

Imagery

in the 21st Century

edited by Oliver Grau
with Thomas Veigl



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1 Introduction: Imagery in the 21st Century

Oliver Grau and Thomas Veigl

Never before has the world of images changed so fast; never before have we been exposed to so many different image forms; and never before has the way images are produced transformed so drastically. Images are advancing into new domains: private platforms, like Flickr with its billions of uploads or Facebook with several hundred million members, have become very powerful tools (figure 1.1, plate 1). Second Life, micromovies, or vj-ing are keywords for a ubiquitous use of images. Television is now a global field of thousands of channels (figure 1.2, plate 2); projection screens have entered our cities (figure 1.3, plate 3); a hundred thousand and one new videos are published every day, in video communities like YouTube and the interactive three-dimensional world of images: a virtual and seemingly authentic parallel universe is expanding. This book offers systematic and interdisciplinary reflections on new forms of images and visualization. The historical development of images, between innovation, reflection, and iconoclasm, is reaching a new level of global complexity in the twenty-first century. These transformations have hit a society that is to a large extent unprepared. Nevertheless, we have to recognize that we will not be able to handle the knowledge explosion of our time without further development of new forms of visualization and "orders of visibility." Digital images have become ubiquitous tools within the global reorganization of labor.

Through digital images, the old dream of talking architecture receives new impetus and an entire new arsenal of options. We are witnessing the rise of the image as a virtual, spatial image—images that appear capable of changing interactively or even "autonomously" and formulating a lifelike, all-embracing audiovisual and sensory sphere where temporal and spatial parameters can be altered at will. Traveling through time in 3D images, ART+COM (figure 1.4, plate 4) allows us to dive into deepening layers of historic sights, while Google Earth (figure 1.5) opens up Earth's spaces to our eyes to an unprecedented degree (figure 1.6, plate 5).

The digital image represents endless options for manipulation. These options also become available for political iconography, which has a long tradition within art history but has only recently been discovered by political scientists. In addition,

THE CONVERSATION PRISM

Brought to you by Brian Selts & JESS3

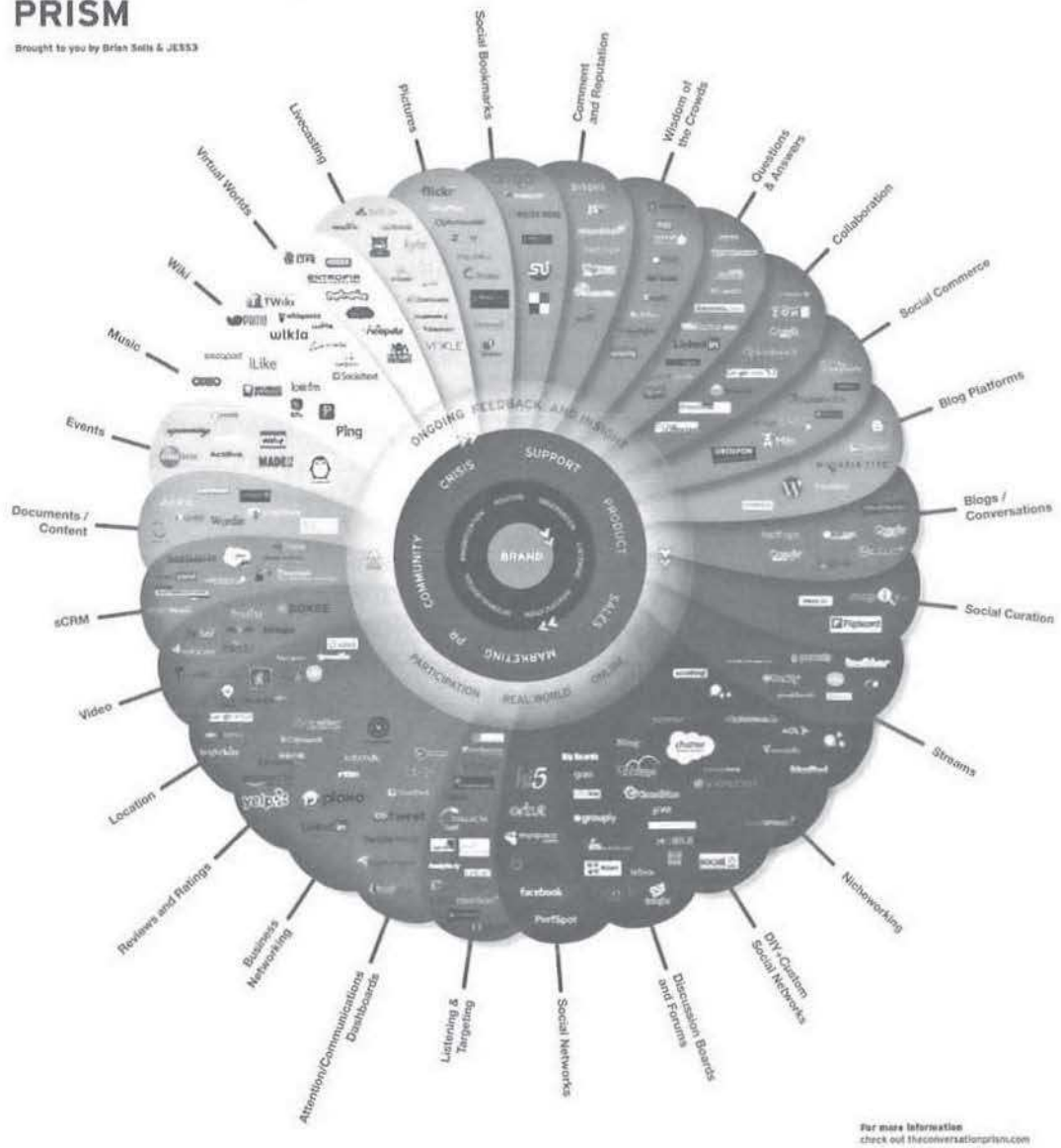


Figure 1.1

The Conversation Prism, <http://www.theconversationprism.com>, Creative Commons. See plate 1.



Figure 1.2

T_visionarium. By kind permission of Jeffrey Shaw, <http://www.icinema.unsw.edu.au/projects/prj_tvis_II.html>. See plate 2.

