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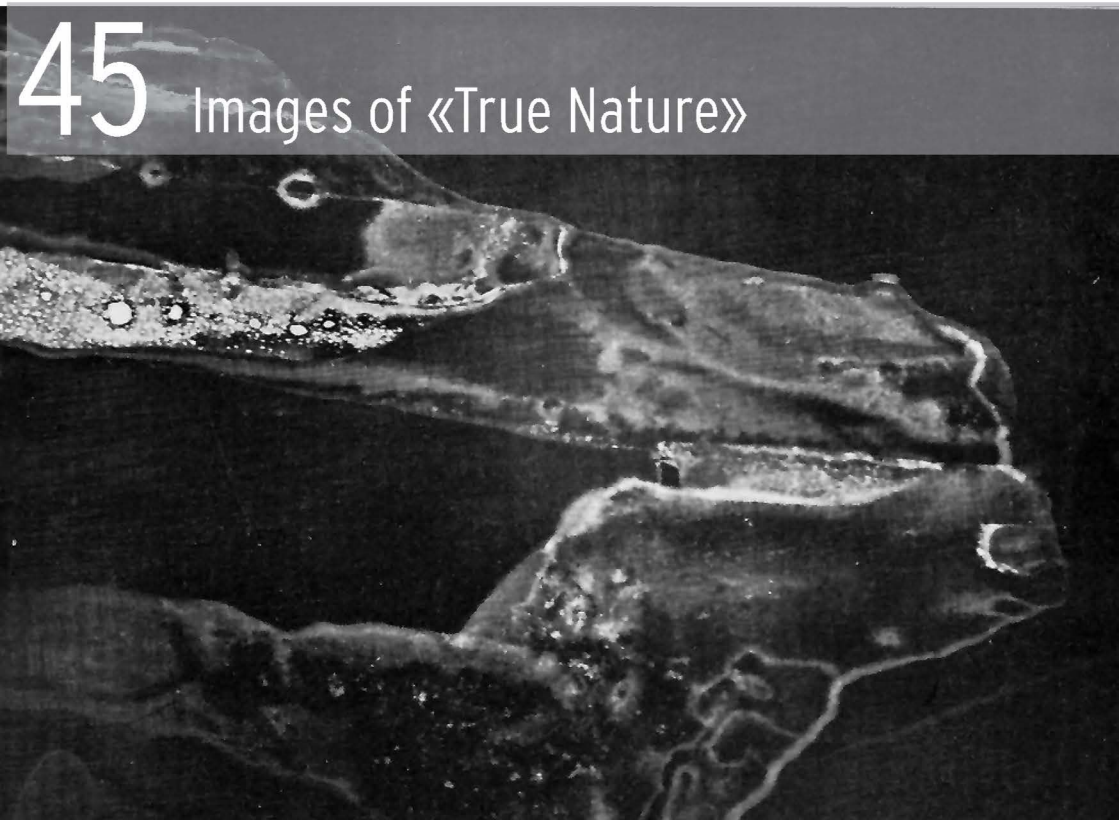

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45

Images of «True Nature»

SCHÜREN

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Angela Krewani / Astrid E. Schwarz

Images of «True Nature» – An Introduction

It has been claimed that only an aerial view is able to give us a «true picture of the splendour and richness of shapes» in nature.[1] This confidence in the aerial image is driven by the hope that it might provide a cognitive «insight into the landscape», because it facilitates an «overview and monitoring» of climate, soil genesis, and so-called lake types. The statement itself comes from Erich Wasmund, who in the 1930s attempted to render aerial images useful for science, as did many of his colleagues from the geosciences and, later on, the environmental sciences. At the time, the question of whether and in what sense the photographic aerial image – including photographic images of landscapes – could be claimed to be »true» was still very much an open one. What was their epistemic and ontological status? Indeed, what status *should* they have, and why?

Mimetic images of nature presented in various media have been part of our cultural memory and everyday practices for a long time. Ever since the emergence of landscape painting in the 17th century, if not before, images of nature have been strongly codified. From then on they have proliferated both in popular culture and scientific disciplines. Looking at current debates around biodiversity or climate change, it becomes clear that scientific knowledge is communicated in part with the aid of images, which rely, to some extent, on the tradition of landscape painting. A range of scientific disciplines, from nanotechnology through to limnology (the science of freshwater ecology), appropriate images of nature, albeit in different ways. While limnology, for example, frequently transforms three-dimensional images into two-dimensional sets of signs, nanotechnology re-constructs traditional images of nature out of a set of digital data.

The idea for this edition emerged in parallel with the construction of a database of images by the editors, who wanted to reflect critically on the visual construction of nature. One essential component of the project in its early stages was to develop a viable tool – a web-based information system – that would make it possible to collect, organize and display the image data. The aim of the now available prototype is to facilitate the creation of various kinds of networks: a) at the level of information technology, b) at the level of users, c) and at the level of content. In terms of information technology, the main aim is to create and stabilize a network link between visual data and metadata, between visual data and literature data, and also between databases. The prototype has already provided a first impression of what form the

1 This quote is from the depiction of an aerial photograph in Wasmund (1930c, p. 536, see Schwarz, this issue). However, the question of visual truth is raised throughout this volume.

many diverse networks of institutions and individuals and of disciplines and types of scientific activity might take in which ecological research and environmental research in general has been and is being conducted.

During this first stage of the project, our collecting activities were focused on a few selective examples of different visual media that have been used in ecological research over the years. Although the emphasis is on photography (landscape and aerial images in particular), there are also some microphotographs, X-ray photographs and chronophotographs. We have gathered visualizations of complete organisms or parts of organisms, populations, biocoenoses and biotopes. The list of keywords covers a variety of media such as drawing, etching or oil painting, as well as different representational techniques, including diagram, scheme, map, plan, table, poster, postcard, cartoon, textbook, scientific publication and popular literature.

The material is drawn largely from books and journals, although we look forward to being able to include hitherto unpublished resources as well. One problem associated with the material, be it from published documents or unpublished archival sources, is that the origin of the images is often not documented correctly (requiring further extensive investigation) or in some cases has been lost completely. This difficulty applies to the medium of photography in general, so that its usefulness as a source in historical research was somewhat underestimated, leading to its underrepresentation in such research until about the 1980s.[2]

Users of the web-based database *Visual Cultures of Ecological Research* (http://bildkulturen.online.uni-marburg.de) are provided with a decentralized structure for researching and recombining data and information via an interactive platform, this being a further aspect of the networking component. Issues concerning the representation of nature in its specific forms or the interplay between society and science may once again be of relevance here, too. Creating a link between content, visual data and literature data ultimately facilitates a topographical representation of the institutions and individuals being researched, thus generating new insights into the history of disciplines, individuals and institutions of the actors concerned with nature «out there». Indeed it is the visualization of the visual data according to historical and geographical criteria that makes it possible to generate new research questions. In this respect the web-based information system can be used as a heuristic tool for simultaneously extending and enriching perspectives from the philosophy and history of science and media studies.

«Ecology» is the name given to a sub-discipline of biology. However, ecological research is not conducted in this context alone – it is also a component of engineering-based disciplines, such as agriculture and forestry, and of subjects based more in the humanities and social sciences, such as cultural or human ecology. Inde-

2 This observation was presented and discussed in detail at the conference «Histoire contemporaine et photographie: paradigmes – Problématiques – perspectives«, a one-day event held at the German Historical Institute in Paris, November 9, 2007.

ed «ecological» has come to be a comprehensive catchword – especially a political one – that structures discourses and provides orientation for action. It follows that «ecological» can be conceived in both normative and epistemological terms.

In this project we are particularly interested in images of nature in its specific forms, that is, the modes of representation of nature «out there» in open space, outside the laboratory. These images are influenced substantially by visualizations of nature that are generated in the context of ecological research. All that is seen, described, analyzed and politically negotiated as «ecological» in society is mediated through the production and transformation of images – through images which wander nomadically between various media and discourses as they move from science into society. Thus in this sense, nature in its specific forms – often visible to the naked eye – is just as much a constructed phenomenon as the abstract nature of the laboratory sciences.

A wide variety of visual images of nature are constantly being generated and defended, depending on the historical, cultural and methodological context in which they occur. These images represent different metaphysical ideas and epistemic models, and they differ in terms of the techniques, strategies and settings involved in their production. Ecological research, as we see it, can be read as a mapping program that presents different ideas of nature as they occur in different scientific, national, philosophical and geographical cultures. Whether a particular piece of nature is considered worthy of protection, is regarded as a commodifiable resource, as unreliable and dangerous, or as accessible to the contemplative mind depends crucially on its cultural environment – and thus, in our knowledge society, on science's visual and conceptual representations.

Against this theoretical background, reflections on images of «true nature» branched out in several directions, as the essays in this edition testify. Certain basic assumptions such as the constructed nature of the image, the hybridity of aesthetic and scientific discourses, and epistemological questions concerning the images' status are woven throughout the respective individual approaches. Valerie Hanson analyzes visual structures within scientific discourse, investigating images produced at a very small scale. The realm of the microscopic image is extremely interesting since, in the absence of an object that is neither visible to the naked eye nor tangible, it illustrates clearly the norms of visual construction. As the database has demonstrated, images rely not so much on their mimetic intention as on the inherent rules governing their composition. These also come into effect when space is concerned. In «Rising Above the Horizon», Astrid Schwarz shows what happens when a line migrates up or down in an image depicting nature. The presence and positioning of the line of the horizon determines whether we see a landscape, a map or something in-between – an aerial photograph, for instance. After introducing a number of general features of early aerial images as technoscientific objects in their cultural and epistemic context, she turns to a specific case in the field of aquatic ecology, reflecting on why the establishment of aerial photography as a scientific tool failed at

the time. It turns out that this was due neither to the dual-use aspect of aerial photography nor to any opposition in principle by the scientific community, but rather to its association with certain conceptions of ecology that were out of favor. Addressing a different scale altogether, Alfred Nordmann is interested in landscape as a picturable space in which signs are arranged in certain ways. He contrasts this with immersive spaces for doing and building, in which the spectator is transformed into an actor. In his account, the cave constitutes a site where these two modalities come together and then part company. The cave's immersive interior can be represented as a landscape, and representations lose their representational character when they serve the construction of so-called *cave environments*. The scientific art of representation requires a carefully maintained distance, which collapses as technoscientific researchers enter the cavernous interior of human bodies, the molecular nanocosm, and other spaces of technical possibility.

Angela Krewani considers the aerial images contained in the database and maps out their history. The bird's eye view already emerged for the most part in Renaissance culture, aerial images related to economic and military interests can be identified as forming a distinct tradition. The conflation of scientific and political interests within the specific use of such images evolves even within the limnological research of the 1920s and 1930s, as the database clearly demonstrates. The database itself provides excellent access to images as well as offering ways of contextualizing knowledge – but still it had to be brought into being in the first place. Stefan Aumann, who works at the computer center at Philipps University Marburg, took on the task of organizing the data according the researchers' needs. His essay gives an account of the overall database concept and its organizational structure, explaining how the images were integrated into this structure. As mentioned above, the database provides an insight into the visual construction of nature «out there», drawing especially on images created through photography and painting. These images of nature can be understood additionally as internalized images, shaping our understanding of nature. In his piece, Alfred Nordmann briefly mentions the capacities of interior landscapes and the history of their realization. Karen Ritzenhoff's essay tackles this topic directly, discussing what she calls «internalized concepts of nature». Coining the term «landscapes of the mind», she analyzes images found in art and film, showing how they contribute towards the creation of mental images of landscape and nature. She has collaborated with the New Britain Museum of Art, Connecticut and she has aimed at re-kindling images of nature and re-establishing concepts of nature and art through individual performance. By discussing and re-enacting a painting of the events of September 11, 2001, Karen Ritzenhoff comes to an understanding of the connection between artistic expression and individual mental landscapes. Her project integrates concepts of art, personal concepts of nature, and the cultural response to public notions of nature and civilization.

The idea of re-introducing nature and gardening into urban landscapes has been put into practice in some American cities over the last few years. New York

City especially has seen a proliferation of activities involving public gardening. As the *Frankfurter Allgemeine Zeitung* reports, vast industrial areas have been redesigned as public parks.[3] The writer Chez Liley from Connecticut has taken up this issue on a slightly smaller scale. Working alongside a group of children, she has created an urban children's community playground in New Britain, Connecticut. Her essay conveys her struggles to achieve a natural playground.

Having begun with a discussion of microscale images, the collection of essays ends with an artistic endeavor aimed at recreating nature in an urban location. The common theoretical ground for these discourses on nature can be seen as being an understanding that visual images are constructed, and that their existence is rooted in specific institutions and traditions and in the general cultural influences that help shape them. Images of «true nature» are viewed throughout as epistemological objects.

3 *Frankfurter Allgemeine Zeitung*, 14.11.2009. Weekend supplement.

Valerie Hanson

Nature as Database?

Microscope Images' Impact on Visual Cultures of the Natural World

In *Keywords*, Raymond Williams observes, «nature is perhaps the most complex word in the language».[1] Williams explains that not only has the word's meaning changed over the centuries, but also its changes have indicated important trends in ideas: nature is «a word which carries, over a very long period, many of the major variations of human thought – often, in any particular use, only implicitly yet with powerful effect on the character of the argument».[2] Williams here comments on the textual use of «nature»; however, conceptions of nature are not only communicated through words, but also through images. Indeed, images of nature have formed a key component of how cultures have understood the concept of nature; as the editors of this special issue assert in their call for papers, «images of nature serve as important media to construct and perpetuate knowledge of nature». Nowhere is this conveyance of nature via images more relevant than in the sciences such as ecology where nature is one of the objects of knowledge. How «nature» is constructed in scientific images, then, becomes a question to explore to not only understand the specific knowledge of nature that is presented in a given image, but also to investigate the larger, complex frame, «nature», by which that knowledge is made visible.

While Krewani and Schwarz rightly observe that scientific images that show «whole pieces of nature» such as landscapes or biotopes are particularly important, in this essay I would like to focus on another kind of image that I suggest is also important – it also constructs and perpetuates knowledge of nature, albeit at much smaller scales. This other kind of image is common in biology and ecology as well as in fields such as chemistry, physics, and materials science: in fact, seventy of these common images appear in the computer database of ecological research associated with this special journal issue. Examination of these images can also illuminate cultural constructions of nature as well as processes of visualization. How do images of what we cannot see with the naked eye – images of microscopic and nanoscopic phenomena – also construct and perpetuate knowledge of nature? What conceptions of nature do they present?

This article explores these questions while also discussing the effects of technology on constructions of nature through an analysis of some of the traditional and

1 Raymond Williams: *Keywords: A Vocabulary of Culture and Society.* Rev. ed. New York 1976, p. 219.
2 Williams, p. 224.

emerging conventions for visualizing the invisible. My analysis suggests that a view of nature emerges in these images that is influenced not only by traditional conventions of depiction but also by the visualization technologies used to see at those smaller scales as well as what they visualize. This view is one that emphasizes a nature different from that suggested by one of the strongest influences on images of «whole pieces of nature», the landscape tradition. Instead, in microscope images, nature appears to be flat, multiple, and manipulable – similar to a database – as this paper will explore.

Although the version of nature that microscope images present may not align with that found in images within the dominant tradition of landscape portrayal, the images do participate within some trends and conventions that make what they portray worth noting. For one, images of microscopic and nanoscopic phenomena have at various times captivated observers, spreading scientific knowledge to wider groups.[3] Biologist and historian of science Brian J. Ford even claims that conveying microscopical information in image form «was the most startling development of the scientific era».[4] Ford also points out that what is conveyed through these images is important, too: «the revelations offered to the specialist and to the public alike have been influential in almost every sphere of existence».[5] The interest in images of the micro- and nanoscale, as well as the usefulness of the information they convey, have thus also helped circulate particular constructions of nature along with the images.

In addition, microscope images highlight cultural conventions and ideas of what they should depict as much as or perhaps more than other scientific conceptions of nature. This is in part because the process of making these images as well as using them to communicate is complicated by the fact that what microscopes show cannot be confirmed by the unassisted eye.[6] Therefore, researchers must identify what they see not by recognition or even sight of the object alone; instead, they must use additional methods so that they can confirm that what they see is consequential and not a defect in the microscope slide, a fleck of dust, or even the reflection of one of their eyes. In addition, when researchers present their images, they need to convince viewers that their images are not only real, but also that they have scientific merit. Finally, how they exhibit information in image form has parallels with digital images' information organization; as more and more visualization technologies use digital imaging, the dynamics of how images communicate as well as what they convey about nature may become more common. These images can reveal insights

3 For example, in 1665, the publication of Robert Hooke's *Micrographia* generated a large enthusiastic response of the publications among its readers (Fournier 40), which included individuals such as Samuel Pepys, who found it a page-turner (Nicolson 169), as well as scholarly publications, such as the Journal des Scavans, who not only reviewed the book, but reprinted some of its plates (Harwood 119–20). Gerard L'E. Turner also mentions the production of books of microscopy for a popular audience (see 149, for example for a discussion of W.H. Fox Talbot's preparation of microscopical photographs for a popular book).

4 Brian J. Ford: *Images of Science: A History of Scientific Illustration.* New York 1993, p. 167.

5 Ibid.

6 See for example: Gerard L'E Turner: *Essays on the History of the Microscope.* Oxford 1980, p. 141.

into how knowledge of nature – and nature itself – is constructed, which may be useful for other images of larger scale natural phenomena as well.

While detailed studies of specific images are crucial to understanding the fine-grained textures of the historical and cultural milieus in which images exist and are used to communicate, this paper pulls back to take a wider view in order to keep the focus on how aspects of images may serve to construct and communicate knowledge about nature. As conventions of depiction are not entirely determined at the level of the individual image but are collectively shaped and used as elements of communication, a larger view can reveal dynamics shared by images that emerge in a common culture, have been developed using a common process, or exhibit unity of another kind. While the study of such dynamics cannot create a full picture of how particular images communicate, it can inform further studies by illuminating some of the larger trends in which individual images participate. Before turning to how some aspects of microscope images help to construct knowledge of nature, I will expand on how conventions help to articulate the dynamics of imaging; and how the specific qualities of the images as influenced by the visualization technologies and objects of scientific knowledge can affect conventions of depiction.

Imaging the Invisible: Dynamics of Visual Conventions, Visualization Technologies, and Objects of Scientific Knowledge

The images that researchers create of the microscale or nanoscale do not exist by themselves – they are communicative acts and exist within complex cultures. Those who create images of the invisible, like others presenting scientific information in visual form, rely on visual conventions in order to convincingly convey what they find. However, microscope images differ from other kinds of images in that researchers making images from microscopes must rely on conventions of depiction more heavily than those who have the benefit of presenting visual information that can be seen with the naked eye, such as a landscape, for example. Makers of microscope images must therefore concern themselves with decisions about how the information will be presented in image form. Focusing on the conventions used to depict microscopic or nanoscopic phenomena, then, is one way to assess some of the social forces and common practices that shape particular images and reveal collective conceptions of what the images show, such as how nature is articulated.

Rhetoricians Charles Kostelnick and Michael Hassett describe four characteristics of visual conventions in relation to information design that further explain conventions' importance as markers of social change and that can help identify them in scientific microscope images. They first explain that conventions need to «solve information design problems that many users share – *typical* problems, not novel or unique ones».[7] As I will explain further below, researchers face some typical pro-

7 Charles Kostelnick and Michael Hassett: *Shaping Information: The Rhetoric of Visual Conventions.* Carbondale, IL 2003, p. 79.

blems as they use microscopes and create images. Conventions must also circulate in the form of images widely enough to be regularly seen by those within the social group in which they emerge.[8] Third, Kostelnick and Hassett state that conventions must be «reasonably economical to imitate»[9] and, finally, those creating the images must be persuaded to use them instead of other conventions.[10]

This last characteristic also explains what happens when conventions change. As Kostelnick and Hassett assert, factors such as new knowledge and new technologies affect visual conventions;[11] focusing on the dynamics of how researchers have wrestled with depicting microscopic or nanoscopic phenomena in visual conventions can then also show the dynamics of how nature is portrayed. The fact that, as mentioned above, microscale and nanoscale phenomena cannot be seen with the unassisted eye, and so are only visible through mediated means, creates challenges in communicating scientific information about these scales to the viewers of such images. As microscopists rely on conventions, the conventions as well as what is presented in the image shift to accommodate each other, creating the need for further examination. Art historian James Elkins explains the dynamics surrounding the use of conventions to visually convey what is unrepresentable in a way that is also useful for considering the dynamics of presenting microscale and nanoscale phenomena. Elkins writes, «images of unrepresentable objects put a strain on the pictorial conventions they inherit, finally breaking them and becoming different kinds of pictures».[12] His focus on the dynamics between what images attempt to show and conventions, and the resulting possibilities of developing new ways of imaging, presents one way to more closely examine scientific visualization of what is invisible.

Another reason that following the visual conventions used in images can be productive is implied by Elkins' use of the word «finally» in the quote above. As conventions exist at a collective level, they are not replaced quickly or on a whim; instead, they are replaced only when users must do so. As Kostelnick and Hassett explain, even less-than-perfect conventions remain at times even when a better replacement is available due to readers' habits of use.[13] These attributes of conventions suggest that analyzing conventions with attention to researchers' imaging processes with visualization technologies can further illuminate how and what images of the microscale and nanoscale communicate.

