to gain acceptance in society.
3. Against this backdrop, for several years now there have been an ever growing number of international conferences/workshops on the subject of artistic research. Most follow the same pattern: they are about—sometimes explicitly, sometimes implicitly—the debate concerning a very basic question: "What is artistic research?,"—even if the topics of the conferences have been different ones. For some time now the course and results of these events have been tedious

[5] This is true even if the Royal College of Art in London, in its comprehensive compendium on research, self-confidently claims its own research tradition of 170 years. See Kemp, Sandra, ed.: *research rca*, London: Royal College of Art, 2007, p. 12ff.

[6] In China, there has been artistic research and artistic PhD since the beginning of the 2000s, with nearly no effect on the international discussion because of the language problem. In the US, artistic research and artistic PhD have started only recently at some art schools. A first, but still rough overview has recently been presented by Elkins, James, "Six Cultures of the PhD", in Wilson, Nick and van Ruiten, Schelte / ELIA, eds.: *SHARE Handbook for Artistic Research Education*, Amsterdam: Valand Academy, 2013.

[7] For a systematic, international overview over the formation, development and current situation of artistic PhD see, Schiesser G (2015) "3. Zyklus", In Badura J et al (ed) Künstlerische Forschung. Ein Handbuch. Diaphanes, Zurich/Berlin. (Forthcoming)

[8] On the term *Eigensinn* and its significance for the arts, see Schiesser, Giaco: "Medien | Kunst | Ausbildung: Über den Eigensinn als künstlerische Produktivkraft," in Schade, Sigrid, Sieber, Thomas and Tholen, Georg Christoph, eds.: *SchnittStellen*, (=Basler Beiträge zur Medienwissenschaft (BBM) no. 1), Basel: Schwabe, 2005. A former version of this article in English is available at http://distributedcreativity.typepad.com/idc_texts/2005/10/working_on_and_.html (accessed July 23, 2014).

and not particularly productive. Only within the recent two years there has been a move from disputing theoretical questions to discuss concrete examples and results of artistic research.

4. Artistic research has long been bombarded, particularly also in the German speaking countries, massively from two completely different sides: on the one hand, from sections of the human and cultural sciences, whose arguments have recently been made with uncommon clarity and acuity by Peter Geimer, a professor in the art history department of the Free University Berlin[9]; and, on the other hand, from inside the art schools themselves, including some of the scholars working there and, perhaps more surprisingly, even some of the artists teaching there. Artistic research thus moves within a complex, overdetermined field, which is characterized by acute observation, stubborn skepticism, or fundamental rejection of artistic research—both from the outside and from within.
5. At art universities themselves, it is possible to identify four respectively five main positions on artistic research. I would term and describe them as follows:

   - *Emphatic*—Artistic work is per se research: art = research.
   - *Critical*—Art should not have anything to do with research: artists should keep their hands off research, since the paradigms of the sciences—meaning the paradigms of the natural sciences—apply there. Because the dominance of the latter cannot be overcome, art as research would have to be placed under the primacy of "the" natural sciences, which would not be productive for it.[10]
   - *Tactical*—Art has nothing to do with research. But when it is a matter of money for research, then all art is research.[11]
   - *Strategic*—Artistic research differs from the practice of art or from art itself in that it presupposes an explicit research question.
   - *Epistemological*—I myself take this last position, though supplemented by a second central criterion: the result of the artistic research project is an *artifact*, whose format is itself an aspect of the process of artistic research and is first generated by it—and not predetermined as in the case of the sciences and the humanities, demanding a written text. The result is not necessarily a "finished" work of art or even a work of art at all plus a "scientific" or

[9] Geimer, Peter: "Das große Recherche-Getue in der Kunst: Sollen Hochschulen 'Master of Arts'-Titel und Doktorhüte für Malerei verleihen?," *Frankfurter Allgemeine Zeitung*, no. 93, April 20, 2011, N5.

[10] Historically, the debates and battles concerning the relationship between art and philosophy are based on this fear. Art as a lower form of knowledge or art as the handmaiden of philosophy (for example, in Kant, Hegel, Lukács) or as an autonomous practice of experience and cognition (as in Nietzsche, Luhmann, Deleuze, and in the arts themselves, especially since the beginning of the twentieth century).

[11] At first glance this position seems simplistic because it is only tactical, but it should not be underestimated as a strategy. Given conditions such as those art universities in the United Kingdom have been working under for many years, this flexible position can make sense.

"discursive text", but rather an *arti-fact* in the emphatic sense: *arti-fact„art-affect, and art-effect* in one.[12] It is this notion of arti-fact that opens new perspectives on the formats of artistic research,[13] because its flexible pluri-folded potential and form plays to practices of research and their results.

11.3 The Lack of Epistemology

An approach of this kind and its related notion of the *arti-fact* are of key strategic importance, as no epistemology of artistic research has yet been produced. At the same time it transforms a problem that still troubles us especially in the debate on PhDs in the arts.

First of all, moving in this direction would defuse the intense conflict raging at universities of the arts concerning the necessity—or alternatively the foolishness—of combining a discursive and frequently rigidly scholarly section of the practice-based PhD with an "artistic" section that is often only vaguely defined.

Secondly, and more importantly, it would seem highly productive to take as our starting point Gaston Bachelard's project of a "non-Cartesian epistemology,"[14] according to which: "The concepts and methods are all a function of the domain of *experience* and *experimentation* [my own emphasis, GS]; all scientific thought must change in the light of new experience; a discourse on scientific methods will always be a discourse on circumstances—a *discours de circonstance*—and will never be able to describe the definitive constitution of the scientific spirit".[15] Bachelard famously went so far as to claim: "that each problem, each experiment, even each equation would have needed its own philosophy in borderline cases".[16] Hans-Jörg Rheinberger, who for many years has been director of the Max Planck Institute for the History of Science in Berlin, subsequently showed how, in what was a drawn-out process, the field of research, the applied experimental systems, the apparatus, the notational systems and methods used led to the generally accepted representational formats (and processes) within the sciences. Rheinberger attempts to break apart these forms and formats which have been fixed in stone and

[12] *Arti-fact*, something that is artificially produced, that is at once *art-affect* and *art-effect*.

[13] Especially artistic PhD all over the world have to be done within this dispositive of a series of art works + a scientific or discursive text. But, what eg. Frédéric Chopin has done with his experiments in his *Etudes* in the nineteenth century or Jean Luc Godard with his experiments in video in the twentieth century—these are subtle examples for artistic research (avant la lettre). And for both the results were arti-facts as results of a research process—a series of artistic experiments, driven to a certain point—and not "finished" art works in a conventional sense.

[14] See the seminal works by Bachelard, Gaston: *Le nouvel esprit scientifique* [1934], Paris: Presses Universitaires de France, 1968 and *La formation de l'esprit scientifique* [1938], Paris: Vrin, 1969.

[15] Bachelard, Gaston: *Le nouvel esprit scientifique*, p. 15, our translation (see note 14).

[16] Rheinberger, Hans-Jörg: "'Die Wissenschaft des Konkreten,'" in *Iterationen*, Berlin: Merve, 2005, p. 107.

advocates a "process epistemology,"[17] an "epistemology of contamination and unseemliness," with which "the method eternally remains ensnared in its application".[18]

Compared with the development of science, artistic research is very much in the starting blocks and still awaits an appropriate, fluid, and yet authoritative epistemology. There is still a need within artistic research to examine and discover the extent to which the methods and concepts of science and/or the humanities can be made productive and in which combination this should occur, as well as the extent to which other, different concepts, methods and procedures are needed over and above this.

For an epistemology in that sense there is a second notion (besides the one of the arti-fact) that is of key strategic importance, the notion of *singular exploration*, this rooted in *experiment* and *experience*. "Aesthetic [i.e. artistic, GS] [. . .] research resembles making experiences [*Er-Fahrung*] without navigation in a pathless landscape, where 'moving' ['*Fahrung*') and 'occurrences' ['*Wider-Fahrnis*'] mix and confront what refuses a clear-cut decipherment [my translation, GS]."[19]

For without an epistemology of artistic research this will not be possible, not even in the form of robust knowledge.

Like in the sciences and humanities artistic research starts with the researcher's (faint) inkling that out there in the field of interest there is something, but you do not know exactly what it is, what you do not know and what exactly you want to know. It has become very obvious that artistic research is a *singular explorative research*, a discovery of and dealing with "gaps", the "precarious", the "unstable" or the "inadequate" etc., in each single case, instead of building *hypotheses* that are verified/falsified (like in the science) or *theses* that have to be argued and made plausible (like in the humanities). And that this singular explorations are based on what Bachelard calls "experiments" and "experience", or in the case of experience, what Ludwig Fleck calls with a more precise term "experienceness" (*Erfahrenheit*)[20] or Michel Polanyi calls "mute knowledge"[21] or I would call "intuition" perceived as "condensed experienceness" (*verdichtete Erfahrenheit)*. What is not very clear yet is, in which way and with which qualities these experiments and especially the experienceness of artists and in artistic research differs from the ones of scientists and in the sciences and the humanities. And it has

[17] Rheinberger, Hans-Jörg: "'Die Wissenschaft des Konkreten,'" p. 112 (see note 16).

[18] Rheinberger, Hans-Jörg: "Mischformen des Wissens," in Iterationen, p. 89 (see note 16).

[19] In German: "Ästhetische Forschung [. . .] ähnelt der navigationslosen Er-Fahrung im Weglosen, dort, wo sich 'Fahrung' und 'Wider-Fahrnis' mischen und dem konfrontieren, was sich eindeutiger Dechiffrierung verweigert." Mersch, Dieter: "Paradoxien, Brüche, Charismen: Strategien künstlerischen Forschens," in Mersch and Ott, Michaela, eds.: *Kunst und Wissenschaft*, Munich: Fink, 2007, p. 97.

[20] Fleck L (1980) Entstehung und Entwicklung einer wissenschaftlichen Tatsache. Frankfurt/Main, p. 126.

[21] Polanyi M (1969) In: Green M (ed) Knowing and being. University of Chicago Press, Chicago, especially part III.

become obvious as well that the methods, procedures and techniques of the research have experimentally to be developed during the research process itself within an experimental setting and are not pre-given at the beginning. As it has become evident that during the research process the "old principle of limited sloppiness" (to use Max Delbrück's term)[22] and a "conceptual nonchalance—attentive inattentiveness"[23] are of highest methodical relevance for artistic research, too.

The question how the formats of the findings of artistic research can be developed out of the research process itself (as artifact), what the results can consist of (in terms of material and media, beyond text), how and where the results are presented and communicated in each individual case is, in this respect, a significant aspect of developing a specific epistemology of artistic research, whilst also retaining the potential for being applied to the dispute with the sciences and the humanities.

11.4 Contemporary Accounts of Artistic Research

A number of facts strike the reader about virtually all of the specific accounts as well as the surveys (which have only recently been published) on artistic research:

They are historically oriented and (commendably) present the lines of artistic research's development in relation to a given institution[24] or with an eye to certain themes or aspects.[25]

Or, and this is new, they provide a (critical) meta-analysis of the status of artistic research in three respects: first, artistic research as a *boom*, as an *economic factor* in a "knowledge society"; second, artistic research as the counterpart of the latter, as a *politic-subversive, militant practice*; and third, they discuss the implementation of artistic research at art universities and its implications, positive or negative.[26]

Or they are overall or specific presentations of aspects, criteria, methods or procedures of artistic research in specific areas of art.[27]

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[22] Quoted from Rheinberger, Hans Jörg: "Augenmerk," in Iterationen, p. 66, note 63 (see note 16).

[23] Rickli, Hannes, quoted from Rickli, Hannes and Schenker, Christoph: "Experimentation", in *Practices of Experimentation* (A former version of this text was published under the title of "'A certain frustration . . . '. Paradoxes, Voids, Perspectives in Artistic Research Today," in: Department of Art & Media /ZHdK, ed.: *Practices of Experimentation. Research and Teaching in the Arts Today*, Zurich: Scheidegger & Spiess 2012, pp. 96. For the present publication the text was revised, updated and extended.), pp. 158.

[24] For example, *research rca* (see note 5).

[25] This has been done, for example, by Tom Holert, who was the first in the German-speaking world to offer a detailed overview of the international lines of development in artistic research since the 1950s. See Holert, Tom,: "Künstlerische Forschung: Anatomie einer Konjunktur," in "Artistic Research," special issue of *Texte zur Kunst* no. 82, 2011, p. 39ff.

[26] On this, see especially the various essays in "Artistic Research," special issue of *Texte zur Kunst*, no. 82, 2011, which provide a good overview of current positions in this debate.

[27] For a comprehensive presentation, see Michael B, Karlsson H (eds) (2011) The Routledge companion to research in the arts. Routledge, London. See also the following important

Texts whose explicit subject is *perspectives* of artistic research beyond the present day are usually written from the point of view of researchers (working either individually or collaboratively) in the context of their research work and focus on specific themes or aspects that result directly from their research.

This is also true, with certain qualifications, of two of the most recent attempts to offer a survey of the state of research and the discussion: the issue of *Texte zur Kunst*, which is a special issue on artistic research, and the extensive anthology *The Routledge Companion to Research in the Arts*, both published 2011. Both mark a turning point in the analysis and description of artistic research, since they attempt to examine its current condition from a meta-analytical perspective. Both can already be regarded as standard publications for future artistic research.[28]

Summing up the developments and experiences of artistic research over the past two decades, the editors of the voluminous, in many respects significant *Routledge Companion* anthology write: "We both felt a certain frustration at the lack of progress on the fundamental nature of research in the arts following about 20 years of international discussion."[29]

But if artistic research is to deliver the desired contribution to a future aesthetics of existence as outlined here—rather than resolving an issue of status at art universities, as Peter Geimer believes, or becoming a playground where a few artists and a few more scholars can earn their living—then it will be necessary to draw several strategic conclusions from the rich but dispersed experiences to date, conclusions that abandon the apparatus within which specific analyses have been made thus far. The proposal is to work out a strategic apparatus for future artistic research that subjects previous artistic research to a symptomatic reading and identifies its structural and programmatic gaps. The implementation of this apparatus networks the specific efforts of individuals, programs, and existing collaborations and art universities in a non-normative but nonetheless binding way that promises to increase substantially the quality of artistic research and its cultural, political, and last but not least financial effects.[30]

publications: Borgdorff H (2012) The conflict of the faculties. Perspectives on artistic research and academia. Leiden University Press, Leiden; "Artistic Research," special issue of *Texte zur Kunst* no. 82, 2011; Mersch D, Ott M (eds) (2007) Kunst und Wissenschaft. Fink, Munich; and Borgdorff H (2006) The debate on research in the arts. Bergen National Academy of the Arts, Bergen.

[28] Meanwhile, there are two additional standard publications to indicate, which have been published only after the completion of this manuscript: Wilson, Nick and van Ruiten, Schelte / ELIA, eds.: *SHARE Handbook for Artistic Research Education*, Amsterdam: Valand Academy, 2013; and Hughes, Rolf: "Leap into Another Kind: International Developments in Artistic Research," in Swedish Research Council, ed.: *Artistic Research Then and Now: 2004–2013, Yearbook of AR&D 2013,*Stockholm: Swedish Research Council, 2013. Furthermore I received a copy of this book only after the completion of this manuscript: Slager H (2011) The pleasure of research. Finnish Academy of Fine Arts, Helsinki.

[29] Biggs and Karlsson: *Routledge Companion* (see note 27), xiv.

[30] Against this backdrop, *The Routledge Companion* represents a milestone for artistic research, because it networks carefully selected authors from various countries, and because the book is the result of a well-thought-out production process that takes into account in equal measure the

For the coming years I foresee the necessity of developing strategies for this new apparatus in nine respects. These strategies are formulated here as theses:

Thesis 1
The Strategy of Developing an Epistemology of Artistic Research
If artistic research is one specific type or a set of specific types of research, and by that a set of specific practices of knowing and of generating knowledge,[31] then we have to make clear what are the differences and similarities compared to research in the sciences and the humanities. What are the contents, the goals, the methods and techniques, the experiments and experiences of artistic research and what are the formats, the artifacts, of its results? Only by also developing an adequate epistemology—some of its aspects I tried to sketch roughly above in this text— artistic research will be able to contribute to and to gain evidence for a new social "aesthetics of existence".[32]

Thesis 2
The Strategy of Comprehensive Sustainability, of a Cycle of Sustainability
The sustainability of artistic research is still insufficiently considered even today and guaranteed only in limited fashion. It is necessary to take the *entire* cycle of *production—reception—dissemination—new productions* seriously and bring it to a conclusion. That means above all pursuing the dissemination of research results beyond established formats such as final reports, exhibitions, catalogues, and so on. Final reports eke out their meager existence among sponsors and are subject to criteria for presentation that are not necessarily interesting or productive for sustainability; exhibitions are performative events with their own quality, but that of their results is more ephemeral. And catalogues are all too often compilations of monadically composed essays with no evident overall conception. In other words, in the usual formats for publication it is often possible to convey only fragments of the findings that have been gathered; many findings remain "dead work" for those not directly involved in the research process. What helps is a detailed evaluation of the dormant potential of *completed* research projects with an eye to detailed practices and processes of experience and insight, and with the goal of making them available to other art researchers and the research community. This has not

history, the status quo, and central individual aspects of artistic research. On the structure and the process of producing the volume, see the "Editor's Preface" in *Routledge Companion* (see note 27), xiiiff.

[31] There has been a vivid discussion within the artistic research community for some time whether artistic research is or should be considered as "knowledge production" or not. I try to deconstruct this discussion by using the term of artistic research as "practices of generating knowledge". From a cultural studies or philosophical standpoint any kind of practice generates (different kinds of) knowledge.

For a radical and substantial attempt to argue for artistic research that is something different from knowledge, see: Varto J (2013) Otherwise than knowing. Aalto University Publication Series, Helsinki.

[32] On this, see also Sect. 11.3 in this text.

really been done as yet. New formats for presenting and conveying information are required in order to do so. Only then can a cycle of sustainability be assured.

Some of the basics are still lacking today, however. For example, astonishingly, most art universities largely lack both well-thought-out documentation strategies and convincing and consistent documentation of research projects on the Internet, something that is indispensable in an age where research is internationalized, interculturalized, and networked.

Thesis 3
The Strategy of Analyzing and Discussing Excellent Examples
What we need in addition today is an international, more detailed discussion based on examples of outstanding works of artistic research. Only by conducting such an in-depth, networked analysis and discussing specific, excellent results of artistic analysis, and by taking seriously the experience gained in research processes in detail in various forms and formats can we move forward. The proposals for works to be considered excellent research and discussed in detail have to come from the universities themselves.

Thesis 4
The Strategy of Letting a Thousand Flowers Bloom *and* of Focusing
Artistic research currently finds itself in a paradoxical situation in that respect: On the one hand, if it is judged by the time it took the natural, technical, and human sciences to break free of the primacy of religion and become autonomous objects and practices, it is still in its early stages. Thus it makes sense to pursue or develop the strategy of many different approaches, especially with regards to methods and procedures, rather than establishing a normative set of rules. That includes also pursuing research outside of PhD structures.[33] On the other hand, it is necessary for individual universities to focus and establish priorities—in terms of content, form, or methodology—and research them over extended periods. That is the only way to ensure the continuity of in-depth research and to improve its quality.

Thesis 5
The Strategy of Higher-Level Objectives and Their Prioritizing
In order to make artistic research substantial, tangible, and sustainable at individual universities, in international networks, and for both specialist and general audiences, it is indispensable to reflect in greater detail on—and indeed to establish—higher-level objectives, time frames, and steps for prioritizing. What are the strategic fields of research from the perspective of a university and for what reasons, in what sequence or with what parallelism, within which time frames, and in which steps should they be worked on? At the same time, it is crucial to keep open

[33] The collected experience in Switzerland, especially at the Zurich University of the Arts and the Bern University of the Arts, demonstrates the productivity of research not oriented around a PhD. Both universities have made contributions to artistic research that are widely regarded internationally and were produced for the most part independently of PhD structures so far, since art universities in Switzerland do not yet have the right to grant PhDs.

structural spaces for quick experiments, for unpredictable, abstruse, or crazy things, and for things that should just be tried out briefly.

Thesis 6
The Strategy of Adequate Formation of Community

For several years, the international community, with its rapidly increasing number of conferences/workshops, and so on, has been marked by an activism that is rarely questioned. In clear contrast, in terms of content and in comparison to scientific research communities, it is still standing on shaky legs. If that situation does not change, it will not be enough to advocate to all and sundry—with a verve that has since become practiced—the postulates of absolute openness, individuality, and difference of artistic research. Rather, like the communities of other disciplines, it will have to develop its own criteria for pursuing and assessing its research from whatever perspective it might choose: content, theme, and or procedure. And it has to permit itself to be measured against them.