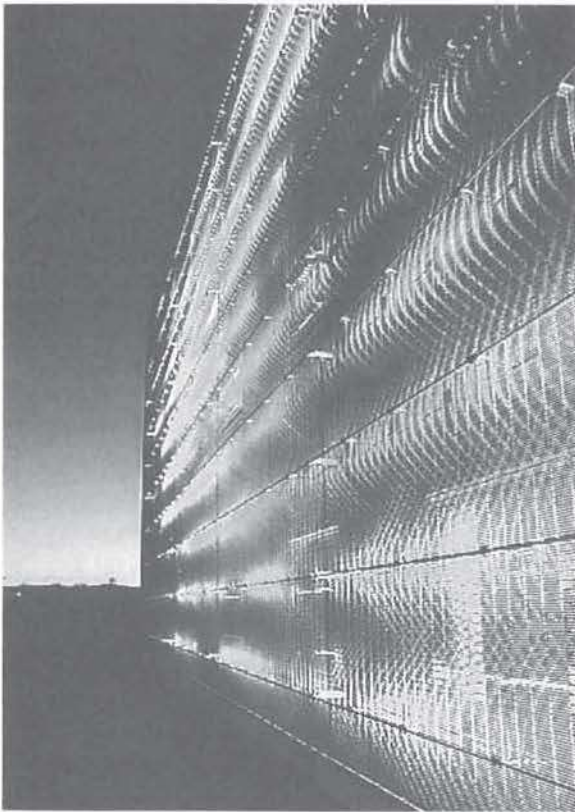


Figure 1.3

Atelier Torce 2007/2009—*Illumesh*, <<http://www.medienfassade.com>>. See plate 3.



Figure 1.4

Traveling through time in 3D images. By kind permission of ART+COM, <<http://www.artcom.de>>. See plate 4.



Figure 1.5

Google Earth.



Figure 1.6
Promotion for *Avatar*, James Cameron (dir.), 2009. See plate 5.

science, politics, and entertainment all profit from new dimensions in the creation of images and their emotive effects (figure 1.7).

These new worlds of the image are creating democratic opportunities and risks, which require sensitive handling and expanded archiving projects; historians of science understand that images in the natural sciences are not only empirical instruments, they are keystones in the creation of knowledge and the “order of things”—to use a Foucaultian term. Images can certainly become instruments of political hegemony; one only has to think of the manipulative use of satellite images to legitimize the Second Iraq War, which were submitted to the U.N. Security Council by the United States. Critical image science has the goal of unmasking such politically motivated visualization strategies, of exposing manipulative image politics, and of shaking the widespread naive faith in the truth of supposedly objective documentary pictures.

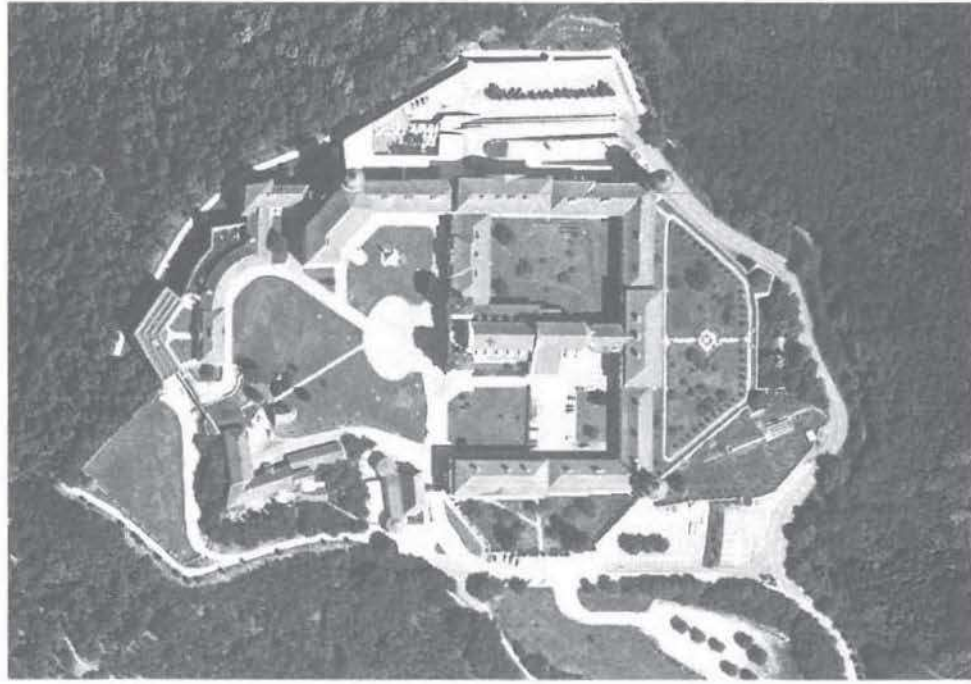


Figure 1.7

Department for Image Science in Goettweig, <<http://www.flashearth.com/?lat=48.365923&lon=15.612105&z=18.3&r=331&src=msl>>.

Historians understand images no longer as illustrations, but as historic documents *sui generis*. Mathematics is fascinated by the beauty of visualized algorithms and their unpredictable chaotic forms (figure 1.8, plate 6), while astrophysicists and nanoscientists receive images out of the depths of the macro-cosmos and the micro-cosmos, respectively. Without massive developments to visualize complex ideas, structures, and systems, the explosion of knowledge we face today is not manageable. This process is inciting vital discussions about images in many disciplines. Images increasingly define our world and our everyday life: in advertising, entertainment, politics, and even in science, images are pushing themselves in front of language. The mass media, in particular, engulf our senses on a daily basis. It would appear that images have won the contest with words: Will the image have the last word (figure 1.9, plate 7)?

We face great difficulties in synthesizing the broad field of the visual: what images are and what they do, how they function and what effects they have—even the concept of the image cannot be clarified by an ontological or elementary definition.

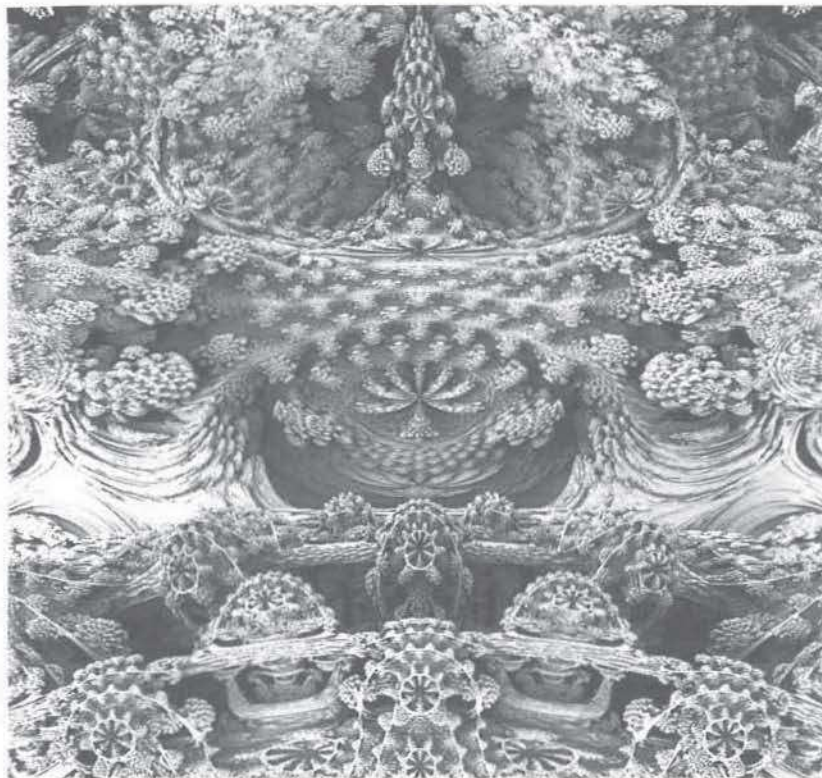


Figure 1.8

Daniel White, *Mandelbulb 3D*, 2009, <<http://www.skytopia.com/project/fractal/mandelbulb.html>>. See plate 6.