Shaping the Image: Landscape Conventions in Microscopy

While the conventional presentation of objects in a three-dimensional space is not the only way that information from microscopes has been presented, this conven-

8 Ibid.
9 Ibid.
10 Ibid.
11 Ibid. p. 43.
12 James Elkins: *The Domain of Images.* New York 1999, p. 44.
13 Kostelnick and Hassett, p. 79.

tion commonly appears in various contexts to convey information about microscale and nanoscale phenomena, including scientific journals, scientific groups' web sites, government documents, and more popular and educational web sites. The visual convention of framing information about the micro- and nanoscale in terms of perspective, which helps viewers recognize objects or at least familiar shapes, performs an organizing function in these images, one which has consequences for understanding how these images function. This framing is by all accounts not new, and as Svetlana Alpers discusses, can be linked to visual practices that have dominated Western definitions of art and images since the fifteenth century (xx). Following some of the key characteristics of this framing helps to explain some aspects of microscope images that make them seem like landscapes or depictions of objects.

This mode of depicting has been called Cartesian perspectivalism by critics such as Martin Jay[14] or has been ascribed to what Alpers terms the Albertian model, based on Leon-Battista Alberti's description of perspectival drawing technique in his 1435 work *De pictura*.[15] Alberti's technique consists of envisioning the drawing surface as a window-like plane out of which the viewer gazes onto the depicted scene. He devised a grid that enables an artist, who immobilizes her or his head and covers one eye, to divide the scene she or he views through the grid into limited, drawable squares, therefore capturing the perspective of what is seen through the entire grid. The resulting drawings show single-point perspective in that they are drawn from one point of view, so that the image's viewer stands in for the artist when viewing the image the artist has produced. This model of perspective has remained the main Western mode of seeing the world and making images.

Perspectival representation's pictorial conventions seem to play a role in some microscope images: examples of microscope images that use conventions of perspective include early images, such as some of Robert Hooke's images, published in 1665 (see, for example, an image of blue mold (plate opposite page 125), which depicts what seem to be a scene of flowers in grass against a dark background). More recent examples include some nanoscale images created with the scanning tunneling microscope that have been included on a web site: one, «Quantum Corral», of quantum states of iron atoms' surface electrons, for example, uses false shadowing and tilting of the horizontal plane to indicate a three-dimensional space.[16] Such details build up an impression of the image as an optical image of an object, or collection of objects, fitting with the Albertian model's view of a representation, which stands in as «an optical substitute for the object itself. [...] It is a facsimile emitting

14 Martin Jay: *Downcast Eyes: The Denigration of Vision in Twentieth-Century French Thought.* Berkeley 1994, p. 69–70.

15 Svetlana Alpers: *The Art of Describing.* Chicago 1983, p. 41–45.

16 IBM Almaden Research Center Visualization Lab. Quantum Corral. *IBM Almaden Image Gallery.* IBM Almaden Research Center Visualization Lab. www.almaden.ibm.com/vis/stm/corral.html (01.10.09).

the same bundles of light rays that would be reflected by the object if it were there, beyond the picture's frame».[17]

One benefit of using such perspectival conventions is that through their organizing functions, they help researchers convince viewers that what is presented with these conventions are solid, believable objects, similar to objects visible to the unaided eye. Such conventions may help to persuade readers of microscopic or nanoscopic phenomena's existence; however, in presenting objects as in the macroscale, these links do not necessarily present accurate information about phenomena at the microscopic or nanoscopic scales. Perspectival conventions also suggest a certain relationship between viewer and object, which also does not accurately explain what these images actually show, as I will explain further below. Conventions of perspective then do not always help microscope image makers solve typical problems they encounter as they convey information about the micro- or nanoscale; instead, the use of perspectival conventions may reveal more information about societal expectations of nature, or expectations of the audience to whom the microscopist is communicating. As Anne-Julia Zwierlein suggests in her study of the connections between seventeenth- and eighteenth-century science and poetry, in that time when scientists were not yet able to articulate the connections between objects and their microscopic structures, what microscope users saw was mostly a reflection of their collective eye – the world they already lived in but saw repeated «below», in miniature.[18] While the conventions of perspective then do function to help orient viewers and remain a dominant form of depiction, they do not necessarily convey information about the microscale or nanoscale as part of their organization. However, other elements of microscope images suggest that other conventions may solve these problems.

Shaping Conventions: Microscope Visualization Technologies and the Image Form

The question of how images construct nature at the micro- and nanoscale depends in part on how they construct microscopic or nanoscopic objects. How images do so directly affects what is shown and how visual conventions are used to present images as meaningful scientific evidence. Presenting information about the micro- and nanoscales in visual form creates a challenge for micoscopists, whether that form is drawings such those that Robert Hooke created from his observations in the 1660s, photomicrographs such as those in the database associated with this journal issue, or digital images of atoms such as those produced with scanning probe microscopes like the scanning tunneling microscope (STM) and atomic force microscope (AFM). While the images that are produced through these different

17 Ivan Illich: The Scopic Past and the Ethics of the Gaze: A Plea for the Historical Study of Ocular Perception. ournature.org/~novembre/illich (01.10.09).

18 Anne-Julia Zwierlein: Queen Mab Under the Microscope: The Invention of Subvisible Worlds in Early Modern Science and Poetry. In: Joachim Frenk (Hrsg.): *Spatial Change in English Literature.* Trier 2000, p. 89.

media have many unique, important characteristics that merit more detailed examinations of how each functions and how each uses visual conventions, a number of remarks can be made about all of these given their general functions and imaging process in relation to the visualization technologies that helped create them. These general remarks can then point to some common dynamics and so illuminate some visual conventions beyond those associated with perspective that help shape conceptions of nature.

For one, images of microscopic and nanoscopic phenomena do not depict what objects would actually look like at those scales if we were able to see that closely. Indeed, issues in resolving and in illuminating the objects that microscopists encounter make it so that even the most seemingly immediate image of microscopic or nanoscopic phenomena is highly mediated. As Ian Hacking points out about optical and electron microscopes, a microscope image is not a direct, photographic representation. Instead, it forms «a map of interactions between the specimen and the image of radiation», or in other words, charts how light or other radiation reacts with the sample under view (208). The reaction between sample and radiation is not analogous to what happens when we see at the macroscale: as Elkins explains, «the difference between the behavior of light under the microscope and in unaided vision is so great that it can seem as if the microscopic image is an entirely new phenomenon – as different from ordinary seeing as a stock market graph is from a snapshot».[19] In addition, newer microscopes, such as scanning probe microscopes like the STM or AFM, do not even use light to visualize. In these cases, these microscopes also create images out of maps of interactions between the sample and a probe, but instead of light, these microscopes use a tip to which current has been applied (which interacts with the electrons in the sample) in the case of the STM; or a tip which is physically dragged across the surface of the sample in the case of the AFM.

Microscope images then are composed of the map of interactions that the microscopes use to make phenomena visible. Therefore, microscope images do not necessarily represent objects as do more macro-scale drawings or photographs of landscapes or flowers. Instead, microscope images can be more precisely called informatic images, in that what they convey is data arranged in a matrix in the image form. Such images also share characteristics with others designed to present information produced with or without computers such as charts, graphs, diagrams, tables, and maps. What links these diverse images created through disparate production processes is that they present information in a visual, at times nonlinear format, where each point presents a certain value that can be assessed individually or in relation to other points' values.

Presenting information about the microscale and nanoscale in image form affects both form – the image – as well as what is presented in ways that challenge what is communicated as well as how the information is conveyed. In *Ontogeny*

19 James Elkins: *Six Stories from the End of Representation: Images in Painting, Photography, Astronomy, Microscopy, Particle Physics, and Quantum Mechanics, 1980-2000.* Stanford 2008, p. 126.

of Information, Susan Oyama argues that information does not exist a priori but instead co-develops ontogenetically with the form in which it is communicated[20]. What this view suggests is that the presentation of the data in an image not only changes the form, but also the form itself carries a certain number of determinants in its constraints and possibilities, which then shape information choices. As form and information co-develop and interact with each other in the process of formation, both the information as well as how it is presented are affected in this process. On this view, elements of «form» and «information» then are inextricably part of the same process; therefore, what is imaged affects the image form, and so the generation of new knowledge also may help generate variations on the image form. This mutual co-development can lead to changes in what is imaged and changes in the image – which can then lead to changes in or the generation of new visual conventions to depict what is imaged.

Shaping Conventions: The Informatic Image

Microscope images as informatic images, then, may generate their own conventions or alter other conventions already in use in the communities in which the images circulate. A closer look at some of the characteristics of the informatic image can suggest some possible typical aspects of images. These aspects can lead to situations where visual conventions of depicting informatic images can communicate (or the lack of visual conventions can create challenges), following Kostelnick and Hassett's point that one of the features of conventions is that they must solve typical design problems experienced by many users.[21]

One appealing attribute of informatic images is that they condense vast amounts of information into the relatively small spaces of images; this condensation, Edward Tufte notes, aids our ability to visually compare as much as possible in a short time.[22] As Elkins explains, many scientific images condense information by presenting it in multiple, disparate modes within the same image.[23] The database image entitled «Über elektive Vitalfärbungen zweier Drüsen von Daphnia magna Müller» is an example of this: there are two main components of the image, and each shows a different aspect of the same species but uses different stains and different stages – in addition, the photograph contains numbers superimposed to draw attention to part of one of the views.[24]

20 Susan Oyama: *The Ontogeny of Information: Developmental Systems and Evolution*, 2nd ed., rev. and exp. Durham 2000, p. 2.

21 Kostelnick and Hassett, p. 79.

22 Edward Tufte: *Envisioning Information.* Cheshire, CT 1990, p. 168.

23 Elkins *Domain*, p. 36.

24 J. Gicklhorn and R. Keller: Image. Über elektive Vitalfärbungen zweier Drüsen von Daphnia magna Müller. *Bildkulturen ökologischer Forschung.* bildkulturen.online.uni-marburg.de/de/suche/detail/aktuell/40/seite/1/suchart/thesaurus/modus/detail?tsr=methodik&lemma=Mikroskopie&kls=01.01.02.01&lemma=Mikroskopie (01.10.09).

These numbers also point to another way in which informatic images tend to condense information into images: they use the spatial, two-dimensional attributes of a page or screen as an organizing device. The use of this organizing device is one reason why the informatic image at first glance not only forms a coherent whole but also may seem to be similar to more conventional images such as photographs or drawings that may represent an object, for example. Indeed, one of the benefits of arranging information in an image is that viewers can simultaneously see the whole as well as be able to zoom in on particulars.[25] However, the informatic image's ability to present so much complex information also creates some challenges for those making the images and those viewing the images. Makers of informatic images rely on visual conventions in order to communicate their data; readers rely on conventions to understand what the images communicate.

The process of viewing an informatic image differs from viewing an image such as a landscape in part because the viewer often may be looking at an image for specific information or the relationship of certain data to other data, not necessarily for a perception of the image as a whole. For example, in Gicklhorn and Keller's image mentioned above, the import is not on the overall look or feel; instead, the image makers have invited comparison between the data in one part of the image and that in the other part by switching magnification and by showing one at a more advanced stage. Another image in the database, which contains four images within one image, also demonstrates this: «Anleitung zur Untersuchung des Limnoneustons» is not just one image of euglena.[26] Instead, what is important about this image is that it shows the effect of time on a population of euglena through four images between which time has elapsed. This focus on close looking, on comparing, as opposed to perceiving a whole view, helps create an overall feel of surface, of flatness. The spatial relationship between the points becomes important, not the depth of a landscape.

The informatic image functions as an interface as the viewer pores over its parts, and if computer-generated, changes them, saves them, or refreshes the image and so produces a new version. The viewer's eyes are directed to the image's surface, not to objects shown within, and in this way informatic image conventions differ from perspectival conventions such as those functioning to communicate a landscape view. The image series in particular, such as Rylov's image, or others in the database, can be seen as pointing to such a reading process in that they show new versions of the data within one image. This emphasis on change, over in this case manually «refreshed» images, invites readers to move from image to image and in some ways go through the process of viewing along with the experimenter.

25 Tufte, p. 31.

26 W.M. Rylov: Image. Anleitung zur Untersuchung des Limnoneustons. *Bildkulturen ökologischer Forschung*. bildkulturen.online.uni-marburg.de/en/suche/detail/aktuell/59/seite/1/suchart/thesaurus/modus/detail?tsr=methodik&lemma=Mikroskopie&kls=01.01.02.01&lemma=Mikroskopie (01.10.09).

Even in the case of a still image, the informatic images' viewer does not stand in the place of the scene's virtual observer: instead, the viewer contemplates the surface, running her or his eyes over the contours to follow the variations in order to make comparisons between different data points or to understand relationships between them. This close reading, observing the pattern of value differences, is a key characteristic of informatic images. Additionally, in viewing an informatic image on a computer screen, a viewer also can spend time exploring the image's data and so altering the image in response to what she or he sees at first to further determine differences, zooming in on a section, for example. This relationship of viewers to images adds to the extreme alterability of the images: not only do the images' creators manipulate the data, but also so can the viewers as they thread their way through the data, whether through moving from image to image, moving from point to point and so rearranging the data in their reading process, whether or not they literally do so on the screen.

While conventions for reading specific informatic images may vary (for example, conventions for creating and reading graphs differ from those for creating and reading tables, or other charts), one main function for all informatic images is to allow readers to follow the thread of information. Attempts to clarify the differences in the data in the database images manifest through techniques such as distance, which appears in images in ways such as marking the differences on the surface of the image with small numbers, letters, or arrows, mentioned above. In including such marks, microscopists emphasize the image's surface, as opposed to allowing viewers to gaze within. An example of this in the database associated with this journal issue is found in «Epidermis einer Blattspitze von Biota orientalis succinea».[27] In the image, an arrow points to what the author wanted to emphasize in the data, according to the explanation next to the image in the database. Other examples occur in the database as well – and in other times and places; such markings form a fairly typical solution to the problem of directing viewers of microscope images to particular information in an image.

Additionally, color has also been used to differentiate data (although not in the database, as it contains only black and white images). For example, in images made with the scanning tunneling microscope (STM), a color scale is often used to indicate electronic differences. The color is false, as atoms are too small for light to resolve them; however, color serves as a useful way to direct viewers' attention. The color scale can also be altered for different audiences: scientific journal articles tend to include images that use black and white scales, or often a sepia-and-white scale that is the default scale of some commercially produced images, while images that appear on journal covers, on group web sites, or in other electronic or print publications designed for wider audiences tend to use bright color. Such conventions

27 H. von Lengernken: Image. Epidermis einer Blattspitze von Biota orientalis succinea. *Bildkulturen ökologischer Forschung*. bildkulturen.online.uni-marburg.de/en/suche/detail/suchart/thesaurus/modus/detail/?tsr=methodik&kls=01.01.02.01&lemma=Mikroskopie&aktuell=24 (01.10.09).

allow image makers to direct attention to one way (or more) of working through the information, and so the conventions help show readers what is important about the particular images.

These techniques become conventions of depiction, even though their specific manifestations may vary from one image to another. These conventions rely on viewers' close reading along the data points, using color, distance, and other differences that series or time can produce to steer through the information. While the viewer reads these images for what they communicate about the microscale or nanoscale, these informatic conventions can perform the rhetorical work of arrangement by building a frame for understanding the scientific knowledge about the microscale or nanoscale. This frame presents the reader with an overall image that leads into the specific information; the specific data then allow the reader to read closely and interact with it.

Conventions of Demonstrating Objectivity and the Microscope

The interaction with information is also emphasized in the use of the microscope, which adds to the pressure to express information as multiple and manipulable and also shows a conflict with an established scientific convention. This challenge occurs as a tension between the established, common conventions that help to convince viewers that scientific phenomena are being presented objectively and the involvement and manipulation which is part of the process of image production that occurs with microscopes. This process includes the manipulation of samples by researchers to prepare them for microscopy and the actual use of the microscopes including the interactions that produce the informatic images.

Images of the micro- and nanoscale have always involved a degree of a microscope user's involvement and interpretation, from drawing the microscopist's observations, to deciding what to photograph, to shaping data into an image. Microscope users have learned to see by becoming involved with the sample or operation since the microscope's emergence in the seventeenth century: Robert Hooke's unpaginated preface to his 1665 *Micrographia*, which introduced many to what could be seen with the microscope through his detailed engravings, presents a particularly clear case of this as he describes building up a picture over a series of observations of the same object.[28] This involvement with samples over time also shows a certain level of manipulation as the image created is not a direct view of the object, but an aggregate that has been arranged by Hooke's drawing techniques.

The emphasis on the use of the microscope as tool for interacting with objects of study in order to gain knowledge of the natural world also makes it so that the process of imaging becomes part of that tool for interacting – and whether the

28 Also see Ford, Chapter 8, for an intriguing photograph of what Hooke most likely saw through the microscope: comparison with the engravings shows that Hooke's view and Hooke's engravings are quite different.

imaging process is through drawing by pencil or Photoshop, the imaging technology becomes that which the researcher uses to interface with the object under view. The imaging technology then becomes not only what he or she uses to present microscale or nanoscale phenomena to others, but also what he or she uses to see for him- or herself. In order to image the microscale or nanoscale, the researcher not only produces an image, but also in interacting with the image's components at different stages, is able to differentiate one object from another within the context of the sample. This then allows her or him to compose a visual system of what she or he sees and so create a visual language, a visual system of conventions that like a language system generates effects in part because it is citable, and so transferable to other contexts.

As Hacking also points out, given the problems with the microscope, «all but the most expert [observer] would require a ready mounted slide to see *anything*».[29] Instead, seeing with a microscope is composed of learned, practiced actions that include not only looking but also doing. Hacking connects this need for intervention to Berkeley's 1710 *New Theory of Vision*, «according to which we have the three-dimensional vision only after learning what it is like to move around in the world and intervene in it»[30]. Therefore, the microscopist must use both hand and eye as well as practice this fused use in order to build up a capacity for seeing under these circumstances.

And yet, as Evelyn Fox Keller observes, «in scientific discourse, looking is associated with innocence, with the desire to understand, while touching implies intervention, manipulation, and control».[31] Barbara Maria Stafford explains one reason for the downplaying of touch in the eighteenth century, for example: manipulation or manufacture was considered the work of charlatans, not scientists, and so what was prized was seeing an unadulterated specimen. Stafford notes that

> ‹objectivity›, or the honest conduct of the practitioner, was thus synonymous with the absence of any visible sign of manufacture. The rise of objectivity as a scientific ideal in the early modern period was facilitated by the development of measuring and distancing apparatuses. These truly ‹automatic› devices seemed to preclude shady handling and phony gadgetry.[32]

As Lorraine Daston and Peter Galison explore in their study of late-nineteenth and early-twentieth century concepts of objectivity in scientific atlases, scientists continued to turn to mechanically-produced images as a way to eliminate human interpretation of the natural phenomena.

29 Ian Hacking: *Representing and Intervening.* Cambridge 1983, p. 192.
30 Hacking, p. 192.
31 Evelyn Fox Keller: The Biological Gaze. In: George Robertson et al. (Ed.): *FutureNatural: Nature, Science, Culture.* New York 1996, p. 107.
32 Barbara Maria Stafford: *Artful Science: Enlightenment, Entertainment, and the Eclipse of Visual Education.* Cambridge 1994, p. 103.

This convention leads to a tension between following convention to emphasize the visible but not manipulable aspects of microscopy in microscope images and the fact that manipulation is important to the process of not only preparing microscope samples but also of creating microscope images. An example of this tension occurs in the nineteenth century – just as microscopists were adopting photography to help them claim that they presented the world untouched.[33] As Keller observes, biologists were able to use the microscope to help them do their biology: «once the microscope was joined with the manual manipulations of an experimental biology – marking, cutting and dissecting *under* the scope – and the interdependency of hand and eye previously reserved for the naked eye was extended into the microscopic realm, the microscope became a reliable tool for veridical knowledge»[34]. This situation shows how important interaction is in the use of the microscope and shows one of the ways that researchers attempted to solve the problem of showing objectivity – they adopted a new medium that was associated with objectivity to convey their work.

This tension between portraying microscale or nanoscale phenomena as untouched and using the interactive attributes of the visualization technology helps to show the sway of conventions. It also may show the sway of the conventions of perspective as well – when the distance between viewer and object (such as in the Albertian model) is not able to be there, the question arises of how one might know nature if one cannot view it with a distanced perspective. The microscope images answer this question – viewers and microscope users are immersed in a way that does not afford perspective, but rather, close reading of the surfaces. As the photomicrographs in the database show, for example, even though the adoption of photography may have leant microscope images a certain sense of objectivity, elements in microscope images display connections with informatic image conventions that do emphasize the fact that the image does not present nature without the touch of the human hand, such as the inclusion of tiny numbers or letters. In this way, viewers' attention is drawn to the surface as well as to the fact that the images have been marked.

In addition, other microscope images do show the hand of the researcher, such as the more recent scanning tunneling image, «Quantum Corral» mentioned above. This image, of a ring of iron atoms, shows the results of an experiment to position iron atoms in a ring in order to conduct experiments on the electron standing waves «corralled» inside.[35] It is clear that this image could not have been created without the experimenters manipulating the sample of the surface, although it is also interesting that they have relied on creating perspective in this image to emphasize the object that they created.

33 See for example: Turner, p. 147–149.

34 Keller, p. 112.

35 M.F. Crommie, C.P. Lutz and D.M. Eigler: Confinement of Electrons to Quantum Corrals on a Metal Surface. In: *Science* 262, 1993. p. 218-220.

Microscope Imaging Conventions' Effects on Construction of Nature

The visual conventions described above highlight cultural ideas of what they should depict, from the focus on objects that would be found in the macroscale that conventions of perspective highlight, to the focus on objectivity in conventions of presenting what is seen as untouched. The informatic conventions apparent in microscope images, too, highlight cultural ideas of what they should depict, albeit ideas that are not quite as dominant in culture as the first two. As microscope images contribute to scientific knowledge, they also contribute to particular constructions of nature and help form our understanding of the natural world in ways that are less grand, perhaps, than a sweeping view of an ecosystem, but nevertheless important.