An indispensable part of appropriate community building (in addition to relevant workshops, conferences, and publications that are usually focused on a specific or one's own university) are internationally led and strategically focused discussion forums, mailing lists, and other electronic periodicals such as the peer reviewed *Journal for Artistic Research (JAR)*, founded in 2010.[34] *JAR* could possibly become such a hub for discussions in the future.[35] There is also currently a lack of networking of older discourses and their journals and mailing lists, such as *Leonardo*, *MaHKUzine*, *Art & Research*, *Rhizom*, and so on, regarding the newer approaches to artistic research and their publication formats.[36]

Thesis 7
The Strategy of Diverse, Parallel Publicizing

At the moment, the research community is still very much occupied with itself—which is historically understandable but no longer appropriate. We should establish and develop various channels of distribution and dissemination parallel to each other, which have different objectives. The point is not only to discuss and encourage research questions and results within the narrower research community but also to disseminate them to various publics at the same time. To that end, everyone should be using existing and yet to be developed formats of dissemination for a specialist audience *and* a broader audience interested in the arts and culture—from disciplinary and transdisciplinary professional conferences to reporting in the various mass media as continuously as possible.

[34] See www.jar-online.net/. The process of *JAR*'s emergence thus far demonstrates how complex and arduous it can be to create such an urgently needed international space for discussion, representation, communication, and dissemination.

[35] Since 2010 JAR raised the number of issues per year from one in 2010 to three or four in 2014.

[36] Holert rightly criticizes this—Holert: "Künstlerische Forschung" (see note 25), p. 53—and also catalogues the most important journals and mailing lists of the older tradition (ibid., p. 61, note 16).

Thesis 8
The Strategy of Differential Connectivity

For reasons of content, university policy, finances, and culture, it is essential that we make the specifics of artistic research identifiable—without making the mistake of establishing normative models—while at the same time ensuring discursive connectivity to the technical sciences, the natural sciences, and the humanities. Either the uncritical or unconscious adoption of standards from the (natural) sciences is still dominant.[37] Or, conversely, it becomes emphatic, as a distant historical echo of a self-image of the artist that is otherwise hardly advocated any longer, the "complete difference" of artistic research is made absolute, and its individualization, incomparability, and uniqueness are emphasized.

Differential connectivity means making the actual specifics—or, more precisely, the specifics of artistic research—known in a more discriminating way[38] and at the same time remaining self-confident and open to connection to research in the sciences in dialogues, controversies, and debates.

Thesis 9
The Strategy of Actually Taking into Account the Procedures and Methods of the Sciences and Humanities

Many statements about artistic research by those working in the field make it clear that the specifics of research in the sciences are not known, at least not adequately, and that there is a naive image of research methods in these areas. The clash of cultures is particularly obvious here.[39] Moreover, "the" natural sciences are seen as synonymous with science and the humanities itself, and the big differences between the natural sciences, the technical sciences, and the humanities—Hans-Jörg Rheinberger, director of the Max Planck Institute for the History of Science, speaks of "epistemically recalcitrant qualities"[40] (*epistemische Widerborstigkeiten*) between them—are left out or simply not known. For example, the specifics repeatedly claimed for artistic research, such as *nonsense*, *purposelessness*,[41] the *transgressive*, *partial lawlessness*, and the *tendency to violate rules*, *work on form*,[42] the *gap*, the *precarious*, the *unstable*, *the reckonable*, *the no-holds-barred* and the

[37] As is still the case in some PhD programs in the United Kingdom.

[38] On this, see also Thesis 9.

[39] In my experience, considerably more natural scientists are interested in the methods, procedures, and findings of the humanities and of artistic research than vice versa.

[40] Rheinberger, Hans-Jörg: "Nachschrift," in Mayer, Andreas and Métraux, Alexandre, eds.: *Kunstmaschinen: Spielräume des Sehens zwischen Wissenschaft und Ästhetik*, Frankfurt am Main: Fischer, 2005, p. 204.

[41] For both terms, see Holert: "Künstlerische Forschung" (see note 25), p. 49.

[42] For all these terms, see Busch, Kathrin: "Wissensbildung in den Künsten: Eine philosophische Träumerei," in "Artistic Research," special issue of *Texte zur Kunst*, no. 82, 2011, pp. 73–77.

inadequate,[43] even *limited sloppiness*[44] and *conceptual nonchalance*,[45] as well as the important method of *epistemological defundamentalization*[46] are also known and a matter of course in the sciences, even in the natural sciences. And this has been true in some cases since their invention in the late fifteenth century (when the natural sciences formed through dissociation with religion), in some cases since the end of the nineteenth century (e.g., in philosophy, psychoanalysis, physics), and in some cases since the 1960s (e.g., political science, biology, constructivism).[47] On the other hand, it is correct to point out that not all criteria, procedures, and methods can be made equally productive in the various sciences and arts. For example, *repeatability* and *falsifiability* are two criteria and methods that make no sense (or for very specific cases only) in artistic research—and not just there but in the humanities as well, where this has been considered obvious since their invention 150 years ago.[48]

For its own work and with regard to its desired effects on society, artistic research has to define its own terrain more precisely, cultivate it, and at the same time seek out and encourage friction, controversy, and collaboration with the sciences and the humanities.[49]

Perhaps the stakes (*l'enjeu*) of artistic research from a societal perspective that was outlined at the beginning of the essay is now clear: making a contribution to the pressing (*not-wendigen*, need-reversing), necessary practices of a social new "aesthetics of existence"—the specific contribution that only it can make. Seeing this as an opportunity and task, this is the in fact challenge for artistic research that aims to have an effect beyond the university system, the "Art System" and "the Arts"—an effect on and within different territories of society.

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[43] For alle these terms, see Mersch, Dieter: "Paradoxien, Brüche, Charismen: Strategien künstlerischen Forschens" (see note 19), pp. 97–98.

[44] Rheinberger, Hans-Jörg, quoted in Rickli, Hannes and Schenker, Christoph: "Experimentation", (see note 23), p. 158.

[45] Rickli, Hannes, in Schenker and Rickli, "Experimentation," p. 158 (see note 23).

[46] Bippus, Elke: "Eine Ästhetisierung von künstlerischer Forschung," in "Artistic Research," special issue of *Texte zur Kunst*, no. 82, 2011, p. 103. For the natural sciences, Feyerabend P (1975) Against method: outline of an anarchistic theory of knowledge. NLB/Humanities Press, Atlantic Highlands/London, is still relevant.

[47] That is to say, artistic research hardly takes into account the fact that the sciences do not constitute a homogeneous entity or that there is a perpetual struggle within them over procedures, approaches, and interpretations and that the relationships of dominance between the various approaches change historically.

[48] My thesis would be that the particulars of scientific and artistic research cannot be determined from their specifics but only from their selection and the way they are connected.

Ernesto Laclau and Chantal Mouffe's concept of "articulation" provides the necessary acuity and distinction to determine the specifics and commonalities of artistic and scientific research. For the fundamentals of the concept of "articulation" in the work of Laclau and Mouffe, see Laclau E, Mouffe C (1985) Hegemony and socialist strategy: towards a radical democratic politics. Verso, London, and Schiesser G (1992) Für eine Hegemonie ohne Hegemon: Anmerkungen E. Laclau/Ch. Mouffe. Widerspruch, no. 24, p. 72ff.

A detailed discussion of this issue will have to await a future publication.

[49] On this, see also Sect. 11.3 in this text.

Chapter 12
Thinking Out of the Urban Design Toolbox

Anton Falkeis

Abstract The essay focuses on the criticism of technology-centered urbanism, demanding a new role of the arts in urban design. Unfolding the course of history of the city in the urban age – from Industrial Revolution to Knowledge Society – key vectors dominating the urban development are discussed. The aim is to open up a larger conceptual field for interventions in the urban environment. The essay promotes Art as an 'Urban Innovator'.

Keywords Urbanization • Urban innovation • Industrial revolution • Knowledge society • City and media • Art and arts-based research

12.1 Urbanizing the World

12.1.1 The Urban Age

Cities in general are condensed descriptions of urban space. They are the most successful self-generated environments of mankind to date. Contemporary growing cities are colonizing the world and can no longer be understood as spatial entities. They behave more like living organisms. Like amoebas, today's cities grow under the conditions of continuous change. The rigidity of form and program has been replaced by an open system in which growth provokes conflict and disorder. Many aspects of Darwin's theory of evolution are applicable to this understanding of contemporary city development. For example, his description of the process of growth as a continuous struggle between equilibrium and disequilibrium has anticipated the current phenomena of urban development. Cities and living organisms such as amoebas share the capacity to establish an ephemeral physical integrity while remaining unstable in their basic conditions. However, this 'biological vision' is unfortunately not the vision that has been guiding our contemporary city planning so far. Urban growth in the twentieth century city planning did not involve models of interaction; it was not at all expected to be evolutionary. Since it

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Fig. 12.1 Informal City/Sao Paolo

was not based on strategies similar to those employed by living organisms, the planned city was unable to operate different activities simultaneously. On the contrary, segregation, fragmentation and exclusion are the precise counter-models of a system where diversity provides the resources for change. The system lacked flexibility, failed to open up the design system and to keep conflicting elements in play. Therefore this model is not based on contemporary conditions. It is not "designed for the real world". The city has grown beyond its initial definition. Consequently, there is a discrepancy between how the actual city operates and how it is perceived by the official planning authority (Fig. 12.1).

While Asia and the Pacific Region are facing a fast-paced megalopolitan progression, Latin American countries are suffering from the consequences of rapid urbanization. All of a sudden, informal urban structures are appearing in the public and published perception and in the planning documents of city developers. What were originally "white spots" on the maps – especially those of Latin America – are being visualized and officially acknowledged. However, this change is based not on an altered perspective of city planners but the abrupt emergence of a political reality. Informal districts have reached a critical mass and the number of inhabitants has become an electoral factor, which is perceived as such by political calculus.

Over the last decades, urban agglomerations have been extremely successful in absorbing population growth and drawing in rural population. As a result, almost more than half of the world's population of today lives in cities (United Nations 2012). The '*World Urbanization Prospects*' published by the United Nations in 2012 is expecting that in 2050 the world's urban population will likely be of the

same size as the world's total population was in 2002. "Urban dwellers will account for 86 % of the population in the more developed regions and for 64 % of that in the less developed countries. Overall, the world population is expected to be 67 % urban in 2050." (United Nations 2012). As a result, cities will increasingly be put under pressure due to densification and concentration of population, economy, capital and media as well as culture and knowledge.

Instead of discussing new qualities of engagement, we export outdated models of urban development. Even in the context of the European city, the planning instruments provided barely still function; in view of informal urban agglomerations, they fail completely. Top-down and bottom-up collide head on, exposing the basic structure common to both strategies. In order to do justice to global processes of change, we should understand this situation as a laboratory in which new instruments can be developed that treat diversity as a resource and that enable transformations. New, unexpected strategies are required in order to synergetically overcome old oppositional situation. The city model of the twentieth century remains a closed model that fails to support an opening-up to contradictory and conflicting elements. Segregation and exclusion are the results, evident to this day.

12.1.2 Industrializing the City

In pre-industrial times, cityscapes changed only gradually by marginal transformations of their constituting elements. They remained practically unchanged up until the city was confronted with the drastic consequences of industrialization (Benevolo 1986). The Industrial Revolution marks a major turning point in history. More or less every aspect of everyday life has been influenced by this development up until the present day. Modern societies as well as modern cities are rooted in this period of radical transformation of work and life.

Fueled by the progression of industrialization, rapid urbanization started to change the concept of urban environment completely. This caused substantial damages to urban space and broke apart pre-industrial societal structures (Kiess 1991). Establishing the production process as a core value empowered the linearity of processing and unraveled complexity into a chronological order. Consequently, linearity was established as a fundamental principle, crucial for all following transformations.

Integrating large-scale technological inventions into the production chain – like steam-powered engines – significantly changed the production routine. As a consequence, spatial concentration of labor established a new type of urban structure: the industrial plant.

Site and location evolved as the essential criteria. Traditional production techniques - defined by spatial coexistence of life and work – dissolved into spatially dissected concentrations of mono-functional activities. Executing this strategy on an urban scale led to a yet unknown and radical segregation of urban life. Thus, isolation and exclusion evolved as core policies of the functionalist city. Organized

alongside linear processes, the city's development followed the path of a solely economical practice. This urban model gave birth to one of the main consequences of the modern world: mobility.

By means of technological inventions it became feasible to increase the velocity of movement: the velocity of machinery replaced the velocity of pre-industrial transportation systems. As a result of industrialization, automobiles appeared on the urban agenda. Gaining the biggest influence on urban planning to date, they became the driving force of city development. Once populated by a variety of activities, streets and public spaces of pre-industrial cities now faced the reduction to traffic only. Depending entirely on car mobility, cities have developed into sprawling urban forms. This development of rapid suburbanization has had a big and long lasting impact on urban as well as societal structures.

During the development of the industrial society, technological progress and innovation amplified the production of wealth. *"For the first time in history, the living standards of the masses of ordinary people have begun to undergo sustained growth."* (Lucas 2002). An increasing income became a common circumstance of life in Europe as well as the industrialized western world. Other parts of the world, however, remained stagnant. This led to great differences in living standards still virulent today.

As a result of the Industrial Revolution, growth had become an important factor of urban life and the theory of growth the driving force of economy. Moreover, the speed of material processing and the huge turnover of energy and labor led to an unprecedented decrease in natural resources and to unbearable pollution and destruction of the environment. Alongside this development, new parameters were established to define and measure the changing urban landscape: the Ecological Footprint and the Carbon Currency.

12.2 City and Media

12.2.1 The Information Age

Throughout history, urban space has been framing activities, defining territories, forming and transforming communities. To be a member of a community meant to reside within its territorial boundaries. This concept of community was directly related to a face-to-face communication structure and to a hand-to-hand distributing arrangement – both clearly operated on a physical level.

The Industrial Age broke apart the pre-industrial social structure. However, less than a century after the advent of the industrial revolution, the world had to face the next wave of a radical transformation of their environment through technological inventions. While the physical abilities of man and animal defined the pace of the pre-industrial world, and the velocity of machinery those of the industrialized world, the speed of electro-magnetic fields is now defining the rhythm of urban

life and questioning the very notion of distance. Boundary-spanning technologies are restructuring social identity and spatial practice. By creating *'technosocial situations'* (Ito; Okabe 2003), aspects of urbanity have been substituted by new media technologies. Especially interactive technologies have been changing our notions of personal and social space, transforming the world we life in into a heterotopian place – actual and virtual at the same time. Thus, the implementation of the World Wide Web as a new means of communication has had a substantial impact on everyday life, on city and society, streets and public spaces.

By entering the information age, a revival of the pre-industrial model has occurred. Up to a certain degree, the model is replacing the consequences of industrialization. A highly individualized time management now substitutes synchronization, which was essential to all industrial production. The industrial plant as a concentration of labor and work partly dissolves back into an independent but technology based type of production. Since interactive technologies are essential for this new-old type of decentralized production, capital is enabled to increase its mobility - ultimately liberating it and transforming it into an autonomous force. To a certain extend, serial production technique is replaced by custom-made just-in-time production. It is replaced by a technology that is based on global real-time communications. As a result of this technological move, the physical presence of a communication space has turned into a specific isolation of the user: every time at every place without changing location (Virilio 1993). Virtual mobility is the antithesis of spatiotemporal mobility.

As a consequence, these high levels of specialization and fragmentation of living conditions are distorting the direct access to the complexity of reality. This ultimately leads to (re)-constructing reality and substituting it with a less complex equivalent. However, approaching reality by means of employing reductionist models involves society into a constant process of 'reality invention'. Based on a corresponding history of civilization and urban development, urban fabric becomes an imprint of these models of reality production. All these paradigmatically influenced 'conceptions of the word' are legible as manifestations of urbanity.

While societal services of public spaces are transferred to media activities, the disappearing visible communication structures are deleting the traces of interaction. Invisible telecommunication networks overlaying the contemporary city have become – in terms of communication and interaction – more important than the built environment. New communication structures are simulating communication services of the city's structure. Streets and public open spaces – the key elements of the European City – are fragments of a visible communication. They are spatial notations of a face-to-face communication behavior (Falkeis 1997). However, extensive and rapid developments in the areas of information, capital and population have led to the emergence of a new social formation: global cities.

12.2.2 City and the Knowledge Society

Digital technology and social logics can produce a third condition that is a mix of both. Structured in electronic space, we call it *'Digital Formation'* (Sassen 2012). Digital Formations are co-evolutions of organizational forms and interactive technologies. They are managing the shift from hierarchical, bureaucratic concepts of mass production – as well as mass media – to networked forms of production and communication. This shift from brokering information to facilitating knowledge (Bach; Stark 2005) indicates the transition from an Information Society to a Knowledge Society.

The concept of the Knowledge Society emphasizes immateriality and specific intangible features of products and services in economic progresses, and of innovation in particular (Hochgerner 2013). "Innovation is our best means of successfully tackling major societal challenges, such as climate change, energy and resource scarcity, health and ageing, which are becoming more urgent by the day" (European Commission 2010). Therefore, our future standard of living depends on our ability to drive innovation into sustainable products and services, social processes and models.

Since the basic function of knowledge is to provide the 'capability to act' (Stehr 1994), the knowledge society is asking for new conditions of knowledge production, new channels of knowledge diffusion and new methods of knowledge utilization. Today's societies are facing an urgent need to manage such processes by new and more efficient ways of information processing and knowledge production.

As a consequence, how society perceives the modern world is increasingly defined by theoretical knowledge. Scientists determine which answers to follow, regardless, which questions on the subject of modern life were asked. Knowledge, unlike information, cannot exist independently of a subject. It is primarily represented in science, technology and innovation. It has taken over the place of industry and agriculture as a key factor in economical and urban development. Once again, rapid advances of technologies are restructuring and redefining communities and markets. *'Just as industrialization served to disadvantage rural areas, so too might the global information economy. In the future, cities – which benefit greatly from economies of agglomeration – will have an even greater advantage over nonmetropolitan areas than they have today'* (Sassen 2012).

Communication technology and information technology helps to bypass the long and difficult process of industrialization, entering the information age straight away. Many developing countries are currently looking for this opportunity in order to speed up their development-processes.

The situation in Japan at the end of the nineteenth century was a similar one. The country escaped from its self-imposed 200 years of isolation by joining the industrial age straight away. The city in Japan, at that time a feudal medieval spatial and societal structure, was confronted with the technological inventions of the western world head on. In a very short period of time, the western technology was adapted and implemented into the traditional structure. This transformed the city in Japan

into a fast-escalating-megalopolitan-project, directly reflecting the societal and spatial dynamics of a technology-driven urban change.

12.2.3 Criticism of Technology-Centered Urbanism

Since the ancient Romans started exporting their urban techniques in the course of conquering the world, urban design became synonym for infrastructure-technology and technological solutions – mainly based on innovations initially driven by military and later by economical interests. In the course of the Industrial Revolution, technology driven solutions had become fundamental to laws and regulations on urban development, ultimately determining the forces shaping the urban space. However, the increase of zoning regulations in the twentieth century is unprecedented in the history of urban design. This proliferation of rules and bureaucratic regulations has disabled local innovation and growth. It has frozen the city in time. (Sennet 2006).

12.2.4 Social Design

'*If technology is the answer, what was the question?*' Considering the role of the arts in urban innovation this quote by Cedric Price provokes a series of questions upon modern urbanism and brings a new term into play: *Social Design*.

At least since Richard Buckminster Fuller's 'Operating Manual for Spaceship Earth' (1969) and Viktor Papanek's 'Design for the Real World' (1971) a critical attitude towards design has become visible. Today the term Social Design has a wide range of meanings: from Whole System Design, Regenerative Design, Sustainable Design and Service Design to Green Urbanism and Urban Metabolism – just to mention a few. All of these design concepts are driven by the desire to reduce the human impact on our planet. Whether they are dealing with the reduction of waste production, reducing the ecological footprint or sustaining urban growth by making more efficient use of the resources at hand. Above all, these concepts share the motivation for taking responsibility, as well as taking position.

According to Viktor Papanek's polemic classification, design ultimately means to destroy (Papanek 2008). Consequently, design in it's underlying meaning of creation – *Gestaltung* – might be defined as 'creative destruction'. In order to make room for the new (Reinert 2006) this process – associated with the name of the Austrian-born economist Schumpeter – is creating wealth by destruction.

The destructive nature of some new technologies and innovative processes has turned Schumpeter's *'creative destruction'* into *'destructive creations'* (Soete 2013).

Planned obsolescence forces the demand for the next generation of products in order to enhance economic growth and expansion opportunities. This type of

'innovation' directly leads to ecologically unsustainable consumerism. Innovations, only profitable for innovators, are generating wealth for a particular market and systematic risk for society. This strategy is directly driving financially motivated innovation into systemic failure.

Thus, Social Design will be a means of critical reflection on innovation, observing the impact of new technologies and processes on urban societies. Social Design as an integral element of communal and transcultural interaction within the urban environment works as an instrument of analysis and intervention. It aims at connecting arts-based research and the abstract and theoretic sciences with hands-on practice of spatial and cultural co-production. It challenges the cross-examination of our built environment on a trans disciplinary level, even integrating expertise not yet represented in an academic discipline. Involving not only academia but other stakeholders as well aims at interweaving the discourse into the very fabric of society. More importantly, this practice evaluates the societal relevance of innovation.