Images cannot be reduced to a specific technology (gravure printing or X-ray), to genres (portrait or silhouette), to practices (taking photographs or programming), to specific instruments or devices (pencil or microscope), to symbolic forms (perspectives), to a social function (edification or diagnosis), to materiality or symbolism—and yet images operate in all of these. To manage the veritable deluge of images, a competence in images is vital, but this is lacking in our culture that is still dominated by writing. Illiteracy has largely been overcome in most countries, but aniconism—the inability to interpret images adequately—until very recently has not even been a matter of public concern.

Thus, a systematic ordering is indispensable for understanding the new image phenomena. It has been recognized that the study of networks and the study of visualizations of these networks complement each other, much in the same way that

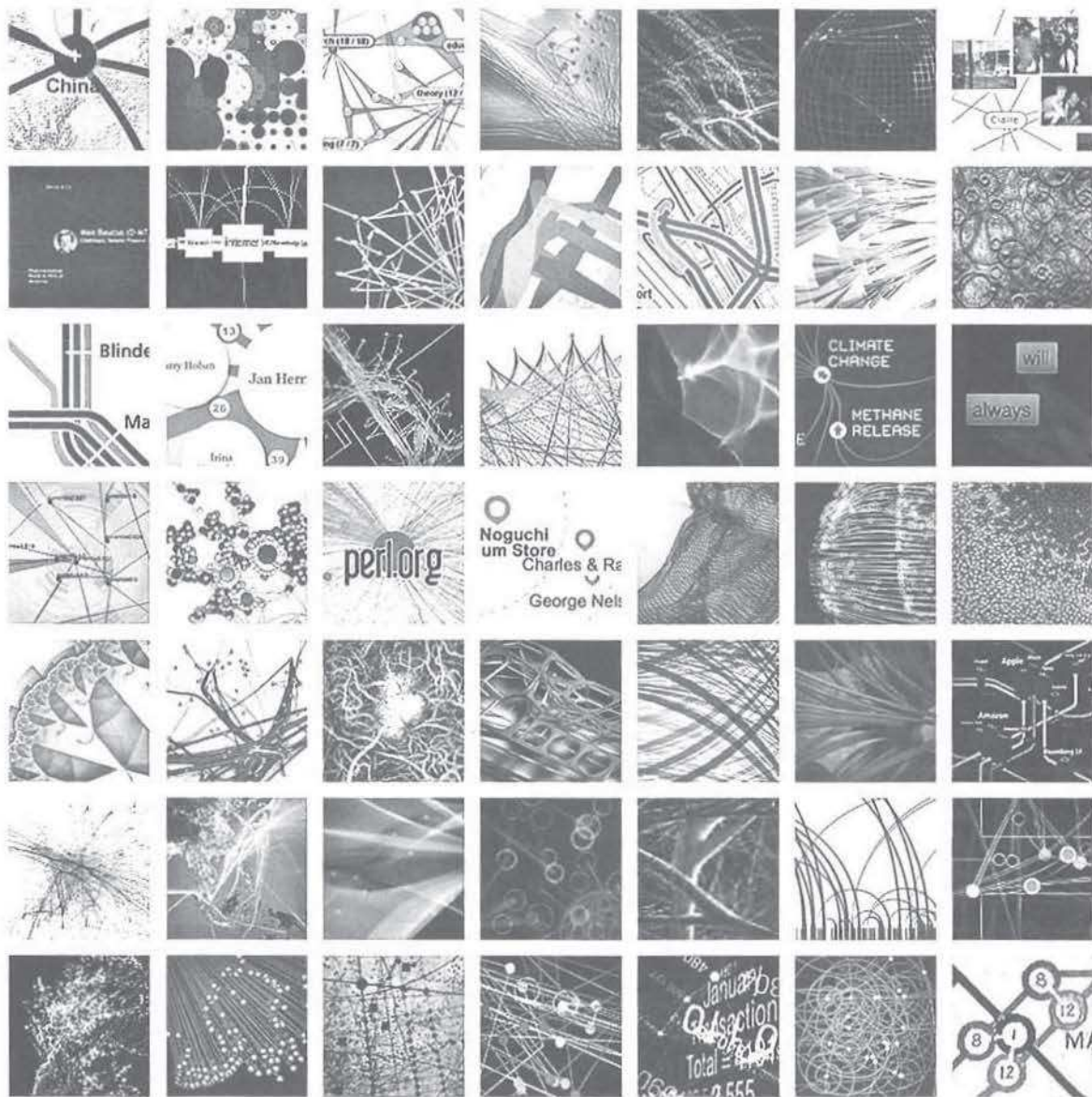


Figure 1.9

For insight in the increasing variety of different visualization methods across the disciplines, see <<http://www.visualcomplexity.com>>. By kind permission of Manuel Lima. See plate 7.

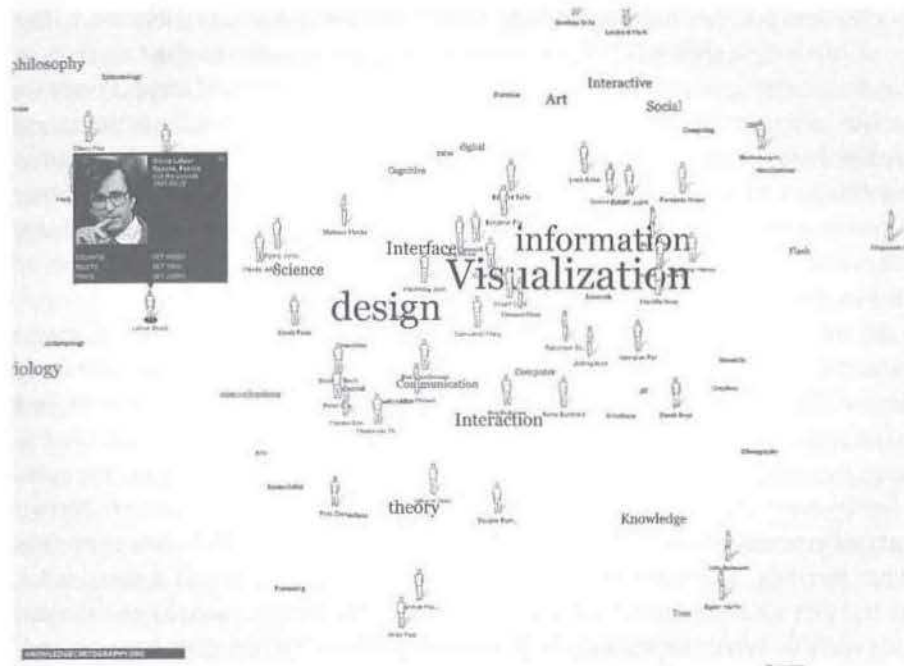


Figure 1.10
Knowledge Cartography, <<http://www.knowledgecartography.org>>.

archaeology cannot live without self-reflective art history; so to systematize our visualization methods, we must engage in complex network studies (figure 1.10). Recently, the High Throughput Humanities conference in Portugal² and the NETSCI 2010 conference in Boston³ concentrated on this subject area.