The characteristic «close reading» of informatic images that allows readers to make sense of the information presented in them suggests a vision of nature that is perceived from close up, as viewers read from detail to detail, like in a database. The overall view of the image can contain information of its own, but it does not have to in order for the image to communicate; the details – and their proximity to each other – are the important elements of the image. These images are also read through conventions such as distance between image elements, time, and color. Such conventions of depiction guide readers through an understanding of the images, as opposed to, for example, representations of objects themselves.

The vision of nature that is created here is not one guided by an overarching narrative or perspective that organizes all of the details. In this way, the nature that is presented in microscope images corresponds to how Christine Hine describes the organizing function of databases as scientific instruments: as she notes, «instead of imposing its own computer logic, the database provides a focus for specifying and tying together particular natural and social orderings».[36] Nature in microscope images is presented as composed of multiples, awash in associations, like the association of data in a database; the viewer is guided through by the accrual of attention paid to details. The flatness of microscope images as they present a matrix of information becomes a key characteristic, as opposed to the depth of a landscape.

The nature that is constructed through the experience of these details is also a nature that is created through the viewer's participation as he or she interacts with the microscope image to learn what information is conveyed. Informatic microscope images thus portray a nature that is multiple, flat, and manipulable – and experienced through interaction.

36 Christine Hine: Databases as Scientific Instruments and Their Role in the Ordering of Scientific Work Export. In: *Social Studies of Science* Vol. 36, No. 2., 2006. p. 269.

Conclusion

Following the dynamics of visual conventions in microscope images is one way to follow social and technical influences on the construction and shaping of knowledge in microscope images, and so also to address the concepts of nature expressed by these images. These sketches of how imaging conventions are affected by the image form, the objects of scientific knowledge, and the visualization technologies that enable them to be created also hint at some of the cultural complexity that pervades both images and conventions. This analysis merely points to some conventions of depiction and suggests how they may help construct ideas of nature – what is missing from this analysis, of course, is further historical and cultural analysis of specific images to reveal the social, scientific, and historical conditions of a given image's conventions of depiction and so further develop these definitions of nature. While each of the above sketches could be situated within a specific historical and social context in order to develop a fuller picture of the dynamics in play, in aggregate the sketches of conventions can also leave us with a sense of nature depicted in these dynamics. As I hope to have suggested, conventions of depiction influenced by microscope images' qualities as informatic images created by manipulation and interaction do have an impact on the resulting images, and these conventions do help shape an idea of nature as flat, manipulable, and multiple – like a database.

The informatic image has existed throughout the history of microscopy, contributing to scientific understanding ideas of nature that form an alternative to the dominant views of nature as landscape that are inherited from the landscape tradition. Such views of landscapes informed by perspectival conventions have seemed natural in the past: as Elkins remarks, «conventions of computer-generated perspectival scenes in military and scientific simulations, architecture, and commercial games appear ‹natural› or mathematically driven to their designers, even though they can be shown to derive from Western landscape painting of the last two centuries».[37] And yet, they are not the only «natural» ways to view nature, if we pay attention to the conventions of informatic images, as exemplified in microscope images.

Indeed, such conventions and ways of organizing and perceiving the world may be shifting in scientific and in other cultural domains – or at least making such conventions that organize information more visible in other domains. For example, recently Timothy Lenoir has argued that the field of biology shifted to become an «information science» in the mid-1960s. As he further observes, the organization of biology may be affected quite dramatically by this shift.[38] Paying attention, then, to conceptions of nature in microscope images may indeed inform us about other trends and ways of both seeing and seeing nature that have existed in the making of

37 Elkins: *Domain*, p. 9.

38 Timothy Lenoir: Shaping Biomedicine as an Information Science. In: Mary Ellen Bowden et al. (Ed.): *Proceedings of the Conference on the History and Heritage of Science Information Systems.* Medford 1998, p. 27. www.stanford.edu/dept/HPS/TimLenoir/shapingbiomedicine.html (01.10.09)

scientific objects. One could expand Raymond Williams' statement that not only is nature perhaps the most complex word in the language, but that following conceptions of nature in images is also complex, yet equally illuminating.

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Stefan Auman

Images on the Net!

The sheer volume of images published on the internet and thus available almost everywhere has reached almost inconceivable dimensions. Within just a few years the internet – or the World Wide Web, to be more precise – has developed into being the most significant medium for publishing images of all kinds. Efficient compression algorithms and the associated low storage requirements for even large corpora have paved the way for this development, as has the increased availability of broadband connections.

If we enter a deliberately non-specific search item – the single letter *s* – into the German Google image search engine[1], it generates around two billion hits[2] (November 2009), with *S-Bahnen* (city trains), *S-Bikes*, the *S-Klasse* (S-Class), the *S-Typ* (S-Type) and the *S-Serie* (S-Series), *S-Kurven* (S-curves) and *S-Budgets*, *S-ATA* and *S-Video*, first names abbreviated to their initial letter, ‹see…› items, and page references (‹page› in German is *Seite*) all appearing high up in the results list. If a newborn human were to spend just one second looking at each result, she or he would have almost reached the current pensionable age by the time they had cast even a fleeting glance at all the images displayed.

Search engines have a purely technical concept of how an *image* as such is to be identified. As a rule, images are referenced in the WWW using the ‹*img*›-element in hypertext markup language (HTML). In this system, it is not at all important initially whether the files labeled with the required src attribute[3] contain photographs, drawings, maps, digitalized pages of books or archive material, diagrams or any other kinds of illustrations.

The filter options developed continuously by Google over the last few months are made possible by an automated content analysis of the image files. They enable, for example, the display of search results to be limited to the types *face*, *photo*, *clipart*, *lineart* or various color characteristics. In the weighting of results from the image search, of course, other methods are applied. Although the search engine developers keep the details of their weighting algorithms as a trade secret, it is nonetheless possible to identify certain patterns. The spatial proximity of a search term to the ‹*img*› element in the source text of a page seems to be especially important. The same applies to the name of the image file incorporated via the *src* attribute. The other at-

1 images.google.de (03.12.09).

2 With Microsoft's search engine, Bing, it is 244 million on the same day: www.bing.com/?scope=images (03.12.09).

3 Every image embedded in a WWW page exists in a separate file. The *src* attribute indicates the location where this image file is stored.

tributes of the ‹*img*› element – especially the obligatory *alt-* (alternate text) and the optional *title* attribute – are also of considerable relevance: both enable information to be provided about what is contained in the image.[4] Finally, another factor taken into account is whether the search term appears in the title, the address (URL), in a heading or in a link to the page containing the image found.

Despite these efforts to specify the content of images, the conspicuously high proportion of ‹false positives› among the search results immediately leaps to the eye when using Google's image search or that of other providers. The people search, in particular, frequently displays supposed hits that are completely absurd. This disproportionately high volume of ‹noise› is due to the weighting procedures outlined above.

For many years now, however, it has been possible to insert metadata into the image files themselves. In this way, information about the content of the image depicted can be linked and rendered more precisely using specific words and terms. The metadata are embedded directly in the header of the image file and can be accessed there not only by dedicated image processing programs[5] but also by search engines or photo community platforms such as Flickr[6] or Onexposure[7]. The special potential of metadata in the context of academic research lies in the fact that they can be used to create self-documenting and variously annotated images which can be fed into quite diverse applications.

Metadata in image files

The idea of embedding metadata in image files originated in the early 1990s when the International Press and Telecommunications Council (IPTC) together with the Newspaper Association of America (NAA) adopted its Information Interchange Model (IIM), which came to be known as IPTC-NAA (or IPTC standard for short). The aim of this standard was to improve the electronic transfer of image files between professional photographers and news or photo agencies. In 1995 software manufacturer Adobe developed a proprietary procedure for embedding photographic metadata in the header of image files. What has since been known on the market as IPTC Photo Metadata is in reality a partial implementation of the original standard, as Adobe did not incorporate every field of the IIM. In September 2001 Adobe released its own specification, the Extensible Metadata Platform (XMP), which aims to facilitate a standardized workflow when working with images. Depending on file type, XMP metadata such as a file's IPTC equivalent can be written into the header of an image file or into a ‹sidecar file›.[8] Many image

4 The *longdesc* attribute, which enables detailed descriptions of content documented in a separate file to be referenced, is rarely used. On the incorporation of graphics using the ‹*img*› element and on its attributes, cf. www.w3.org/TR/REC-html40/struct/objects.html#h-13.2 (03.12.09).

5 Such as Adobe Photoshop, GIMP, Corel Photo-Paint etc.

6 www.flickr.com (03.12.09).

7 1x.com (03.12.09).

8 Sidecar files have the same name as the actual image file, differing only in their extension (*.xmp*).

processing programs synchronize the relevant fields when changes are made to the metadata. In 2005 the IPTC released its ‹IPTC Core Schema for XMP› specification in order to adopt a successor to the IIM that would be more authoritative. Adobe was involved in the preparatory work for IPTC Core. Since July 2009 IPTC Core has been a component of the IPTC Photo Metadata Standards, while the XMP technology developed by Adobe handles the technical implementation aspects.[9]

Professional image archives can no longer be operated without a consistent use of metadata. Nonetheless, conventions affecting the specific design or semantics of the individual fields may well differ from agency to agency or from one provider to another. The example below documents extracts from the metadata associated with a photo of Herta Müller, winner of the 2009 Nobel Prize for Literature, which was distributed via dpa (*Deutsche Presseagentur*)[10]:

Keywords:	.Kultur, .Literatur, .Nobelpreise, .Personen
Date Created:	2009:10:07
By-line:	Bernd Weißbrod
City:	Stuttgart
Province-State:	Baden-Württemberg
Country-Primary Location Code:	DEU
Headline:	Herta Müller
Credit:	picture-alliance/ dpa
Source:	Dpa
Copyright Notice:	usage worldwide, Verwendung weltweit
Caption-Abstract:	Die Berliner Schriftstellerin Herta Müller, aufgenommen vor einer Lesung aus ihrem neuen Werk Atemschaukel im Literaturhaus in Stuttgart am Mittwoch (07.10.2009). Herta Müller ist in den engen Favoritenkreis für den Literaturnobelpreis aufgerückt. Einen Tag vor der diesjährigen Vergabe in Stockholm wurde die in Rumänien geborene Autorin bei allen Spekulationen an vorderster Stelle mitgenannt. Auf den Ladbrokes-Wettlisten ist Müller auf den vierten Platz vorgerückt. Foto: Bernd Weißbrod dpa/lsw +++(c) dpa – Bildfunk+++
Writer-Editor:	bw_dt

9 For IIM, IPTC, XMP and IPTC Core cf. iptc.org/IPTC4XMP; for XMP see also www.adobe.com/products/xmp (03.12.09). A helpful introduction to the issues appeared in the German computer magazine c't in 2006: Andrea Trinkwalder: Für die Ewigkeit. Metadatenstandards fürs Bildarchiv (For eternity: Metadata standards for image archives). In: *c't* 16, 2006, pp. 156–158. For the latest developments, cf. iptc.org/cms/site/index.html?channel=CH0099 (03.12.09).

10 Published in Spiegel online: www.spiegel.de/fotostrecke/fotostrecke-47571-5.html (03.12.09). The free extension *Exif Viewer* is available for the Firefox browser; this enables the metadata contained in the files to be displayed directly.

These kinds of conventions and regulatory mechanisms – such as those relating to the design of the keyword field – facilitate a flexible response to specific requirements. A range of procedures used either complementarily or exclusively is available for academic research purposes, including systematic cataloguing codes of a subject classification, a controlled vocabulary, or other procedures for indexing or classificatory subject cataloguing.

Pilot project: ‹Visual cultures of ecological research›

These were indeed the kind of requirements posed by the project ‹Visual cultures of ecological research›, funded by the Hessen Ministry for Higher Education, Research and the Arts.[11] This project makes use of a mark-up scheme that enables terms allocated via the keywords field to be categorized as subject, personal or geographic keywords. The database tables required for the index search or extended search are also generated on the basis of this categorization. In the course of processing the metadata embedded in the image files, keyword entries are additionally examined to see whether they are part of a controlled vocabulary covered in an additional search option, the thesaurus search.

Among the other requirements of the information system to be realized as part of the project was the possibility of the images being edited by more than one user in one location. This meant having to devise a workflow that enables not only the project partners in Darmstadt and Marburg but also future partners to undertake all aspects of cataloguing work using their own locally available and established tools.

The project partners make use of Adobe's Photoshop Lightroom[12] software, an integrated workflow solution aimed in part, though not exclusively, at professional photographers. In its library module Lightroom offers an exemplary mode of support for working with cataloguing metadata: Keywords, for example, can be organized hierarchically, allocated synonyms, and exported in many different ways[13]. The allocation of keywords to one or more images is possible, as is a differentiated filtering of the total inventory of images.

Workflow

Unlike more straightforward electronic image browsers, digital asset management (DAM) programs like Lightroom manage their metadata in their own program database, the catalog. In addition to the metadata generated automatically by digi-

11 bildkulturen.online.uni-marburg.de (03.12.09).

12 www.adobe.com/products/photoshoplightroom (03.12.09).

13 For example, with regard to keywords that are part of a hierarchy or a thesaurus, it is possible to specify whether the generic terms, subject headings etc. under which they appear are to be exported automatically as well.

Fig. 1: The Lightroom library module, here in grid view. For cataloguing the user switches to a full-screen view of the individual data set

tal cameras[14], the catalog also manages the cataloguing information, development settings for specific images and program-specific data – for example about images' association with user-defined collections[15] (Fig. 1).

The first task in the project workflow is to digitalize the images to be included. Once they have subsequently been imported, all the other data are then recorded in Lightroom. This includes both formal information – such as the original place of publication – as well as the actual content-related cataloguing. Specifically, data are stored regarding the individuals, institutions or objects pictured, the location where the image was created, and issues relating to media technology and methodology. This is followed by keying in a title for the image and a content description.

As soon as the images have finished being edited – the number of images can be determined freely – the process of exporting them for transfer onto the WWW information system is set in motion. The file format (here JPEG) is set within the

14 So-called exif data (*Exchangeable Image File Format*). These document photographic settings such as aperture, exposure, ISO setting, focal length, details about the lens and the image size, date and time taken.

15 For Lightroom's catalog concept, cf. Marc Altmann: Foto-Verwaltung. Katalogkonzept von Lightroom, Teile 1–4 (Organizing Photos. Lightroom's catalog concept, parts 1 – 4). In: *c't special* 02, 2009. pp. 128–139.

Fig. 2: The map interface of the information system

export settings. These also determine the storage location as well as the format of the metadata to be embedded. In order to guarantee the greatest degree of self-documentation possible, the metadata are written in parallel in both the IPTC and the XMP area of the image file header. This makes them accessible, in principle, to programs that do not yet support the more modern XMP format.

All that is left to do then is to transfer the exported image files to the WWW server. The procedure is just as straightforward for all the other project partners; whether they do their cataloguing locally using Lightroom or some other application that enables the incorporation of metadata is irrelevant. All that has to be set up are the necessary (once and for all) authorizations to upload files. As soon as the image files have been transferred to the WWW server they are available for fully automated further processing.

Metadata can be extracted from the image files using command line programs such as the free, very efficient *Exiftool,*[16] whose source code is also available. There are also dedicated collections of subroutines (libraries) for a host of programming languages, where the required function can be obtained and added in. The Perl program developed by the project team draws on several such libraries to enable various stages of processing to be combined:

16 owl.phy.queensu.ca/~phil/exiftool (03.12.09).

- scanning in all the image files;
- extracting the metadata;
- creating database tables for individuals, places, institutions, objects etc.;
- generating previews for the individual image files.

The automatic processing procedure can be activated as often as users see fit. In many cases it is sufficient if the automated mechanism checks once a day whether new files are contained in the upload folders on the server.

The search functions

The information system required as part of the visual cultures project was designed as a heuristic tool. The aim was and is to create for the object of the project – the study of visualization strategies of ecological research – differentiated search options which facilitate quite different strategies for accessing the processed images. These include:

- the *simple search* similar to the function offered by search engines;
- the *extended search*, in which various descriptors can be linked or time filters set;
- the *thesaurus search*: this facilitates a systematic and hierarchical extension or restriction of the overall image inventory with regard to media technology, object, methodology, institution, individual;
- the *index search*, which allows for more exploratory points of access via alphabetical indices; the index search is helpful not least in gaining an overview of the basic cataloguing categories, such as main headings.

In addition to this, a *map interface* was created using OpenStreetMap technologies[17] (Fig. 2).

One characteristic feature of the information system is the variable presentation of results. The grid view provides a rapid guide to the results set (Fig. 3); additional cataloguing data can be superimposed in list view. While the detailed view shows the data set in its entirety, the map view makes it possible to view the results set in such a way that all the locations identified in the hits are represented in a dynamically generated map.

As information about individuals, locations and subjects – the latter include a list of the thesaurus terms allocated to the image in question – are represented as links in the detailed view, new results sets can be formed in an ad hoc way, thus enabling relationships between images to be rendered visible or indeed established (Fig. 4).

17 OpenStreetMap is a wiki project aimed at producing a free map of the world, cf. www.openstreetmap.org (03.12.09).

Fig. 3: The results set from a simple search in grid view

Fig. 4: Representation of a hit in detailed view; all metadata originally recorded as keywords are represented as links

All the options provided by the information system for searching for images and displaying results are ultimately based on the metadata embedded in the images, thus demonstrating the power of this simple approach.[18] All that has been added to them are basic data concerning geographical units (locations, landscapes), as these coordinates need to be available for the map interface and map view. Finally, a literature database has been integrated into the information system, through which bibliographic details can be incorporated into the detailed view. The primary keys for the linkage are again part of the image metadata.

The information system itself was programmed using a web application framework. Such frameworks support the development of dynamic WWW applications by providing components for database access, roles and rights management, internationalization (I18N), localization (L10N) and much more. The visual cultures project makes use of the Zend Framework[19], based on the PHP programming language. It makes available very efficient and fully developed libraries for full text search (Apache Lucene Technology[20]), PDF generation, input validation, internationalization, authentification and authorization, and mail etc.

A further strength of the Zend Framework is that it supports search engine-friendly addresses (*URL*s) very well. This, along with the way the results are presented and the metadata embedded in the files themselves, makes it highly likely that the images will be found even if the information entered into search engines is not very specific – and this in the context of the information system through which all further search options are opened up. Good support for technologies in the Web 2.0 environment additionally provides ideal conditions for the future expansion of the information system.

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18 A minor limitation is given simply due to the fact that changes necessitate the renewed exporting of the images concerned. Although it would easily be possible to make corrections, additions etc. via the WWW (the changes could even be written back into the metadata of the images), the associated risk of discrepancies between the cataloguing system and the information system is averted by ensuring that all writing operations take place in principle in the cataloguing system.

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Astrid E. Schwarz

Rising above the Horizon: Visual and Conceptual Modulation of Space and Place

1. Changing Perspectives – from Map to Landscape and back

In a landscape picture, the higher the horizon is lifted, the more the viewer gets to see of the terrain: hills no longer obscure much, if any, of the view and, rather than looking into a space organised by the methods of central perspective, the viewer increasingly finds himself looking at a surface. A photograph of a point of elevation shot vertically from above – best of all from a freely floating flying device – has no horizon in it at all: the entire terrain has become a surface that can be read like a map. In the course of moving

> «from the earth-bound photograph (horizontal view) to the aerial photograph shot vertically, the icons have become even smaller, but the image itself offers an even larger detailed view of the terrain.»[1]

By virtue of their surface-like quality, which remains even when techniques such as hatching are used, such perspectives and their corresponding projections (such as the widely used Mercator projection) render themselves anonymous. They suggest a view from nowhere in particular, one to which all is revealed and from which nothing can be concealed – the eye of God, as it were. The «landscape» exists here as pure external space; it seems to manage perfectly well without a subject that looks at and thus constitutes it. In a certain way this perspectival construction is similar to a mediaeval panel painting of the Earth's surface which, as literature scholar Albrecht Koschorke notes, is quite «lifeless» in this respect, whereas a «landscape backdrop must first be penetrated, incorporated, animated by a human being»[2]. Thus even the designation «landscape» is inappropriate for surface projections. Instead, some other descriptive term such as «terrain formation» (in geomorphological terms) or «piece of nature»[3] (in the terms of natural philosophy). This «cartographic view»[4] –

1 Eberhard Fischer: *Lesen des Luftbildes.* Berlin 1938, p.13.

2 Albrecht Koschorke: *Die Geschichte des Horizonts*. Frankfurt/M. 1990, p. 146. Historian and philosopher of ecology Ludwig Trepl emphasizes that «meaning-making nature» need not necessarily be constructed by means of an individual subject: God or a collective subject (such as «nation» or «spirit of the age») can also be creators of nature as landscape (Ludwig Trepl: Zur Geschichte des Umweltbegriffs. In: Naturwissenschaften 79, 1992, p.387).

3 See, for example, Hans Werner Ingensiep und R. Hoppe-Sailer: *NaturStücke. Zur Kulturgeschichte der Natur*. Ostfildern 1996.

4 Christine Buci-Glucksmann: *Der kartographische Blick der Kunst*. Berlin 1997.

which is also typical of the aerial photograph – has medial predecessors that reach far back into history.[5] Over the course of time they have been manifested visually in panel paintings, site plans and city views.[6] Typical of the cartographic perspective is a surface-like, sketched depiction of the Earth, whereas in landscape art the horizon sinks into the lower third of the picture and the rest is filled with sky: a wide-open space filled with possibilities.