12.3 Art as an Urban Innovator

12.3.1 Innovation

Schumpeter – referring to innovations as the main forces of economic development – is describing innovation as *'new combinations'* of already existing ideas. Weitzman (1998), when discussing the *'black box of innovation'*, is following the same line of argumentation. He is aiming at building up explicit models of knowledge production based on combinatory logic. Hence, new ideas are not the product of conventional relationships between input and output. They rather arise from existing ideas as a *'cumulative interactive process'* where pairs of existing ideas are combined in order to generate new *'hybrid ideas'*. However, the idea that new knowledge consists of (re)combinations of knowledge can be traced back to Adam Smith. He has already discussed in '*The Wealth of Nations'* the idea of *"combining together the powers of the most distant and dissimilar objects"* (Smith 1976).

12.3.2 The Role of the Arts in Urban Design

Arts as urban innovation[1] are following the same combinatory logic of a cumulative interactive process. Transdisciplinary research and project structures are combining

[1] University of Applied Arts Vienna, Master Programme: Social Design_Arts as Urban Innovation.

the powers of distant fields of expertise. While opening up new perspectives onto urban challenges, it allows for unexpected solutions.

Acknowledging the global restructuring phenomenon we are going to face within the next decades, we will have to investigate new strategies operating beyond technology-centered approaches**.** This is not meant to argue against technology in general, but to question the exclusive character of technological solutions. Solving problems only within highly specialized disciplines means dealing with projections of the problems onto a disciplinary surface – onto its dividing barriers. To overcome this paradigm we will have to make the disciplinary barriers more porous. The distinction between the inside and outside of a discipline has to be replaced by intersecting 'fields of expertise'. This concept demands for strategies of transdisciplinarily overlapping territories beyond demarcational behavior – as, for example, represented in the arts. Being aware of the complexity of today's world, it is obvious that multifaceted problems cannot be solved from the perspective of a single (academic) discipline. Therefore we have to focus on collaborative research and cooperative project structures.

Involving the arts into the process of urban design will enhance the overall process of knowledge production, allowing for more inclusive solutions. The role of art within this process will not be defined as a practice of subsequently adding esthetic value to a given result. To the contrary, art will be the driving conceptual force, fueling the process of development from the very first moment of investigation to the final conclusion. Arts-based research has the capacity to create strategies for both the spatial and social fabric of urban agglomerations. It has the ability to formulate new, distinct perspectives on the inherent logic of cities and the corresponding dynamics of societies.

Arts-based research has the capacity to deliver a descriptive model of structural possibilities of society, not by imitating reality but by anticipating the unexpected. Involving the arts in the process of knowledge production would be a means of creating comprehensive solutions as well as flexible concepts of societal change. Art in synergy with project-related scientific methods and knowledge is able to develop new instruments of urban investigation replacing out-dated models of city development. It is able to describe a novel perception of space.[2]

For example, it visualizes a different notion of mobility, related to a choreographical movement of bodies in space. This approach makes it possible not to describe density in numbers only, but also as the intensity of a physical presence. Moreover, an acoustical phenomenon of a city can be evaluated beyond its physical existence and technological description.[3] This approach also allows understanding and interpreting communication independently from technical devices as tools that provoke heterotopian situations –situations of simultaneously virtual and actual communication. Arts-based research has the ability to articulate

[2] See Appendix A.1- bodytecture.

[3] See Appendix A.2- Nanjing Notation Project.

new, distinct perspectives on the inherent logic of cities and the corresponding dynamics of societies. It is creating strategies for both the spatial and societal fabric.

By moving on three-dimensional trajectories across the urban realm it is penetrating all 'disciplinary surfaces', making disciplinary boundaries permeable like cellular walls.

According to Richard Sennet, the idea of a cellular wall, which is both resistant and porous, can be extended from single buildings to the zones in which the different communities of a city meet. Allowing cities to operate as open systems – by incorporating principles of porosity of territory, narrative indeterminacy and incomplete form – they become democratic not in a legal sense, but as physical experience.

Appendix

A.1 body_tecture

The project has been developed within the 'Aspect of Space' programme, an architectural programme for non-architectural students at the University of Applied Arts in Vienna.

The aim of this programme was to develop tools and strategies to transform architectural demands - to shape the idea of space. Substantiating these demands offers the students the chance to understand arts as an urban innovator and as a means of taking [spatial] position.

body_tecture reconstructs the existing built environment as body language, unfolding their spatial behavior. This unique approach creates descriptions of the external communication structure of the built object as well as its building geometry and its structural performance. Unexpected spatial qualities in terms of tension flow are revealed.

As a design strategy *body_tecture* describes a conceptual tool comparable to 'blind drawings' eliminating visual control of the action. Like drawings produced by the unconscious, *body_tecture* produces a 'speechless' figure-ground relation (Fig. 12.2).

A.2 City Score_The Nanjing Notation Project

The ***Nanjing Notation Project*** (Nanjing University of Arts, 2012) was about representing the city's physical body by its construed perception. It was about re-scripting and transposing the cityscape into a soundscape, focusing on the interrelation of space and sound. Acoustics as a tool to describe an urban situation is not very common in city planning. If ever recognized in this field, acoustical experiences are then classified as noise pollution. In contrast to this general attitude, all acoustical sensations were treated as relevant sources of spatial-descriptions. They had not been approached beyond their solely physical existence and

Fig. 12.2 *body_tecture* by Lisa Mijsbergh

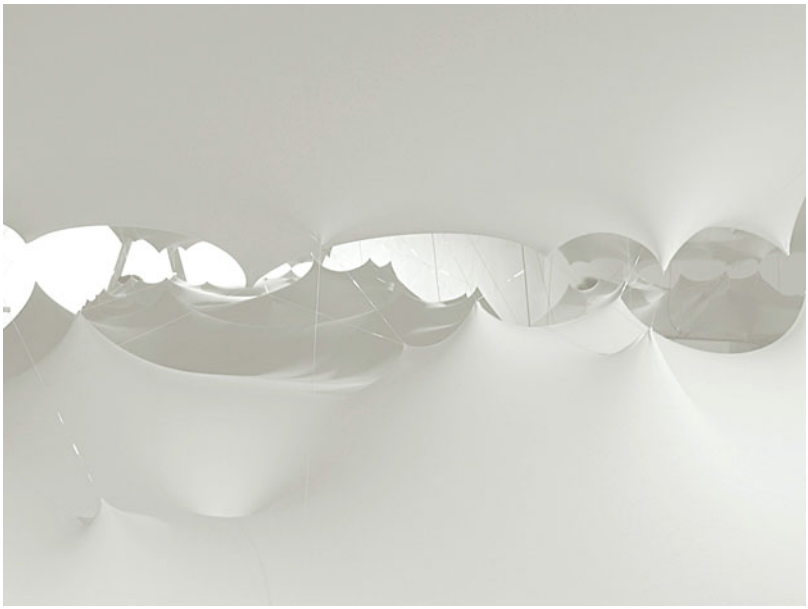

Fig. 12.3 Nanjing Notation Project _ The City Score (physical model)

technological description before. Aiming at identifying elements of communal and cultural interaction, instruments and strategies for urban analysis and intervention were developed. Classical instruments of city planning - like spatial density – were not described in numbers, but by the intensity of physical presence – such as spaces, buildings, sounds or people.

In the *Nanjing Notation Project*, the interaction of all acoustical phenomena produced *in* the space and *by* the space were recorded and transformed into a notation system, unfolding the unique soundscape of a city. The identification and descriptive determination of all different quantities and qualities were transcribed into a 3D-code system: the city score (Figs. 12.3 and 12.4).

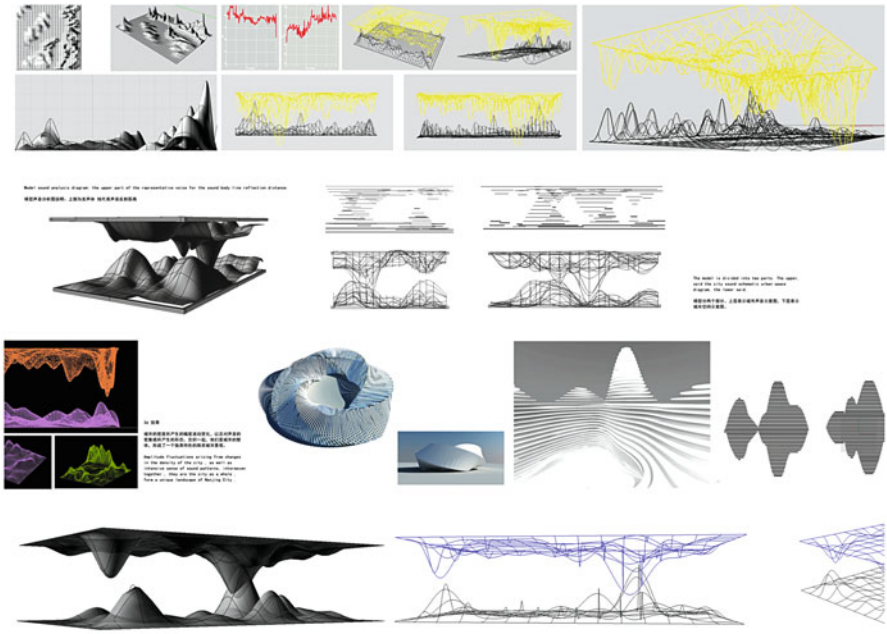

Fig. 12.4 Nanjing Notation Project _ interrelation of space and sound

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Chapter 13
Heterotopoetic

Alexander Damianisch

Abstracts The heterogeneous challenges the undisputed. Phenomena that question the unspoken do exist; they do so by mirroring the core values of society. Describing this, Michael Foucault developed the term "heterotopia"; these are places beyond hegemonic circumstances. Universities have been addressed as such places. But a revision of this concept is required as there is an option for a more lively reading beyond dichotomy, meaning that there is a possibility to challenge critical interaction. Art can play an essential role in this; the notion of poesies can provide this, making the heterotopos heterotopoetic, making the undisputed eloquent, uncovering the hegemonic and thereby formatting the core values of society. The Art University is the very space of heteretopoetic development challenging the outside and inside in a permanent flux.

Keywords Art Universities • Bottom up against Top down • Creativity • Competences • Extensions • Formation • Freedom • Governmental responsibility • Heterotopies • Impact • Institutional challenges • In flux • Opposition • Poetics • Potentials (incl. Space and Time) • Reflective • Responsibility • Serendipity • The New • Unexpected • Universities • Visionary • Innovation • Applied Art • Education • Research

With reference to the description of institutions as spaces of unorthodox practices described by Foucault as heterotopic[1] within the heteropoetic the possibilities of formation is the core. According to Foucault, Heterotopies are those places, "(. . .) real and effective spaces which are outlined in the very institution of society, but which constitute a sort of counter arrangement, of effectively realized utopia, in which all the real arrangements, all the other real arrangements that can be found

[1] Foucault, Michel: Of other spaces. In: Miskowiec, Jay, Des Espace Autres, 1984, pp. 1–9. Weblink: http://web.mit.edu/allanmc/www/foucault1.pdf; accessed 28.12.2013.

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within society, are at one and the same time represented, challenged, and overturned: a sort of place that lies outside all places and yet is actually localizable. In contrast to the utopias, these places which are absolutely other with respect to all the arrangements that they reflect and of which they speak might be described as heterotopias".[2] The whole complex of formation respectively developing action based on a poetic competence needs to be added. Defined as a reflective and visionary known act for the process of the relations and as a contract within the entities to be understood by itself, in regards to production and towards applied and reflexive contexts, the process should always be reflexive.

Art Universities are accordingly entities of analytical production of alternative hetereopoetological competences. What does that mean? Through the connection within individual working logic (see the Greek word logos = "I say", "word"; "a plea"; "an opinion"), supported by a cautious, responsible planned handling, a more open process is possible, all of this beyond the thematic, disciplinary, methodological or other constraints. The openness determines the new designated through the Greek prefix héteros – which means something like different, unequal, foreign – in conjunction with the open space, in this case, for example, the university, described by the term tópos – the space or place – and the act represented by the Greek word poieĩn – which refers to formation. Thus, deriving from practice, an exemplary institutional concept can be developed, the core being the different/new, the space used for formation, all of this, but especially the last point are to be understood as explicit quality in particular. The different/new comes together in a particular space, connects freely and develops, so alternatives are available.

It is about the new, the different, the unfamiliar, not as an external force as an enemy, but as a challenge and a constant impact, it is about the interaction that makes something possible that would not be possible internally. Within the influence development takes place, not from the internal alone, but in extension new options unfold and are shaping activities. Internally, the danger of the challenge being less demanding exists; apart from the danger of tiring, the competences, the activities would only happen to act autolog.[3] No, it is about the different, which is hard to get a grip on. The goal should not be to describe, what has been, but to see what may be. Oswald Wiener has described referentially work as successful slagging once. Already the predecessors are stuck in a quagmire, the quagmire of known assumptions; to believe, one could overcome the familiar paths by using the known didn't seem to be obvious to him.[4] Regardless of the pointed assumption, it must be about the development of an open and sensible setting. It is rather difficult to manage without references, as well as without the description and inclusion of

[2] See. p. 4.

[3] The term autolog is yielded in favour of the term autogenously. The term "autolog" is commonly used in aesthetic medicine, especially in plastic surgery, but also in reproduction medicine and transfusion medicine.

[4] Oswald Wiener in the framework of the event discussing the crossing boundaries between art and science, Symposium, 15–16 November 2013, Vienna.

concrete hypotheses. The *Nightsciences*[5] (Francois Jacob), which is about the unexpected, should be the goal and alongside a risk. Sometimes it is better to turn off the light.

With the prefix hetero in this context lays the answer to the question of the registered critical potential in space. The search for alternatives can be understood as critique per se. On the one hand, it is about connecting the different with each other so that something new can be developed out of the coincidence, on the other hand it is about understanding the work itself in a heterological manner. In addition, something appears to be registered within the body of work. One could describe this as a critical turning point, which is registered within the object. In short, the object is s a document reflexive and as an object visionary at once. That can be considered as artwork displaying dual talent, and the point where needs and expectations from and for the art mostly drift apart. Art as an object and in practice must be understood as chance.

The challenge that stands out in the focus on something as "new" lies in the fact that it defines an approach of a particular action, thus regarding something that runs contrary to an original open-endedness. In the case of seeing something as new the New is part of a continuous development. In the best-case scenario – similar to a film-still – the description of the New is the focus of a momentum that maybe gives a clue to what could have been and what should be expected. With regard to Magrittes "Le trahison des images" from 1929, one can say that the description is not the practice, but it is only a medium to make something understandable.[6] Particularly since the taste of the tobacco in the depicted image of a pipe cannot unfold. One does not stop, one continues.

It is actually also not important, how and what narrative is found, but its about the situation itself, the spaces, in which a connection can unfold; it is about a fulfilled ritualization of flows and transitions, in order to carefully construct the conditions for the things to come, spaces where connections can develop themselves, in a way not visible before. It concerns project-spaces without narrowing the provided conditions too strongly; it is a matter of Practice and Documentation as well.

In institutions like art universities one can see the strong tension between reflexive (Document) and the visionary (Practice), as here lies the space where development, whose overcoming and formation is integrated. One is interested

[5] See; "Night sciences is a sort of workshop of the possible where what will become the building material of science is worked out. Where hypotheses remain in the form of vague presentiments and wooly impressions. Where phenomena are still no more than solitary events with no link between them. Where the design of experiments has barely taken shape. Where thought makes its way along meandering paths and twisting lanes, most often leading nowhere." Francois Jacob: Of Flies, Mice, and Men, Harvard University Press 1998, p. 126. According to Hns-Jörg Rheinberger: Iteration. Merve Press Berlin 2005, p. 87. Noteworthy here is the circumstance, which on one hand follows up on to the quote by Hans-Jörg Rheinberger, and secondly, using his rhetorical pictures of one of his timely metaphors, the night, Jacobs changes space in sync with the labyrinth of the Heterotopos.

[6] See also Michael Foucault: This is not a Pipe. Quantum Books, 2008.

lesser about results than their development. A central aspect to development is the continuous making of content and a constant formal challenge within the praxis. This space is necessary. An open understanding of institutions, especially those of art, is therefore essential.

The formatting element is not only one that is led by the involved individuals. The conditions do not carry little meaning, and therefore the framework in which the potential can and should unfold. Hans-Jörg Rheinberger, in his scientific theoretical considerations, coined the term of the epistemic thing.[7] He understands this as one that co-designed the thought process, whereby this influence in the learning process, every now and then the not intended, contains his special attention. The thing to be understood as a scalable term is legitimate, which goes from material over to the medium and until the space. Thereby, the context shows its definitive power that has always been centrally engraved in the consciousness of the artistic concern, and therefore, the art university is an ideal place to turn a possibility into something possible.

Its about the search for an original lever, for something with which the unexpected would move in the center by itself, precise and actively.[8] And for that it needs a framework, otherwise the lever would not be able to sustain. This framework itself must be able to react recursively with and within the flow; otherwise everything would be hanging in mid-air. I am convinced, that it has to be quick and easy, clear and comprehensive, in other context, the talk was about intuition; the context should be intuitive as should be the producer of the work and the work itself.

Heterotopoetology is not about the setting of ex post, but about the content, which has the possibility to be unfolded. These are volatile and are always overcome, and pass unbelievably fast. Just like one throws a shadow, the other throws light; thereby the surrounding shows itself as dark. That could be maybe the tempting attraction of the illusion. The terms illumination, insight and enlightenment are to be understood in this context. The language illustrates the problem. It stylizes. Subsequently, the concept of the past is stringent and the 'New' is visible, but everything is unclear in the defining moment, and thus undisciplined. That is what is it about; that Moment needs a ready setting. Once that is attained, results will be successful.

The joy for what is ahead and the joy that comes from the transition is possibly what make the dynamic of the heterotopoetic so special. The phases in which the trusted becomes unfamiliar, are those of the development for which there is no term. As an even concept for the description of open perspectives, convincing by its

[7] See Rheinberger, Hans-Jörg: From Experimental Systems to Cultures of Experimentation. Historiality, Narration, and Deconstruction. Science in Context 7, I (1994), pp. 65–81.

[8] A reminder on the events around the critic on the Lueger monument in place in Vienna, a former governor of Vienna, whose anti-semitic stance dwells to continue uncriticized. An event took place regarding this with the goal to newly construct the monument, including the discussion of the idea to only raise the monument by a few centimeters from its epicenter. See: http://luegerplatz.com/presse/Handbuch_Lueger.pdf, accessed 2013.11.20.

consideration of the transitions, the flow can be consulted. Here, its about a concept, which tries to describe how in a balanced equilibrium of competences and challenges in the doing of the participant is to find something that practically brings something new to the front. A focus on the production of these conditions for an institution, which is for its infrastructure, whose individuals should have an organizational as well as content goal, with which the idealized approach of a climatic oriented access is replaced and therefore, allowed conditions have more meaning.[9]

The object in the art is not just like the epistemic thing describable, but it also contains aesthetic meaning, since it requires a productive and determined receptive calculation, and then poses an interpretative correlation. Apart from the production of results it is the setting for the reception to be considered, when the search is for the power of the influence. Perception, which produces artistic work, gives the validity to create and to receive. The artwork has to be looked on as a reflexive object and a coining document of recursive effects.

Societal affairs are objectified institutionally within and thereby documented implicitly. To see and experience what challenges relate to the unexpressed at the moment, an insight on certain spaces where art finds itself radically and is found pays off.

Art Universities count as such places in which questions regarding society are objectified. Objectively, it can be seen, that something acts in relation to something differently, whereby this relation in case of art shows a special aspect. The relation is not only to be understood grammatically, but also concretely and representationally. In this sense, art provides as an entity from content and form something, and thereby it also presents something; it is autonomous, reflexive, but also at the same time it documents this autonomy and reflexivity, always as a subject and document at the same time. In this sense, places are also artistically describable in practice, characterized by content. The specialiatiy lies within the fact, that the creation in the core of its activities are engraved, thereby 'change' is its central competency. The transformation of different influences within something is its goal; the spaces where these take place, I would like to call heterotopoetic.

[9] See: Csikszentmihalyi, M. (2009). Creativity: Flow and the Psychology of Discovery and (p. 480). HarperCollins.

Chapter 14
Art and Design as Social Fabric

Ruth Mateus-Berr

Abstract This paper describes art and design and its capacities as inspiration for innovation processes and interference in societal affairs at times of crisis and change. In a form of a case study as an example, a general approach will be described, how art and design can engage with human needs and co-develop innovative solutions with specific target groups. Deriving from interdisciplinary approaches, students used design- (arts-) based research, art & design as social fabric. One of the main objectives was designing shelter for the human body and evoking emotion through material. Various layers of material were explored through subjective perception, exploration of different technologies, participatory and sensual research, problem solving strategies applied and analyzed by cultural and emotional codes in cooperation with inhabitants of Women's Shelters. New textile objects were created as Ist-analysis of need and association of shelter, which can be considered as textile archive for future. Either interior design for inhabitants of Women's Shelters or refugees can rely on outcomes or designing "survival kits" for target groups like women who have been victims of domestic violence a, refugees or victims of the global crisis a situation every one of us may wake up tomorrow. Education at tertiary level can facilitate new approaches and interdisciplinary teamwork. Collaboration with less well-off social groups, protection of users, consumers, environment and citizen participation allow students new experiences and empower societal responsibility. They develop tolerances and learn to negotiate. Through designing and documenting cooperative workshops as well as own artistic design work, arts and design-based research develops innovative insights and solutions for students and empower disadvantaged target groups.