Moreover, numerous projects have emerged on the categorization and analysis of visualizations methods. Gerd Dirmoser's great studies on diagrammatics, for example, the monumental diagram *Performance Art Context*, which shows the manifold network of artists, authors, institutions, and galleries; Lev Manovich's *Cultural Analytics*; Christa Sommerer's *Netlife*; and Jeffrey Shaw's *T-Visionarium* have to be mentioned here, to name just a few. Another pioneer project, *Many Eyes*,⁴ is a public Web project allowing users to gather and visualize data, and then discuss their visualizations. The platform tests the hypotheses that visualizations spur communication and social interaction and asks how these activities may yield new insights into data.

There is also some research being done in connection with the term "visual literacy": some educators are recognizing the importance of helping students to develop visual literacy in order to survive and communicate in a highly complex world.⁵ However, the ongoing image revolution requires that all of us have the ability to

engage with images and the opportunity of continuing our image education. The concept of life-long learning (LLL) provides an adequate response to the fact that, in increasingly shorter spans of time, our knowledge loses its power and impact once we leave school or university. While our written culture has produced a differentiated and dedicated pedagogy, our society still lacks educational programs dedicated to understanding images—to a degree where we can even speak of visual illiteracy. A further central problem of current cultural policy stems from the serious lack of knowledge about the origins of audiovisual media. This stands in complete contradistinction to current demands for more media and image competence.

The multitude of new possibilities in producing, projecting, and distributing images has led to the formation of new image genres. The spiral movement of image history from innovation, understanding, and iconoclasm has resulted in the twenty-first century in a globally interwoven fabric. In an age where many people are skilled in using graphics and image-editing software, making home videos, and creating websites, we are now dealing with consumers and producers of visual culture. Former recipients of cultural products have become actors who extract their own meanings from what they see. This volume seeks to trace what seeing means on a social level, both in the arts and the worlds of popular images. Answers are sought to essential questions such as: What inspiration do these new worlds of images gain from art and/or science? What influence does the given medium have on the iconic character of the image? What opportunities and challenges do image dealers and museums face given the “liquidity” of the image? This volume, whose incubation began during the international conference “Gazing into the 21st Century,”⁶ analyzes new image phenomena, such as machinima, collectively made videos, the images of bio art and the life sciences, and the scientific image in neurobiology and various other disciplines, and discusses new critical terms like the Web 2.0 revolution, interface, software, cute engineering, database economy, new strategies to create emotional image worlds, the dramaturgy of hypermedia, and more. The book offers systematic discussion and critical scholarly reflection by some of the most influential researchers in the field of the inventory, classification, and historiography of the latest image worlds in the domains of publicity, art, entertainment, and science.

In general we must ask ourselves whether the power of the image will supersede our current ability and quality of reflection, or if new worlds of images will enable new support for the development of human consciousness. We are looking for more and more deeply understood, competent, and useful definitions of image phenomena. Finally, the volume examines new tools for image research in the early twenty-first century, as well as their potential in view of the need for scientific tools to deal adequately with the questions that challenge the humanities now and in the coming decades; tools not only for research, but also for museums, universities, and schools. The goal is to offer detailed discussions of image phenomena and landmarks to expand

visual competence concerning new image worlds and also to build cross-disciplinary exchanges between the humanities, arts, and natural sciences.

The individual chapters do not merely stand alone but also refer to each other. Ideas and models reappear viewed from different perspectives. The book should thus be understood as a collaborative text, where each contribution is a coherent discussion of a particular theme, yet in combination with the others represents a collection that is more than the sum of its parts.

Although in many instances “visualization” means the use of imaging techniques to gain cognitive knowledge, it has another definition that is more precarious: visualization as the translation of the invisible into the visible. This could be the trigger for “iconoclastic panic,”⁷ for even in technological and scientific imaging the resulting images are not entirely reliable. Confusion tends to arise in connection with the character of the images’ construction, through interpretative distortions or even considerations of aesthetic design. Yet here the illusion of accessibility, of seeming presence, can practice an easy deception. Competence in image analysis is needed more than ever before. This can be facilitated by the realization that visualizations—as Hans Belting most importantly differentiates between the “visual” and the “visible”—operate with technological adjustments.

I Image Phenomena of the 21st Century

The first section of the book introduces the subject, discussing new image phenomena that recently emerged in art, popular culture, and science. The contributions showcase various new visual technologies, their background of emergence, as well as their social and cultural impact. Along with visualizations from art, computer games, screen technologies, television, and online video platforms, particular attention is paid to life sciences such as medicine and neuroscience.

Opening the discussion with contemporary screens, Sean Cubitt deals with the relationship between technologies and the public life of citizens and consumers. He explores the *database economy*, where screens are normative technologies that shape and articulate social structure and, in this way, are the central tool of management of markets and populations. From this Cubitt deduces the necessity to observe media through examining the social organization in which they emerge.

Martin Schulz uses examples from Michael Moore’s *Fahrenheit 9/11* to highlight the connection between face, mask, image, and medium with regard to *telepresent* images. From the fact that every instance of pictorial representation is followed by a chain of prescriptions, Schulz argues that images are both subsequent and antecedent at the same time. This anachronic imagery principle of masking demonstrates that modes of representation persist in new electronic media that have a much older history.

In science, the image has become an independent tool of thought. Images count as arguments and proofs; they document and project, model and simulate, show things visible and invisible. The Nobel Prize in chemistry rewarding the initial discovery and later important developments of green fluorescent protein, GFP, was only awarded in 2008. Art, however, had made this a theme years before: The artist Eduardo Kac created a transgenic green fluorescent rabbit by inserting the DNA sequence of a Pacific jellyfish with GFP into the rabbit's DNA. Kac, who pioneered telecommunications art back in the 1980s, now more than ten years later explores and experiments with the exploitation of genetic engineering technologies for creating new artistic visualizations. His exhibitions of bio- and transgenic art, which address key questions of our times that have emerged from the life sciences, have social ramifications and have provoked heavy public debate. Stressing the necessity of respect and care for the living organisms created, in his chapter Kac points out milestones and the current status of these developments. Here the step-wise shifts of ethically discussed boundaries are especially apparent.