To put it rather pointedly, the concept of landscape brings into play a view of, or rather into nature and its representations, which simply cannot manage without a subject at the center of their perspectival construction. By the turn of the 19th century this is the perspective of the bourgeois subject[7], which increasingly makes landscape the object of literature, art and science, appropriating nature for itself through the landscape perspective. «The transformation of nature into image – as with the growing fashion of plein-air painting – is supposed to occur there and then».[8] In these representations the line of the horizon is a boundary line in front of which a new instrumental access to nature is displayed in the foreground, in a space secured by perspective. In art, the visualization of nature through landscape becomes a means of rehearsing a controlling gaze cast upon nature. This is no longer a nature that is elevated and menacing but rather one that is culturally conditioned and, precisely because of this, is beautiful. This is a perspective that is powerful in literature as well, one example being the writing of Goethe, who sets before his readers a harmonious cultural landscape on his travels through Italy. His account is informed by the facts of natural history concerning animals, plants, and the morphological gestalt of a region, all of which combined holds out the promise that the things of this world will increasingly yield to the penetrating gaze of science and thus be rendered transparent.

Getting to grips with this increasing penetration of an opaque medium in the form of oceans and inland waterbodies provides some impressive insights, perhaps not least because, in this context, the gaze penetrates the depths rather than scouring the distance: it is limited by the opacity of the medium and not by the line of the horizon. Moreover, natural history and natural science repeatedly encounter,

5 In the history of cartography the increasing tendency to represent space on the basis of topographical features is identified with a transformation in which the human view of the world is no longer imagined from the inside, from a history of redemption, but as a view from outside onto the world, a human view of humans themselves. It is no longer the places in the Bible that provide the coordinates by which the world is ordered but rather the abstract system of geometry. For more detail on this, see Ute Schneider: *Die Macht der Karten*. Darmstadt 2004.

6 See also Peter Galassi in *Before Photography*: «[T]he ultimate origins of photography – both technical and aesthetic – lie in the fifteenth-century invention of linear perspective». (*Before Photography: Painting and the Invention of Photography*. New York 1981, p. 12).

7 As geographical theorist Ulrich Eisel puts it in mildly sarcastic tones: «It [the landscape, A.E.S.] is the most concrete thing we have in the world if we want to observe our complacency» (Ulrich Eisel: Triumph des Lebens. Der Sieg christlicher Wissenschaft über den Tod in Arkadien. In: *Urbs et Regio* Sonderband 65, 1997, p. 42.).

8 Koschorke 1990, p. 144.

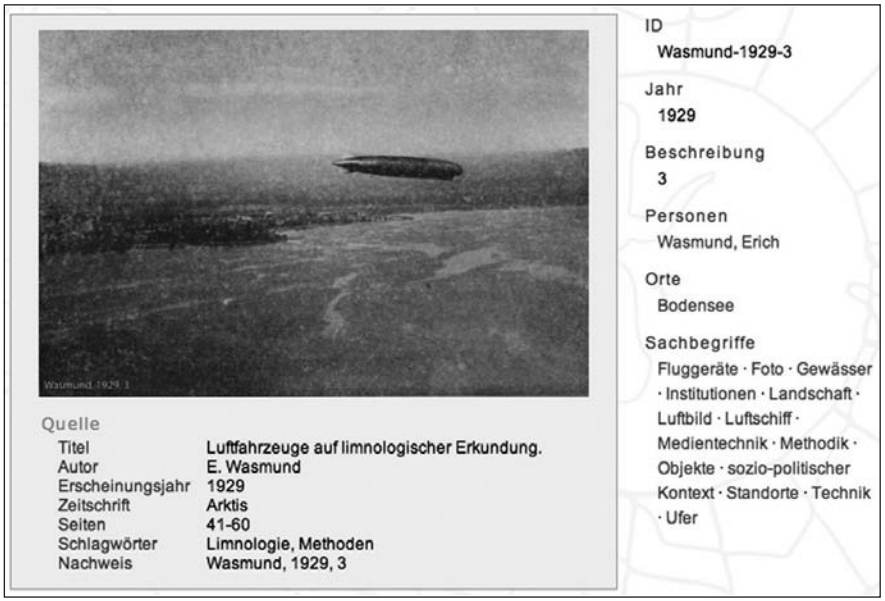

Fig. 1: Screenshot from the image database «Visual Cultures of Ecological Research», depiction in the mode of «detailed view».

confront, but also interpenetrate one another here through the perspective each imposes. Sciences which concern themselves with these objects, including geography, oceanography and limnology (the ecology of lakes and rivers[9]) use methods and concepts from both domains – the laboratory and the field sciences, nomothetic and idiographic methodology.[10]

2. Narrative Strands

The following questions provide the overall structure of this article, which seeks to do no more – but also no less – than offer a brief account of the historical transformation affecting the visualization of «landscape» in ecology. What this contribution additionally seeks to do is demonstrate how the image database containing «visual cultures of ecology»[11], to which all the articles in this publication – to a greater or lesser extent – refer, might be able to realize heuristic potential. This issue is linked

9 Limnology is the science of fresh water, sometimes also called hydrobiology or aquatic ecology. The name and the program of the discipline were coined by Swiss naturalist François-Alphonse Forel (François-Alphonse Forel: *La limnologie, branche de la géographie*. In: *Report of the Sixth International Geographical Congress held in London 1895*, London 1896, S. 593-602). Unlike hydrological or purely biogeochemical problems, limnology is concerned with questions relating to organisms.

10 This distinction was introduced by Wilhelm Windelband (*Geschichte und Naturwissenschaft.* In ders.: *Präludien II*. Tübingen 1884).

11 http://bildkulturen.online.uni-marburg.de/

here with the notion of rising above the horizon and is elucidated using the historical case study of aerial photography in limnology during the 1920s and 1930s.

So how does landscape enter the sciences which, at the beginning of the 19th century, are subject to increasingly high expectations? How does the landscape help to purify people's perception of nature and to keep their imagination and sensibilities in check? And what is the nature of the heuristic potential of landscape in ecology?

Within this transformation particular attention is given to aerial photography, a technique that spread very rapidly in various fields of research during the first two decades of the 20th century. This is related to issues concerning the technological and socio-political context in which this technique was able to achieve such a great innovative leap. Did the notion of «science as a weapon» already play a role in the First World War with regard to the technoscientific development of aerial photography? What contribution do aerial images make in the transformation from subjective multilayered landscape into objective, transparent and clear-cut scientific images? What innovative potential do aerial images offer in comparison to maps? And what makes the medium of photography stand out in the field of remote sensing?

The analytic focus of this piece is directed in part at lakes and their scientific description in the context of limnological research, in part also at sketching the outlines of an institution – «Illuft», the International Aero-Limnological Center – which went down in history even before it had a chance to begin work. This was an institution whose rise and fall occurred within the space of about half a decade and which was linked primarily with the name of a sole individual, namely limnologist Erich Wasmund. This raises questions that have to do, on the one hand, with Wasmund's institutional and disciplinary environment as well as, on the other, with the extent to which remote sensing was able to make use of theory building in limnology. What types of visualization were current in this science, and which theories were linked with which representations? In this regard, how is the program of the typologization of lakes – one quite prominent during the 1920s – related to functional approaches such as studies of the phosphorus cycle? Why was Illuft unable to follow on successfully from the research program of regional limnology, the classification of lakes? Was the descriptive method too close to natural history procedures, did it promise too little «lawful» quality and therefore not fit into the image this up-and-coming discipline had of itself? Could the «extra» information yielded by raising the horizon in aerial imaging not be appreciated because it seemed to offer too little explanatory potential?

All that can be done here is to tease out the ends of the narrative threads: weaving these individual strands into a pattern would require separate research projects in each case. What is crucial at this initial stage, however, is to highlight the possibilities for elucidating a number of epistemological and media theoretical issues by exploring the visual cultures of ecology. Accordingly, the following sections focus on

various aspects of early aerial photography in limnology and its failure. One thread is picked up by considering the relationship between place and space in the field sciences, another is followed by tracing the brief history of the institution and the individual who ran it. A further narrative thread sketches the status and handling of theory in early limnology, while yet another wraps itself around the aerial image as a medium used in the natural sciences.

3. Landscape goes Scientific

Humboldt's «Naturgeographie», regarded by many geographers as the founding concept of their discipline[12], certainly represents a key contribution towards making good on the promise it implies. At the center of Humboldt's ideas is the bourgeois subject who perceives and describes «his landscape». Aesthetic nature on the one hand and scientific nature on the other become united in a single practical entity which is the subject, resulting in an epistemic perspective that makes the metaphysical and the physical level appear as a unity. This perspective and, along with it, the conceptual preference for individual, specific places becomes a central element in constituting the object of geography initially and of other field sciences later as well. Humboldt's methodological physiognomy constitutes a scientific concept which offers a «new form of empirical natural science alongside the experimental one», at the heart of which lies the notion that «the universal lies in the emphasis on sympathetic guidance for aesthetic observation, which prompts and leads to comparison».[13] This approach links in with a philosophical conceptual position from the 19th century, according to which the experiential sciences are able to operate in the mode of either a nomothetic or an idiographic methodology.[14] The latter focuses on the individuality of a form or a place, which are conceived of as a manifestation of the universal in the particular, the particular being the measure of validity. This methodology comes to acquire relevance for virtually every one of the field sciences, whether geography, geology, ecology, ethnology, sociology or hydrology, united as they are by the strong tie to place. Yet it is not place as an individual unit of measurement that is decisive here, but place as an individual form, or gestalt. This tie to place is also what distinguishes the disciplines just mentioned from the laboratory sciences: these generate a variety of knowledge that is independent of place to the extent that the objects of study are either brought into the laboratory or, more usually, come into being there in the first place and are designed as mov-

12 ... and thoroughly misunderstood by them in the process, as geographical theorists such as Gerhard Hard, Uli Eisel and Hans-Dietrich Schultz have repeatedly emphasized in many publications.

13 Eisel 1997, p. 104.

14 The identification of nomothetic methodology predominantly with the natural sciences was not intended by Windelband. Indeed he regretted the way in which boundaries had been drawn around different realms of objects, describing these divisions as »unfortunate«. His terminological and theoretical innovation had little impact on this »habit«, however, so that the ideologization of the separation between the natural sciences and the human sciences was carried forward.

able objects. These might be, say, lab animals or special plant breeds geared towards a specific experimental design, such as the various types of mice produced at JAX laboratory, or some other techno-phenomenological artefacts such as preserved frog muscles or cell cultures. Historian of science Robert Kohler has summed up the difference between the laboratory and the field sciences very succinctly:

> «(Labs) are places apart from the world – placeless places. [...] Apparent placelessness also encourages us to think that the beliefs and practices of labs are 'objective', because we know from their visual sameness that the same rules of procedure and evidence must apply in all. We take this placelessness as a diagnostic of universality [...] The obvious way for (ecologists) to achieve credibility is to make their practices and workplaces more lablike: adapt laboratory objects and practices to field conditions, or use natural places in ways that can be read as lablike and quasi-experimental. [...] Field practices are not the placeless practices of labs but practices of place. Selecting, reading, modifying, and comparing places are the essential elements of field practice.»[15]

This kind of «objective» and nomothetic method is used in the so-called lawful sciences (Gesetzeswissenschaften), frequently in identification with the natural and laboratory sciences. The main aim here is to generate universal knowledge that is represented at best in general statements and mathematical formulae. Space – like time – is an abstract and geometrically determined category here which, at first sight, appears to manage without any subject at all. At the same time, however, space, according to Kant, is founded on an «a priori intuition»[16] and thus is always both imagination and experience. As such, three-dimensional space is basically a dual figure which, in conceptual terms, cannot manage without a subject to unite the two.

In this context the horizon appears as a measurable line and thus as an empirical entity that provides a fixed point for measuring devices; as such, it can be used in conjunction with geometrical methods as a means of orientation in three-dimensional space. Accordingly, the line of the horizon and the heavenly bodies were an important orientational aid in global maritime navigation – nautical science; indeed,

15 Robert E. Kohler, R. E.: Place and practice in field biology. *Journal of the History and Philosophy of Biology*, 2002, p. 191 f.

16 In the *Critique of Pure Reason* Kant explicates why time and space are, necessarily, not empirical terms but are given a priori: through them the reality of phenomena becomes possible in the first place. «The representation of space cannot, therefore, be empirically obtained from the relations of outer appearance». (Kant in the translation from Norman Kemp Smith 1929, p. 69). Despite this, geometry in his opinion is a science that cannot determine space entirely without intuition, that is, in a purely conceptual manner. It determines space through concepts a priori, but at the same time presupposes characteristics of space as an a priori intuition, such as three-dimensionality: «For geometrical propositions […] are bound up with the consciousness of their necessity; for instance, that space has only three dimensions». (Kant transl. Smith 1929, p. 70; http://www.hkbu.edu.hk/~ppp/cpr/toc.html). Kant calls such statements apodictic. The consequence of this is that we can speak of space «solely from the human standpoint». «If we depart from the subjective condition under which alone we can have outer intuition, namely, liability to be affected by objects,the representation of space stands for nothing whatsoever». (Kant transl. Kemp 1929, p. 71). This is a finding that will play a role in relation to the ideas presented later on in this article, when three-dimensional landscape and its subject-bound perception are «tipped» into a two-dimensional, horizon-free and objective representation.

this is where the horizon first came into use as a specialist term. Together with the theoretical data provided by latitude and longitude coordinates, empirical data collection enabled space to be surveyed and thus, ultimately, place to be determined.

The visualization of these place data in maps made the latter increasingly reliable and capable of yielding more information. This in turn facilitated the emergence of an increasingly precise and tightly-meshed network of places archived within a geometrical system of coordinates consisting of latitudes and longitudes as well as height and depth contours. This knowledge and system of surveying also plays an important role in early geography, ecology, and hydrology, sciences that began to emerge as disciplines and institutions from the mid-19th century onwards. Images of various kinds are therefore an integral element within the body of knowledge of these disciplines. Measurement data are represented in diagrams, instructions are given for handling samples and planning travel routes, morphometric schemata and cross-sections of terrain are offered, and morphological drawings and landscape pictures produced – initially in the form of etchings, watercolors and oil paintings[17] and then, from the late 19th century onwards, photographs.

The innovative power and radicalism accompanying the invention and rapid spread of the medium photograpy, compared to previous customary ways of looking, is described by art critic Paul Fechter as an «intrusion of photography» into the world of pictures. Nowadays in the 1930s, he asserts, we want and need to see much more than «before», when «pictures [used to] accompany text»; now, by contrast, we only have «text accompanying pictures». Fechter pointedly attributes the ambiguity of this state of affairs to the difference between the subjective/artistic and objective/photographic origin and reception of images.

> «The way film and photography offer that which they record is one-eyed, through a photographic lens; combinations and excerpts are produced whose effects often border on the artistic, albeit from completely different vantage points. The work of art comes alive through being filled with the life of the artist, the work of photography through being filled with the life of the surface».[18]

In his reference to photography poised at the gateway to art, Fechter sums up polemically what photography itself asserts in equally polemical terms as a method in science and technology (and what makes it so interesting as such), namely the putative neutralization of the photographic lens and, with it, the cultivation of the cartographic and objectified scientific gaze. The kind of expectations people had

17 See, for instance, Chunglin Kwa: Painting and photographing landscapes: pictorial conventions and gestalts. In: *Configurations* 16, pp. 57–75.

18 Peter Fechter: *Der Einbruch der Photographie. Deutsche Rundschau 62,* 1936, p. 121. The attitude of Paul Fechter towards national socialist ideology was recently examined by Andreas Zeising in Ruth Heftig, Olaf Peters, Barbara Schellewald (eds.) *Kunstgeschichte im «Dritten Reich». Bd. 1. Theorien, Methoden, Praktiken*. Eds.. Berlin 2008.

of aerial images, accordingly, were (and probably still are) widespread. This is how geographer Paul Perlewitz gives expression to these expectations:

> «The aerial image depicts – objectively – the current state of the object to be studied; it shows the multiform character of an area of land, often only then enabling local causal interrelationships to become apparent».

What is interesting, however, is how Perlewitz continues, referring to the aerial image in terms of both scientific methods discussed above, the nomothetic and ideographic:

> «On the other hand it brings out the details and characteristic features in a very vivid way, thus greatly supporting current research efforts to study individual phenomena by providing a natural depiction.»[19]

The aerial image thus announces its arrival in rather ambiguous conceptual terms.

4. The Domestication of the Aerial Image – From Weapon to Method?

Photography is rapidly taken up in the disciplines of the field sciences, its usefulness being seen above all in extending the existing inventory of methodological tools. The use of the new medium makes it possible to work more quickly, creating more opportunities to compare objects in space and time. It makes things visible that had previously been invisible to the human eye,[20] documenting and objectifying things that had previously seemed to be at the mercy of the hand doing the drawing.[21] Photography holds out the promise of providing backup for scientific authority: it represents control and objectivity along with greater efficiency and precision. It was brought into play as a new economy of seeing, and it runs through all areas of the field and laboratory sciences, including so-called applied and basic research.

All these elements are amplified when it comes to aerial photography. After the First World War, photogrammetry is conceived of as a cross-cutting technology, one that has great innovative potential, one that opens up new spaces for opportunity. This, indeed, is to be understood quite literally, as photogrammetry is seen and used, in both the scientific and cultural context, as a technology for appropriating space. This is further reinforced by its «vehicle», flight: first with hot-air balloons and then, particularly in Germany, with the Zeppelin airships and, eventually, with airplanes. Optimism regarding the speed and spread of aircraft gives rise to a host of technological visions that stretch the imagination: «There will probably soon be just as many aeroplanes as there are drivers of powered vehicles who populate

19 Paul Perlewitz: *Die Luftfahrt im Dienste der Geographie*. In: *Geographische Zeitschrift 32*, 1926, p.9.

20 Some impressive examples of this include studies of movement by Jules Etienne Marey and Edward J. Muybridge, the inventors of chronophotography, as well as X-ray photography and photographic and film production using optical (light) microscopy.

21 Drawings of microscopically preserved objects, for example, come increasingly to be replaced by photographs.

our country roads today».[22] Bauhaus teacher Moholy-Nagy attempts to grasp the unbelievable thus:

> «Space in every dimension, space without boundaries. Boundaries become fluid, space is recorded in flight: enormous number of relationships. The aeroplane has a special task in this context: new views arise from the aeroplane, from low down to high up, but the most crucial for us is the view from the aircraft, the fuller experience of space, because it alters every previous notion of architecture.»[23]

With the advent of the aeroplane a whole new view of the city and land opened up – «a geopolitical eye»[24]. The incredible and, at first, barely imaginable shortening of distances drew attention to new political possibilities – and vulnerabilities. «By the 1920s, the planet itself had become a manageable standard of measure, a vast space familiar enough for airlines to impose their modernist geometry.»[25]

«Space» here is used not predominantly in the sense of geometry but is rather conceived of above all as «Lebensraum» (living space). Moreover, the distance between «space and nation» (Raum und Volk) and «nation without space» (Raum ohne Volk) is a short one, demonstrating above all how extraordinarily fragile this space is in the 1920s and 1930s, and how ideologically charged. The focus, however, is actually on surface, terrain, nation-state soil.[26] Architect Karl H. Brunner takes up these themes in his attempt to lend the bird's-eye view a little metaphysical gravitas by introducing, in *Instructions of Bird's Eye View* (Weisungen der Vogelschau), the expression «optical spirit of totality». In this way he seeks to generate support for the great unifying whole, to summon up collective enthusiasm for a German Nation, which had already been borne up to unprecedented heights by the airships of Ferdinand Graf von Zeppelin, in particular the Graf Zeppelin[27]:

22 From H. Koppe: Luftnavigierung und die Arbeiten des Navigierungs-Ausschusses der WGL. In: *Jahrbuch der wissenschaftlichen Gesellschaft für Luftfahrt*, 1929.

23 Laszlo Moholy-Nagy: *Von Material zu Architektur.* München 1929, p. 222.

24 This highly apposite expression was coined by historian of science Peter Fritzsche in his highly informative book *A nation of fliers. German aviation and the popular imagination*. He explains: «Nature had become a guest in what was now coming to resemble the global house of humankind.» (1992, 172).

25 Peter Fritzsche: *A nation of fliers. German aviation and the popular imagination*. Cambridge 1992, p. 173.

26 A large corpus of literature exists on this set of themes and, in particular, on the role of geography and ecology in scientifically reifying nation and space. To mention just two of these here: Margrit Bensch: *Die «Blut und Boden»-Ideologie. Ein dritter Weg der Moderne.* Berlin 1995; Joachim Radkau und Frank Uekötter (eds.): *Naturschutz und Nationalsozialismus.* Frankfurt/M. 2003.

27 Fritzsche emphasizes the heroic aspect here, the isolation from the outside, which generated the unifying national feeling. «Numerous commentators echoed this theme of national unity. According to one Konstanz newspaper, the world flight of the Graf Zeppelin in August 1929 had unified the German people. […] Modern technology restored the heroic and in doing so recomposed the nation.» Fritzsche 1992, p. 152.

> «The overall picture shows every inhabitant the area around his home […] This picture-framed awareness of *Heimat* has so far been available only to those who inhabit towns in the hill and mountain areas.»[28]

The aerial image shows *Heimat* from a modern perspective, by presenting the total view from above. It is produced with the aid of sophisticated German technology, while simultaneously constituting a perfect representation of the ideology of «nation and space» («Volk und Raum»-Ideologie). Thus from the 1920s onwards, cultural events, villages, towns, bridges, landscapes, sanatoriums and historical monuments begin to be shown from an aerial perspective. The postcard – also known as «photocard» – helps to cultivate and propagate this new perspective. It rapidly becomes a popular cultural practice: «Nearly all large and many medium-sized towns have felt the need to produce such cards in order to channel their yearning for expansion in the right direction.»[29] The medium is the message, widespread quote from media theorist Marshall McLuhan seems to fit accurately for this cultural practice of creating space (Raumerschliessung).