Keywords Arts & design based research • Education • Health • Shelter • Participatory • Sensual research • Education • Empowerment • Innovation • Women

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14.1 Introduction: Paradigm Shift: Arts and Design Based Practice

In the first half of the article aspects of paradigm shift in arts and design will be discussed, then a new perspective on teaching and researching will be presented and in the second part target groups, societal needs will be re-defined and a case study with the Women's Shelters' presented. The whole article does not aim for one answer but for many new arising questions or at least to walk with Anton Chekhov to post a question sufficiently (Spielmann 2013).

14.2 Crisis, Values and Change

The paradigm shift within the arts and the design world is driven by critical reflection of meanings and highly variable *regimes of values* (Appadurai 1986/2010, p. 15) of things, triggered by the crisis of the financial markets and not to forget – the intrinsic art and design practice, the political engagement of the arts itself. Rapid urbanization, the devasting of rural landscapes, increasing density in cities, structural unsustainability and conflicts over diminishing natural resources, massive explosion of environmental and economic refugees, design must become politics. Current social, economic, politic, governmental and technological responses are poor compared to growth and speed of this problem of human creation, not one stone seems to be left upon another. Societal laws of supply and demand rotated by 180° and Baudrillard deconstructed "need" and "utility" justified. Objects lost their functional identity and turned into simulacra, an avatar of themselves. The real turned to a real utopia (Baudrillard 2006, p. 123). The paradigm shift is determined by reflections about values and the recognition that 'The Times They Are A-changin' (Bob Dylan) in periodic modes: now we have to participate, design our future and become agents of change. "As with massive changes of the past, responses to our situation will be from necessity rather then by choice" (Fry 2011, p. 2). Value is never considered as an inherent property of objects but as a judgment made about them by subjects (Appadurai 1986/2010, p. 3; Simmel 2009, p. 73). Yet many of the actions that follow from these judgments have significant consequences for the wellbeing of others, our health, the environment etc. When exchange of commodities is the source of the mutual valuation of objects, balance and gift exchange (which rise reciprocal exchange – Mauss 1967) seems to be needed. Human actors encode things with meanings and significance and the world of things as contemporary tendency is described as mute, only decipherable by persons and their words. We have to follow the things themselves, for their meanings are inscribed in their forms, their uses and their trajectories to illuminate their human and social context (Appadurai 1986/2010, p. 5) and empower the subjects to re-design the world with their voices as a democratization of design to re-inforce relationships between human beings and environments. To

use the capability of art and design means to use its tools as instruments and we also need to move design out of economic function and put it into a political frame (Fry 2011, p. viii). Participatory research was founded on work in developing countries, but "developing" situations and marginalized populations expand in highly developed countries, participatory research should have relevance everywhere (Conrad and Campbell 2008, p. 249).

Design writer Nick Currie (2005, p. 1) reflects on the conceptual and immaterial qualities of current designers work saying that "Rather than products, these people are designing situations, intervening in existing arrangements, framing everyday activities in ways that make us think of them, unexpectedly, as 'design'. And although they're often satirical in tone, these designers share a concern with ethics and responsibility; one of the reasons the design they make is so often immaterial is their sense that the last thing the world needs is more objects, more consumer goods". Currie (2008, p. 1) talks of a current generation of young designers that seem to share in the spirit of Conceptual Art. He writes: "Once upon a time it was easy to distinguish design from art: designers had briefs from clients, practical problems to solve; artists found their own problems. But something has been happening to design – something as significant, in its way, as what happened to painting when photography came along. It's been getting more conceptual, more playful, more self-directed, less tied to clients, less servile, less practical. Design is, you might say, having its Marcel Duchamp moment".

The current moment of self-critique, question and challenge within design briefly mapped out here seems to fit easily within Mitchell's description of the interdiscipline as a moment of breakage when continuity within a practice is disrupted and that practice comes into question (Mitchell 1995). Self titled Critical Designers Anthony Dunne and Fiona Raby who are "showing how designers can use fine-art means – provoking, making ambiguous, making strange- to question how we cohabit with electronic technology and to probe its aesthetic potential" (Crampton-Smith 2005, p. ix). A shift in Squires' dimension of mode can be claimed here in the sense that through the contemporary practices of critical, conceptual and experimental practice design is entering into a more philosophical, speculative and reflexive analysis of its itself. This brings it closer to one of the distinguishing characteristics of art. Good examples here are designers like Marti Guixé, Jop van Bennekom, Anthony Dunne and Fiona Raby who use the mechanisms of commercial design contexts in a critical and reflexive way to self-critique the discipline of design. For Mitchell it is a result of a shifting at the inner or outer boundaries of a discipline and for (Squires 1992, p. 201–209) it is an enlarging along one or more of the dimensions of a discipline. "The old dividing lines between artists and designers appear to be dissolving into one another. Indeed, the breath and range of investigation and inspiration they share is possibly the widest to date" (Greff 2007, p. 1; Winters 2009, p. 3). Fiona Raby postulates aesthetic potential but provokes f.e. medical impossibilities in her work where a dog transports oxygen or dialyses takes place at a sheepfold. Her guiding principle is to change the world. The difference between art and design might have been described by "L'art pour l'art" versus the task of function in design. So actually also

staged photography (allocated within the arts) with a design topic could have an impact on function which first has to be discussed, but in conceptual design doesn't have to be analyzed.

In contemporary discussion about *Social Design* e.g. at the Symposia Social Design, Public Action in September 2013 at the University of Applied Arts Vienna, Social Design was discussed in the relation to the north–south conflict: The north borrows lost values from the south, behaves colonialist etc. but on the same hand Portuguese have now to work for their former colonial countries as Brazil. Gupta et al. (2013, p. 60) regrets that "people who are disadvantaged in terms of material resources, invariably leverage the resources in which they are rich, i.e. knowledge, values and institutional networks. Many of them don't share their ideas with outsiders. But some do. A frugal, flexible, friendly innovation conveys what grassroots movement is all about." The Openness of innovation platforms will depend on legitimacy provided by popular participation and will require trust and vigorous growth of social and ethical capital. "Social capital" is said to have first appeared in Lyda Judson Hanifan's discussions of rural school community centres (Hanifan 1916, 1920), who used the term to describe 'those tangible substances [that] count for most in the daily lives of people' (Hanifan 1916, p. 130). "Hanifan was particularly concerned with the cultivation of good will, fellowship, sympathy and social intercourse among those that 'make up a social unit'" (Smith et al. 1995). Nowadays all cards are reshuffled. What is important to perceive is that a re-distribution is taking place, the research methods are a-changing and a mode of participation needed. Art and design in these fields are considered as inheriting key strategies for massive change (Mau et al. 2004) and global innovation.

14.3 Arts and Design Based Research

Artistic research facilitates new approaches, which can lead to both appropriate and more breakthrough solutions. It is an advised method for innovative solutions.

It is simply not possible to show all approaches through history to arts and design-based research in this essay but this essay seeks to draw a short subjective position on history, development and understanding of the terms. For most part we have not been thinking of the arts and the design as vehicles of important knowledge. The paradigm shift in research approaches will lead to innovative solutions in future times, because its importance was never regarded as today. The world could benefit from knowledge about how to see the ideas through other media as already Aristotle recognized: "Most of all the senses, makes us know and brings to light many differences between things" (Aristotle 1984; Johnson 2011, p. 156). Only artists that retained a proximity to childhood engaging in playfulness seem to remain with these attitudes. Maybe it is the phase of brainstorming, where artists and designers can express their innovative thoughts, deferring judgment, aside from measurements and tests. This was the inspiring reception after the lecture of Anil K. Gupta on "landscapes of love" at the Symposia Social Design, Public Action in

September 2013 at the University of Applied Arts Vienna. It was discussed whether innovation has to be facilitated or rather re-discovered in adults and preserve the unawareness of kids, because they "think out loud" and innovate without thoughts of feasibilities and regulations. Adults have to create a *child*-like insight into the nostalgic non-responsible time to be creative and innovative, in a dreamer-phase. The *Dreamer* phase is the time for "wild ideas" and is a Brainstorming-process. "The *Dreamer* enabled new ideas and goals to be formed, the *Realist* turns the dreamer's ideas into reality, the *Criticer* is the one who will filter out any ideas that are too ambitious" (Wake 2010, p. 65).

Indicators of crisis proved to be not researched in the traditional sciences, but should be approached by the broader speculative methods derived from philosophy, history, religion, design and art. Feyerabend (2010, p. 132) argued, that "knowledge needs a plurality of ideas, (. . .) and that well established theories are never strong enough to terminate the existence of alternative approaches." He considered science as a confused political process, a new experience and argued "against established methods" in science. He calls into question methods of exact and systematic methods and encourages "irrational approaches" as a basis for experimental research. He believes that scientists should use artistic research (Sandquist 2013).

The "arts and design based turn of research" might have come into existence through Konrad Fiedler, at the turn of the nineteenth century (Über den Ursprung der künstlerischen Tätigkeit 1887a, b). His philosophy based on Kant, Marées, Hildebrand and defined art as an autonomous field within the arts. During his lifetime he wanted to understand the mental and spiritual activity of the artist (Konnerth 1908, p. 16). Marées scholar, Pidoll published Marées records of "Workshop of an artist, memories of the painter Hans von Marées during the years 1880–1881, 1884–1885" (Konnerth 1908, p. 7). During his artwork, Marées analysed his own artwork step by step. Inspiration and selection of motives do not occur coincidently, they are result of observation, as Marées defined: "Learning to see is everything" and "Drawings document the inner process of an artist", (Konnerth 1908, p. 11), therefore drawing might be considered for Marées as the artistic development of an imagination, neglecting the "mystic intuition" of Shopenhauers' descriptions. Fiedler wanted to learn to read artworks "in the languages they were written in" (Konnerth 1908, 18). Fiedler was conscious that his approach was a philosophic one and that he never could compete with the artist himself. His view was that the process of an artwork was a work of research and reflects societal interrelation and reciprocally the autonomy of artistic laws and not the other way round. For this reason his worldview could be defined constructivistic: The constructed worldview, the psycho-physical process of building consciousness of an artist was the relevant part to be discovered, because the subjective "Denkzusammenhang" (Translation of the author: context of language and thought) determines evaluation (Riehl 1912, p. 18). The scientific research on the arts was in his opinion just a doubling of science without generating any insight into the art process itself (Konnerth 1908, p. 21, 22). So already at the turn of the nineteenth century arts based research was discussed as a discipline, which was for sure

experienced widely before (Leonardo da Vinci notebooks etc.). Arts based research is highly connected with educational approach but rather associated with aesthetic research, quoted by educators, not just art educators and summarized as a sensual experience without clear definition (Selle 1990, p. 34): Swiss educator Pestalozzi, Johann Friedrich Hebart – influenced by aesthetics of German philosopher Schiller 1802 suggested that aesthetics ought to explore the dimensions of experience that were hidden in the push to impose reason on all levels of human endeavor. Froebel and Montessori were to build educational theory and curricula on these ideas (Profoundly arts-based!). John Dewey (1934, 1938) was convinced that learning begins with an experience and declared against "aesthetic"= formalistic appreciation for the benefit of emotional, experimental basis of knowing as critical learning-sensory experiences. Dewey observed the human tendency to flee uncertainty in search of something fixed and eternal that never changes and "observed that live is about change and growth" (Johnson 2011, p. 145). Nowotny notes that it is impossible to say where a particular area of research will lead and that one must accept the unexpected and the disquieting (Nowotny 2011, p. xviii; Jacob 1983, p. 94).

Donald A. Schön (1983) wrote a book about "the reflective practioner" (related to artists and designers) which is highly quoted from related disciplines as educational sciences rather then arts and design based ones, where he seeks for making tacit knowledge explicit. Helga Kämpf-Jansen (2012, p. 19) developed an *aesthetical research and experience* methodology for elementary schools (2012, p. 252) secondary and tertiary level in schools, which was expanded by Gert Selle 1992 (Selle et al. 1994). Kämpf –Jansen (2012, p. 254) linked "everyday life", "art" and "science" as interdependent essential related fields.

Another example for arts based research as "interdiscipline" might be Fritz Kahn (1888–1968), an innovator who merged medicine with the industrial age, who drew explanations of the human body, accordingly to industrial achievements "Man as industrial palace". He was a Berlin based gynecologist and popular science writer who visualized the structure and function of the human body in a very unique way by using visual analogies and metaphors. Medicine was for the very first time of its disciplinary existence in crisis and challenged by another field: industry. Kahn touched the need of explanations by comparisons to this field and interfered as a physician in graphic design. Hundred years later stereotypes of research are again discussed: What is research? What does it involve and deliver?

Arts-based research was first formally cited around the mid 1990s (Barone and Eisner 1997). Arts-based research posits knowledge as sensory knowing and a form of critical engagement, a socially engaged process of reflection and action that discloses new meanings and possibilities (Barone 2008). Eisner derives from an educational observing context as research and borrows methodologies of the social sciences. Andrea Sabisch (2007, p. 18) who derives as Kämpf-Jansen from educational background, reflects in "Staging of research" on the empty map of Lewis Caroll ("Hunting of the snark") and contradicts Kämpf-Jansen that a research has to start with an inquiry but with something undefined before. If this were the case, that every research starts with a question, an answer might be expected and not

remaining in discussion which should be the objective (Pazzini 2000, p. 37). Borgdorff (2012, p. 80) believes that "artistic research as a rule does not start off with clearly defined research questions, topics, or hypotheses whose relevance to the research context or to art practice has been established beforehand (. . .) it is not "hypothesis-led" but "discovery-led" research (Rubidge 2005, p. 8). Mullican (2008, p. 7) writes "you can't answer the question, you can only demonstrate it" (Kozel 2011, p. 209). Damianisch (2013, p. 124) quotes that "the formulation of a question is crucial for any kind of research, often in conjunction with a concrete working hypothesis, whereupon follow-up questions unfold dynamically". On the other hand Frayling criticizes the exceptional positioning of arts and design, which he considers rather institutional then conceptual. He differs the three categories from Herbert Read (1944, 1974) who deals with art and design education and not with research (Frayling 1993/1994, p. 5; Friedman 2008, p. 156):

- Research **into** art and design (Art historical research)
  (Historical research, aesthetic or perceptual research, social, political, critical, economic, iconographical, technical, material, structural, . . . research)
- Research **through** art and design (Artefact & Research)
  (Studio work and research report, research diary, practical experience, project in the studio, communication of results: material research, development work, action research)
- Research **for** art and design (Artefact stands alone)
  (Research where the end product is an artifact, where the thinking is embodied in the artifact, where the goal is not primarily communicable knowledge in the sense of verbal communication but in the sense of visual or iconic or imagistic communication)

Rubidge (2005) explains the differencies even between "research **for** art and design" as follows:

- **Practice-based research**
  Research that tests pre-formulated questions and/or hypotheses derived from artistic practice ("blue-sky-research", hypothesis-led); The artist is the researcher (Rubidge 2005, 5).
  (Bennet et al. believe that only someone other than the artist can only do the research (Bennet et al. 2010)). This research method is grounded theory, developing theory out of practice (Friedman 2008, p. 154).
- **Practice-led research**
  Research using practice to research, practice itself. Often without an initial clearly defined question or hypothesis, it may lead to a formal question or hypothesis; discovery-led; "the artist uses his or her professional experience insights and skills" (Rubidge 2005, p. 8).
- **Practice as research**
  The term 'practice-based' is frequently used as an umbrella term for academic research which incorporates artistic practice as a research methodology" (Rubidge 2005, p. 2),

> Research in which artistic practice is the primary research methodology" (Rubidge 2005; Bennet, et al. 2010, p. 8)

Friedman criticizes this method because he believes that many designers confuse practice with research (Friedman 2008, p. 154). He also refers on Polányi (1966) in *The Tacit Dimension*. "Our stock of tacit knowledge enables us to practice. Putting tacit knowledge to use in theory construction requires rendering tacit knowledge explicit through the process of knowledge conversion" (Friedman 2001, p. 44; Nonaka and Takeuchi 1995, pp. 59–73). These possibilities need explicit knowledge rendered articulate for shared communication and reflection. Nigel Cross (1999, n.p.) remarks that he also did not see any strong evidence of the output of this applied methodology. Johnson (2011, p. 151) observes, that "making strong contrasts between scientific methods and arts practices ignores the central role of the qualitative aspects of any inquiry, whether in the arts or sciences." Damianisch (2013, p. 123) argues that "the number op possibilities of artistic practices is unlimited".

The author agrees with Friedmann that original sources need to be read, trawled and critically rethought, but believes that a mixed method works and meets international recognition (research *into*/*through*/*for* art).

The dOCUMENTA(13) was "dedicated to artistic research and forms of imaginations (. . .) and to a holistic non-logocentric vision that is skeptical of the persisting belief in economic growth" (Damianisch 2013, p. 123; Christov-Bakargiev doCUMENTA (13) 2012, p. 2)

The goal of any inquiry is to be able to act on the knowledge gained. Understanding is as significant as explanation as an outcome of research. The quest of understanding means individual and social transformation is a worthy human enterprise, for to know means to be able to think and act and thereby change things, evoke a cultural change, change of paradigm for our future world. Artistic research should "continue providing potential as a platform for knowledge (. . .) it serves as the innovation of basic research" (Damianisch 2013, p. 125, 127).

Perceiving the need for new approaches, Barnhart (1970, p. 250) suggested that development of social indicators cannot be researched in the traditional sciences, but should be approached "by the broader speculative methods derived from philosophy, history, religion, and art". Feyerabend (2010, p. 132) argued, that "knowledge needs a plurality of ideas, (. . .) and that well established theories are never strong enough to terminate the existence of alternative approaches." He considered science as a confused political process, a new experience and argued "against established methods" in science. Regarding the academic debate from "appropriate (or inappropriate) use of methodologies and theories to demonstrate the existence (or absence) of rigor in creative practice research" (Finn 2010, pp. 1820–1829), the students were required to document and reflect their artistic research (aim: tacit knowledge transfer) by diaries and protocols and develop, according to the changing paradigms for the definitions and presentation of research, performative lectures. Much artistic research has focused on 'enriching our world by developing new products (like compositions images, performances,

installations) and on broadening our understanding of reality and of ourselves' (Borgdorff 2011, p. 69). Florian Dombois (2007, p. 86) suggests that, 'Because Science has explained the world successfully, but not exhaustively, an alternative is needed that returns to view the things that science has neglected'. It will be interesting to define new research methods within the arts- and design-based research fields that exceed established definitions (Mateus-Berr 2013b, p. 162).

14.4 A New Perspective on Teaching

The Applied Design Thinking Lab (ADTL) Vienna is situated at the University of Applied Arts in Vienna and was founded by the author in 2009. It might be understood as an application model for universities, companies and institutions of all kind, as it can be considered as a 'hypothesis and action model' (Mateus-Berr 2013a). ADTL embodies understanding and experimental applying. Students "show" and "don't tell", in order to clarify their concepts for other colleagues by visualization in each session. This implicates a trustful atmosphere, where failures are expected (Weingardt 2004), and "rapid prototyping" becomes state of the art. "The notion of play that incorporates participants being willing to fail and try again as a means of solving problems, can result in their minds being freed through play to function creatively" (Zimmermann 2009, p. 395). Professor of strategic management, Roger Martin, believes that "innovation is about seeing the world not as it, is but as it could be", describes Design Thinking: "(. . .) it focuses on accelerating the pace at which knowledge advances from mystery (an unexplainable problem) to heuristic (a rule of thumb that guides toward a solution) to algorithm (a replicable success formula)" (Martin 2009, cover) and demands abductive reasoning (Peirce 1940), which is rather "wondering", "guessing" than observation (Martin 2009, p. 64; Mateus-Berr 2013). It was considered as extremely important to agree in the ADTL team to the method of appreciative feedback and inquiry. Creative students react highly affective to judgements and should rather be encouraged to experiment then be destroyed, though need to adapt rules and roles. The ADTL chair has to understand herself/himself as part of the learning team, equipped with special knowledge of the topic, interdisciplinary challenge and social skills. The ADTL obtains various role-types of team-members in accordance to Lieshout, Belbin and Raymond (Belbin 1993/2010; Lieshout 1998; Raymond 2010). Team skills and roles are discussed and rethought. The team-roles should be switched and experimented (Mateus-Berr 2013). Because roles and rules were not clearly defined, the group did not always work cooperatively and output – not relation orientated.

But the situational state of mind – defining and switching team roles – is regarded as essential. Interdisciplinary approaches are made and developed. The twenty-century academy organized itself firmly around the concepts of disciplinary conceptual structures, problems and methods. The National Research Council (NRC) of America discovered "that almost all significant growth in knowledge

production in recent decades was occurring at the interdisciplinary borderlands between established fields" (Klein 2010 S. 17). During the ADTL sessions simultaneity of "flow" was observed (a nexus of relations, an entity of flows and stoppage as Deleuze and Guattari describe (2004)) Csikszentmihalyi coined the term flow in 1990 (Csikszentmihaly 2010), where individuals get involved in an activity that nothing else matters, ideas sprout and grow. The students document their work and the ADTL meetings in their diaries and protocols. Arts and design-based approaches are discussed and reflected, documented. The Lab covers a broad range of problem domains from pattern making to fashion for buildings with inflatable membranes, inspiration from science, how to make mathematical problems more tangible, how to establish a fashion branding or how to co-design an art piece or survival kit for shelter.