It is well known that in just a few years the gaming sector has overtaken the film sector in terms of economic performance and has also created a large number of new genres. Discussing the historic development and current status of machinima, Thomas Veigl shows how social and cultural change, evoked by unanticipated user interaction with computer games, is occurring in our new media environment. With examples of economically exploitable forms, which have provoked legal reverberations, Veigl argues that machinima has to be seen as an emancipatory new visual media technology that has far-reaching consequences for the future of computer games, legal questions of copyright, and established production techniques of computer animation, as well.

Expanding video theory of recent years, Stefan Heidenreich offers an approach for explaining the emergence of a future Web-based video aesthetic. With reference to existing platforms such as Flickr, YouTube, or Online Games, Heidenreich argues that the increased variety of videos produced on the Web, such as videowikis or videoblogs, are currently being reshaped and will ultimately emerge in a new dominant form. Depending on the given conditions of our ecosystem the dominant form consolidates and sets the general conditions for the crucial parameters of time and authorship, which are decisive for the aesthetic form.

Discussion is just beginning in the natural sciences about the role of new imaging techniques, although the theoretical and practical instruments for their analysis is lacking and in science education images are absent from the curriculum, in spite of the fact that in the meantime they have become perhaps the most important tool of communication. It is significant that the two most important science journals, *Nature* and *Science*, have begun to engage with images, and between the lines mention is often made now of the "art of science." However, so far the natural sciences appear

to be unwilling to subject their basic tenets, which over the course of history have undergone dramatic changes, to rigorous scrutiny, as the current debate about brain research demonstrates. Although doubts are now surfacing in this discipline about the veracity of their new image worlds, images are still being utilized as arguments, while the extremely artificial conditions under which the images are generated are hardly analyzed at all. Whereas the scientific images produced by Leonardo or Dürer were drawings that were as accurate as possible, today in medicine, for example, practitioners readily admit or even flaunt the fact that the massive and increasingly “designed” use of images is common practice today when applying for research funds. Thus, it is hardly surprising that more and more “science images” are being processed by advertising agencies: They create images that look like scientific images, which then replace the originals. The same phenomenon can be observed in connection with images from nanotechnology.

Today the life sciences rely heavily on images to demonstrate the performance of models that otherwise could hardly be communicated or even thought of. New visualization techniques are needed; they are being produced as well as analyzed. In the area of neuroscience, Olaf Breidbach illustrates the necessity to overcome adaptations to former visual schemata to develop an alternative theory of brain functionality. For Breidbach a skin-deep examination of the visual is lacking; he asks: How can models be used as tools to put forward certain hypotheses? Can they be ascribed a certain heuristic value? How can we think in pictures, without taking them to be the reality we use them to argue about? To select the right way of visualizing, Breidbach demonstrates a kind of experimental approach to using new types of pictures, model machines, and performances.

Resulting from their practical experience as medical scientists and developers of sophisticated tools for visualizing blood flow, Dolores and David Steinman provide first-hand insights into the challenges that medical text illustrators have confronted over the centuries: the integration of scientific truth, aesthetic trends, and established scientific and medical conventions. Like the bloodstream’s dynamics, organic processes elude the human view, which makes computer-aided imaging techniques indispensable for timely diagnosis and therapy. The absence of a predefined visual vocabulary makes it a necessity to develop both the medical technology and its novel visual conventions.

As an important representative of the American image science community, James Elkins provides an interdisciplinary overview and classification of scientific visualizations, showing the diversity in function and form of imaging practices. Based on the commonplace that ours is a visual culture and that learning today is increasingly done through images, Elkins argues for university-wide courses of image use to take up this challenge and develop a more unified practice.

II Critical Terms of the 21st Century

The character of current images underwent radical changes in recent years. To discuss images at the beginning of the twenty-first century, we need a critical conception that reflects these changes to our theoretical foundations. The book's second section therefore deals with examinations of significant aspects of computer-generated images, user interfaces, and emotive effects, as well as presentation and distribution of images.

With a critical view of new media studies moving in the direction of software studies, Wendy Hui Kyong Chun argues against theoretical conceptions overestimating *source code* at the expense of a network of machines and humans. She points out that source code serves as a kind of fetish and that the notion of the user as superagent, buttressed by real-time computation, is the obverse, not the opposite, of this "sourcery."

For a current concept of "image," the link between image and interactivity is decisive: the interface. Christa Sommerer and Laurent Mignonneau uncover the roots of interactive cultural *interfaces* in a variety of fields, such as social psychology, human computer engineering, cybernetics, interface design, and interactive arts. They show how interactivity as a concept has influenced media artists and researchers alike, and moreover has led to applications and appliances in the fields of mobile computing, intelligent ambiances, smart homes, intelligent architecture, fashionable technologies, ubiquitous computing, and pervasive gaming.

Assessing the current renaissance of feelings and emotions, Marie-Luise Angerer sees a fundamental shift in modes of "thinking the human" that is neurobiological rather than humanistic. Because there is no perception without *affection*, for Angerer the affective and emotional addressing of recipients of digital media leads to a massive manipulation of the body by images (*Bilderflut*), which connects the classic term of liberalization with image politics.

Peter Weibel discusses the new role of the *museum* under the aspects of *Web 2.0*, user-generated content, and the new quality of interactivity. In Weibel's view, to avoid becoming obsolete for presenting experiences of contemporary cultural behavior, museums must adapt to these new circumstances and enter into an alliance with the Internet. As an example of the Internet-based nonlocality of museums, Weibel introduces the ZKM project *FLICK_KA*, where the interactive virtual world comes together with the localized museum.

As is widely known, almost all landmark technologies in history have been used by people to try and create artificial life, androids, or at least simulations thereof; the history of the Golem or the previous century's many fantasies about robots provide a wealth of examples. With "cuteness" a further chapter is now being written in the

projection of attributes of the living onto machines and human interactions with them. Cuteness is a relatively new development in interactive systems. Focusing on the Japanese culture of *Kawaii*, which has had a large impact around the world, especially in entertainment, fashion, and animation, Adrian Cheok describes the concept and its history, and further introduces *cute engineering*, the approach of a next generation of interactive systems.

Tim Otto Roth and Andreas Deutsch, referring to the 1940s concept of *cellular automata* by Stanislaw Ulam and John von Neumann, question the notion that digital images really do constitute a pictorial novelty. Driven by simple rules, cells in a grid undergo self-organized dynamic growth without a central directing instance, simply by interacting with their neighbor cells. Cellular automata are cybernetic pictures that constitute a mathematical picture model with no predecessors in human cultures, which is open for media theory and new artistic concepts.

The need for improvement in the dramaturgy of museum websites is highlighted by Harald Kraemer. By classifying *hypermedia* applications and analyzing several case studies, he argues that in to simplify the complexity of the information the recipient should be integrated through a feeling of solidarity, by empathy, which can be achieved through a holistic attempt at the symbiosis of content, navigation, and design. In this way information design would be created that is at the same time complex yet still intuitive.