In order to be capable of being an efficient and, above all, an economically profitable cross-cutting technology, photogrammetry is reliant on the broadest possible disciplinary basis in the sciences. Overtures are made quite explicitly to disciplines that rely on «fieldwork», disciplines oriented towards the scientific work that goes on outside the laboratory and is carried into areas of societal practice, such as cartography, agricultural and forestry, as well as mining, water management and transport, among many others. The following quotation is taken from a talk given in 1927 at the «2nd General Assembly of the International Society for Photogrammetry»:

> «What made the photogrammetry measuring method stand out from most of the others was, firstly, the rapidity of the field photograph (Feldaufnahme), which more or less shows the state of the object to be measured as it is now, then the short duration of the object to be measured, then the brevity of the homework to be done afterwards to deliver the desired outcome before interest in the changing object has started to fade, and finally the vivid nature of the measuring result, which is due to the image-like effect of the photographic method. Set against this, the sometimes lower level of accuracy and the high costs of the field and home work are not always taken into account. Let us now turn to some areas of the economy in which photogrammetry is acquiring significance, beginning with water management.»[30]

28 «[Das] Gesamtbild zeigt jedem Ortsbewohner die Gegend seiner Wohnstätte […] Dieses im Bild gefaßte Heimatbewußtsein konnte bisher nur die Stadt in bergigem Lande darbieten.» Karl H. Brunner (1928) *Weisungen der Vogelschau*, quoted in Carlberg, Klaus: *Zeppelin. Die Geschichte eines unwahrscheinlichen Erfolges*. München 1979, p. 129

29 «(f)ast alle großen und viele mittleren Städte haben das Bedürfnis nach solchen Karten empfunden, um ihren Ausdehnungsdrang in richtige Bahnen zu leiten.» Loc. cit., p. 130.

30 Sebastian Finsterwalder: *Bedeutung der Photogrammetrie für Technik und Wirtschaft. In: Vorträge gehalten bei der 2. Hauptversammlung der internationalen Gesellschaft für Photogrammetrie.* Berlin 1927, p. 11.

The etymology of the name by which the method becomes known in German-speaking countries is intended to mark it off from photography, clearly illustrating once more the programmatic nature of photogrammetry: it is principally to be about measurement and control, about the exact mapping of the terrain. «The significance of photogrammetry lies in the fact that the photographic image provides a perfect determination of a specific state, including every detail, at the moment the photograph was taken, one that can be tested at any time.»[31] It is precisely this – recording the moment – that Paul Virilio identifies as the major strength of photography: it lies in the «momentariness of its [photography's] perception»[32], or again, as Pierre Noras puts it, in the «moment plucked out» from a continuous series of events and becoming fixed as a photographic image. If we consider, in addition, the etymological ambiguity of the Greek suffix *-graphy,* then the politics of naming being pursued by photogrammetry comes much more to the fore. The suffix can be read as being either passive or active, it is an «abstract noun of action or function».[33] «In one brilliant stroke of language, the naming of photography replicates the fascinating dilemma of its own impossible historical and epistemological identity.»[34] Photogrammetry is to be preserved and purified from this ambiguity, which is inherent to the medium of photography from the very beginning. It is an ambiguity which is still acknowledged in the 19th century but which, at the beginning of the 20th century, with the monopolization of photography as an *objective eye* in the scientific context, is increasingly overlooked.

4.1 Taking Feldaufnahmen with the Armed Eye

The «field» mentioned in the quotation by Finsterwalder in 1927 hints at other, additional meanings, though: the «field photograph» is quite plainly associated with military connotations at this time. And so it was, too, even before the start of the First World War, although in this case, the focus had been principally on the use of airships as a vehicle to carry the optical eye. «One might say that certain branches of military science are hard to conceive of without photography.»[35] The exhibition of photogrammetry and aerial photography almost brazenly provides information about their military origins, as the majority of the pictures on show come from the Reich archives and document the strategic as well as didactic importance of aerial photography in warfare. The military past need not pose any structural impediment to civil uses – this is the mantra running through just about all the talks given at this meeting of the

31 Erich Ewald: *Ausstellung über Photogrammetrie und Luftbildwesen. In: Vorträge gehalten bei der 2. Hauptversammlung der internationalen Gesellschaft für Photogrammetrie*. Berlin 1927, p. 15.

32 Paul Virilio: Die Kamera als Waffe und das Ende der Fotografie. Ein Gespräch mit Heinz-Norbert Jocks. In: *Kunstforum «Der Gebrauch der Fotografie II»,* Wien 2004, P. 64.

33 Oxford English Dictionary

34 Geoffrey Batchen: *Burning with desire. The conception of photography*. Cambridge 1997, p. 107.

35 M. Frank: Vorbereitung zum Kriege und Photographie. Photographische Korrespondenz. In: *Zeitschrift für Photographie und photomechanische Verfahren* 51, 1914, p. 474.

photogrammetry society. Take the following example, with its rather unfortunate metaphor of the phoenix rising from the ashes, which is all the more instructive for it:

> «It [photogrammetry, A.E.S.] is still surrounded to a large extent by the eggshells of its wartime development. But once it has shaken these off and become fully-fledged, it will be able to follow freely the line of flight of enterprise for the benefit of humanity. It will pay back with interest the capital invested in it by science in the past and in the present.»[36]

The formulation leaves open the extent to which «science» here is conceived of quite unthinkingly as a part of the military apparatus.

The dual-use aspect of technology appears in textbooks, too, more or less explicitly, more or less intended. *Instructions for reading the aerial photograph* by Eberhard Fischer, for example, was published in the series «Serving in the *Luftwaffe*», containing a first part, *photographs of terrain* and a second part, *photographs of troops*. While this compact little book was intended in the first instance for use in the military context, a whole series of other works existed that pursued a similarly didactic program but were intended more for civilian use. Reading and interpreting aerial imagery becomes more and more a civil society affair after the First World War – not only in Europe but also in the United States, as the book by Herbert E. Ives *Airplane Photography*, published in 1920, shows. The author is himself a member of the military – «officer in charge of experimental department, photography branch, air service» – and does not neglect to make mention of the military origins of photogrammetry. His approach is not so much to frame it as a cross-cutting technology but rather to see it as a science in its own right, namely «aerial photography».

Aerial photography was not alone in having experienced a powerful innovative stimulus during the First World War. Other technologies that were to become part of the canon of the engineering and natural sciences experienced a similar developmental stimulus. These included, for example, the materials sciences and mechanical engineering, which were entrusted with the task of developing an array of different vehicles for use on land, in the air and in the water. Certain sub-disciplines within chemistry, medicine and biology were also affected, as was the development of nitrogen production and bacteriology, which took place in a technoscientific environment. In his pithily entitled book *Forschung als Waffe* (Research as a weapon) Helmut Maier has produced an impressive study, rich in primary material, about armaments research at institutes that were part of the Kaiser-Wilhelm-Gesellschaft during the first half of the 20th century. In it, he demonstrates that a certain political and institutional consistency existed in the web of relationships between the military, engineering disciplines – Maier's study focuses here on materials research – and of science in general. Such points of contact were already considered perfectly normal prior to 1914; in the years leading up to 1918 they shifted even further towards armaments research, so that in the Second World War the following statement was able to appear quite unremarkable:

36 Finsterwalder (1927), p. 14

> «Research serves life quite in and of itself; for that very reason it is a weapon, because it is sustained by its own set of laws and remains aware of its theoretical foundations, which give it direction, power, an eye for the fundamental as well as creative imagination.»[37]

The moment army commanders decided to consider industrial facilities and the civilian population as military targets, so Maier argues, a military and strategic «boundary removal» occurred, taking technoscientific research into society in a real-world or social experiment. The limited geography of the battlefield was left behind; instead, the entire «field» was declared a laboratory for the nation state's armaments research program. Also in the 1920s a process of increasingly close intermeshing occurs between «science and foundation policy and the lab bench», an «industrialization» of the scientific system, which is controlled by a corresponding resource management. More and more scientific institutions are supported by an ever growing number of foundations and orders from industry, mostly with material donations and grants but also by the provision of scientific personnel.

> «‹Doing the rounds› of the foundations and other organisations – including ‹competing› ones –was just part of the daily job of an institute director in the Weimar Republic».[38]

All these interconnections seem to apply likewise to the institutionalization of photogrammtery.[39] But why, then, was Illuft, the International Aero-Limnological Centre, not able to become established? This appears all the more astonishing given that water management, or the object inland watercourses in general, was considered an especially favourable context in which to apply the method, at least from the perspective of one doyen of photogrammetry, Sebastian Finsterwalder[40]. Here he is again: «Let us now turn to some areas of economics in which photogrammetry is gaining in significance, beginning with water management»[41], which he goes on to speak about for almost half his lecture, providing considerable detail about problems and issues to do specifically with water. He speaks of mapping rivers and lakes in inaccessible terrain, of measuring waterforces, and of identifying suitable flood protection measures and more easily implementing them; he also speaks of the de-

37 From a wartime report from 1942 of the same title, from the KWI, quoted in Helmut Maier: *Forschung als Waffe. Rüstungsforschung in der Kaiser-Wilhelm-Gesellschaft und das Kaiser-Wilhelm-Institut für Metallforschung 1900-1945/48*. Göttingen 2007, p. 17.

38 Maier 2007, p. 242.

39 So far there has been no detailed study of this that might elucidate the disciplinary, institutional and technical historical aspects.

40 Sebastian Finsterwalder (1862–1951) held a Chair in mathematics and later in geometry at the Technical University of Munich. His interests included geodesic surveys in the highlands and used aerial images for this, which he himself took (from a hot-air balloon). Finsterwalder tried to institutionalize aerial photography, and he was also a member of the consultancy panel for Graf Zeppelin. (Biographical information at http://www-hm.ma.tum.de/geschichte/node20.html)

41 Finsterwalder 1927, p. 11.

sign of hydraulic engineering measures in general, of how agricultural land might be managed and, finally, of navigation on canals, rivers and lakes.[42]

The section to follow will not be able to clarify entirely the reasons why Illuft failed, not least due to the difficulties encountered in searching for sources. But one or two leads can be followed nonetheless. First, though, let us return to the question posed at the start of this section, namely whether there actually was a domestication of the aerial photograph, an integration into civil society of the dominant bird's-eye view – that is, whether the path from weapon to method was followed. Seeing the camera itself – like research – as a weapon[43] is a widespread analogy. Indeed the figure of the armed eye is an age-old metaphor that also fits well with aerial photography's special capacity to record landscapes scientifically. Using the camera as an instrument, the method of remote sensing creates a distance between those photographing and the world. It generates images that are open to interpretation and yet are considered to be objective. It also makes it possible to occupy land visually and provides the means by which the terrain thus fixed can then be colonized. It seems as if the dual-use aspect of photogrammetry which, regardless of the change from analogue to digital, extends right through to current-day remote sensing is inextricably linked with the medium.[44]

5. Airy Knots: The Rise and Fall of ILLUFT

Illuft, the International Aero-Limnological Society, was established in 1930 at the fifth meeting of the International Association of Theoretical and Applied Limnology (Societas Internationalis Limnologiae, SIL). The host country, after a three-year break, was Hungary, and the main part of the conference took place in the Institute of Chemistry at Budapest University. The initiator of Illuft, Erich Wasmund, had organized an exhibition with picture and map material, which was set up in the neighboring Institute of Mineralogy along with an exhibition of optical and other instruments. As part of the program of entertainment on offer between slide lectures and a steamboat ride, the exhibition is visited by all the conference participants – theoretically about 150 individuals, as this is the number of conference participants registered.[45] Wasmund's lecture two days later takes place, by contrast, in front of «a smaller circle of interested participants», parallel to a talk on «Semi-

42 Finsterwalder was not alone in his assessment. Geographer Paul Perlewitz emphasizes that the aerial photograph facilitates «finding fishing grounds, mussel banks etc. for sea fishing». «In America it has been possible to discover whales and seal colonies from an aircraft. In times of war this method is used to find submarines and mines in the water, which has influenced warfare and global economy thereafter.» (Perlewitz 1926, p. 16f.).

43 Virilio (2004) paraphrases Mussolini when he says that the camera is the most powerful weapon for controlling the people.

44 At any rate as long as warfare is based predominantly on visual and less on acoustic or other signals.

45 The Society had about 650 members in 36 countries at this time.

micro laboratory rapid procedures with demonstrations».[46] *Illuft – Rationale for an Aero-Limnological Center* is the title of the programmatic lecture which, not unexpectedly, concludes with a reference to the urgency of setting up Illuft. The project is supported by a memorandum that had already been circulated in the community and whose commentaries are then published along with it in a special offprint. Interestingly, at the same conference and independently of the Illuft activities, an international exchange of transparencies showing objects of limnological and marine biological interest is agreed. Panoramic all-round views are considered to be of particularly interest, as they are suitable to «determine data from lake typology, silting processes, topographic conditions and conditions important for regional production biology.»[47] At the final conference session on 28th August the participants decide that Illuft should be established, that it should be affiliated to the SIL and operate under the directorship of Erich Wasmund. It is emphasized in doing so that Illuft should function as a kind of organizational interface for limnological research, and that it should be supported by all countries. At the same time, though, «active aerial research remains the prerogative of each individual country».[48] It is also emphasized that Illuft cannot expect to receive any kind of financial support and that it must try «to finance itself with the aid of institutions and state authorities with an interest in aviation», since the SIL was in «rather a state of crisis».[49]

The aim of establishing the Illuft as a company is pursued by Erich Wasmund (1902–1945) from the end of the 1920s onwards. He himself undertakes long journeys by airplane[50], attempts to demonstrate, on the basis of various research questions[51], how aerial pictures could be used in limnology (Fig. 2 & 3). Clearly, then, Wasmund is not content merely to expound theory, he also offers a sort of guide to the practice of aerial photography, referring to his own experiences in exploring the «oceans of the air».

46 Friedrich Lenz: Tagungsbericht. *Verhandlungen der internationalen Vereinigung theoretischer und angewandter Limnologie 5.* Stuttgart 1931, p. 28, 27.

47 Friedrich Lenz: Tagungsbericht. *Verhandlungen der internationalen Vereinigung theoretischer und angewandter Limnologie 5.* Stuttgart 1931, p. 22. This is an idea offered by Buschkiel after a slide lecture given by Thienemann on tropical inland water. Whether or not this collection was created and what became of it, I do not know. This could be interesting with regard to researching visual cultures of ecology.

48 Erich Wasmund: Arbeitsbericht der internationalen limnologjschen Luftfahrtsstelle 1930–1932. In: *Verhandlung der internationalen Vereinigung theoretischer und angewandter Limnologie* 6, 1933, p. 38.

49 *Verhandlungen der internationalen Vereinigung theoretischer und angewandter Limnologie* 5, 1931, p. 28, 12. The Secretary of the SIL, Friedrich Lenz, points out that, after all, International Marine Research also receives state funding and that those countries ought to be just as interested in limnological research. It is decided to write a «letter of application» and to send it via the 36 SIL representatives to their respective governments.

50 Erich Wasmund: Luftfahrzeuge auf limnologischer Erkundung. In: *Arktis,* 1929, p. 41–60 and ibid. Flugbeobachtungen über Mittel- und Osteuropäischen Gewässern. In: *Geographische Zeitschrift* 36, 1930b, p. 528–546, 593–611.

51 Erich Wasmund: Pollenregen. Seeblüte auf dem Bodensee im Luftbild. In: *Paläontologische Zeitschrift* 12, 1930a, p. 73–99.

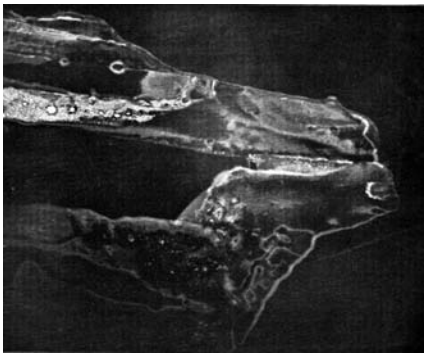

Fig. 2: «Senkrechte Aufnahmen mit der Reihenbildkammer der deutschen Versuchsanstalt für Luftfahrt, Berlin-Adlershof, entstammend einer Aufnahmeserie Februar 1929 über dem vereisten Bodensee. Die weißen Flecken sind sich schon zusammenfügende feste plattige Eismassen, die grauen oder nur schillernden Streifen und Schlieren lose treibende Eisnadelmassen, die bei den Belichtungs- und Durchleuchtungsverhältnissen vom Luftschiff aus sich beobachten lassen, während die Reflexion und die geringe Übersicht auf der Wasserfläche selbst sie dem Beobachter an Bord eines Seeschiffes im allgemeinen ganz verbirgt. Bemerkenswert die schlierigen und gerundeten, gelegentlich auch an rhythmische Fällungsbilder erinnernden Strukturen, die in völlig gleicher Form bei Algenwasserblüten vom Verf. vom Flugzeug September 1929 über dänischen Seen beobachtet wurden und die den Formen der Seeblüte ähneln.»

Fig. 3: «Technisch und örtlich wie Abb.1. Bei etwas niedrigerer Flughöhe und stärker gesenkter Aufnahmerichtung wird der Einblick und die Durchsicht in die Struktur der Pollensuspension deutlicher. Besonders klar erscheint der Ansatz zu rhythmischer Fällung, in Art der LIESEGANG'schen Ringe, im Vordergrund.» («Abb.1: Schrägaufnahme mit Fliegerhandkamera, aus Dornier-Delphin-Flugboot des Bodensee-Aerolloyd durch Pilot W. Truckenbrodt, Anfang Juni 1929 vor dem Konstanzer Trichter im Obersee zwischen Horn (Landspitze des badischen Bodanrücken) und Münsterlingen (Kanton Thurgau), auf Ersuchen des Verf's aufgenommen. Flughöhe ca. 300m, man sieht auf der leicht gewellten Seefläche breite Zonen mit Pollenregen erfüllt, in der Mitte ein typischer gerundeter Streifen dicht schwefelgelb angereichterter Pollen.»)

> «The significance of aviation as a means of limnological research in its own right lies in being able to look at the inland waters from above, to look into them, onto them and through them – all of which is possible only when moving at altitude»[52]

he writes in 1930, thus presenting his scientific community with the prospect of a new method and theory. Wasmund stresses that aviation can and should become a method not only for limnology but that the aerial image has its «own intrinsic value». He goes on to explain what he means by outlining the possibilities that aerial photography opens up to limnology. Wasmund names the following as potential applications: a view of freshwater and riverbanks from above; an insight into the morphological conditions of, say, a catchment area or of beach formations; insight into a river's history provided by a view of soil moisture – visible in its totality only from above; a view of sociological plant formations, identifying turbulences caused by

52 Erich Wasmund: Illuft. Begründung einer Aero-Limnologischen Zentrale. In: *Archiv für Hydrobiologie* 21, 1930c, p. 503.

Fig. 4: «Grimselpaß-Seen. Blick vom Aaeretalursprung nach S über Grimselpaß (2165 m) mit Hospiz, Passstrasse, Grimselsee (1875 m) und Totensee (2166 m) ins Obere Rhonetal mit Dorf Obergestelen (Oberwallis). Flughöhe 4000 m. Glaziale Rundhöckerlandschaft, die Paßseen durch Eisschliff entstanden. Luftbild zeigt regionale Bestimmtheit des hochalpinen Urgebirgssees. Nährstoffarme Unterlage (Gneisgranit, Hornblendeprotogine, Schneedecke spät ausapernd wie auf dem Bild, kümmerliche Vegetationsdecke) Ursache der Oligo-Dystrophie der meisten Paßseen im Hochgebirge, Humusbildung über Waldgrenze, bei fehlendem Kalk sowohl unter wie über Wasser typischer Boden, bezeichnend auch Name «Totensee», ähnlich häufig in gleicher Lage auch «Schwarzer See». Luftbild Einsicht auf Landschaftsbild, Zusammenhang mit Seenentstehung, Übersicht und Aufsicht auf Bodenbildung. Klima und Seetyp als Folge. Hingegen Vertikalgliederung zugunsten des glazigenen Eindrucks zu gering hervorgehoben, vgl. Abbildung bei Collet (Taf. I), mit Blick vom Nägelisgrätli herunter, dort Bodenbildung aus geringerer Höhe mit seinen Vor- und Nachteilen. Abgedruckt auch bei Pesta, dort weitere Lit.