The Applied Design Thinking process works with the so called *dreamer phase*, where the rule works *Show – don't tell*. And it is better to fail then to get stucked on theory. *Empathy – Define – Ideate – Prototype – Test* is the iterative process rhythm, that shows up in different order of precedence.

Recent experiments reveal new perspectives for fashion, health and, additionally, bring up educationally fruitful methods for working with scientific topics using a creative base. Interim results are presented through performative lectures at international conferences (Kasetart University Bangkok/Thailand: 2nd international Textiles and Costume Congress 2013; ELIA Biennial Conference Vienna 2012, AT; ELIA Teachers' Academy, Porto 2012, PT; Bridges Conference art & mathematics, Coimbra, 2011, PT; Wiskunst Sint Lucas University, Gent, 2011, BE; Bridges Conference art & mathematics Pécs, 2010, HU; pechakucha Künstlerhaus-Vienna Design Week; Vienna 2011, AT). "We believe that there is room for innovation in every aspect of education, and that it can be taught", Stanford's website reads (Crandall 2011) and the author believes. According to Kristensen (2004, pp. 89–96), many design problems arise because there is little integration between the environment, people and technology. He recommends that physical, virtual space and a visual working methodology need to be interconnected in order to enhance a collaborative participation and performance for dispersed teams. The Applied Design Thinking Lab is such a space and develops innovative and performative transfer of design (and involved disciplines) knowledge. Art and design based research is biased scientifically and applied practically at once. Developed innovative tools may be transferred in the fields of educational subjects (schools and universities), interdisciplinary applied in technologies or unto the fields of the creative industries.

14.5 Re-defining Target Groups and Societal Needs

Inspired by a scientific result, innovation and sustainable entrepreneurship might serve as a solution within the operational framework of Open Innovation Diplomacy (Carayannis and Campbell 2009), which "encompasses the concept and

practice of bridging distance and other divides (cultural, socio-economic, technological, etc.), which focused and properly targeted initiatives to connect ideas and solutions with markets and investors ready to appreciate them and nurture them to their full potential"(Carayannis and Campbell 2012, p. 2), or applied through "Mode 3" (Carayannis and Campbell 2009), where people, culture and technology meet, interact and build clusters (Carayannis and Campbell 2012, pp. 4, 8–9).

Victor Papanek (1970/1985) desired a "Social Turn" in design with his book "Design for the real world, Human Ecology and Social Change", which became the bible of the responsible design movement. He compared design and medical profession by imagining all doctors would mainly concentrate on "plastic surgery and cosmetics" (Papanek 1970/1985, p. 234; Whitely 2006, p. 99) and was concerned about the fact that most of the designers were not interested "to the social and human dimensions in design" (Papanek 1970/1985, p. 352; Whitely 2006, p. 99).

Papanek proposed six design priorities:

- Design for the Third World (2009, p. 235)
- Design of teaching and learning medias for people with disabilities (2009, p. 241)
- Design for medicine, surgery, dentistry and hospital equipment (2009, p. 242)
- Design for experimental research (2009, p. 243)
- Design of systems for human life protection under extreme conditions (2009, p. 245)
- Design for fundamentally new concepts (2009, p. 245)

One of them reflected on design for medicine, surgery, dentistry and hospital equipment. Though he rather proposed to evaluate psychological aspects of design as the effects of colors and forms for example, another design priority demanded the rethinking of processes. Papanek et al. (2009, p. 77) considered minorities as people with special needs, to which we all belong once in a lifetime.

14.6 Social Investigations

A current arts-based project should be mentioned in advance: Ulrike Möntmann collects in her artistic research project "This Baby Doll will be a Junkie" observations by junkies, observations that are very seldom heard, on the circumstances of their lives before and after the beginning of their addiction. This project interacts at the interface between violence and power and enhances the visualization of unknown biographies. "This Baby Doll will be a Junkie" suggests that addiction is a matter of destiny; an ominous prediction about a new human life. The title contradicts the idea of the autonomy of the individual, based on equal opportunities, and conflicts with the right to physical and mental self-determination"(Möntmann 2013). Another design-based example might be described with Katie Gaudion, who

engages with design and autism in order to develop empathetic design approaches to improve everyday life for adults with autism (Gaudion 2013, pp. 82–83).

The use of artistic and design-based methods lead to different information, which makes a different handling of the topic possible. The entire ceramic process of casting porcelain body parts of the dolls in the project "This Baby Doll will be a Junkie", who represent the biographies of drug addicted women in different countries, demonstrate the fragility of forgotten individuals in a society. Similar objectives, as empowerment and transparency in societal context, although more silent and introvert, can be found in the following case study:

14.7 Case Study Women's Shelter "Textiles as a Social Fabric"

2013 the ADTL was asked to engage with the Women Shelter's in Vienna. Vienna's four women's refuges offer women and children protection, assistance and temporary accommodation. Their nationality, religion or income is irrelevant. The association was founded in 1978 and offers space for 175 persons.

14.7.1 Methods

The student investigation of the theme was semantically, questioning *values* of textile surfaces associated with shelter and social impact. Textile was used as material, concept and experience. As women and textile might speak different languages, the ADTL concentrated on tactile experiences, and developed a non-verbal "Applied Design Thinking Workshop" (inspired by open source d. school) with various textiles, icons and reduced language tasks. This form of adapted workshop was experienced in an organized workshop at the University of Applied Arts a month before. Experts were invited to give feedback to the concepts and people invited who rarely speak German to test the readability of the workshop tasks.

In this project *textile narratives* and associations as research strategy were used. The women designed for each other a desired symbol for shelter (small rapid prototype), made of carefully selected fabrics. Human skin forms the boundary between our viscera and the external environment and provides sensation and protection. It is one of the on-the-ground-needs of people in general. What kind of sensation and protection women might wish? What kind of fabric will express their need? Anzieu (1991) developed the notion of the "skin ego" where the epidermis performs a series of functions such as support, shield, individuality etc. Boradkar (2010, p. 152) describes therefore five typologies of skins that can help to classify and organize the meanings and associations of the surfaces: "protective,

informational, technological/intelligent, mythical/fetishistic skins". In this project the students focused on protective skins and explored the women's associations by verbal and non-verbal approaches. The women selected "fabrics of shelter" visually and by touch, therefore using sensual research methods. This sensual design research approach is a new qualified method.

Bakhtin's (1929) work posits the centrality of the border of the "verbal and nonverbal" and Law and Urry (2004, pp. 403–404) suggest that traditional research methods are not able to reveal the "sensory", "emotional" and "kinaesthetic", enhance a "performative social science", and therefore Jones (2006, p. 69) advocates a different research approach through senses. The project "Textiles as a social fabric" even transfers the narratives into textile articulations. Text and textile derive from similar roots through the Latin *texere*, to weave. *Learning through seeing* was a prejudice throughout centuries. *Learning through touching* – is a changing hierarchy, because the undervalued place touch inhabits in our understanding of textiles has to be reconsidered, especially in the western culture, which was privileging words and ocularcentrism. The finnish architect Juhani Pallasmaa (2005, p. 11) argues with the anthropologist Ashley Montague (1986, p. 3) that "touch is the mother of the senses". June Hill "argues for the value of listening to objects as well as to people, of poetic understandings, and integrity of process" (Hemmings 2012, p. 4). Hemmings (2012, p. 4) considers touch to be referred not only to the physical contact with a surface "but also to the ways in which we are touched, and moved, by our world." Trauma survivor narratives can be identified by three major components: coherence, turning points, and replotting (Harvey and Bryant 2001; Leavy 2009, p. 30). The participants of the workshops seem to have gone from a victim mindset to a survivor mindset. It was not aimed to recite the coherence, rather to reset the replotting, *re-weaving* and *re-framing* focus on positive memories by touching textiles and making a structured assessment. Textiles remember and are unremittingly democratic, moments of joy and tragedy are recorded on the surface and into the structure of cloth, textiles "are a form of memory" (Stallybrass 2012, p. 76) (Fig. 14.1).

Objective of the first (out of three workshop) was to identify textiles, textile memories associated with *protection*. More then ten women participated with a big crowd of children between 0, 5–10 years of at least two Women's Shelters. Eight students participated from disciplines as Social Design, Textile Design, Psychology, Art & Design & Textile education, Transmedial Art, Slavic linguistic and journalism, five women, two men.

Fig. 14.1 Non verbal icons for textile workshops. Workshop 1. © Joanna Coleman

General goal was to co-create new textile objects with inhabitants of Women's Shelters as actual-analysis of need and association of *shelter*, which can be considered as textile archive for future. Either interior design for inhabitants of Women's Shelters or refugees can rely on outcomes or designing "survival kits" for target groups like women who have been victims of domestic violence, refugees or victims of the global crisis – a situation every one of us may wake up tomorrow. What kind of material, what kind of fabrics would suit functionally and especially emotionally for "shelter and survival kits"? To integrate users into design, Redström concerns as "use before design" (Redström 2008, pp. 410–423). Future use and design anticipates there in actually lifeworlds of people as a strategic position of meta-design. To take a social and architectural perspective, results of these design processes can be defined as things, which modify the space of interaction of the user, which is rich in aesthetics, cultural values and opens up new ways of thinking, changes and behavior (Mareis et al. 2013, p. 82).

In the first workshop it was considered as very important that the women worked in pairs, designed empathic solutions for each other. As they know each other for a short time, living together in the Women's Shelter, they could develop confidence easily. Empathy for each other and designing-for somebody else facilitated a new form of collaboration (Figs. 14.2, 14.3, 14.4, 14.5, 14.6, 14.7, 14.8, and 14.9).

After the first workshop the students met to evaluate the results. Not only the textile preferences associated with shelter, also the evaluation of language association and memories was performed. The women stressed the benefit in working through material and not by words, which forced them to define visions rather their problems and fears. Women were asked to select their most preferred textile, associated with shelter out of more then 50 textiles, which were put down on the green lawn at one of the Women's Shelters. The evaluation can be divided by four

Fig. 14.2 Workshops in pairs. Workshop 1. © ADTL 2013

Fig. 14.3 Selection of tactile material. Workshop 1. © ADTL 2013

Fig. 14.4 Positioning of tactile material. Workshop 1. © ADTL 2013

main colors: red, blue, white, green. White (jersey) was associated with freedom, cleanliness, silence, luck, inside, comfortable, "pleasant to sleep". The blue textiles (viscose and woven satin) were associated with freedom and favourite colour. The five red textiles (orange organza with flower pattern, red tull, striped dark red cord,

Fig. 14.5 Positioning of tactile material. Workshop 1. © ADTL 2013

Fig. 14.6 Presentation of textile meaning. Workshop 1. © ADTL 2013

crepe with black flower pattern, pink nylon) were associated with power, love, safety and security. The green felt textile was associated with nature.

The students considered the workshop as a key experience to join their private interest and artistic practice. Aim of the proceeding workshop was to co-design

Fig. 14.7 Presentation of textile meaning. Workshop 1. © ADTL 2013

Fig. 14.8 Evaluation of the results. Workshop 1. © ADTL 2013

Fig. 14.9 Workshop Method © ADTL 2013

solutions for women and check them. According to the feedback gained by the women who demanded to be further involved especially in practical work, students designed a workshop, which inherited textile experiences, excluding the sense of sight. Their aim was to test the selected fabrics – which might have been selected just by visual preference – and gain further information on "things they would take with them in case of emergency". The women were asked to grap into a basket with closed eyes in which all selected most favourite textiles were collected and they should decide for their most pleasant textile by the sense of touch.

In the second part of the workshop women chose fairytale or TV-series avatars as pseudonyms.

To remain anonymous but document their approaches personalized, they were asked to give themselves pseudonyms. They used and identified with strong, powerful (Mejkpisova ((Glynis Barber- British noblewoman, Sgt (Lady) Harriet Makepeace, in Dempsey and Makepeace (1984–1986), a British television crime drama)), Nikita – agents (Nikita Mears is the primary protagonist and eponymous character of Nikita, an American action and drama television series, or worshiped (Amira ((Al Taweel)) – Saudi princess, Katrina: Katrina Kaif, a British Indian actress Bollywoodstar), some enhanced the rather protective women (Mamma Ziege – "mama goose" from:, a German fable collected by the Brothers Grimm), some the seductive smart identity (Magical Jeannie – American sitcom with a fantasy premise, Shérérazade (Scheherazade is a legendary Persian queen and the main storyteller of One Thousand and One Nights) etc.

Inspired by Eva Heller (1993), the students developed a workshop strategy to let women select textiles (instead of colors) in order to rank the importance of textile as a social fabric of comfort and shelter. The percentage of the material, assembled on the canvas frame determined their preference. Akutinha et al. (2003) quote that "Intonation establishes the close connection between the word and the extralinguistic context. Living intonation is virtually able to release the word from its verbal

Fig. 14.10 Tactile qualities. Workshop 2. © ADTL 2013

limits ... Intonation is always at the boundary of the verbal and nonverbal, the spoken and the unspoken ... Intonation is oriented in two directions: towards the listener and toward the object of the utterance as if to a third living participant (Akutinha et al. 2003; Voloshinov 1926, p. 252, 254). Bakhtin stresses the interdependence of word, colour and spatial form (Akutinha et al. 2003). Akutinha and Bakhtin emphasise the fundamental importance of the senses. The evaluation of narratives was expressed by the intonation of colour, texture and association.

In this case mode 3 was applied (Carayannis and Campbell 2009; Carayannis and Campbell 2012, pp. 4, 8–9), where people, culture and material meet, interact and build emotional clusters. People met, interacted and co-designed an artifact. Each phenomenon constrains all the threads of which the social fabric is composed (Figs. 14.10, 14.11, 14.12, 14.13, and 14.14).

In order to develop a prototype of a "Survival Kit", the second part of the workshop was designed as an enquiry to list all items the women would take with them in case of emergency. Concrete items were named as well as values or metaphors. Some only would take their children. Others enumerated *cloth, cloth for children, photography of their parents and children, Deodorant, documents, pepper spray, alarm, necklace of their mother, book of philosophy, toothbrush, perfume, shampoo, handbag, lipstick, food for children, sunlight, comb, wet wipes, shoes, toys, make-up stuff, mobile, iPad, residence permit, wallet, computer, TV,*

Fig. 14.11 Material semantics. Workshop 2. © ADTL 2013

Fig. 14.12 Material semantics. Workshop 2. © ADTL 2013

Fig. 14.13 Material Semantics. Wokshop 2. © ADTL 2013

Fig. 14.14 Evaluation. Workshop 2. © ADTL 2013

Fig. 14.15 Survival kit. Workshop 2. © ADTL 2013

Fig. 14.16 Survival kit. Workshop 2. © ADTL 2013

Design Thinking material, my faculty, oriental world, flowers, Arabic literature, history, classical music, Sahara (desert), my past (childhood), my parents, my girlfriend, my village, the smell of celery, Mrs. Fischer, my grandma, my mother, patchouli perfume, women's shelter, my brother, my sister, my dog, passports,

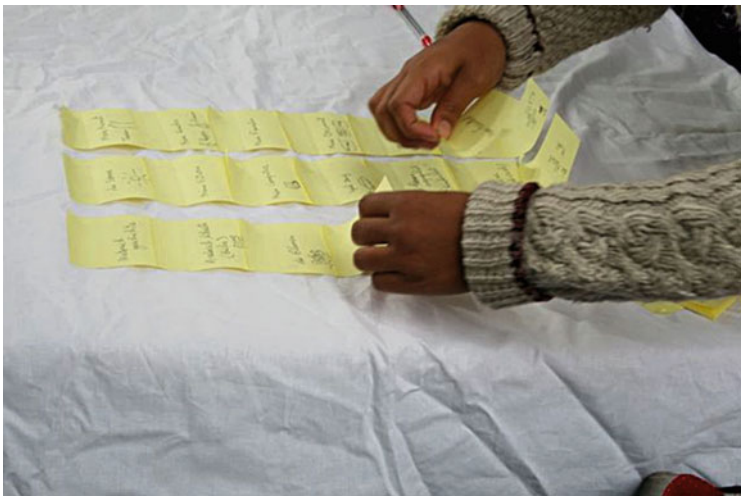

Fig. 14.17 Survival kit. Workshop 2. © ADTL 2013

Fig. 14.18 Survival kit. Workshop 2. © ADTL 2013

Shower-gel, insulin for my sun, cigarettes, keys, etc. (Figs. 14.15, 14.16, 14.17, and 14.18).

After the second workshop the students met to evaluate the results. The haptic evaluation of the fabrics had the effect of 56 % cotton, jersey; synthetic fibre turquoise with pattern 11 %, synthetic fibre transparent; Community of cotton and synthetic fibres 11 %; synthetic fibre pink metallic 11 %. The most associative fabric for shelter in general was cotton jersey, a white fabric with flower pattern.

The canvas were put together as domino parts, organized in colors and semantics, inspired by a little boy who would draw a funny story on the canvas frame. The students discussed and experimented with frames and canvas and how to map the brainstorming of "material semantics on shelter". The mounted the pieces in four elements, signifying the four Women's Shelters and the four initial colors of associations, as well as according to their percentage dimension.

They added essential word associations on the canvas frames in order to document the process and associations (Figs. 14.19 and 14.20).

The third workshop took place in one other of the four Women's Shelters. The parts were transported to the festival hall and discussed with women, living there and joining from other houses. Then the parts were put on the wall and mounted together. It was recognized that some women tried to drill and cement, who never had before, had fun and were proud of the joint work of art. This flexible connected wall artifact can stay as an assemblage or be divided in four parts as there exist four Women Shelter's in Vienna. It is documented with a booklet Textiles as social fabrics, 35 years Women's Shelters, in autumn 2013 (Figs. 14.21, 14.22, and 14.23).

Fig. 14.19 Mounting. Workshop 2. © ADTL 2013

Fig. 14.20 Mounting. Workshop 2. © ADTL 2013

Fig. 14.21 Mounting. Workshop 3. © ADTL 2013

Fig. 14.22 Mounting. Workshop 3. © ADTL 2013

Fig. 14.23 Mounted brainstorm assemblage. Workshop 3. © ADTL 2013

14.8 Silk Comfort, Health Kit, Survival Kit

Aim of the project was to involve women in a design process through material and elaborating health issues for women in general for a survival kit. The special electro-static and micro-biotic abilities of the material silk makes it suitable for use in health precaution and disease control as well as for garment with low cleaning requirement. A "Silk Comfort and Health Kit", especially developed and designed for women in various stages of life (lactation, menopause, ...), shall increase public awareness of the broad potential of silk. The "Silk Comfort and Health Kit" engages to strengthen women's autonomy and mobility. The students engaged in materiality and content for a "Survival Kit" for *vagant* people. After a first brainstorming, which included small and intimate kits, also sleeping bags and other solutions were discussed. Then they researched in art and design literature about similar projects and solutions and developed prototypes, which shall be discussed and realized by fundraising (Fig. 14.24).