III New Tools for Us: Strategies for Image Analysis

The book's final section demonstrates that image science and digital humanities cannot progress without new technologies of image collection management, new forms of distribution within a global science community, and new forms of analysis. The development of the field is supported in an increasingly enduring manner by new scientific instruments. Discussing examples from a variety of projects, this section demonstrates the strategic importance of collective projects, especially in their growing importance for the humanities.

Although nowadays interactive visualizations are essential for progress in dozens of scientific fields, humanities research and cultural institutions rarely use them for either study or presentation of cultural artifacts. Lev Manovich and Jeremy Douglass describe the methodology they have developed to quantify, measure, and visualize patterns in visual and media cultural data sets. On the basis of case studies they show how cultural analytics can be used, for example, to visualize cultural epoch changes or patterns of user interaction with digital media artifacts.

The heuristic use of computing for research on visual media brings new challenges for analyzing images. Digital humanities offer unique new possibilities for archiving

and analyzing, simultaneously connected with new questions. How do these media affect scientific research, and what do our disciplines have to contribute to our knowledge of computing?

Martin Warnke introduces *HyperImage*, a Web-based digital medium for image-oriented research, which meets the long-wished-for requirement of not treating visual forms in a semiotic way. The user may mark, arrange, utilize, and publish observations on images to discover pictorial similarities prior to any verbal categorization. In this way *HyperImage* implements a digital version of the Warburg Image Atlas with a Luhmann-filing box in its background. The nonverbal methodology of pointing instead of naming is eminently suitable for expressing pictorial similarities without falling into verbal categorization, thus taking the evolutionary aspect of images seriously.

Although digital art became "the art of our time," Oliver Grau claims that it still has not "arrived" in the core cultural institutions of our societies. Meanwhile, we even witness a total loss of digital art, including its documentation, and with that the erasure of a significant portion of the cultural memory of our recent history. To overcome the typical placement of media arts in an academic ghetto, Grau proposes to learn from other fields to develop a strategy to solve the problems of media art and its research, to answer the challenges image science is facing today in the framework of the digital humanities. Just as research in the natural sciences has long recognized team efforts, a similar emphasis on collaborative research should make its way into the thinking of the humanities. Only when digital art gains entrance to our science and culture systems and is collected systematically will its entire technological and intercultural potential be able to enrich our culture.

The iconic turn is definitely capable of holding its own in the face of the overpowering fixation on language and text—by conferring on the image its own cognitive capability. The image is not just some new theme; rather it concerns a different way of thinking. Images are much more than just objects of study; they are an important category of analysis. This entails thinking with images: images as an independent means of cognizance. Yet even here we see that the iconic turn remains reliant on language.

IV Coda

With the acute eye of the historian of the visual, Martin Kemp critically highlights the main topics of this volume. With his extensive historical knowledge Kemp unmasks connotations of the *new image*, such as increasing democratization or the new quality of ubiquity, as being overvalued by an idea of progress that has shadowed us since the Renaissance. To better analyze novel imaging, Kemp reminds us to consider which aspects are new, and which aspects are inherited.

Notes

1. According to the military online resource "Strategy Page" (<<http://www.strategypage.com/htmww/htintel/20070102.aspx>>): "Google Earth has revolutionized military intelligence, but the military doesn't like to admit it. . . . Just enter certain coordinates and 'Fly to' . . . The Pentagon: 38.87, -77.506 . . . The North Korean nuclear test site; 41.279, 129.087 . . . Russian subs in Kamtschatka; 52 55' N 158 29' 25 E." Or go directly to a very different site—our Department for Image Science in Goettweig (see figure 1.7).
2. See <http://www.arts-humanities.net/event/high_throughput_humanities_eccs2010>.
3. See <<http://www.netsci2010.net>>.
4. See <<http://manyeyes.alphaworks.ibm.com/manyeyes>>.
5. See various contributions in the *Journal of Visual Literacy* of the International Visual Literacy Association: <<http://www.ohio.edu/visualliteracy>>.
6. The Second international Conference on Image Science, Goettweig/Austria, which took place in autumn 2008, resulted out of a call for papers with applicants from 19 countries and a variety of different disciplines.
7. W. J. T. Mitchell, *Bildtheorie* (Frankfurt: Suhrkamp, 2008).

Contributors

Marie-Luise Angerer is Professor of Media and Cultural Studies and Gender Studies at the Academy of Media Arts Cologne. Since 2007 she has been Head of the Academy. Her publications include: "Vom Phantasma des Lebens," in *Der Einsatz des Lebens: Lebenswissen, Medialisierung, Geschlecht*, ed. Astrid Deuber-Mankowsky, Christoph Holzhey und Anja Michaelson (Berlin: b_books, 2009), 145–160; *Gender goes Life: Die Lebenswissenschaften als Herausforderung für die Gender Studies* (co-eds) (Bielefeld: transcript, 2008); and *Vom Begehren nach dem Affekt* (Zürich, Berlin: diaphanes, 2007).

Olaf Breidbach is Chair for the History of Sciences and Head of the Institute for the History of Medicine, Science and Technology and the museum "Ernst-Haeckel-Haus" of the Friedrich Schiller University, Jena. His publications include *Die Materialisierung des Ichs* (Frankfurt: Suhrkamp, 1997); *Das Anschauliche oder über die Anschauung von Welt* (Vienna: Springer, 2000); ed., *Naturwissenschaften um 1800* (Weimar: Böhlau, 2001); *Deutungen* (Weilerswist: Vellbrück, 2001); *Bilder des Wissens* (Munich: Fink, 2005); with T. Bach, ed., *Naturphilosophie nach Schelling* (Stuttgart-Bad: Cannstatt, 2005); with G. F. Frigo, ed., *Scienza e filosofia nel positivismo italiano e tedesco* (Il Poligrafo casa editrice srl, Padova, 2005); *Goethes Metamorphosenlehre* (Munich: Fink, 2006); *Visions of Nature: The Art and Science of Ernst Haeckel* (Munich: Prestel, 2008); *Neue Wissensordnungen* (Frankfurt: Suhrkamp); editor of *Theory in Biosciences* and *Yearbook for European Culture of Science*.

Adrian David Cheok is Director of the Mixed Reality Lab, National University of Singapore. He is currently an Associate Professor at the National University of Singapore where he leads a team of over twenty researchers and students. He has been a keynote and invited speaker at numerous international and local conferences and events. He is invited to exhibit for two years in the Ars Electronica Museum of the Future, launching in the Ars Electronica Festival 2003. His works "Human Pacman" and "Magic Land" were selected as one of the world's top inventions by *Wired* and invited to be exhibited in *Wired NextFest* 2005. He was invited to show the works "Human Pacman" and "Magic Land" at *Wired NextFest* 2005. He was IEEE Singapore

Section Chairman 2003, and is currently ACM SIGCHI Chapter President. He was awarded the Hitachi Fellowship 2003, the A-STAR Young Scientist of the Year Award 2003, and the SCS Singapore Young Professional of the Year Award 2004. In 2004 he was invited to be the Singapore representative of the United Nations body IFIP SG 16 on Entertainment Computing and the founding and present Chairman of the Singapore Computer Society Special Interest Group on Entertainment Computing. Also in 2004, he was awarded an Associate of the Arts award by the Minister for Information, Communications and the Arts, Singapore.