Fig. 5: «Lena in Nordsibirien. Von der Lena, drittgrößtem Strom Asiens, brachte «Graf Zeppelin» aus der Gegend bei Jakutsk ebenfalls ein prachtvolles Luftbildmaterial heim. Aufnahmen zeigen breite Flußniederungen bei herbstlicher geringer Wasserführung, erfüllt mit riesigen Stromarmen, schmalen Kanälen und abgeschnürten Flußbögen. Grüne Wiesen mit Buschwerk über dem in 2m Tiefe ewig gefrorenen Boden heben sich von gelben Sandbänken ab, die Rippelung, Zungenbildung und andere Stromwirkungen zeigen. Über dieser so russischen Weite erhöht hohe Alto-Stratus-Decke imposanten Eindruck sibirischer Monotonie. Man vergleiche solche Strombilder z. B. mit Bodenbildern der Wolga in jüngeren limnologischen Arbeiten, die dem Nicht-Landeskenner nie das wahre Bild von Größe und Formenwelt geben. Nur das Luftbild vermag, wie vieles, auch das (Hervorhebung A.E.S.). Auch der Mensch, dem das Fliegen noch nicht neues Lebenselement geworden ist, könnte angesichts solcher Bilder, die uns das Wort Vogelschau ungern gebrauchen lassen, das Wort Mittelholzers verstehen, das ihn beim Flug über Spitzbergen überkam: ‹Es ist, als ob die Erde ein neues Antlitz, der Mensch ein neues vollkommeneres Auge gewonnen hätte.›»

navigation; the visualization of interference by currents; research into temperature and pressure conditions caused by the movement of water; the mechanics of glacial structures. And finally, seeing through the water ultimately makes it possible to map underwater mountains or to quantify and examine the behaviour of animal groups – and in any case, as Wasmund says, photos are more intuitive than maps (Fig. 4 & 5).

5.1 Ideal Starting Position?

When Wasmund goes to Lake Constance in 1926, the conditions for setting up an Illuft appear especially conducive. Not only are the objects of study, Lake Constance and other Alpine lakes in the immediate vicinity, there are also scientific resources close to hand – the *Biologische Seeninstitut* in Langenargen and the *Anstalt für Bodensee-Forschung* in Konstanz-Staad[53], and above all companies such as *Dornier-Werke* and the *Zeppelinwerke* in Friedrichshafen, with its corresponding «fleet», the *Drachenstation* (Kite Station) Friedrichshafen with its airships, and the Konstanz air travel company. From the very start, Wasmund conceives of the whole Illuft company as a project involving close cooperation between private enterprise, politics and science. This is reflected in the list of supporters and contributors – by no means only regional – to the exhibition at SIL conference in Budapest. They include *Deutsche Luft Hansa* Berlin, *Luftschiffbau Zeppelin*, *Bodensee-Aero-Lloyd*, *Luftverkehrs AG Österreich*, the German Experimental Institute for Aviation (Berlin), the *Wetterflugstelle* (met flight station) of the *Deutsche Seewarte* (Hamburg-Fuhlsbüttel), the Swiss *Luftverkehr AG Astra-Aero* (Zurich), representatives of the *Luftbildstelle* of the Prussian Ministry for Trade and Commerce (Berlin), among others. He is also supported by established scientists in limnology, meteorology and geography, such as Einar Naumann from Lund (Sweden), Franz Ruttner from Lunz (Austria), Wilhelm Halbfass from the Geographical Institute Jena (Germany), Reinhard Demoll from the Bavarian Biological Experimental Institute for Fisheries in Munich and the Director of the MPI Plön, Chairman of the SIL, August Thienemann. Wasmund has a knack, it seems, for «doing the rounds» of the institutions and foundations and creating networks among research and industry. He hopes that his networking activities will also give him access to the stock of aerial images already in existence which, he estimates, amount to about 50,000 pictures.

The companies and also the state authorities are not disinclined to support Illuft, as is clear from the commentaries on the Illuft circular. The company Deutsche Luft Hansa, for example, and the Experimental Institute for Aviation consider cooperation between limnological research and aviation to be desirable. This includes

53 William Maerker worked at this institute until 1927, spending his «spare time taking photographic images of the Lake Constance region from an airplane: splendid pictures bear witness to the high degree of skill he achieved in this art form», as Max Auerbach notes in his obituary in the *Verhandlungen der internationalen Vereinigung theoretischer und angewandter Limnologie* 5, 1931.

airship captain Oberleutnant Hans von Schiller[54] from Luftschiffbau Zeppelin and aircraft captain W. Truckenbrodt from the Bodensee-Aero-Lloyd and Luftverkehrs-Gesellschaft Konstanz, who were happy to assure him that materials, aircraft and hand-held aerial camera «are available as often as possible». The voices of the scientific community are not quite in such accord. Nonetheless there are supporters here, too. They include the Austrian Franz Ruttner, who expects aerial images to be able to provide extraordinary services to limnological research, and the Italian M. Bossolasco, who supports Wasmund not only with a detailed commentary but also with an article of his own entitled *Questioni fotogrammetriche di aerolimnologica*, which was published in the year of the conference, 1930, in the renowned *Internationale Revue für die gesamte Hydrobiologie und Hydrographie*. Even the well-known meteorologist Hugo Hergesell «agree[s] in principle», although he strongly recommends that institutional ties be sought to an established institute, while Swedish limnologist Naumann also considers a «clear, image-based representation of the inland waters» to be desirable and indeed feasible, but scientifically tenable only if they are «real overviews» and if there is no danger of them being mistaken for «a random collection of touristic images that offer no real overview».[55] Thienemann, too, displays a certain skepticism towards the medium of photography, which he sees as a method located mainly in geographical research, whose task it is ultimately to produce a «picture of the Earth's surface».

> «Certainly, this so-called geographical thinking also dominates large parts of limnology: for it is, after all, nothing other than the synthesis of all phenomena which occur in and at a certain *Lebensraum*, and the *Lebensräume* with which limnology is dealing, the inland water, are parts of the Earth's surface, like all other living habitats. [...] But no geographer would see biological limnology, i.e. the idiobiology and biocoenology of freshwater, as being part of his science! Rather, these are parts of general ecology, parts whose uniqueness is conditioned through the particularity of the area of life being studied. [...] Limnology at its highest level treats the inner waters as a unified whole, not only in spatial terms: rather, it conceives of it as a unified whole of *Lebensraum* and *Lebenserfüllung* (living fullness): it sees biotope and biocoenosis in mutual interaction. [...] Limnology as we understand it, though, is saturated at its very highest level with biological perspectives, with biological thinking, and is not content with geographical thinking.»[56]

54 Schiller was also navigation officer on the first round-the-world flight of the LZ 127 from August 1 to September 4 1929, in which roughly 50,000 km were covered in 6 stages.

55 Naumann had identified such unscientific pictures in the publications and considered them to be no less damaging to the reputation of the new upcoming science of limnology *Verhandlungen der internationalen Vereinigung theoretischer und angewandter Limnologie 5,* 1931, p. 27 – and almost verbatim 7 years previously in Einar Naumann: Einige allgemeine Gesichtspunkte betreffs des Studiums der regionalen Limnologie. *Verhandlungen der internationalen Vereinigung theoretischer und angewandter Limnologie 5,*1923, p. 100–110.

56 Thienemann 1931, p. 5. The title of his lecture at the conference, «The Use of the Leica camera in limnological excursions and research trips» (p. 564 f.) appears to contradict the skeptism implied here towards images.

Two points can be drawn from this rather polemic statement:

One is the disciplinary demarcation from geography which had been preceded by a disciplinary wrangle.[57] This may have also meant that the research program of Carl Troll, for example, who was mapping ecotopes based on aerial images, was simply ignored. The second point is the reference to the different kind of philosophical framing of limnology as a science, which seeks to be biological and ecological, in other words, is interested in proposing general theories and laws. At the same time, however, it also turns its attention to the particular, to the gestalt – to the individual lake, for example, or to a plant or animal community in a particular place. And it is precisely this, according to Thienemann – the use of both perspectives – that makes limnology stand out, and indeed makes it even better than geography, because limnology «is not content with geographical thinking».

5.2 Unhealthy conditions

With his *Working report from the International Aero-Limnological Center 1930-1932* in 1933, Wasmund himself announces the end of Illuft.[58] He reports soberly that the goals achieved and the amount of work involved stood in «no healthy relation» to one another. The responses to a circular letter sent out by Wasmund asking for co-workers are rather sparse, the limnological community is not especially interested in aerial pictures, half the inquiries directed at Illuft come from geographers and natural scientists. The financial situation of the aero-limnological center is pretty gloomy, too, principally due to the economic crisis, as Wasmund opines. Since November 1930 he has been at the limnological station in Plön and is able to take advantage here of the resources of Thienemann's institute, but these consist above all, quite literally, in having a share in the postage kitty and in the possibility of setting up and storing a small collection of literature and pictures. This includes especially a collection of aerial images encompassing 525 shots, as well as a few large aerial maps; Wasmund is especially proud of «a splendid aerial plan of the Chiemsee at a scale of 1:5000». Wasmund also refers to the political situation as a factor affecting the sluggish progress of the institution: the emergency decrees made a company such as Illuft virtually a «hopeless» undertaking. The prospect of the «dictated peace» that limited «aerial interests» to German territory and research and development of aviation technology perhaps being less strictly enforced with the establishment of the Reich Ministry of Aviation in 1933 is only a weak hope.[59] Concluding, the reporter

57 The geographers did not want to include the limnologists in their subject canon. For more detail on this, see Astrid E. Schwarz: *Wasserwüste, Mikrokosmos, Ökosystem. Eine Geschichte der «Eroberung» des Wasserraumes.* Freiburg i. B. 2003.

58 *Verhandlungen der internationalen Vereinigung theoretischer und angewandter Limnologie* 6, 1933, p. 34–45.

59 The fact that the Allies' ban on the production of military-related technology was not especially effective is now well-known and could be discussed under the rubric of dual use. Peter Fritzsche points out that as early as «1928, just two years after the lifting of restrictions on German commercial aviation, Luft Hansa flew more miles and carried more passengers than all other European

(Wasmund) explains that he «(must) consider the expansion of the external organization as hopeless, if this expansion meets with no positive response.»

Illuft is not expanded further. A position is created for Wasmund at the Kiel center for marine geology. And thus the trained geologist turns to other techno-scientific projects – underwater drilling and diving, submarine mapping, coastal protection and land reclamation. Whether Wasmund's analog aerial image database survived the war or even acquired significance as a source for post-war limnology cannot be discerned as yet from the archive material available.[60] But was it really principally the unfavorable political and economic conditions, as Wasmund suggests, that meant Illuft could not become a success? After all, in other scientific spheres such as geographical or meteorological research, the method certainly was a success. The arguments suggesting that its failure might have had more to do with matters internal to science can be outlined only briefly here.

6. Iconoclastic Controversies in Limnology

The following quotation taken from a piece about *Remote sensing at Lake Constance* offers evidence for the supposition that satellite-based remote sensing was to develop a strongly heuristic character in limnology from the 1960s onwards:

> «Why aerial photograph? Why remote sensing? The aerial photograph […] has the largest density of information per unit of surface and thus offers an optimum amount of information. […] Images and measuring data from remote sensing [are] a local and national kind of information independent of administrative points of reference, which is needed especially in cases of difficult questions of environmental research and monitoring.»[61]

In the 1960s, if not before, limnology uses remote sensing technology and develops a positive heuristics that enables it, via the technical evaluation of information and especially visual language, to link up with global environmental discourse.

In the 19920s and 1930s there is a series of competing research programs in limnology which range across the entire spectrum from experimental to descriptive research of nature, from nomothetic to idiographic methodology. The *Regionale Seentypologie* (regional study of lake typology) is a synthetic program which is con-

companies combined. […] Junkers and Dornier planes dominated aeronautical markets […]. Even before Hitler's military buildup, Germany possessed in Luft Hansa not only a considerable reserve of trained aviators in case of war but also a fleet of airplanes that experts believed could be converted to military use in a matter of days.» (1992: 178).

60 The initiative would have had to come from elsewhere, such as from institute director August Thienemann, because Marine Commander Erich Wasmund dies on 28.4.1945 as a result of a bullet lodged in his pelvis August Thienemann: *Erich Wasmund (2.8.1902-28.4.1945). Ein deutsches Forscherleben.* Plön 1948. The author is grateful for further information on this archive or other limnological collection projects (see the slide project 1930), which are of particular interest for the project Visual Cultures of Ecological Research (http://bildkulturen.online.uni-marburg.de).

61 Peter Rokosch: Fernerkundung am Bodensee. In: *Garten und Landschaft 2,* 1975, p. 70.

cerned, on the one hand, with classifying and mapping the diversity of individual bodies of water found on land. On the other hand, the lakes are to be examined in terms of their «relations of production» – meaning here not economic production such as fish stocks, but the biological productivity of lakes in general. The question is more one of functional interrelationships, such as the way in which nutrients are distributed and stored in the sediment and free bodies of water, and how the physical-chemical conditions effect biocoenoses (communities of plants and animals). The regional typology of lakes served two purposes: first, to develop scientific theories about the *Seetypen* (lake types), but also, second, to get an idea about the potential of the nation's water resources.

However, there is no agreement about how organisms ought to be entered into a characterization of water body types. August Thienemann proposes that lakes should be classified on the basis of the relations of production of their bottom fauna. Einar Naumann believes that «special faunal characteristics have been too prominent».[62] Another controversial issue is which factors are to be taken into account in characterizing production, and how they are to be weighted. Thus various strands of discussion and debate are sparked off which gradually harden along terminological lines and increasingly develop a negative heuristic until, by the closing years of the 1950s, regional lake typology peters out as a research program. In part, the rigid terminology is not equal to questions concerning functions and processes. In part the program is completed, the recording and typologizing of the lakes accomplished, with some of its specialist terms (such as oligotrophic and eutrophic, referring to low-nutrient or high-nutrient bodies of water) becoming part of the basic terminological inventory of limnology today.

Regional limnology seems almost predestined to be addressed using the aerial photography method. In 1923 – that is, at least 8 years before Wasmund presents his Illuft to the wider scientific community – its founder, Einar Naumann, also holds this view still: he considers «the clear pictorial representation of inland water» to be a very important task because «photographic material selected for the purpose offers, first, a good overview of the dependency of bodies of water on surrounding nature» and thus provides «an excellent illustration to accompany the information on the regional map. Second, though, the most varied culturally-based relations can also be read off from it.»[63] Naumann is so convinced of the idea of «representative images» for regional limnology that he himself takes the initiative and establishes a private archive which, thanks to the assistance of many colleagues, seems to him to be «reasonably useful»; «on the whole, though, it is highly primitive».[64]

At first sight Naumann's problem seems to be above all a technical one: he does not trust contemporary photography to be capable of providing «real overviews»: the advantages of air transport would have to be used better to do this – and that, he

62 Naumann 1931, p. 72.
63 Naumann 1923, p. 105.
64 Ibid., p. 106.

says, is both complicated and costly. His forceful criticism of and rejection of «touristic images put together at random» in limnological publications, however, reveals another area of unease. Naumann recognizes that his community needs to develop a different visual culture in order to be able to use photographs scientifically, yet he sees above all a «touristic» view widespread, a «country and its people» view, which he considers to be unscientific.[65] But what the «right view» looks like that provides these representative images from which the picture data can then be «read off» for limnological questions – in other words, how a «limnological image» must be produced and read – Naumann fails to specify. Accordingly, no photographs appear in his numerous publications about lake types, only conceptual schemata.

The fact that Wasmund's aerial images were by no means «touristic pictures» is documented in the programmatic Illuft publication of 1930: twelve figures are included in it with which Wasmund seeks to demonstrate his new program. He is well aware of the fact that it requires special technical skill to read and interpret aerial images. He attempts to demonstrate where the epistemic gain of an interpretation of aerial images might lie for limnology by reference to the twelve selected examples (see picture captions 4 and 5). His terminology of seeing into, over and onto proves here to be, if anything, somewhat lacking in conviction: he repeatedly reverts to the geological mode of description – it is not so much the image that is being described as the expectation of the «regional determination of the high-alpine primeval mountain lake». His expectation of the aerial image manifests perhaps most clearly in his description of the *Lena in northern Siberia*, namely, that it provides «the *true* picture of greatness and world of forms» (emphasis added). Wasmund provides a thoroughgoing ontologization of the medium of «aerial image» here:

> «It is, after all, a well-known and natural thing, that most limnological text illustrations – if there are any at all – look so similar that one might confuse the one with the other. If that is already true of certain partial views that are important for some specific problem, then even more so for the lake as a whole, as an individual, which almost never fits into the film plane. It is a different matter with the aerial image, which captures the lake as organism in its entirety, intermeshed with the landscape which, like a mother, enables it to form and mature.»[66]

This suggests yet another interpretive possibility as to why Wasmund had such little success with his Illuft. He may have been capable of making the right contacts with industry and state authorities, and even the scientific community was prepared to accept images as epistemic objects. But what Wasmund was not able to do was to demonstrate an appropriate method of interpretation that would have convinced,

65 The extent to which there is a hint here also of establishing a distinction from geography as a science, possibly also specifically from German geography, and/or colonialist programs of expansion, the stylization of the other as exotic, must remain an open question here.

66 Wasmund 1930c, p. 506. The language here also reveals Wasmund's proximity to the current ideology at the time. But this is not the place to investigate his ideological involvement in the Dritte Reich – however, it would be an important issue to grasp the full picture of the failing of Illuft.

for example, tourism skeptic Naumann of the epistemic gain to be had from aerial images. Instead, he drifts off into an almost mystical organicism which, in a certain way, represents a reversal of perspective with regard to the motif of landscape in early plein-air painting. For Wasmund, it is not nature that is «transformed» into the image[67], but conversely nature which appears to disappear completely in the picture: the aerial image captures the lake. This stands in stark contrast to the description of the image which he offers, however, as here the aerial image is credited with as good as no cognitive function whatsoever: the «regional determination of the regional primeval mountain lake» is already given before the aerial image has even been looked at and interpreted. Wasmund's ontologizing holistic rhetoric is quite at odds, at any rate, with the contemporary use of aerial images by geographer and landscape ecologist Carl Troll, who definitely was not after the «unifying view from above» but rather sought «a fragmented landscape»[68]. Whether or not Troll really was able to divest himself of holistic rhetoric and, if so, what then distinguished his natural philosophy from that of his colleagues, must remain an open question here, as must the question of whether a notion of fragmentation played a role in regional limnology, which was ultimately concerned with developing at once a functional and typologically efficient system or organization for different bodies of water in the landscape. One interesting point of debate would also be whether spatial fragmentation is «produced» by a raised horizon.[69] This, it seems to me, can be proven neither by theoretical nor by historical arguments. On the contrary, it seems to have been very difficult – if not impossible – to resist the impression of a «total space» in the face of the first photographic images taken from a «bird's eye view». The «fuller experience of space» so pleasantly formulated by the artist Laszlo Moholy-Nagy is described as being virtually unavoidable, bringing into play an «enormous number of relationships».

Perhaps, to conclude, this leaves more questions open than were posed at the start of this piece. It is my hope, nonetheless, that the narrative strands mentioned at the beginning are now ready to be picked up and woven further or re-spun, enriched with further visual material – or that they may even bring to light new visual material.

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67 To remind the reader, here again is the statement made by Koschorke, quoted in the introductory section «Changing perspectives? From maps to landscape and back»: «The transformation of nature into image is supposed to occur – as with the growing fashion of plein-air painting – there and then.» (1990, p. 144).

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Alfred Nordmann

Of Landscapes and Caves and the Collapse of Distance in the Technosciences

I.

Landscapes need spectators. Even when it is not pictured by a painter or photographer, the landscape is a picture of space that is seen from some distance and that is framed by the position and visual reach of the viewer. The space that is seen has not been entered though it is definitely a space that one might enter.

Astrid Schwarz shows in her contribution to this volume what happens if one changes the angle and views a landscape from above by means of aerial photography. When we look horizontally into and beyond the scene, we see a lake in its natural setting. Here, the landscape organizes an interplay of multiple features and its aesthetic unity permits the viewer to question these relations. Seen from above, however, the lake becomes absorbed into a two-dimensional aerial map and reduced to a detail of a whole. Here the new media technology of aerial photography transforms the landscape into a map and turns the picture of a space into a flat arrangement of signs.

One might also consider another transformation by another media technology. It constructs landscapes that transform the spectator into an actor. Here the landscape ceases to be the picture of a scene but becomes identified with a space for doing and building. It is no longer an object of beauty or knowledge that is beheld by artists and geographers. The scene becomes a terrain that needs to be negotiated as one passes through it. Astrid Schwarz describes the move from landscape to map as a discontinuous change within the continuous movement of seeking higher and higher vantage points. Similarly, the profound transformation from spectator to actor, from pictured space to negotiated terrain results from a continuous development that started with attempts to render interior spaces visible by rendering them as landscapes. However, as cavernous spaces yield landscape views, the landscape becomes a cavernous space that beckons to be entered and explored. Indeed, one might trace this transition quite literally from techniques for the representation of the interior landscapes of caves to techniques of rendering representations as interactive caves.

In 1654, Matthäus Merian produced what is probably the first published view of the interior of a cave.[1] It appeared as part of a *Topographia* which catalogued cha-

1 Stephan Kempe et al.: Die beiden Merian-Texte von 1650 und 1654 zur Baumannshöhle und die dazugehörigen Abbildungen. In: *Die Höhle* 52(2), 2001, pp. 33–45; Stephan Kempe: The Baumann's

racteristic views of «the most distinguished cities, castles, and other places and sites» in a politically defined region of Northern Germany.[2] Merian's prints typically provide scenes that situate the selected site at the horizon and within its natural setting, they are therefore paradigmatic for the visual conception of landscape as something that is seen from a vantage point that is removed just enough to show an entire scene of a site in its surroundings.[3] For the depiction of the cave, a large hall is selected that affords the proper distance to a scene, and the scene itself resembles a somewhat amorphous mountain range with a valley stretching through. The vantage point of the spectator is dramatized by two figures in the foreground who illuminate the scene with their torches and indicate by their small size that the stone formations in the cave are overtowering them.