Cornelia Bast designed a health kit for various situations in a woman's life: There are various situations in which the material silk can help either preventively or supporting the healing process. Therefore the "Silk Comfort and Health Kit" contains:

Breast pads, to avoid skin damage and infection as well as to support healing in case of an already existing infection (Material: silk), Panty liners, as a preventive and in case of vaginal infections (Material: 100 % silk jersey), T-shirts, helping during the time of transition to menopause, when it often comes to hot flashes and

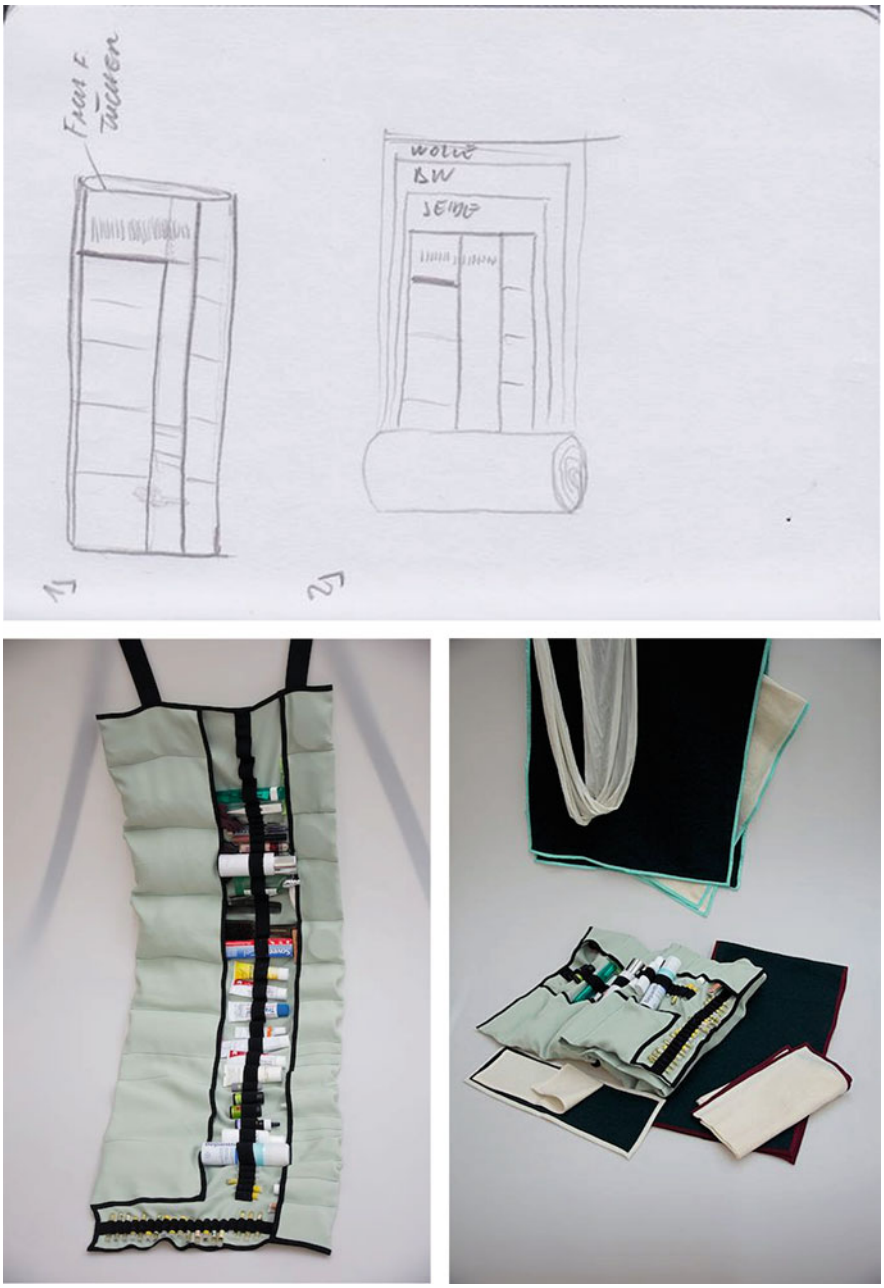

Fig. 24 (continued)

Fig. 24 (continued)

Fig. 14.24 (**1–8**) Silk health kit. © Cornelia Bast 2013

thus excessive transpiration. Despite numerous "hot flashes" the smell that comes with a bacterial growth, significantly is retained.

(Material: 100 % silk jersey), Scarves, for various throat a silk scarf offers optimum protection at ambient temperatures higher than about 20 °C (68 °F). Depending on the intensity of transpiration, the suitable material is chosen (Material: 100 % silk jersey and 100 % silk Poultice). Further on, the kit contains fabrics to make throat, thoracic and abdominal poultices. For each body region, there is a woolen cloth for the outside and a cotton cloth for the inner layer. The matching cloths are color-coded by their bordures – Color guidance system. The attached manual describes how to prepare and to use the poultice.

A compilation of homeopathic globules for common ailments, recommended by a doctor are added, all glass vials with plastic plugs are labeled and correspond descriptions. The kit provides space for objects that were specified by users during the preliminary stages of designing the kit. These three areas are covered: health, hygiene and beauty.

Each object has its place. In consideration there is a planned extension to design and mount Icons – for easy understanding and finding needed objects. Double-sided filling could reduce the surface of the rolled up kit (Figs. 14.25, 14.26, and 14.27).

A workshop with Walter Lunzer developed further strategies for solutions of carrier systems for the survival kit. Different goals were approached: Health, protection and comfort. It was important not to produce a trash aesthetic and follow up their need for beauty, dignity and recognition (Fig. 14.28).

Fig. 14.25 (**1–6**) Sketches for survival kit. © László Lukács 2013

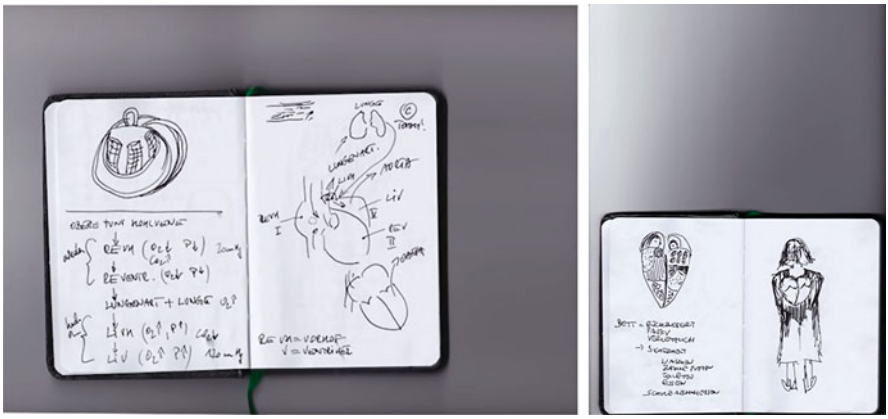

Fig. 14.26 (**1–2**) Sketches for survival kit. © Ruth Mateus-Berr & Tommy Berr 2013

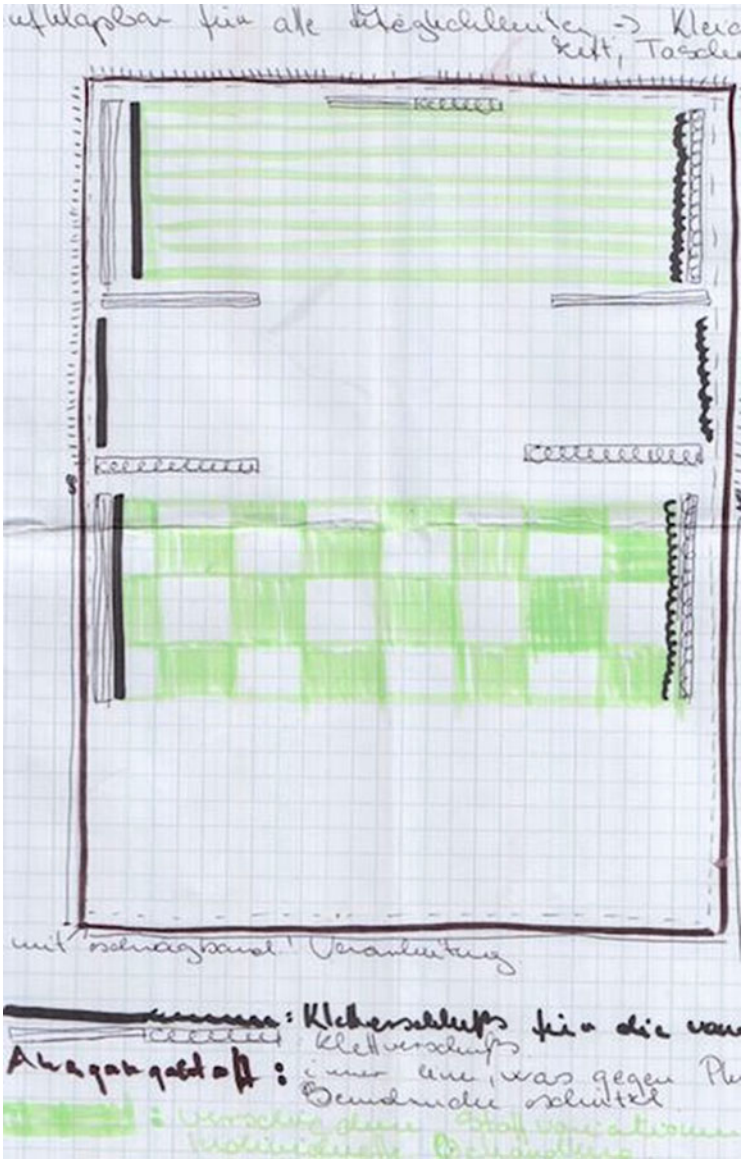

Fig. 27 (continued)

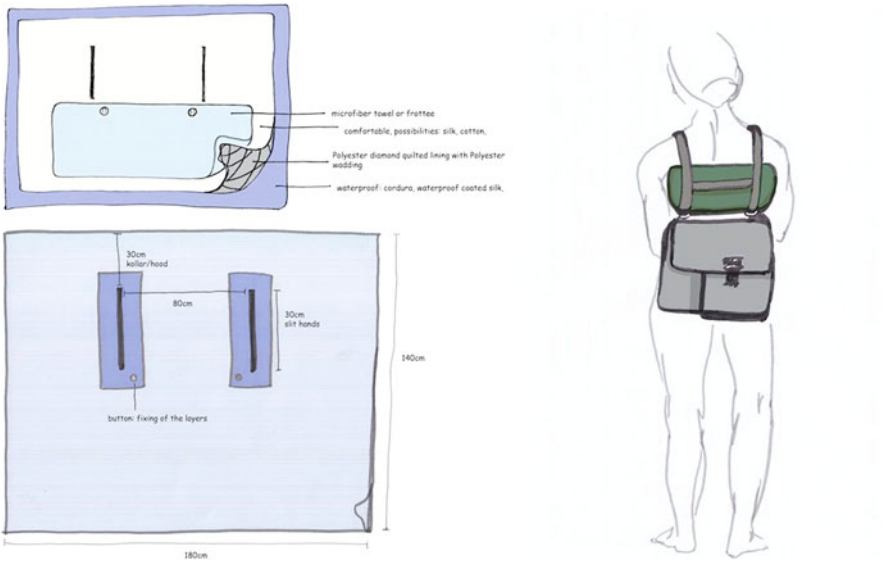

Fig. 14.27 (**1**–**4**) Sketches for survival kit. © Klaudia Kozma 2013

Fig. 14.28 (**1–3**) Prototype survival kit. © Klaudia Kozma 2013. © Foto Georg Gläser 2013

Conclusion

It is evident that the vision of knowledge transfer and inspiration took place. Textiles remember and are unremittingly democratic, moments of joy and tragedy are recorded on the surface and into the structure of cloth, textiles "are a form of memory" (Stallybrass 2012, p. 76). Textiles as social fabrics interwove women and students throughout the project, too. Women from Shelters became friends who haven't been before, because different understanding was generated by *empathic design*. "This method challenges to not just understand the problem mentally, but also to start creating solutions from connections to deep thoughts and feelings" (IDEO 2011, p. 89). Most of them seemed to be intertwined within threatening experiences in their past, during the collaboration they focused on future visions and shared them with each other through the qualities of material and textile semantics of *shelter*. The students engaged with the scientific topic and co-created with inhabitants of Women's Shelters. They derived from different faculties, cultural background and worked cooperatively, a team spirit was set up. Interdisciplinary methods of ADTL were applied, lust to practice, to succeed or also fail was experimented. They worked in competition for best results, helped each other in development but on the same hand supported each other in all different activities as brainstorming, planning, protocolling, organizing, designing, iterating, researching, translation, documentation, co-developing and prototyping. The most challenging part was the negotiation of different point of views, which were difficult to handle for novices and as well in interdisciplinary context. The participative research with women in Women's Shelters has proved an arts/design based research on textile receptions, and have begun to examine sensual values of social fabrics. Knowledge production was experimented with different approaches in workshops with the textile material and approached successful solutions by participative Design Research. The students discovered textile design as social fabric, silk as a second skin, co-developed "health-kits", "survival-kits" with women, which might be developed further. Collaboration with less well-off social groups, protection of users, consumers, the environment and citizen participation allow students new experiences and empower societal responsibility. They develop tolerances and learn to negotiate. Integrating an arts-based organizational framework for such a collaboration can be further supported by the resurgence of interest in the arts as well as aspects of cognitive development, replotting and re-weaving positive memories and empowerment. Women at Women's Shelters experimented through arts, they improved structuring material of positive memories and their lives and focused on future visions. Through documenting cooperative workshops and own artistic design work, arts and design based research develops innovative insights and solutions for students and empower disadvantaged target groups. Therefore future

(continued)

directions are to continue the praxis of the ADTL as an exceptional unit at universities for co-designing and social interaction.

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Chapter 15
Provocation as a Constructive Element in the Arts and in Education to Foster Societal Development and Innovation: Experience and Knowledge as Forms of Social Relations

Barbara Putz-Plecko

Abstract The essay puts the *new* in art and the notion of cultural innovation into relation with the apparatus of creativity of a western consumer culture and with an understanding of innovation that is at the economic-technological heart of our capitalist society. It examines the social figure of the creative individual and his or her position as a role model in the context of creative industries and creative cities. It raises the issue of expectations connected with this concerning forms of artistic education and pleads in favor of an academic space for mutual exchange that is alive and, in the best sense of the word, provocative. Included here, in the spirit of exchange, are examples of projects that present artistic methods of research from a broad range of current practice at the University of Applied Arts, practice that places itself in contexts of meaning quite different from those of the dominant economic rationale of utilization.

Keywords The *new* in art • Cultural innovation • The social figure of the artist • The artist as a role model for the New Economy • Qualities of provocation • The essence of innovation • Imperative of creativity • Culturalization of the economy • Economization of culture • Cultural entrepreneur • Creative industries • Creative cities • Aestheticization • Increasing precariousity • Gentrification • Critical and divergent art practices • Schools of thought • Art education and social agency • Potentiality • Spaces for thought and action • Provocative communities • Artistic research • Experience and knowledge as forms of social relations • Good way of living

Art, as currently reflected in our media and as a topic of public debate, is seen primarily as shares of stock, as a means of acquiring distinction, as a field of

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projection and a repository for what is "other" – what deviates from norms, the extraordinary, the surprising, the vague, what escapes our grasp, lacks rules, the unbounded – and for that reason it is at once appealing, fascinating, unsettling, discomforting, threatening, off-putting. A recent example of this is the story of the one thousand four hundred modern masterpieces that had for decades been believed lost forever and the media reports on their discovery by customs investigators in the apartment of a son of Hildebrand Gurlitt, an art dealer who had collaborated with the Nazis – reports on the confiscation of sensational "hot goods" of inestimable value, which, presented in spectacular contrast to the allegedly rundown apartment where they had been stored, are becoming the focus of mass-media and voyeuristic attention primarily because of their immeasurable capital value.

Constantly emerging new movements that exclude and include on the part of certain interest groups and systems – whether in effect marking boundaries, setting limits, establishing exclusiveness or dissolving boundaries – determine not only the nature of discourse but also artifact systems, social practices and forms of subjectivization. A society that assigns to the figure of the artist the role of *agent provocateur*, as societies often do, routinely delegates to a specific social field a function that is vital to its development, that of vigorous dissent – continuous critical questioning, movement against the grain, the necessary processualization of boundary lines and territories defined within society – in other words, societal "construction sites", impulses to move on. At the same time, it assimilates even radical artistic criticism as being something aesthetic and digests this selectively from the standpoint of utility. Dissent is thus swallowed up, sub-cultural practices are utilized for cultural fashions, and provocation, in the end, finds itself being calculated, integrated and, in the process, defused and eviscerated.

Indeed, provocation, "*provocare*" in the sense "to stimulate", "to excite", "to arouse", "to challenge" and "to expect something of", is a quality that is not only encoded in the practice of an art, it is a dynamic process of sensuous and affective stimulation that is directly at its source. Processes in which the creatively new is brought forth, in which existing solutions to problems are no longer recognized as adequate and are therefore questioned, in which one seeks new ways to arrive at solutions and in which new ideas or new visions evolve, such processes are, as a rule, extremely virulent because they are pervaded by stimuli and friction, by conflict, and by conscious and unconscious provocation. (Whereby the latter, through conscious alteration of characteristics or constellations, can be construed in a way that gives rise to unusual – even absurd – consequences, and thereby opens up the field.) And these processes are determined by the complex interaction between talent, knowledge, ability, motivation, by individual characteristics and specific contextual circumstances.

We know: that the history of art can be read as a succession of ruptures, as a history of artistic invention; that in each case it was the clear distancing from what already existed, the quality of being different – the new – that accounted for the fact that artistic works were considered worthy of being remembered, that they were seen as having significance.

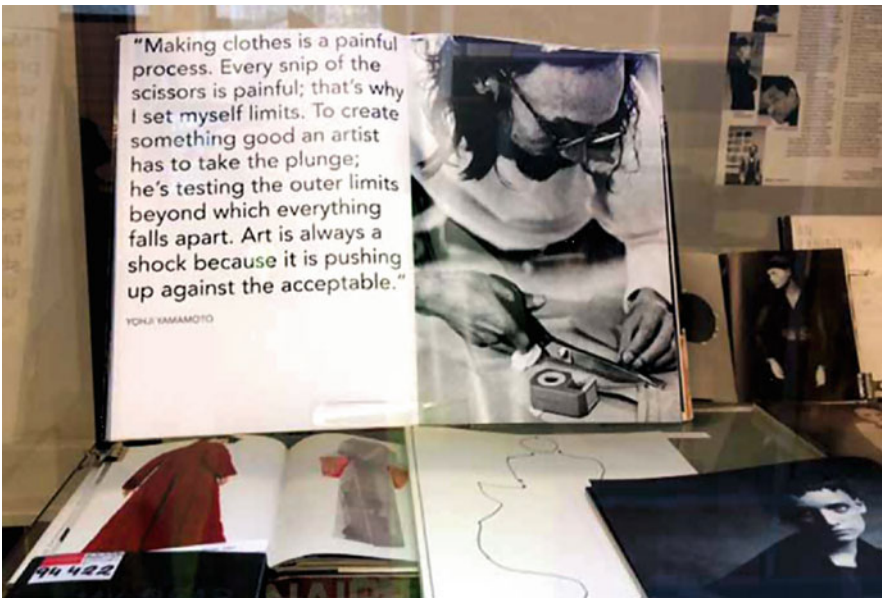
But what is this quality of being "new" that justifies their being remembered?

Boris Groys, in his culture-philosophical essay "On the New", offered, at the end of the twentieth century, some rather sound insight as a response to the apparatus of creativity, the economies of innovation and target-oriented progress, by re-examining the traditional criteria for the new. In a keen tour de force that cuts across contemporary history of thought and art, he writes of the new as being something obviously unavoidable, inevitable, indispensable, something from which there is anyway no escape. "It is impossible to break the rules of the new, because such a break is precisely what the rules require. And in this sense, the demand for innovation, as it were, is the only reality that finds expression in culture. By virtue of its being indispensable, innovation is reality...Aspiration towards the new manifests the reality of our culture precisely when it is freed from all ideological motivation and justification and when the distinction between true, authentic innovation and false, unauthentic innovation is dropped...The essence of innovation does not lie in the revealing of something that was hidden, but rather in the fact that the value of something that has always been seen and known is revaluated."[1] Thus, with respect to innovation, he discards both the requirement of particular authenticity as well as its supposed particular aptitude to reveal "truths". The new is thus the valorization of something considered worthless until now (he uses Marcel Duchamp's "ready-made" as an example), and artistic innovation a constant redrawing of a boundary between the "valueless profane" and the "culturally valorized" – whereby both of these layers of value are present in every work of art and every theoretical work, but without fusing into an organic whole. It is precisely this dichotomy of values in each individual work of art that constitutes the inner tension of innovation. For Groys, cultural innovation thus takes place above all in a cultural-economic form of exchange; in the course of this exchange, "certain things from the profane realm are valorized and find their way into the *cultural archive*, inversely, certain cultural values are devaluated and find their way into the *profane realm*."[2] Groys thus sees innovation as being a crossing of a boundary in two directions – as a devaluation of what has value, and as a valorization of what has none – and cultural innovation as the best means of exploring economic logic, which, however, he sees not as being limited to the trade of goods, but equally as being connected to archaic or obsessive phenomena.[3] However, every innovative exchange calls for decisions and is a risky undertaking.

[1] Groys, Boris (2004): Über das Neue. Versuch einer Kulturökonomie. Carl Hanser Verlag (1992), Munich, Vienna; quoted from the 3rd paperback edition, Fischer Taschenbuch Verlag, Frankfurt/Main, pp. 12–14.

[2] Ibid., p. 119.

[3] Cf. Georges Bataille; also Walter Grasskamp: zeit.de/1991/47/ueber-die-aufwertung-des-wertlosen.



Yohji Yamamoto is an award-winning and highly influential Japanese fashion designer based in Tokyo and Paris. The photograph shows a display case containing magazines and books devoted to the designer and artist, a compilation of images and texts in the library of the University of Applied Arts Vienna. A quote by Yamamoto: "Making clothes is a painful process. Every snip of the scissors is painful; that's why I set myself limits. To create something good, an artist has to take the plunge; he's testing the outer limits beyond which everything falls apart. Art is always a shock because it is pushing up against the acceptable."

For, according to Groys, it is impossible to develop a cultural strategy that will guarantee that a work or an artist or author will find a place in the cultural archive. They all possess both value levels inherently and can be understood, interpreted and appreciated in different ways. "No ability, no knowledge, no social privileges can guarantee an author's success, no authenticity, no proximity to the real, to the profane, to the true." For this reason, Groys considers cultural innovation to be the most consistent manifestation of this logic, a logic that operates just as relentlessly – although covertly – in other areas of life as well.[4]

Running counter to an economically oriented imperative of creativity and innovation and to linear, technological fancies of progress and control, this essay continues to possess a remarkable potency. The understanding of cultural innovation as developed by the author is rooted in a perception of artists – *subjects* in the philosophical sense – and of aesthetic production and lifestyle that differs totally from their being seen as fully convertible into measurable data adapted to the demands of the economy. Such reductive attempts at conversion and quantification inevitably founder on the inherent antagonisms and complexities involved.