Wendy Hui Kyong Chun is Associate Professor of Modern Culture and Media at Brown University. She has studied both Systems Design Engineering and English Literature, which she combines and mutates in her current work on digital media. She is author of *Control and Freedom: Power and Paranoia in the Age of Fiber Optics* (MIT Press, 2006), and coeditor (with Thomas Keenan) of *New Media, Old Media: A History and Theory Reader* (Routledge, 2005). She is currently finishing a monograph entitled *Programmed Visions: Software, DNA, Race* (MIT Press, 2011).

Sean Cubitt is Professor of Global Media and Communications at Winchester School of Art, University of Southampton, Professorial Fellow in Media and Communications at the University of Melbourne, and Honorary Professor of the University of Dundee. His publications include *Timeshift: On Video Culture* (Comedia/Routledge, 1991); *Videography: Video Media as Art and Culture* (Macmillan/St. Martins Press, 1993); *Digital Aesthetics* (Theory, Culture and Society/Sage, 1998); *Simulation and Social Theory* (Theory, Culture and Society/Sage, 2001); *The Cinema Effect* (MIT Press, 2004); and *EcoMedia* (Rodopi, 2005). He was the coeditor of *Aliens R Us: Postcolonial Science Fiction* with Ziauddin Sardar (Pluto Press, 2002) and *The Third Text Reader* with Rasheed Araeen and Ziauddin Sardar (Athlone/Continuum, 2002) and *How to Study the Event Film: The Lord of the Rings* (Manchester University Press, 2008). He is an editor of *Cultural Politics* and serves on the editorial boards of a dozen journals including *Screen*, *Third Text*, *Visual Communication*, *Futures*, and the *International Journal of Cultural Studies*. He is the series editor for Leonardo Books at MIT Press. His current research is on public screens and the transformation of public space, and on genealogies of digital light technologies.

Andreas Deutsch is Head of the Department of Innovative Methods of Computing at the Centre for Information Services and High Performance Computing, Technische Universität Dresden. The research efforts of his lively research group are directed toward theoretical biology with an emphasis on modeling key problems of developmental biology and cancer growth. He is author of a monograph on cellular automaton modeling of biological pattern formation (Birkhäuser, 2004).

Jeremy Douglass is a Postdoctoral Researcher in Software Studies at the University of California San Diego, in affiliation with Calit2, the Center for Research in Computing

and the Arts, and Visual Arts. He researches critical approaches to software and code using the analytic frameworks of the humanities and social sciences.

James Elkins is E. C. Chadbourne Professor in the Department of Art History, Theory, and Criticism, School of the Art Institute of Chicago. He writes on art and non-art images; his recent books include *On the Strange Place of Religion in Contemporary Art*, *Visual Studies: A Skeptical Introduction*, *What Happened to Art Criticism?* and *Master Narratives and Their Discontents*. He edited two book series for Routledge: *The Art Seminar* (conversations on different subjects in art theory) and *Theories of Modernism and Postmodernism in the Visual Arts* (short monographs on the shape of the twentieth century); currently he is organizing a seven-year series called the Stone Summer Theory Institute (stonesummertheoryinstitute.org).

Oliver Grau is Professor of Image Science and Head of the Department for Image Science at the Danube University Krems. Recent publications include *Virtual Art: From Illusion to Immersion* (MIT Press, 2003); *Mediale Emotionen* (Fischer, 2005); and *Media-ArtHistories* (MIT Press, 2007). He has been on international invited lecture tours, and has been presented numerous awards. His work has been translated into twelve languages. His main research is in the history of media art, immersion (virtual reality), and emotions, as well as the history, ideas, and culture of telepresence and artificial life. His awards include, among others: Elected into the Young Academy of the Berlin-Brandenburgische Scientific Academy and the Leopoldina; Media Award of the Humboldt University; InterNations/Goethe Institute; Book of the Month, Scientific American.

Stefan Heidenreich is working as writer and journalist (*taz*, *F.A.Z.*, *de:bug*), art critic (*F.A.Z.*, *Monopol*), Web consultant (Metaversum, Designmai, Iconicturn), photographer (s.cr&sh.de), and Assistant Professor (Humboldt-Universität Berlin). He studied philosophy, science of communication, German philology, and temporarily economy and physics at Bochum and Berlin. He published "Flipflop: Digitale Datenströme und die Kultur des 21. Jahrhunderts" (2004) and "Was verspricht die Kunst?" (1998).

Eduardo Kac is internationally recognized for his telepresence and bio art. A pioneer of telecommunications art in the pre-Web 1980s, Eduardo Kac (pronounced "Katz") emerged in the early 1990s with his radical works combining telerobotics and living organisms. His visionary integration of robotics, biology, and networking explores the fluidity of subject positions in the postdigital world. His work deals with issues that range from the mythopoetics of online experience (*Uirapuru*) to the cultural impact of biotechnology (*Genesis*); from the changing condition of memory in the digital age (*Time Capsule*) to distributed collective agency (*Teleporting an Unknown State*); from the problematic notion of the "exotic" (*Rara Avis*) to the creation of life and evolution (*GFP Bunny*). At the dawn of the twenty-first century Kac opened a new direction for

contemporary art with his “transgenic art”—first with a groundbreaking piece entitled *Genesis* (1999), which included an “artist’s gene” he invented, and then with *GFP Bunny*, his fluorescent rabbit named Alba (2000).

Martin Kemp has written, broadcast, and curated exhibitions on imagery in art and science from the Renaissance to the present day. His books include *The Science of Art: Optical Themes in Western Art from Brunelleschi to Seurat* (Yale University Press) and *The Human Animal in Western Art and Science* (Chicago University Press, 2007). He has published extensively on Leonardo da Vinci, including the prize-winning *Leonardo da Vinci: The Marvelous Works of Nature and Man* (1989, 2006). Increasingly, he has focused on issues of visualization, modeling, and representation. He writes a regular column *Nature* (published as *Visualizations*, Oxford University Press, 2000, and developed as *Seen and Unseen*, Oxford University Press, 2006, in which his concept of “structural intuitions” is explored).