Fig. 1: From the cave to its representation: Merian's view of the Baumannshöhle

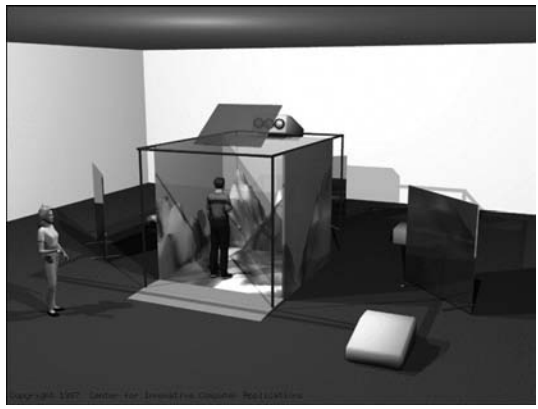

Fig. 2: From the representations into the CAVE (Cave Automatic Virtual Environment)

Merian's cave is a subterranean version of the world experienced above with its landscapes, ground and horizon and breathtaking views – and significantly, it does not have a ceiling. With the publication of this print coincided the beginning of

Cave at Rübeland/Harz, Germany, one of the Caves Noted in Early Science History for its Cave Bear and Cave Hyena Bone Deposits. In: *Scientific Annals, School of Geology, Aristotle University of Thessaloniki (AUTH)* 98 (Special Volume), 2006, pp. 213–220.

2 Matthaeus Merian (Ed.): *Topographia und Eigentliche Beschreibung der Vornembsten Stäte, Schlösser auch anderer Plätze und Örter in denen Herzogthümern Braunschweig und Lüneburg, und denen dazu gehörenden Grafschafften und Landen*. Frankfurt 1654, pp. 31–33, 63.

3 Albrecht Koschorke: *Die Geschichte des Horizonts.* Frankfurt/M. 1990; Chunglin Kwa: Painting and Photographing Landscapes: Pictorial Conventions and Gestalts. In: *Configurations* 16, 2008, pp. 57–75.

tourism in caves, and ever since the mid 17th-century guided tours would lead visitors to vantage points from which to behold these subterranean landscapes. And also since these times, the spectacular scenery in the great cavernous halls served as a stage quite literally for musical and theatrical events. The interior of the cave thus becomes staged as a landscape, and the landscape as scenery and stage serves to organize the tourist's experience of the cave: The geological history of the Earth represents itself by way of a bizarre cast of stalagmitic characters that animate the scene (Fig. 1 & 2).

Leaping forward several hundred years to the end of the twentieth century, one encounters an inversion of this technique. In universities and science museums alike, the cave appears as a representational device and instrument of inquiry. By stepping into this artificial cave one steps, for example, into the interior of a cell. Equipped with a joy-stick for navigation, the investigators are surrounded on four walls, ceiling, and possibly even the floor by the various kind of molecular machinery. This is to enable them to see molecules as molecules «see» each other, and thus to experience viscerally the forces that draw molecules together or hold them apart. By becoming actors within their own simulations, they can feel the effects of their own interventions and acquire intimacy with the actions of the protein they wish to inject or with the tumor they are about to surgically remove.[4] Here, representational capabilities are extended to create an environment in which the investigators are no longer spectators but explorers of the cave. Instead of watching the scene from a distance, they act on and in the scene, and accordingly they do not see a landscape but find themselves in the midst of the action.

Between the cave as a landscape and representation of a space and the representation that constitutes a cavernous space of exploration, numerous media techniques explore a middle ground, namely that of inner space travel which leads the explorers to sublime views of interior landscapes and casts them also as actors in this scenery. There are cinematic adventures in subterranean worlds or in the inner space of the human body, such as *Journey to the Center of the Earth* or *Fantastic Voyage*. There are also video games that afford players the experience of being immersed in a half-familiar scenery as they navigate their fighter jets through narrow canyons. There are finally the nanotechnological surface-scapes created by scanning probe microscopy and its associated software that, often enough, is adapted from the topographic visualization tools of geographers.[5] These surface-scapes open a

4 See for example, Inge Hinterwaldner: ‹Actions of Interest› in Surgical Simulators. In: Bruno Latour et al. (Eds.): *Making things public. Atmospheres of Democracy*. Cambridge MA 2005, pp. 338-341; Colin Milburn: Atoms and Avatars: Virtual Worlds as Massively-Multiplayer Laboratories. In: *Spontaneous Generations: A Journal for the History and Philosophy of Science* 2:1, 2008, on the web at jps.library.utoronto.ca/index.php/SpontaneousGenerations/article/viewArticle/4895 (22.12.09); Inge Hinterwaldner et al. (Eds.): *Topologien der Bilder*. München 2008.

5 Jochen Hennig: *Bildpraxis: Visuelle Strategien in der frühen Nanotechnologie*. Bielefeld 2010 (forthcoming).

space of deliberate technical action that did not exist prior to their visualization. They show that, indeed, there is plenty of room at the molecular level and that this space is largely uninhabited as yet. Topographically, these molecular landscapes are quite familiar, only the colors are off as they might be on another planet. And just like those on Mars they invite *homo faber* to come in and start shaping the world atom by atom.[6]

When lakes become absorbed into the totality of a two-dimensional map and when the observers of nature become actors in their own plays, what has changed is how researchers behold their objects. In order to appreciate this change, it does not matter much whether a new manner of beholding research objects results from the changed media dispositif of new technologies,[7] or whether new technologies and novel uses of old technologies answer to a change of epistemic standards and expectations. What does matter is the collapse of distance that results from a gradual improvement of representational techniques and that signals the discontinuous end of science as a representational practice which aims for a theoretical description of the world.

«Collapse of distance» refers to a change in the manner of beholding an object or of being related to the object, that is, of the dispositif that orients mind and body to the world. Since our orientation towards the world includes sensory as well cognitive modalities, an inquiry into the collapse of distance necessarily involves aesthetics and epistemology simultaneously. And this is where «landscape» came in – it refers to an aesthetic unity that arises with a certain manner of beholding sites and their surroundings, but it also refers to the epistemology of the scientific observer as spectator of a scene. The distance between the observer and what is observed resides in the fact that a landscape is the picture of a space in which the observer is absent. As soon as we move into the immersive, video-gaming space of the cave, its representational devices no longer require distance but serve to produce immediacy: The cave is not a scene to be watched from some distance, but a stage to be entered and explored.

Another simultaneously aesthetic and epistemological category is «experiment.» If one conceives of experiments primarily as means to assess theories and hypotheses, this involves a particular cognitive and sensory orientation which once again casts researchers as distant observers of a scene. After setting the stage and building an experimental system, these researchers step back in order to convince themselves that they have nothing to do with what happens next: The experiment

6 For an account of nanotechnological inner space travel and its relation to the slogan «Shaping the World Atom by Atom» see: Alfred Nordmann: Nanotechnology's Worldview: New Space for Old Cosmologies. In: *IEEE Technology and Society Magazine* 23:4, 2004, pp. 48–54; also Astrid E. Schwarz: Shrinking the Ecological Footprint with Nanotechnoscience? In: Davis Baird et al. (Eds.): *Discovering the Nanoscale*. Amsterdam 2005, pp. 203–208.

7 See for example, Jean-Louis Baudry: The Apparatus: Metapsychological Approaches to the Impression of Reality in Cinema. In: Philip Rosen (Ed.): *Narrative, Apparatus, Ideology: A Film Theory Reader*. New York 1986.

begins when things simply unfold and when some spontaneous effect can be observed on the stage that was meticulously constructed by the researchers. But one can conceive of experiments differently, namely in terms of dramatic events that harbor surprise and the challenge to control it. In this regard, the researchers do not observe the experiment from a safe distance but are deeply implicated in its performance. They participate in the experiment's dynamics of suspense and revelation by demonstrating to their audience what they have learned to do and what effect they can achieve.[8]

A third category appears to be primarily epistemological on first sight. However, the «model» is not just a tool for mediating between theory and reality but also a way of relating to the world and of beholding the objects, phenomena, and processes in the world.[9] Here it is the advent of animal models and simulation modelling that signals a collapse of distance where the model no longer stands at a representational distance to reality but where it becomes a substitute reality by virtue of participation and similarity. It is here that the opposition of pictorial representation vs. immersion and participation in a cave-like situation can be discussed most generally, and where the collapse of distance serves most clearly to distinguish not only two ways of beholding but two ways of conducting research, one scientific, the other technoscientific. But this requires us to step back for a moment from landscapes and caves, different conceptions of experimentation and modelling, and to consider more generally scientific and technoscientific ways of conducting research.

II.

Peter Galison studies the work of physicists of which other physicists say that it is «no longer physics».[10] In particular, he focuses on certain conceptions of string theory, nanotechnology, and simulation modelling. He is careful not to pass judgement on whether or not the contested work is, in fact, physics. He is equally careful not to rank this work as inferior, methodologically deficient or epistemologically naïve. Instead, he is interested to show what might be meant by the claim that something is «no longer physics.» He identifies the fault-line of the debate as the question of ontological indifference: Is it the task of physics to ascertain first and foremost what is or isn't the case, what the building blocks of matter are, what is artefact and what reality, what a necessary feature of a conceptual model and what a measurable

8 To these different ways of conceiving scientific experiments epistemologically and aesthetically correspond different ways of experimenting in the arts, see: Alfred Nordmann: Experiment Zukunft: Die Künste im Zeitalter der Technowissenschaften. In: *subTexte 03: Künstlerische Forschung – Positionen und Perspektiven*. Zürich 2009, pp. 8–22.

9 Alfred Nordmann: ‹Getting the Causal Story Right›: Hermeneutic Moments in Nancy Cartwright's Philosophy of Science. In: Stephan Hartmann et al. (Eds.): *Nancy Cartwright's Philosophy of Science*. New York 2008, pp. 369–388.

10 Peter Galison: The Pyramid and the Ring. Presentation at the conference of the *Gesellschaft für analytische Philosophie* (GAP). Berlin 2006.

process? Certain approaches to string theory, nanotechnology, and simulation are indifferent to such questions. They care not about the existence of things but about their properties and functions and what to make of them.

Where building takes the place that was formerly occupied by knowing, where «what works?» takes the place of «what is?» and where «how can we extend our capabilities?» takes the place of «how is the world hierarchically organized?» scientists are still involved in basic research. Even when physics goes beyond the purview of physics, classically conceived, this research does not directly lead to technical applications, it does not necessarily consist in scientists working on the creation of devices, and it does not always respond to societal demands or specific human needs. And yet, Galison accurately refers to an «engineering way of being in science». To put the point more generally, ontologically indifferent technoscientific research is not about the true description of the world and not about the functioning of devices but consists in the acquisition and demonstration of basic capabilities.[11] In particular, these are basic capabilities of visualization and manipulation as embodied in the scanning tunnelling microscope as an icon of nanotechnology.[12]

Even though basic technoscientific research need not be application-driven, it is research in a context of application. It can afford ontological indifference only to the extent that it can rely on the fact that its objects of research as well as its modelling tools belong to a world that is already the product of science and technology. Ontologically indifferent research is parasitic on the pervasive technical implementation of the knowledge produced in the 19th and 20th centuries. In a somewhat loose manner of speaking, technoscientific research takes place in the medium of science and technology. In this medium, there is no linearity of application from one domain – namely, scientific theory – to another domain, namely technical capability. Instead, what is applied is science and science-based technology as a whole and what is applied are the scientists themselves: A large repertoire of theoretical resources, of laboratory skills, of modelling techniques, of black-boxed instruments, of interdisciplinary collaborations is applied to the production, explanation, control of novel phenomena. These phenomena in turn, and thus the objects of research inhabit the knowledge society, they require for their existence the contemporary technologized world and are not eternal inhabitants of nature that are only now brought to the light of day.[13]

All this suggests that technoscientific research takes place within a self-contained world or second nature which in the form of scientific knowledge, technical instruments and practices takes up or absorbs much of the «natural world» or first nature.

11 Alfred Nordmann: Philosophy of Nanotechnoscience. In: Günther Schmid et al. (Eds.): *Nanotechnology*. Vol. 1. Günther Schmid (Ed.): *Principles and Fundamentals.* Weinheim 2008, pp. 217–244.

12 Davis Baird et al.: Probing the History of Scanning Tunneling Microscopy. In: Davis Baird et al. (Eds.): *Discovering the Nanoscale.* Amsterdam 2004, pp. 145–156.

13 Here, the philosophy of technoscience links up with sociological accounts of a «reflexive» second modernity (Ulrich Beck et al.).

By the same token, the relation between these worlds becomes opaque and thus the relation between the technoscientific presentation of effects to the phenomena in the «real world out there.» In other words, where ontologically vigilant science tends to the gap between the sphere of representation and the sphere of what is to be represented, there is no such gap for ontologically indifferent technoscience: It moves laterally between practices of production, construction, visualization, modelling and assumes that these practices lead to the discovery and control of dynamic processes that obtain in the «world out there» just as much as they do in the technoscientific context of application, if only because the latter partakes in the former.[14]

This is not the place to fully elaborate, let alone justify all these claims about technoscience. In particular, it cannot be argued here whether and to what extent technoscience is something novel. Also, it cannot be shown why and how technoscience *can afford to be* ontologically indifferent. Instead, a particular aspect is to be singled out: How do scientists behold their objects in ontologically vigilant science and within the engineering way of being in science? How does a manner of beholding constitute the scientist along with the object as an object of scientific experience? Or inversely, what kind of attitude towards the object is implied by research interactions, how does the object appear in scientific experience?

A very schematic history might distinguish several stages but the focus here is even more schematically on just two. These stages are distinguished by the representational practice of modern science as an artful construction of immediacy and by characterizing the immersive practice of technoscience as a symbolic substitution of a dynamic system of nature by a technologically constructed dynamic system.

The artfully artless construction of a scene is characteristic for the laboratory of modern science where an experiment is set up to enable the exhibition of nature. It is underwritten by a dispositional account: The phenomena of nature were always there, lying ready to manifest themselves when prompted. Laboratory technology and the experiment finally provide that prompt for the phenomenon to show itself. Here, the experimenters can maintain a clear conceptual distinction between what they have done and what nature does; they can transition from their role as prompters who actively set the stage to that of witnesses or spectators. The phenomena can speak to them as if on their own accord, the simplified laboratory constructions appear as if they were unadulterated nature, the models of reality are taken as if they were reality itself. Such «as if»s need to be artfully maintained; the necessary distinctions require a work of purification that typically consists in distinguishing experimental artefacts from meaningful measurements, controlling variables, or finding out what in our conceptualizations belongs to nature and what belongs to the apparatus required for picturing nature. Scientists as masters of the «as if» thus solve a problem of representation: Well aware that the representation

14 For this and much of the following see Alfred Nordmann: Collapse of distance: Epistemic Strategies of Science and Technoscience. In: *Danish Yearbook of Philosophy* 41, Kopenhagen 2006, pp.7–34.

and what is represented cannot be immediately compared but are separated by an abyss of «aboutness», they create conditions under which nature appears to spontaneously and immediately agree or disagree with its representation: The gap between a mental construct here and a physical event there can be closed when the event yields a measurement or confirms a prediction.[15] The very difficulty of producing a true representation of the world thus prompted a variety of artful constructions of immediacy, that is, methodologically crafted institutions that let nature speak as if untutored. Ontological vigilance is just another word for an awareness of these difficulties.

It is the progress of representational techniques that prepared the shift from representation to symbolic substitution. Technoscientific representations are so good, that is, so saturated with reality, that they stand in for reality itself rather than refer to a reality «out there». So, here we encounter again the collapse of distance that comes with the neglect of the aboutness-relation between the representation and what is represented. This is not to say that technoscientific visualizations and models are not meant to refer to a reality beyond themselves. Instead, this is to claim only that their relation to an external reality is for the most part taken for granted, that its details often remain opaque, and that it requires a special and highly specialized effort to recover the representational qualities of these models. The unquestioned assumption of an opaque representational quality is another word for ontological indifference.

Two examples make that point. Medical and pharmaceutical research frequently relies on so-called animal-models of disease. Sometimes these animal-models are genetically engineered like the infamous cancer-mouse.[16] The animal offers a living substitute for a human breast-cancer patient. Researchers can spend their entire careers studying the animal model without asking how the model represents human cancer and without transitioning from the animal model to a human patient. As they watch tumors grow and shrink, they cannot resort to a dispositional account that permits them to separate the work of technology and the work of nature: It is not the case that experimental interventions prompt the manifestation of natural phenomena. After all, the dispositions of the cancer-mouse, and foremost its disposition to get cancer, are themselves a product of engineering for the purposes of experiment. And what is engineered is not a single experimental artefact but a population of genetically identical mice, and thus a whole second nature with its laboratory ecology. This second nature is thought to partake in the world of the cancer patient. The use of the animal model is justified in general terms by the straightforward idea that the disease process in the cancer mouse shares in the dy-

15 The foregoing characterization relies on various case-studies and amalgamates much Science Studies scholarship. For at least some more detail see the paper referenced in note 14.

16 Again, the following is informed by numerous accounts, first and foremost the one in Donna Haraway's *Modest_Witness@Second_Millenium.* New York 1997.

namics of breast-cancer growth more generally. Since the animal model and the human cancer victim are thought to participate in the same dynamic process of tumor growth, it should be possible one day to transfer what one has learned about the animal model to the human patient. In the meantime, research is totally immersed in the substitute reality. While this substitute reality is heavily invested with features of the intended reality-of-interest, it is a formidable task to recover just how, precisely, this substitute reality serves as a representation of the reality-of-interest. And since researchers are working to heal human cancer by healing cancer in mice, this formidable task would undermine this confidence of purpose – suddenly, the animal model would appear as a model of a state of affairs other than itself.

The second example contrasts the ball-and-stick models of molecular structure of the 19th century with the animated and interactive 3-D molecular imaging software of today. It is hard to overlook the discrepancy between model and reality when the model itself is crudely constructed to aid human imagination. Indeed, the early models wore their constructedness so openly on their sleeves and were so clearly expressive of a conceptual or explanatory structure that their users generally subscribed to positivist vigilance[17]: «since all we know are the models of our constructions, we know nothing of reality». In contrast, users of immersive and interactive software enter the cavernous world of molecules, analyze structures, discover potential bonding sites and thus afford their ontological indifference: «these models are so saturated with reality that all we need not to learn about reality can be learned right here.»

In both examples, representation has given way to symbolic substitution. At the same time, the artful construction of a scene in which the constructed phenomenon can appear as the artless manifestation of nature gives way to immersion in a substitute reality of dynamic processes that are thought to participate in the dynamics of the natural as well as socio-technical world. Representation requires that the careful opposition of the sign and signified, of knower and known yet permits an agreement between the two. The improvement of representational instruments and techniques produced a collapse of these oppositions. They allow for the incorporation into a substitute reality of the subject and the object of research as they are entangled with one another by way of the socio-technical world of which they are both participants.

To be sure, this tentative diagnosis only sets the stage for a research agenda into this kind of incorporation, how it comes about and what it means. So, like some of the other essays in this collection of momentary analyses, this one concludes with research questions rather than answers. Epistemologically, for example, one needs to ask about inferences from similarity when observations of the substitute reality (e.g., simulation experiments) are taken as the basis for judgements about

17 Christoph Meinel: Molecules and Croquet Balls. In: Soraya de Chadarevian et al. (Eds.): *Models: The Third Dimension of Science*. Stanford 2004, pp. 242–275.

«real-world» phenomena. Since what we see in the calculated picture looks like the picture obtained from empirical data, we conclude that the empirical data are due to a similar dynamic process as the one modelled in the simulation. Traditionally, such arguments from similarity have been considered highly suspect, but might they be warranted where the substitute reality is constructed from the tool box of successful theories and algorithms and centuries of accumulated scientific and technical knowledge?

There are further questions, some concerning the philosophy of technology and the demand for transparency and control: Does the opacity of immersive and interactive rather than representational relations leave us with a magical sense of wonder how well things can work when the world is on their side, when they participate properly in its dynamic structure? Then there are many questions regarding the way in which the incorporation of the subjects and objects of research into a substitute reality is supposed to work: Does it rest on the supposition that all one needs are algorithms which express functional relations between properties and traits, and that these then allow us to move with ease between an insubstantial «natural« world and the symbolic substitutes that can fully absorb us? And in an essay on epistemological as well as aesthetic dimensions of research, there must also be aesthetic considerations. The artful «as if» of the modern scientists can be described as a proper balance between absorption and theatricality.[18] It involves the construction of a vantage point from which scientists can be transfixed by the constructed scene in the laboratory, but transfixed in such a way that they do not appear as actors on their own stage. This is the view from nowhere, the gaze of objectivity. How is this view from nowhere transformed by the immersive and interactive experience of scientists who step into cavernous worlds and seem to move within and among them? And how is objectivity transformed when the objects of research become invested with social meaning and physical dynamics as is the case, for example, with the cancer-mouse? When research-objects become animated, literally and figuratively through animation-techniques, do they become research subjects and does it require a critical media theory to restore their representational meaning and thus their objectivity?

Perhaps, the artful apprehension of the landscape is a modern achievement that relates the observant and critical subject to a civilized and acculturated nature. The opposition of subjects and objects of research testifies to their interdependence, perhaps mutual constitution. Along Kantian lines one might say that by setting the stage on which nature can be observed, scientists cast themselves as sovereign lawgivers of a lawful nature. In contrast, technoscientists submit themselves to nature and its endless play of similarities by seeking to control it from within. As the notions of similarity and submission, immersion and substitution, simulation and participation suggest, technoscientists might just be pre-modern shamans and

18 Michael Fried: *Absorption and Theatricality: Painting and Beholder in the Age of Diderot*. Berkeley 1980.

tinkerers in a world that is shaped by modern science and technology. By choosing to return into the cave[19], they question what the landscape once taught us about distance and respect, about representation and truth, about limits of knowledge and control.