[4] Groys, Boris: Über das Neue. See above, p. 163.

Gerhard Treml: EDEN'S EDGE. An artistic research project. University of Applied Arts/FWF (PEEK)[5] Presented in the exhibition Out of the Box. 2013. Eden's Edge is a trans-disciplinary research project that investigates the narrative nature of landscapes. During the process, new questions emerge about how landscapes are perceived and used in stories of everyday life, the sciences, in films, the daily news or computer games. The objective is to develop narrative strategies for application in research and the practice of landscape design. The project makes use of techniques from the film industry, especially the art of screen writing, which is able to create durable connections to places through forceful place references. Based on the production of nine exemplary "life-story-landmarks" Eden's Edge attempts to reinterpret one of Hollywood's most prominent landscape icons – the Californian desert – through stories told by the people who live there. See more: www.edens-edge.org

Nevertheless, in the discourse on creativity and *creative industries*, which, beginning with Great Britain, brought about a reorganization, a repositioning of cultural production that opened the way for a culturalization of the economy as well as the economization of culture, the artist, in his or her function as *cultural entrepreneur*[6], has come to serve as a role model for the New Economy.[7] In the service of the economy, working individuals, or subjects, are reconceived and thought of as conforming to this figure of the artist, which stands in contrast to that of the ordinary employed person and embodies "the successful combination of an unlimited spectrum of ideas, creativity on demand and clever self-marketing".[8]

[5] Artists today work as researchers. They research, experiment, study and change perspectives, perhaps also precisely by virtue of the fact that they cross tightly drawn disciplinary boundaries, invent new rules and also allow for failure. The exhibition titled "Out of the Box. 10 Questions on Artistic Research" provides insight into ten artistic research projects presently being presented at the University of Applied Arts Vienna. These projects are being funded by the Austrian Ministry of Education and Research as part of the FWF's PEEK program for developing the arts.

[6] The notion of cultural entrepreneur was introduced into the discourse by Anthony Davies. Cf. Davies, Anthony/Ford, Simon (1999): "Art Futures" in: Art Monthly, no. 223, Feb. 1999.

[7] Cf. Raunig, Gerald/Wuggening, Ulf (Eds.) (2007): Kritik der Kreativität, Vienna.

[8] von Osten, Marion: Unberechenbare Ausgänge. In: Kritik der Kreativität, ibid., p. 103.

A construct, the creative, these subject positions "represented as being self-motivating sources of productivity and exalted as creators of new, subversive ideas and innovative work and life styles (and passionately attached to these)",[9] seem to be just what is needed in view of the malfunctions and merciless dynamics of deregulated institutional and organizational structures and free markets. Not only are the creative accustomed to coping with uncertainties, they also possess the ability, time and again, to turn these to their advantage; flexible, able to meet challenges with spontaneity and creativity, they are mobile, resourceful and autonomous. In such a way of life, work is no longer truly distinguishable from non-work, nor is it clearly identifiable. A derivative of the *cultural entrepreneur*, the figure of the "*work entrepreneur*" – in its turn a modern transformation of the classical *employee* – is accordingly expected to show a new attitude towards optimization, production speed-ups and commercial utilization.[10] However, the conditions for these newly defined relations of production, their background and the realities they represent – such as the rapidly growing precariousness, with whose grueling, alarming, existence-threatening effects artists and the so-called creative also have to struggle – are hardly ever examined, or, even, they are consciously obscured. Budget cuts are to be offset by inventive ideas; hard times in the social, political and economic arenas are to be endured and overcome as a personal challenge. In order to tap unrealized potential, new "techniques" and "tools" are developed, as well as appropriate forms of "training" geared towards "enhancing" and "optimizing" performance. This means that a normative model of creativity, as well as practices of guidance and control, attempt to capture that fleeting moment of creativity, to make it serve and to institutionalize it. When, in 2000, Richard Florida, in his seminal study *The Rise of the Creative Class*, describes the central transformation of society over the past 50 years as being more cultural than technical and hails this *creative class* as being the professional group that will have the most to say in the future, when he brings in creativity not only in the sense of personal development but also as a means of dealing with the ever-present economic demands of the professional and labor world,[11] he situates creativity's realm of applicability deep within the economic and technological heart of capitalistic societies. The apparatus of creativity thus becomes "a system that systematically seeks to mobilize its own resources, and in so doing leaves the residue that cannot be mobilized behind".[12]

[9] Ibid., p. 106.

[10] Cf. ibid., p. 105.

[11] Florida, Richard (2000): The Rise of the Creative Class. And How It's Transforming Work, Leisure, Community and Everyday Life. New York.

[12] Reckwitz, Andreas (2012): Die Erfindung der Kreativität. Zum Prozess gesellschaftlicher Ästhetisierung. Berlin.

Carla Bobadilla: CREATIVITY IS OUR HOPE, photographic work devoted to creative forms of activity beyond the established norms. Valparaíso, Chile, 2011. The work is part of a project of the same name by Carla Bobadilla. As a general rule, the artist takes as her point of departure "social occurrences, unsolved problems, the economics of survival, unrecognized errors, human failure and, in particular, everything that breaks the mold of systems, everything that does not fit. The works presented here are part of a vast study of the relationships between art and economy." Carla Bobadilla was born in Valparaíso, grew up in Chile and is now living in Vienna. See more at www.carlabobadila.at

With regard to the apparatus of creativity, art of the late twentieth century – with its transgressions of limits and efforts to do away with the distinction between what should and what should not be considered an object of art, its integration of non-artistic events and artifacts, or its artistic appropriation of techniques and methods belonging, for example, to practices in the social and scientific fields characterized by collective forms of work – art of this period, then, to a certain extent can serve in an exemplary way as a format for developments within all of society.

New forms of activity, new work methods and the constant production of new types of things are characteristic features of the transformation mentioned above – that is, the break with work routines, with standard ways of dealing with subjects and objects, the break with classical models of organizations and institutions. Organizations have come to be regarded as dynamic "cultural and affective organized events"[13] that constantly generate new ideas, signs and forms of experience and whose stability is bolstered by a set of values and a sense of identity specific to each organization that operate in the background. Development and production are viewed, ideally, as group endeavors (that is, the figure of the individual artist is not the model, but rather the artist collective). Management techniques such as

[13] Ibid., p. 185.

design thinking "are based on the assumption that all goods and services can be aestheticized as bearers of symbols, percepts and affects,"[14] and they set the pace for a design economy that is no longer centered on the object itself, but rather on the satisfaction the customer derives from a sensual-affective experience and on insubstantial atmospheres. Responding to cultural developments, the aesthetic work, the creation of the new proceeds above all by means of new arrangements of signs, sensory stimuli and affects and thus addresses itself to an active, affectable public, described by Nigel Thrift as a community of consumption and affect, driven and guided by fascination and hedonism. This public seeks the lure of the new. And affectivity results from aestheticization. The apparatus of creativity is therefore geared towards the most intense forms of stimuli that can be produced by the aesthetically new.[15]

In processes related to these, cities evolved and continue to evolve into cultural entities; western metropolises are being converted into rivaling *creative cities*.[16] With the culturalization of cities – a process involving conversions of codes and uses as well as urban transformations resulting from an "artistic mode of production"[17] – cities in Europe that formerly had a functional-industrial character and were intended to provide for their citizens' old age have turned into pulsating centers of steady, concentrated production of new signs, places where intense, sensual-affective atmospheres are purposefully being cultivated.[18] Thus, flexible capitalism (with its characteristic features, such as "fluid" work processes, increased mobility and market-like structures of organization) has produced the entrepreneurial city of experiences – with an elaborate consumer culture as the central factor behind its image – which is meant to attract the artistic and creative as active participants, as well as scientific and technological communities, so that their creative achievements can corroborate and expand the success story of the "creative city", the "city of knowledge", as being a hot spot of innovation. Attention management does its advertising with glossy brochures that give a consistent picture of prosperous metropolises, even when these hot spots have recently proven totally unstable, especially due to the effects of speculative flows of capital from the finance and real estate sectors and local-strategy decisions made by multinational business concerns. Creative artists – as artist figures role models, in a sense, of the creative city, and only too often precariously self-employed – are very frequently, but in most cases unintentionally, accomplices in a profit-oriented scheme of urban redevelopment along the classical lines of gentrification. Many of them recognize

[14] Ibid., p. 187.

[15] Cf. Thrift, Nigel (2008): Non-Representational Theory: Space, Politics, Affect. London, New York.

[16] Cf. Landry, Charles (2009): The Creative City. A Toolkit for Urban Innovators. London.

[17] This term was used by the American sociologist Sharon Zukin (1991) in reference to the creation of an architectural environment favorable for displaying and selling cultural symbols and signs. In: Landscapes of Power. From Detroit to Disney World. Berkeley. Los Angeles. Oxford. Cf. Ronneberger, Klaus (2012): Urbanes Rauschen. In: Kulturrisse 2012/3. Widersprüche der kreativen Stadt. IGKultur Österreich.

[18] Cf. Reckwitz, Andreas (2012). Ibid., chapter on creative cities: Die Kulturalisierung der Stadt.

the conflicting nature of their role within the urban structure and feel themselves, for that reason, deeply challenged.

Katharina Gsöllpointner, Ruth Schnell, Romana Schuler: DIGITAL SYNESTHESIA. SYNESTHETIC DIGITALITY AS A GENUINE FIELD OF ARTISTIC RESEARCH. An artistic research project. University of Applied Arts/FWF (PEEK). Presented in the exhibition Out of the Box. 2013. The Digital Synesthesia project broadens the scientific spectrum of synesthetic research, tapping the possibilities of digital technologies as artistic research media. While science hopes to find answers to unexplained questions of the study of memory and perception through specially configured stimuli processed by the senses and the human brain, there are artists who are deploying the means of digital arts in the realm of experimental perceptual art, reflecting the accelerated development of technology with all its epistemological and aesthetic potential. The experimental setting is designed by both artists and scientists at the interfaces of perception research and aesthetic study as well as digital art production. The artists research the synesthetic dimension in the perception of digital artworks taking into account recent neuro- and cognitive research findings, thus allowing for completely new insights in the realm of synesthesia research. The twelve interactive multimedia digital artworks produced by the artists create an experimental field facilitating the study of synesthetic modes of perception in participants from Europe and Asia. See more: www.digitalsynesthesia.net

Should one, with conscious approval, serve a commercialization lobby? And if not, how does one avoid being drawn in? How can an artistic practice, a practice of cultural work be developed effectively in such complex and fragile dynamics? And how – beyond temporary methods of intervention – can sustainable structures for self-empowerment be put in place? If it is true that the city, as space, belongs to everyone, then how is it possible to act freely in spaces that are occupied? How is it possible to open up spaces for deliberation and action so that the city's syntax can be altered? From these questions addressing artistic-urban practices, challenges arise

that aim at longer-term effectiveness, and, due to the complexity of the conflicting interests, structures and policies involved, meeting them is not a simple task.

Nevertheless, it has always been the case that alongside multifarious practices that reaffirm and endorse the status quo, critical and divergent practices have also evolved (as society's apparatuses are never without inconsistencies) that pose other, new questions, practices that stand out against the prevailing logic, that develop new visions, instruments and strategies and make innovative advances.[19]

Daniel Aschwanden: THE ART OF READING MAPS. A trans-disciplinary walking tour of the city incorporating performance as part of urbanize! 2013 CITOPIA NOW. Vienna. 2013. In the context of the urbanize! festival the artist-performer set out in search of hidden potentials in the urban interstices. This festival, with tools taken from science, art and actionism and by means of lectures, discussions, exhibitions, workshops, films, walking tours through the city and art intervention, has for years done its part to "help latent conceptions and visionary ideas about revolutionizing everyday urban life to germinate." With a walking tour of the city that cut across disciplines and incorporated performance, Daniel Aschwanden staged Thomas Ballhausen's text Kunst des Kartenlesens. The city, Vienna's urban space, became the stage, and the artist himself, participants, city dwellers and the public – the actors. A complex choreography, augmented by various multimedia contributions by artists from Accra and Beijing, situated the text in local space and opened up new areas of trans-cultural communication. Evolving through the urban space, the staged event was an exploration of the stress ratio between reality and fiction; everyday panoramas interfaced with those occurring in the text, triggering chains of associations and creating synapses with the potentialities of a city that was perhaps not so familiar after all. See more: dadax.org

[19] In this respect, see Barbara Holub/transparadiso and her database on the trans-disciplinary Urban-Practitionners. urban-matters.org.

Often, processes of a provocative nature – experimentation, the dissolution of boundaries, the breaking of rules and sequences – have a part to play as an impetus in artistic exploration.

Those weighty factors that Boris Groys describes as crossings of boundaries in two directions – a process by which values are both increased and decreased, a process of valorization and profanization – determine the nature of every artistic work and place it in a relationship.

Virgil Widrich, Roman Kirschner: LIQUID THINGS. An art-based-materials research project. University of Applied Arts/FWF (PEEK). Presented in the exhibition Out of the Box. 2013. The field with which Liquid Things is concerned can be described as art-based-materials research. Practically and theoretically, the project aims at exploring the activity or vitality of materials, in particular those that have fluid or transitive qualities or modes of response. Materials are not 'fluid' only by virtue of the fact that they are largely in flux in a physical sense. The concept aims more generally at the variable and transitory nature of the objects that emerge from the process. Their forms being in process, they are not limited to a concrete, definitive form. The artistic thing should be largely shaped in a temporary sense by the activity and dynamics of its own materials. One consequence of this is that the boundaries of the 'fluid things' also become dynamic. The project is decidedly committed to the intrinsic aspects of the creative pertinacity and the productivity of stuff. Instead of reducing the latter to passive and compliant material, Liquid Things tries to give the materials as much leeway, room for action as possible. The materials are allowed to play an active role. Their immanent dynamics and tendencies are acknowledged and contribute to determining artistic and scientific processes

In this sense, every artist faces decisions, goes either along with – in varying degrees – or against current values that society establishes as signposts, against

prevailing modes of thinking, formats and practices considered to be fail-safe. By no means situated outside the dynamics of society, the artist rather plays a part in creating them.

Bernhard Cella: NO_ISBN. An artistic research project. University of Applied Arts/FWF (PEEK). Presented in the exhibition Out of the Box. 2013. In the Museum of Applied Arts, Bernhard Cella installs a production environment that is about to disappear – the world of the printer's workshop: table, shelves, paper, printing plates, color, work clothes, work bridge, and a Heidelberg flatbed letterpress. The installation comes to life and reproduces a book: How to Disappear Completely and Never Be Found from the year 1985. It is a precise instruction manual about how an individual can withdraw from all of society's supply and control systems. Cella draws connections between this idea and the present, the apparent crisis affecting the "capacity to disappear", and the numerous signs indicating a society's collapse. In contemporary US American perception this title effectively stands for the attitude towards life of those who are truly and thoroughly disgusted by the world. In his artistic research project NO_ISBN – The Privatization of the Publication, Cella is concerned with books that were published without an ISBN number and thereby evade the records of the international goods-exchange system. With the development of digital means of production, making books has become relatively affordable; many works are printed solely for the immediate social group – friends, colleagues, or family. To what extent is there a conscious strategy behind NO_ISBN books today? Cella researched and gathered empirical data by means of newsletters, posters, and direct enquiries. His object of research encompasses the complete spectrum from subversive gestures to the new Biedermeier

Consequently, it befits academies and universities specialized in the arts to reflect in a consistent manner on just what kind of "space" they create for – and through – teaching and research, and on their place within the context of the processes of culturalization and economic homogenization mentioned above. Like artistic works, they too deserve reflection with respect to the above-described dynamics of the cultural-economic exchange between the two value levels that are always present simultaneously. In the constant tug-of-war between their own aspirations, expectations and assumptions brought in from the outside as well as

various powerful apparatuses, they too must define, time and again, their position within the context of developments in society. Observation of the academic landscape shows that standpoints and self-profiles differ quite significantly.

More than 7 years ago, in a contribution to Frieze Magazine under the title *Schools of Thought*, Okwui Enwezor, artistic director of documenta 11 and at the time Dean of Academic Affairs and Senior Vice-President at the San Francisco Art Institute, wrote critically of the interlinking of art education programs and economic models and made the case for an art education beyond economic models. He describes the art school of the last decade as clearly being an increasingly attractive subject of fascination in the context of the creative hype, and he asks what underlying interests might be at work here, suggesting that a close look at the particular impact of an article by Daniel Pink published in the Harvard Business Review in 2004 entitled *The MFA is the New MBA* might provide some answers. Pink, in his article, argues that the must-have degree for survival and success in today's business world is no longer the Master of Business Administration but the Master of Fine Arts, and he offers reasons why. Enwezor sees Pink's claim as problematic and too much of "a vindication of the business model of constant enrolment growth and expansion which drives art education in the US", and he criticizes its implicit reduction of art education to purely economic values. In Enwezor's view, social and intellectual capital has priority. As he states it:

> Gaining an art education...is an investment in social agency. In this sense our view of the art school today needs to take into account its new context on the global stage at large... The task I see for art schools lies in reconciling the experimental, radical practices of the individual artist with the unruly, unpredictable, asymmetrical relations that constitute the world in which such art is fashioned and realized. What seems apposite for me in this new context is the relation between art and education as two versions of a process of reaching awareness: self-discovery and self-emancipation. Both involve taking chances, opening oneself up to one's limits, and being challenged by the labour of making obscure knowledge immanent and palpable. Most importantly, understanding the relation between the two is a way to keep one step ahead of the MBA.[20]

This space for which Enwezor makes a plea – this open space of experimentation, of daring, of emancipation, one in which self-awareness and worldly wisdom enter into a relationship and in which constant innovation is self-evident and unaffected by the sway of economic policies – this space is not only being undermined by what the Bologna Process has sought to bring about in the academic field, it is also gradually being altered and even spoilt by its regulations. The focus on effectiveness inherent in the Process – and the relative neglect of content and of what should be made possible – governs and increases output in a preconceived, controlled fashion and defines innovation above all as technical progress. Consequently, those open spaces that should foster development are being reduced and suppressed, spaces which, considered holistically, are so essential to a society's

[20] Enwezor, Okwui: Schools of Thought (2006) in: Frieze Magazine. Issue 101, London.

awareness of important, urgent issues of today and tomorrow and to its ability to deal with problems. Spaces that possibly open up entirely new perspectives. Educational institutions such as art schools wear themselves out struggling – under constant pressure to conform – to keep providing those open, generous structures, that room for thought, that room for maneuver, room for action and freedom, which is prerequisite to what Irit Rogoff[21] sees as being essential to structuring education for, with and through the arts, namely, potentiality.

For Rogoff, potentiality "inhabits the realm of the possible without prescribing it as a plan". She considers one of the most interesting aspects of potentiality the fact "that it is as much the potential for not doing as it is for doing" and refers to Giorgio Agamben's understanding of *to be potential* as "to be one's own lack, to be in relation to one's own incapacity". She urges us to reflect on this potentiality as "being at the very centre of acts of thinking, making and doing",[22] as being at the heart of *academy*, and calls for a stance to be taken against the marginalization of educational spaces as strictly organized and clocked *training grounds* through simplistic, *input-outcome* forms of logic.

Irit Rogoff's criticism of the usurpation of *education* and her résumé of what *academy* is and what it can do with respect to the future have in 7 years lost none of their topicality. On the contrary. The pressure to produce quantifiable outcome is noticeably increasing, which makes a reinforcement of positions seem imperative.

However, as before, the quality of academies, of universities specialized in the arts, still manifests itself not in systematic training geared towards on-time, pin-point delivery of products and results in predetermined formats following strictly defined, disciplinary rules, but rather in the steady determination to provide and safeguard open spaces where *circumstances* can be interpreted and learned from in unconventional ways, spaces that encourage bold steps and permit open-ended processes in which no one is expected to know in advance where thought and practice are to lead. The goal is to create within the framework of studies a space for learning and development that gives impulse to thought processes and work methods which are not automatically adapted to transmitted knowledge and established practices without questioning; and this means opening up spaces for thought and action where difference and disagreement are welcome.[23]

[21] Irit Rogoff is Professor of Visual Cultures in the Department of Visual Cultures, Goldsmiths College, University of London.

[22] The quotations in this paragraph were all taken from Rogoff, Irit: Schools of Thought (2006) in: Frieze Magazine, Issue 101, London. Cf. Rogoff Irit: academy as potentiality, called up on 3 October 2013 at http://summit.kein.org/node/191. Summit – non-aligned initiatives in education culture. SUMMIT is organized by Multitude e.V., in collaboration with Goldsmiths College, London University and Witte de With, Rotterdam. SUMMIT is funded by the Culture Foundation, Germany.

[23] Cf. Höchtl, Nina (2008): Casa Refugio. Citaltepetl in Mexiko Stadt. Ein Zufluchtsort des "Wissens"? in: Kulturrisse, issue 2/08; Wissensproduktion und Widerstand, IG Kultur, Vienna.