Harald Kraemer is a producer, designer and director of online and off-line hypermedia applications. His work includes *Vienna Walk Demo* (1998) with Science Wonder Productions; *Documentation and Methodology of Contemporary Art* (1999–2001) for the German Research Foundation (DFG) at the University of Cologne; and *Artcampus* (2005–2007) for the University of Berne. With his own company Transfusionen he has realized: *Art and Industry* (2000), *Virtual Transfer Musée Suisse* (2002–2003), *Museum Schloss Kyburg* (2004), and *Elisabeth of Thuringia* (2006). He has written and published widely on the subject of hypermedia, museum informatics, and digital collections, as well as contemporary art. After teaching art history and new media at the universities in Berne, Cologne, Constance, Luneburg and Zurich, he is recently Docent at the Department for Design at Zurich Academy of Arts and at the Department for Image Sciences at Danube University Krems. Currently he is working on documentation about *Knowledge Hypermedia Design & Museum*.

Lev Manovich is a Professor in Visual Arts Department, University of California–San Diego, Director of the Software Studies Initiative at California Institute for Telecommunications and Information Technology (Calit2), and Visiting Research Professor at Goldsmith College (University of London), De Montfort University (UK) and College of Fine Arts, University of New South Wales (Sydney). His books include *Software Takes Command* (released under CC license, 2008), *Soft Cinema: Navigating the Database* (MIT Press, 2005), and *The Language of New Media* (MIT Press, 2001), which is hailed as “the most suggestive and broad ranging media history since Marshall McLuhan.” He has written 100 articles that have been reprinted over 300 times in 30+ countries. Manovich is much in demand to lecture around the world, having delivered over 400 lectures, seminars, and workshops during the last ten years.

Tim Otto Roth has held lectureships in Madrid, Valencia, and Kassel. He is currently working on a doctoral thesis at the Academy of Media Arts Cologne. His research

focuses a phenomenology of shadow pictures and a redefinition of the postphotographic image. Roth is known for his large art and science projects in public space, including work with scientists of top research institutions especially in biology, astrophysics, and particle physics (www.imachination.net and www.pixelsex.org). He has received numerous awards including the International Media Art Award/Centre for Art and Media ZKM Karlsruhe.

Martin Schulz is Professor at Hochschule für Gestaltung in the Center for Art and Media in Karlsruhe Staatliche Hochschule für Gestaltung, Karlsruhe, and coordinator for the Ph.D. program "Image, Body, and Medium: An Anthropological Approach." He has published numerous texts concerning contemporary art and picture theory, including (with Hans Belting), *Quel Corps? Eine Frage der Repräsentation* (Munich, 2002), *Ordnungen der Bilder* (Munich, 2005); with Birgit Mersmann), *Kulturen des Bildes* (Munich, 2006); "Die Sichtbarkeit des Todes im Medium der Fotografie," in *Die neue Sichtbarkeit des Todes*, ed. Thomas Macho and Kristin Marek (Munich, 2007), 289–313; and "The Immersive Image of Landscape: Space Voyages and Time Travel," in *That's What a Chameleon Looks Like: Contesting Immersive Cultures*, ed. Kiwi Menrath and Alexander Schwinghammer (Cologne, 2009).

Christa Sommerer and Laurent Mignonneau are internationally renowned media artists and researchers. They have jointly created around 20 interactive artworks, which can be found at <<http://www.interface.ufg.ac.at/christa-laurent>>. These artworks have been shown in around 200 exhibitions worldwide and installed in media museums and media collections around the world, including the Van Gogh Museum in Amsterdam, the Museum of Science and Industries in Tokyo, the Media Museum of the ZKM in Karlsruhe, the Cartier Foundation in Paris, the Ars Electronica Center in Linz, the NTT-ICC Museum in Tokyo, the NTT Plan-Net in Nagoya, Japan, the Shiroishi Multimedia Art Center in Shiroishi, Japan, the HOUSE-OF-SHISEIDO in Tokyo and the ITAU CULTURAL Foundation in Sao Paulo. They have won mayor international media awards, among others the "Golden Nica" Prix Ars Electronica Award for Interactive Art 1994 (Linz, Austria). Mignonneau and Sommerer have published on artificial life, complexity, interactivity and interface design, and they have lectured extensively at universities, international conferences, and symposia. They are currently heading the department for Interface Cultures at the University of Art and Design in Linz, Austria, which specializes in interactive art, interactive media, and interface design. They have published two books: *The Art and Science of Interface and Interaction Design*, ed. C. Sommerer, L. C. Jain, and L. Mignonneau (Springer Verlag, 2008); and *Interface Cultures—Artistic Aspects of Interaction*, ed. C. Sommerer, L. Mignonneau, D. King (Transcript Verlag, 2008).

David Steinman has spent more than a decade working to integrate the fields of computer modeling and medical imaging. He is a Professor of Mechanical and

Biomedical Engineering at the University of Toronto, where he heads the Biomedical Simulation Laboratory. Dr. Steinman holds a Career Investigator award from the Heart & Stroke Foundation.

Dolores Steinman trained as a pediatrician, before finishing doctoral and postdoctoral research in cancer cell biology. An accomplished photographer, she is interested in the relationship and connection between the humanities and science. Dr. Steinman is currently a Guest Researcher at the University of Toronto.

Thomas Veigl studied and worked at the Institute for Cultural- and Social Anthropology at the University of Vienna. With a main focus on the origination of media technologies and their dependency and influence on social evolution, he wrote his thesis about a cross cultural comparison on the evolution of letterpress printing with movable metal type in East Asia and Europe. Since 2008 he is part of the scientific staff of the Department for Image Science at the Danube-University Krems, where he was responsible for the organization of the second international conference on image science "Gazing into the 21st Century." Currently he is preparing for his doctoral thesis.

Martin Warnke initiated the Department of Computers and Culture, where he developed a curriculum that combines cultural, artistic, and computer science issues theoretically and practically. Since 1983 he has taught continuously in Lüneburg, Basel, and Klagenfurt. His interdisciplinary methodology is illustrated best by the protection and archiving of the artistic estate of the late Anna Oppermann. This methodology consists of hypermedia, interactive systems, image processing, and media technology. He has completed a number of research projects; HyperImage, funded by the German BMBF (Ministry for Education and Research), is being completed right now. During one of his projects the XML standard PeTAL (Picture Text Annotation Language) was developed, which is now entering the scientific community. A project recently funded by the DFG (German Research Association) carries on this research. Together with colleagues from Lüneburg, Berlin and Basel he has established annual "HyperKult" Workshops and the discourse that evolved with it. Since April 2009 he has been the Chairperson of the Kunstverein Springhornhof (an art club in Neuenkirchen).

Peter Weibel was appointed Professor for Visual Media Art at the Hochschule für Angewandte Kunst in Vienna in 1984, and from 1984 to 1989 was Associate Professor for Video and Digital Arts, Center for Media Study at the State University at Buffalo, New York. In 1989 he founded the Institute of New Media at the Städelschule in Frankfurt on the Main. Between 1986 and 1995 he was in charge of the Ars Electronica in Linz as artistic consultant and later artistic director. From 1993 to 1998 he was curator at the New Galerie Graz. Since 1999 he has been Chairman and CEO of the ZKM/Center for Art and Media in Karlsruhe.