Foreground: Ursula Möntmann: THIS BABY DOLL WILL BE A JUNKIE. An artistic research project. University of Applied Arts/FWF (PEEK). Presented in the exhibition Out of the Box. 2013. This long-term project by Dutch-German artist Ulrike Möntmann – the audiovisual portrait of women drug addicts living in Europe – consists of notes, diagrams, words and languages, series of speaking porcelain Baby Dolls, interventions in public space, analyses, statements as well as discourse. The project questions conventional "knowledge" about junkies. With TBDWBAJ, Poetology of Knowledge (Joseph Vogl) can emerge, which is concerned with the rules and procedures according to which a coherent statement is created and completed and a representation is dictated, in which its performative power is secured. A poetology of knowledge transcends its disciplinary confines and thus endangers its secured methods, competences and horizons of knowledge. It imports theories from other circumstances and unrelated disciplines. It is a critical practice which reflects the performative dimensions of documentation, the practices or the forms of dialogue, uses strategies of staging and notwithstanding adversity, opens itself up to the intrinsic specificities of disciplinary methods, strategies, concepts and concerns. See more: www.thisbabydollwillbeajunkie.com
Background: Barbara Imhof, Petra Gruber: BIORNAMETICS. An artistic research project. University of Applied Arts/FWF (PEEK). The Biornametics project combines the method of bionics with the contemporary interpretation of the ornament. "Biornametics" is a newly coined term that consists of both "bionics" and "ornament". In the Biornametics project, the following research directions seem particularly promising for the field or architecture: interpretation of growth phenomena in the sense of building as growing; integration of biology in material systems; interventions of living organisms in existing buildings. All three research approaches were taken up in the followup project GrAB. Within the frame of GrAB – Growing As Building completely new qualities are to be introduced in architecture and the spectrum of conceivable, sustainable solutions is also to be expanded considerably

As a rule, art schools, compared to other institutions of higher learning, are relatively small and manageable, and they maintain spaces that are consciously structured to ensure that encounter and debate regularly take place, in the form of art classes for example. These are spaces in which individuals, with their experience, show and recognize themselves as being distinct, spaces in which meaning and value emerge through a mutual exchange – through the recognition and

creation of relationships, interconnections and affinities within groups and networks. In these "provocative communities", experience and knowledge can be understood as forms of social relations. As art critic and author Jan Verwoert wrote in a catalogue for the Städelschule in Frankfurt/Main, it is precisely this provocative exchange among persons of different ages – of different generations – it is their "provocative" asynchronicity, that sets something in motion. "To provoke experiences by provoking relations that are enlightening" is, as he sees it, the task of the academy. And what is the value of the academy? Verwoert's answer: "If what takes place in the academy has any value at all, then it must have some significance with respect to the 'good life'."[24]

Christina Lammer: FEATURE. VIENNA FACE PROJECT. An artistic research project. University of Applied Arts/FWF (PEEK).2010/2014. The artistic research piece Features: Vienna Face Project focuses on four children whose expressive ability was partly impaired by facial paralysis. The girls and boys who were operated on received support during the treatment. They were given a video camera to take home with them to film their social setting but also to film themselves. The progress they made after their surgical procedures was extensively documented by means of video and photography while they were doing their exercises. The research project was conceptualized and realized in close collaboration with the plastic surgeon Manfred Frey, the Austrian artist Elke Krystufek and the Polish video artist and filmmaker Artur Zmijewski, with the Canadian art historian and performer Tamar Tembeck and the New York based dancer, theatre director and movement trainer Selma Trevino. The goal of this rich, multi-facetted project, which combines the approaches of body art, choreography and of dance as well as visual and sensory anthropology is to create art proceeds from the viewers' feelings, triggering a greater awareness

This assertion, in my view, truly – and finally – draws our attention to a notion, to an aspiration that is central: good way of living. No clear, sure, universally valid answers in concrete terms that necessarily apply to us all can be given to the

[24] Verwoert, Jan (2007): Frei sind wir schon. Was wir jetzt brauchen ist ein besseres Leben. In: kunst lehren – teaching art. Städelschule, Frankfurt/Main. Cologne.

question of what this good way of living is. So much the better. But it would be worthwhile to discuss with each other the different conceptions we have of it, the visions that motivate us, in order to bring these into sharper focus and to give utopia some room. Because, as diverse and divergent as possible responses might be, the mere active attitude, the mere creation of a relation generates positive energy that can prove fruitful. Of course, we have to accept the risk of failure – as we do when we seek to innovate. And all the more so if good way of living is what it is all about.

Chapter 16
Arts, Research, Innovation, and Society (ARIS): Conclusion

Elias G. Carayannis, Gerald Bast, and David F.J. Campbell

Abstract ARIS (Arts, Research, Innovation, and Society) is being conceptualized to add to the understanding of how art, research, innovation, and society are being interlinked in structure and process, and which creative and innovative designs are possible. Arts, artistic research and arts-based innovation are essential for the further progress in sustainable development of economy, society, democracy and ecology in a new balance. Our vision and our understanding are: creativity in general and the arts in particular are increasingly recognized as drivers of cultural, economic, political, social, and scientific innovation and development. In this conclusion chapter, it is attempted to summarize the different chapter contributions to this book within broader context. The summary drafts a résumé and synopsis for further debate. A typology of three main themes is being proposed, which serves as a conceptual framework, and to which the individual chapter contributions can be referred to: *arts, innovation and creativity; arts, arts and the sciences, interdisciplinary and transdisciplinary knowledge production and research; arts, economic growth, quality of democracy and the context of society.*

Keywords ARIS (Arts, Research, Innovation, and Society) • Art • Context of society • Creativity • Economic growth • Innovation • Interdisciplinary and transdisciplinary knowledge production and research • Quality of democracy • Research • Sciences • Society

In the following, we attempt to summarize the different chapter contributions to this book within context of a conclusion. This is also the first book that introduces to the new series of **Arts, Research, Innovation, and Society (ARIS)**. The summary tries to draw and to draft a résumé and synopsis for further debate. However, the conclusion here is more tentative in character and experimental in form. We do not assert to have arrived now at a fully integrated conclusion that addresses all

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aspects and ramifications of the individual chapter contributions that were provided for this volume. Instead, the summary is rather interested in offering interpretations and developing propositions, which should generate input for the flow of discussion. In the introduction (Chap. 1) we suggested a concrete typology, how the specific issues, topics and themes of ARIS could be structured and combined. The complete spectrum of (possible) topics was clustered into three (possible) thematic fields. We use this "typology of structure" to structure, arrange, discuss, and summarize the different chapter contributions. *Therefore, we iterate, re-iterate and re-run the introduction in terms of a general thematic summary and "cloud", for generally clustering the whole thematic spectrum that was being approached here. We extend this re-iteration by specifically assigning the individual chapter contributions to this general outline*. We place the interpretation and analysis of individual chapters within this conceptual context. In several cases, the chapter contributions could have been assigned to different themes (in that typology). Therefore, the following taxonomy is only provisional and should provoke a debate.

1. *Arts, innovation and creativity:* Innovation is important for economic activities. However, innovation is a concept much broader than the economy and by this innovation clearly transcends the boundaries of the economic system. In our opinion it is important to liberate innovation from narrowly streamlined economic considerations and constraints. Innovation, understood comprehensively, will always acknowledge the context of society. Innovation combines the traits of change, "being new", "being knowledge-based", and with a progressive momentum. Innovation provides for the change in human history (and in the human future) with a potential for improvement, betterment and learning. There is economic innovation, but there is also social innovation, political innovation, innovation in democracy, innovation in knowledge production and "innovation in innovation", and innovation in the arts. *Innovation depends on the input of creativity, and creativity is encouraged by diversity, heterogeneity, and pluralism*. This appears to be necessary, so that innovation can evolve and so that there is a sustainable evolution of innovation. *Creativity in general and the arts in particular are increasingly recognized as drivers of cultural, economic, political, social, and scientific innovation and development*.

    1.1 In Chap. 2, **Gerald Bast** focuses on the issue of "creative literacy": "Illiteracy with regard to art and creativity damages a society to the same extent as illiteracy regarding the written word". He emphasizes that arts and the sciences can multiply each other. The dramatic increase of knowledge creates a demand for de-fragmentizing knowledge and for implementing the connection of knowledge synapses. Bast demands: "In the post-industrial societies creativity should replace shareholder value as the guiding societal value. Creative literacy has to be spread throughout the entire society". Furthermore, Bast summarizes: "Teaching, learning, research and dissemination of art and science need to be reconnected again. An innovation society has to focus on educating specialists in de-fragmentation".

1.2 **Lou Yongqi** and **Ma Jin** assert that radical changes in the social and economic context of innovation require also changes in the design education (Chap. 7). The authors argue that there is a growing need for integrating vertical and horizontal capabilities during the course of a design education and that this would support innovation. The authors express this with the concept of "T-shaped people". Their proposed case study focuses on the College of Design & Innovation (D&I) at Tongji University in China. The newly planned curriculum emphasizes the aspects of "breaking the rigid barriers between disciplines, developing new modes of design education by integrating and restructuring the knowledge arising from distinct areas and disciplines, and facing complex and diverse real world challenges". This framework could be regarded as representing a "hermeneutic tool" that wants to encourage and motivate innovation talents in design.

1.3 Art can be promoted to be applied as an "urban innovator". **Anton Falkeis** criticizes a too technology-focused urbanism, and demands that also other roles are being assigned to arts in context of urban design (Chap. 12). In reference to the historical transformation from Industrial Revolution to Knowledge Society, Falkeis encourages society to "open up a larger conceptual field for interventions in the urban environment". In that sense, art also acts as a strategy for change and social change.

1.4 In Chap. 13, **Alexander Damianisch** engages in reflections about art universities. Damianisch departures conceptually from the term of "heterotopia", which was developed by Michael Foucault and which addresses "places beyond hegemonic circumstances". Damianisch introduces the idea of being "heterotopoetic". With that understanding he emphasizes: "Art can play an essential role in this; the notion of poesies can provide this, making the heterotopos heterotopoetic, making the undisputed eloquent, uncovering the hegemonic and thereby formatting the core values of society". Therefore, Damianisch can offer the following proposition for universities of arts: "The Art University is the very space of heteretopoetic development challenging the outside and inside in a permanent flux".

2. *Arts, arts and the sciences, interdisciplinary and transdisciplinary knowledge production and research:* There exist several, also competing definitions of arts. In a traditional understanding, aesthetics (the beautiful, but also the ugly) plays an important role. A newer understanding of arts also emphasizes the additional aspect to also interpret the arts as a manifestation of knowledge production. Knowledge production (knowledge creation) in the arts represents a form of research, *creating artistic research,* and by this moving the arts closer to research, also research in the sciences. Artistic research enables various and multifold linkages, interlinkages and overlaps between research in the arts and research in the sciences. *Therefore, artistic research contributes to the creation, formation, and development of interdisciplinary and transdisciplinary designs, architectures and networks ("clusters of clouds") of research (knowledge production) and innovation (knowledge application) that integrate the whole*

spectrum of disciplines in the sciences and arts. Interdisciplinarity is more than multidisciplinarity. *Transdisciplinarity may be defined as interdisciplinarity in application or the context of application*. Art represents a strategy that also aids the sciences in efforts of realizing a greater amount of interdisciplinarity and transdisciplinarity in their research activities. The arts support unconventional synapses-building between different fields of knowledge and approaches to knowledge production. By this the arts allow for greater creativity and a wider spectrum of new, unconventional, disruptive and innovative approaches to knowledge production and research, which are also essential for the sciences and research in the sciences. Here, the arts act as a driver for the progress of research in the sciences. *This demonstrates the "epistemic" qualities and potentials of arts for the further and continued evolution of research, also of research in the sciences*. Artistic research furthermore transforms the self-understanding of universities and other higher education institutions of the arts. Artistic research connects arts universities to processes of research and re-defines arts universities as being crucial institutions for innovation systems (in the multi-level architecture of global, national and subnational, the local).

2.1 **Vivienne Wang** envisions (in Chap. 5) the formation of a new inter-linkage and of new inter-linking processes between art, innovation and society: "We are coming to a very interesting place in history where new ecology of art, scientific and technological innovation, and society, is emerging". This will impose changes on the further development of society. The relationship between art, innovation and society should be re-invented: "Reexamining the relationships of art, techno-scientific research and society is thus to help both artists, scientists, policy makers and the public understand the emerging ecological system to fully utilize the great opportunity and better cope with the new challenges".

2.2 In Chap. 6, **Richard Jochum** argues in favor of redefining or reinventing the role of the artist as the role of being a researcher: "This article will examine the role of the artist as a researcher in the context of a highly specialized and complex information and network society". The relationship between art, research and society is changing and is in change, therefore the arts can bridge knowledge and culture: "Following structural changes in the relationship between art, research, and society at large, including higher education, and their impact on contemporary practitioners, it will establish art practice as a privileged spot to produce both unique knowledge and cultural agency". Artistic practice may resemble forms and processes of knowledge production.

2.3 **Mitchell Joachim** and **Maria Aiolova** formulate the following proposition (Chap. 8): while research in the sciences often continues previous research and is based on older knowledge, there is more of a demand to focus on the new in design. "Design is frequently regarded as the act of generating something new, something that didn't entirely exist before. Scientific research, as it's typically defined, is for generating new knowledge based

on long standing paradigms". In that sense, design is more radically new than research in the sciences. "Designers never copy; almost everything is reset from scratch. Imagine an architect exactly replicating Frank Lloyd Wright's Guggenheim Museum with the modest addition of improved ramp sizes". But there are characteristics in design, which also imply aspects of similarity between design and the sciences: "Design is not simply a creative process; it is also another form of a focused scientific endeavor. Like science, design is experimental, but in a way that prominently recognizes invention. Our current research attempts to establish new forms of knowledge at the confluences of design and science activity". Mitchell Joachim and Maria Aiolova explore also alternative and innovative approaches to design: "Our goal is to invent an alternative design process to foster designs that are interdependent with the natural world. The study of biology and synthetic biology is essential to creating connections between designers and the environment. It can also open the possibilities of new solutions to the current environmental crisis".

2.4 **Peter Weibel** argues that traditionally it is the language that is being regarded as the primary medium of knowledge (Chap. 9). He emphasizes: "The dominant ideology is, language serves as the primary medium of knowledge". In metaphoric terms, Weibel refers to the hierarchy of the tree of knowledge: "For thousands of years, knowledge was organized according to the metaphor of a tree. Therefore, we speak of trees of knowledge". Peter Weibel creates and supports the argument that there is also a need for new media that complement the medium-of-language: "This essay argues that language was only the first medium to describe the world but we have developed new media, new tools to describe and to construct the world. Technology is seen as an extension of the medium of writing".

2.5 The work of **Anthony Dunne** and **Fiona Raby** could be interpreted in a way that the arts may be addressed as an approach that contributes in re-inventing society (Chap. 10). What results are forms of "conceptual window shopping": "When we see a strange shoe or ritualistic object we wonder what kind of society must have produced it, how it was organized; what values, beliefs and dreams motivated its citizens; if it was wealthy or poor; democratic, feudal or totalitarian". Arts also contribute to re-invent the knowledge production in the research in the sciences: "If rather than looking back in time, we presented people with hypothetical products from alternative versions of our own society, or a near future, would people begin to relate to them in the same way—a sort of speculative material culture, fictional archeology or imaginary anthropology?"

2.6 **Giaco Schiesser** pleads for a new "aesthetics of existence" (Chap. 11). He argues in favor of an epistemology that would transcend the world of arts and artistic research. In his own words, Schiesser emphasizes "the need to develop an epistemology for the future that allows artistic research to become a crucial practice far beyond the artistic research community and the art world only". This also would help to identify and to reflect further on

paradoxes, problems and voids of the "international artistic research practice".

3. *Arts, economic growth, quality of democracy and the context of society:* The comprehension of economic performance often is being guided by conventional models that focus on (short-term) quantitative growth measures. This narrows economic development down to specific paths, routes and trajectories of possible development. However, for the purpose of long-term economic progress and economic opportunity it appears necessary to emphasize more clearly the criteria of sustainable development that bring economic growth in balance with social, democratic and ecological considerations. Too much of a focus on short-term economic efficiency may in fact destroy economic development. The interest in a longer perspective for economic prosperity requires the realization of a broader basis of sustainable development that re-contextualizes economic progress into the frame of a co-evolution of economy, society and democracy (with the ecology). Economic innovation must be accompanied by innovations in society and democracy. *Here the perspective of **ARIS** is essential for exploring new routes to new models of economic growth and economic progress. Arts, artistic research and arts-based innovation aid in creating a new vision, for how the economy, society and democracy may be interlinked in moving and for moving toward the frontiers and horizons of today and of tomorrow*. Arts are essential for promoting diversity, heterogeneity, pluralism and creativity, which feed into interdisciplinary and transdisciplinary knowledge production (research) and knowledge application (innovation). Economy and economic development must realize more clearly the qualities of arts and of artistic research and artistic innovation. *There is no sufficient innovation for the economy, without innovation in society (and democracy) that is not being determined by economic considerations.* Quality of democracy encourages a "democracy of knowledge" that supports pluralism in knowledge production and innovation. **ARIS** (**Arts, Research, Innovation, and Society**) reads as the blueprint and vision for a new master-plan for strategy and policy-making for the economy, but also for society and democracy. *The economy is too important to be left only to economists.*

   3.1 In a traditional understanding, the arts are more closely associated to an aesthetic dimension. However, **Elias G. Carayannis** and **David F. J. Campbell** underscore in their Chap. 3 that the arts may additionally be assigned to knowledge production: "Art and arts can also be understood (and re-invented) as a manifestation of knowledge, knowledge production and knowledge creation". This additional dimension does not replace the aesthetic meaning of arts, but extends the meaning of arts, which makes the arts clearly multi-dimensional. This enables the building of linkages between arts, knowledge production and innovation systems. Between research in the arts and research in the sciences inter-disciplinary and trans-disciplinary configurations are possible. "Arts and artistic research add to the interdisciplinary and transdisciplinary spectrum of research organizations and of

research networks, and can assist the sciences in building interdisciplinary arrangements". Arts, artistic research and arts-based innovation are essential for the further evolution, progress and progressing of innovation systems. In essence, the arts contribute to the creation of a basis for new models of economic growth, where "growth in quality" challenges the traditional focus on "quantitative growth" of selected economic benchmarks. It appears to be necessary to "liberate innovation" from narrow economic considerations. Innovation is more than economy only. Furthermore, the arts also interrelate and crosslink with ideas and the concept of quality of democracy.

3.2 "Culture of Information and the Information of Culture" defines the main theme in Chap. 4, compiled by **Elias G. Carayannis**, **Denisa Popescu** and **Ali Pirzadeh**. Information can be seen as a commodity. As the authors argue, the current knowledge society may be regarded as a "mass culture produced from commercialization of information and its increased ability to wire people through information".

3.3 The analysis of **Ruth Mateus-Berr** is being driven by the desire to demonstrate, how "art and design can engage with human needs and co-develop innovative solutions with specific target groups" (Chap. 14). She "describes art and design and its capacities as inspiration for innovation processes and interference in societal affairs at times of crisis and change". The practical case study, to which she refers, focuses on Women's Shelters: "Either interior design for inhabitants of Women's Shelters or [for] refugees can rely on outcomes [of] designing 'survival kits' for target groups like women who have been victims of domestic violence, refugees or victims of the global crisis, a situation [in which] every one of us may wake up tomorrow". This challenge and situation was approached from an interdisciplinary perspective, different materials were used, also for evoking emotions. Mateus-Berr underscores that "education at tertiary level can facilitate new approaches and interdisciplinary teamwork. Collaboration with less well-off social groups, protection of users, consumers, environment and citizen participation allow students new experiences and empower societal responsibility".

3.4 **Barbara Putz-Plecko** focuses her attention on art, innovation and creativity, and how these relate to each other (Chap. 15). Her points of departure are the "new in art" and "cultural innovation", and she reflects on the current situation and status that innovation is placed at "the economic-technological heart of our capitalist society". What defines the creative individual? Putz-Plecko "examines the social figure of the creative individual and his or her position as a role model in the context of creative industries and creative cities". Putz-Plecko speaks in favor of an academic space that encourages the provocative: "It raises the issue of expectations connected with this concerning forms of artistic education and pleads in favor of an academic space for mutual exchange that is alive and, in the best sense of the word, provocative". In her practical examples, she refers to projects of artistic research that are being conducted at the University of Applied Arts Vienna

> in Austria: "Included here, in the spirit of exchange, are examples of projects that present artistic methods of research from a broad range of current practice at the University of Applied Arts, practice that places itself in contexts of meaning quite different from those of the dominant economic rationale of utilization".

Our vision and our understanding are: *creativity in general and the arts in particular are increasingly recognized as drivers of cultural, economic, political, social, and scientific innovation and development*. **ARIS** (**Arts, Research, Innovation, and Society**) is interested in opening new terrains and in pioneering new horizons. ARIS is designed to contribute to this international discourse in global format. ARIS is being conceptualized to add to the understanding of how art, research, innovation, and society are being interlinked in structure and process, and which creative and innovative designs are possible. Arts, artistic research and arts-based innovation are essential for the further progress in sustainable development of economy, society, democracy and ecology in a new balance.

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