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19 With surprising eloquence, the Wikipedia entry on the «Cave Automatic Virtual Environment» notes that «The name is also a reference to the allegory of the Cave in Plato's Republic where a philosopher contemplates perception, reality and illusion» (*Wikipedia, The Free Encyclopedia*, en.wikipedia.org/w/index.php?title=Cave_Automatic_Virtual_Environment&oldid=327636238; 23.12.09). Of course, the return to Plato's cave is the return to a prison of sorts, and what imprisons the inhabitants is ignorance about the nature of representation – they assume that the pictures on the walls give them immediate access to reality.

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Angela Krewani

The Eye of God?

Nature Research and Satellite Images

Fig. 1: The Earth from the Apollo Spaceship

For a long time it remained the privilege of God alone to view the Earth from the heavenly heights. Geographers, cartographers and artists all wondered what this view would look like and thus sought to reproduce it. The view of the Earth from space has since been amply documented, beginning with the first attempts at space travel. The photograph taken from an Apollo spaceship in December 1972 using a Hasselblad camera constitutes one of the first ever visual documents of planet Earth and proved to be a highly effective advertisement for the Swedish manufacturer. Since these images were produced, this – once spectacular – view has become a more or less commonplace element of everyday culture. Captured by orbiting satellites, we encounter it daily along with less spectacular images of the Earth's surface shown on the weather forecast and in advertisements (Fig. 1).

One consequence of the centuries-long idealization of this view of Earth is the potential for it to become overladen with religious meanings, something that is also evident in secular contexts such as discourses about the ‹blue planet›.[1] The image of the blue planet has since become an iconic symbol warning us of the perils of climate change.

Although both the Apollo photograph and the digital satellite image were produced for supposedly documentary reasons, they nonetheless carry within them fixed visual conventions and meanings which, as Denis Cosgrove puts it,

> have drawn upon and reconstituted a repertoire of sacred and secular, colonial and imperial meanings, and […] these representations have played an especially significant role in the self-representation of the post-war United States and its geo-cultural mission.[2]

1 Brian J. (Brian John) Skinner: *The Blue Planet: An Introduction to Earth System Science.* New York Chichester, 1999.

2 Denis E. Cosgrove: Contested Global Visions: One-World, Whole-Earth, and the Apollo Space Photographs. In: *Annals of the Association of American Geographers* 84.2, 1994. p. 270.

The aim in the following is, first, to explore the technical and visual traditions in which satellite images are produced and to show, second, in what ways images are involved in the construction of contemporary concepts of nature and to what extent the convergence of different media enable these constructions to find their way into generally shared communications throughout society.

In terms of the history of technology, satellite images came about as a result of military interests. With the start of the Cold War and the first attempts at space travel, efforts were also undertaken to study the Earth from space, following on from the military tradition of using either moored balloons or aeroplanes to produce photographs of landscapes from a higher vantage point. Naturally, military interests and military financial clout played a prominent role here. This is confirmed in the following comments made by Lyndon B. Johnson, who approved the cessation of regular flights by spy planes in view of the satellite technology being developed in the Soviet Union in the mid-1960s.[3]

> I don't want to be quoted on this, but we've spent thirty-five or forty billion dollars on the space program. And if nothing else had come out of it except the knowledge we've gained from space photography, it would be worth ten times what the whole program cost. Because tonight we know how many missiles the enemy has and, it turned out, our guesses were way off. We were doing things we didn't need to do. We were building things we didn't need to build. We were harboring fears we didn't need to harbor.[4]

He was able to approve the ending of flights by spy planes because it was already abundantly clear that a satellite system was to be built. As far back as 1946 the American military authorities had charged the RAND (Research and Development) Corporation with developing a satellite system to discover information about the enemy. On May 2, 1946 RAND brought out a report entitled ‹Preliminary Design of an Experimental World-Circling Spaceship›, thereby reviving fantasies of conquering space. Explicit mention is made of the possibility of having ‹observation aircraft which cannot be brought down by an enemy who has not mastered similar techniques›. RAND estimated the costs of this project at $ 150 million.[5]

Interestingly, ideas about how to transport data corresponded to communication media technologies available at the time. The satellites worked partly with photographic stills or moving pictures, and the resulting films were hurled back down to Earth in capsules. The more modern technology worked similarly to television. A television camera was used and its images stored on magnetic tape until the satellite had passed by a receiving station and the images could be passed on as electric signals. This kind of technology was used in satellite transmission until the end

3 Georg Erwin Thaller: *Spionagesatelliten: unsere Augen im All.* Baden-Baden 1999. p. 12.
4 Thaller, p. 12.
5 Eric Dyring: Wie die Erde entblößt wird. In: Annagreta Dyring (Ed.): *Erdsicht – Global Change.* Stuttgart 1992. pp. 28–29.

of the 1970s. At that point photography was replaced by a new technology, which recorded and stored the light using a sensitive electro-optical technique – just as in the video camera which was to be developed later.[6] Here, too, the analogy between media technology and satellite imaging begins to become apparent.

After the end of the Cold War satellite surveillance gradually began to be used for civilian purposes. The first to recognize the value of panoramic photography were the meteorologists.[7]

Drawing on photographic techniques and combining these with elements from electronics, optics and informatics, remote sensing was developed in which data on emitted radiation are recorded and transformed into images.[8] In terms of media theory, this represents a radical change. No longer are we dealing with technical records of the Earth's surface but with digital imaging which transforms data into visual structures.

The history of observing the Earth from satellites offers clear documentation of military interests in media technologies. Military technologies were apparently able to engage in observation of the Earth away from the gaze of a public whose mass media were based on the same technological structures.

The first war against Iraq in 1990 (Gulf War) was described as a ‹media war›[9], not least because the division between military uses and mass media communication could no longer be upheld. Images of swaths of land selected for bombardment functioned simultaneously as material for reporting news. The considerable discrepancy between media functions became apparent here: digital images being used for a specific (military) purpose were attributed documentary character. In this respect, the Gulf War is the first war in which the public mass media collaborated with the military's guidance technology.

However, there is a long standing tradition of collaboration between media technology and military technology. In his publication *War and Cinema* [10] French media philosopher Paul Virilio uses media theory to highlight the parallels between war and cinema, working with a tightly woven technological analogy between the apparatus of war and the film camera:

> It was in 1861, whilst travelling on a paddle-steamer and watching its wheel, that the future Colonel Gatling hit upon the idea of a cylindrical, crank-driven machine-gun. In 1874 the Frenchman Jules Janssen took inspiration from the multi-chambered Colt (patented in 1832) to invent an astronomical revolving unit that could take a series of photographs. On the basis of this idea, Etienne-Jules Marey then perfected his chrono-photographic rifle, which allowed its user to aim at and photograph an object moving through space.[11]

6 Dyring, p. 29.
7 Ibid., pp. 34–35.
8 Ibid., p. 35.
9 Paul Virilio: *Krieg und Fernsehen* (War and Television). München, Wien 1993.
10 Paul Virilio: *War and Cinema*. The Logistics of Perception. London 1989.
11 Ibid., p. 19.

In the course of his subsequent comments on this issue, Virilio emphasizes the efforts made by the military to acquire filmic and photographic aerial shots: still or film cameras were tied to hot air balloons or airships to obtain aerial photographs of strategically important swaths of land. Virilio continues:

> Soon the army was rigging together the most varied combinations: camera-kites, camera-pigeons and camera-balloons predated the intensive use of chronophotography and cinematography on board small reconnaissance aircraft (several million prints were made during the First World War). By 1967 the US Air Force had the whole of South-East Asia covered .[12]

This theory should not be dismissed off-hand, and indeed it does form part of my argument here. Nonetheless, Paul Virilio's argument fails to address some important aspects of the origins of visual traditions and of the discursive attributions of media apparatuses. In addition to the technical inscriptions of images, formative visual traditions and habitualizations of images exist which function as more than just technical inscriptions. Instead of exploring the formative power of these inscriptions, however, Virilio implicitly takes them as given and is thus able, drawing on historical visual traditions, to formulate his theory of the dominance of technological inscription. In this way, his ideas confirm the persuasive power of images, which has emerged in the course of a long historical process. They are images which, on account of their technical and visual traditions, establish an objective spatial perception.

My assumption– drawing on Cosgrove's comments – is that beyond the technologies there are image-related conventions and structures of communication which perform the task of transforming meanings and enabling them to function in adjacent discourses. According to this, images are nodal points for a multitude of different discourses. I would like to elucidate these ideas by taking a historical look at visualizations of landscapes from a bird's eye view.

Since there are real disadvantages to focusing methodologically on the technical aspects of photographic and filmic imaging, in the following I shall offer a way of looking that relates both cultural and visual traditions and technical dispositifs to one another. This way of proceeding draws on Arjun Appadurai's ideas about strategies of signification that work in different ways, which he calls ‹scapes›. According to Appadurai, a specific way of looking necessarily emerges from the combination of these different discursive spaces.[13]

Overviews of landscapes are images that are indispensable to warfare and are created using historically varying imaging technologies. Currently, warfare makes use of satellite pictures of the Earth or of specific landscapes. These images are generated technically in a variety of ways: they are not photographs but digital

12 Ibid., p. 19.

13 Arjun Appadurai: *Modernity at Large. Cultural Dimensions of Globalization*. Minneapolis, London 1996. pp. 27–47.

Fig. 2: Abraham Ortelius, Teatrum Orbis Terrarum (1570)

Fig. 3: Planet Blue Earth. Nasa photography of the earth

constructions pretending to be photographs. Jörg Döring sees in them ‹ways of world-making› rather than depictions of reality.[14] William Mitchell, a theorist of digital photography, radicalizes assumptions about digital images in that he denies them all mimetic or indexical status. According to Mitchell, digital photography or digital imaging which no longer requires the use of any photographic apparatus has given rise to a form of image production representing an exclusive interpretation of data and their visual presentation.[15]

With regard to digital photography and other digital imaging methods, however, it is possible to identify a considerable discrepancy in terms of attribution. On the one hand, the indexical quality of images – in other words, the reference to an actual object – has diminished, while on the other photography, along with all its successor imaging procedures, transports within itself its historically attributed guarantee of objectivity. Thus many images whose origin is diffuse, to say the least, continue to live from their attribution to the medium of photography.

Interestingly, implicit assumptions regarding photography and its capacity to offer a supposedly objective reflection of the world have remained a part of discourses about digital images. According to Lorraine Daston and Peter Galison this

14 Jörg Döring: Raumdeutung. Vorläufiges zu einer ‹spatialen Hermeneutik› des digitalen Medienumbruchs. In: *Navigationen* 6.1, 2006. p. 57.

15 William J. Mitchell: *The Reconfigured Eye: Visual Truth in the Post-Photographic Era*. Cambridge, Mass. 1992.

attribution of ‹truthful representation› to photography arose in the context of the suppression of subjectivity in scientific discourses of the 19th century, at the same time as the shift occurred from drawing to photography. While illustration was still allowed to carry the marks of subjectivity, photography was accorded the role of being both symbol and imager of the new objectivity – suggested not least by its mechanical equipment.

Fig. 4: Provost, Sacred Allegory, 1510–1520

Evidently, those engaged in military research as well as in civil use see the need to maintain the scientific claim (to objectivity) of their own images by seeking to perpetuate traditional photo attributions that have already long become obsolete: in contrast to technological progress, the representations of landscapes provided by limnology as well as the satellite images of the Earth follow fixed visual traditions for which clear evidence can be found. Thus the images serve not only as up-to-date documents they also reveal more far-reaching political and cultural interests.

One of the first landscape overviews arose long before any technical means of recording reality existed. In the year 1570 Abraham Ortelius's representation of the Earth, Teatrum Orbis Terrarum, displays astonishing similarities to contemporary representations[16] (Fig. 2 & 3).

Common to both these images is the way the viewer's gaze is guided from a seemingly divine standpoint down to the landscape below: viewers are equipped with the eye of God, giving them total control over the image and what it depicts. A particular viewing direction is established here which later on becomes very important in the military context and guarantees the objective perception of landscapes (Fig. 4).

Provost's painting SACRED ALLEGORY (1510) constitutes clearly the linking together of gaze, property and ideological legitimation. Next to the risen Christ stands his mother Mary, elevated to Queen of the World both appear to float among

16 Cosgrove: Contested Global Visions, p. 271.

Fig. 5: Jacopo di Barbari, Map of Venice (ca. 1500)

the clouds while between them, held out by a disembodied hand, is a globe which is exposed to the all-dominating and controlling gaze of God.

This scene, a clear representation of imagined power relations, is dominated by the eye of God, which takes up the central viewing position like the sun in a solar system. Here, the eye of God is the ideal point of escape from which to gaze upon the Earth. Even though this is not represented explicitly in early modern representations of maps or landscapes, the gaze of God – that is, the gaze from above – is etched onto the map as an ideal typical position.

This representation also reveals much about the way the landscape is viewed – in a controlled and controlling way. The eye of God or of some superior authority gazing down from the heights onto the landscape is another highly stable tradition of European imagery. Representations which portrayed the seeing and possessing or appropriating eye of God from the outside were especially popular. This gaze of God is also imitated by the early maps of the Renaissance, which are based on an imagined view from the air (Fig. 5).

> There is a mutual correspondence here between the views of the controlling eye and the viewing constellations of the eye itself. The view from outside cements God's claim to power and objectivity (we can assume that photography took over this role in the 19th century), and the consequence of the objective gaze of God is the way in which the landscape is represented. Thus we have a tradition of imagery running parallel to the maps and pictures of landscapes, which documents the positioning of the gaze in the form of a media dispositif.[17]

According to Denis Cosgrove, the representation of landscape arose as a mode of seeing the external world in the 15th and 16th centuries and was closely associated with the visual endeavors of the Renaissance and its concept of humanism

17 Cosgrove: Contested Global Visions, pp. 272ff.

and space. As Cosgrove shows, representations produced in different disciplines and areas of society, such as in painting and in landscape gardening, adhere to the same demands of the linear perspective as were also used in cartography and land surveying. The purpose was ‹the control and domination over space as an absolute, objective entity, its transformation into the property of individual or state.›[18]

Spatial processing, modified according to the discipline concerned, was taught in a special manual.[19] This fact explains the varied usage of conceptions of space in different scientific disciplines. In this sense we can say that cartography and taking possession of the landscape occurred in parallel with one another, while the application of geometry often had the purpose of making the acquisition of actual space easier or preparing the way for it.

> Implicit in the landscape idea is a visual ideology which was extended from painting to our relationship with the real world whose frame and compass Elizabethans so admired and which Georgian English gentlemen would only approach through the language of landscape painting.[20]

Cartography was happy to subordinate itself to this purpose: this emerges from a comment made by John Dee, the famous Elizabethan mathematician and magician. Dee praises geometry and the art of drawing in the following terms:

> ... great skill of Geometrie, Arithmetik, Perspective and Anthropographie with many other particular arts hath the Zographer need for his perfection... This mechanical Zographer (commonly called Painter) is marvelous in his skil, and seemeth to have a divine power.[21]

Naturally, military interests, including the need for ballistic calculations requiring reliable information about distances, are relevant to the perspectival use of space. Historically speaking, for example, there is a close link between the mode of representation and economic and military interests. Bruno Latour even goes so far as to describe the central perspective as a new kind of communication medium in prehistory whose function was to link different pieces of information together.[22] If we take Latour's ideas seriously we see that the central perspective is more than an esthetic decision: it links the various scientific disciplines and social domains with one another, thereby facilitating the interchangeability of visual representations. Images could now be used within and exchanged between different contexts, such as economic or esthetic ones, without a hint of disruption.

18 Denis E. Cosgrove: Prospect, Perspective and the Evolution of the Landscape Idea. In: *Trans. Inst. Geogr. N.S.* 10, 1985. p. 46.
19 Ibid., p. 46.
20 Ibid., p. 55.
21 Quoted in Cosgrove: Prospect, Perspective and the Evolution of the Landscape Idea, p. 58.
22 Bruno Latour: Drawing Things Together. In: Steven Woolgar, Michael Lynch (Ed.): *Representation in Scientific Practice*. Cambridge 1990.

Fig. 6: Honore Daumier, Nadar in a captive balloon (1858)

As we have shown, by the beginning of the 19th century stable visual structures already existed for organizing a great variety of discourses. Two technical innovations in the 19th century seem to perfect cartography and its claim to domination: the beginnings of aviation and the introduction of the technical image-making apparatus of photography. From its very beginnings, aviation sought to generate photographic images of the landscape. In 1858 the French painter, author and photographer Felix Tournachon, also known as Nadar, took an aerial photograph from a moored balloon in Paris. This undertaking was recorded by Daumier in a cartoon drawing (Fig. 6).

It was the combination of aviation and photography in particular that excited the cartographic imagination of the time. Contemporary texts provide evidence of the varied and exaggerated expectations made of photographic procedures, as indicated by a speech given by *Geheimrat* (Privy Councillor) Prof. Finsterwalder in 1923 about the merits of ‹photogrammetry›:

> The necessities of war have – more quickly than one might have expected – removed the optical and photographic difficulties that stood in the way of taking aerial photographs from an aeroplane.[23]

Finstewalder reflects further on the astonishing burst of innovation in photogrammetry, which he attributes to the First World War:

> ...and soon enough a thousand busy hands set to analysing the content of pictures from war maps, initially using laborious drawing methods, later with the help of photographic procedures.[24]

23 Geheimer Rat Finsterwalder, Prof. Dr. S.: Bedeutung der Photogrammetrie für Technik und Wirtschaft. *Hg.v. Oberregierungsrat von Langendorff, Vortrag gehalten bei der 2. Hauptversammlung der internationalen Gesellschaft für Photogrammetrie.* Berlin 1927. p. 11.

24 Ibid., p. 11.

Fig. 7: Erich Wasmund, Aircraft on limnological excursion

The advantage of the aerial photograph when compared with traditional photographs is the temporal proximity within which the images can be taken, as Finsterwalder notes:

> The maps of the high mountains sketched previously in the interests of warfare are generally fifty, or indeed a hundred, years old and give only an imperfect picture of the mountainous formations and their current ice cover.[25]

It is interesting to note how, in the course of his talk, Finsterwalder shifts between the civil and military uses of aerial photographs, which can be used for both purposes. In this way, just like the perspectival pictures of early modernity, they meet the demands of a society which itself is constantly shifting between civil and military interests.

Whereas the visual strategies of perspectival representations have been adopted in barely modified form, the discursive contexts of the images have changed. This becomes especially clear when looking at the example of limnology (lake research) which works principally with cartographic material in conjunction with aerial photographs.

In his capacity as a limnologist, geologist Erich Wasmund mapped a range of landscapes in the 1920s, which seem to be located in the Romantic visual tradition

25 Finsterwalder, p. 11.

of the 18th and 19th centuries[26], as shown by his images of lake landscapes which, in line with this tradition, depict reflections on the water's surface and sloping rays of sunlight falling on it.

His aerial photographs also fit with the traditions of landscape representation highlighted by Denis Cosgrove. If we look at the aerial images of Lake Constance, we can identify correspondences with the conventions of Renaissance cartography down to every last detail. Although the medium has very clearly moved away from drawing with the advent of photography and far more varied ways of looking at landscape have emerged since the advent of aviation, the aerial view of Lake Constance does display remarkable similarities in its iconography to the imaginary aerial images of Venice. Both images follow a central perspective which structures the aerial view of the landscape and conveys the illusion of a landscape that presents itself freely to the observer's gaze and apparently subordinates itself to its claim to dominance. The categories of water and land stand out through the use of especially sharply drawn lines: it almost seems as if the island of Lindau is sitting atop the water. In certain respects the photograph creates a separation between water and land, the water remaining an indefinable mass and the land appearing as an object awaiting appropriation.

At the start of the 1930s Erich Wasmund turned to cartography, apparently filled with the spirit of National Socialism, as demonstrated by his publications which appeal for geologists to be deployed in the regime's labor service (1934) and establish the use of military geology for the nation (1937).[27] Scholars of literature are familiar with the close interconnections between the homeland movement (*Heimatbewegung*), nature conservation and fascist ideology. What seems astonishing in the context of Wasmund's limnology and study of landscapes is how straightforwardly the proximity between landscape images and military geology can be created.

Wasmund's images alternate between an esthetic representations of landscape and obviously cartographic depictions that barely conceal their military usefulness. In this sense, many images of ecological research, too, are designed to be able to serve multiple functions in various discourses and can thus be deployed at random, regardless of discourse.

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Karen A. Ritzenhoff

Mapping the New Britain Museum of American Art: Mental and visual Landscapes from the Past and in the post-9/11 World

Joseph Beuys captured the brainwaves of his artistic mind 1971 in a visual depiction on a large chalkboard. Sharp lines of erratic seaming (and screaming) scribble, sections of words, fluid letters, arrows and circles, numbers, boxes, small and large icons, spots of color, horizontal and vertical moves, lines and bubbles, are all condensed within an artificial space, contained within the dark frame of the blackboard, the invisible made visible, and for everybody to see.[1] What usually occurs in a privately conscious or sub-conscious monologue in one's head, is translated into scripture, legible features and recognizable patterns. It gains a physical form that can be stored and moved, eventually exhibited in an international forum of modern art, thirty some odd years later. What was originally erasable with a quick swish of a wet sponge (after finishing a lecture or presentation), turned into preserveable music of the mind. The title of the piece: «Unterrichtstafel aus dem Büro für Direkte Demokratie» («Blackboard from the Office of Direct Democracy», 1971, Collection Adolf-Luther-Foundation, Krefeld, Germany). I encountered this specific one of Beuys' possibly more methodological mental landscapes, apparently famous in the mid 1970s, rather haphazardly when roaming in an art exhibit, turning around the corner in the Art Gallery of South Wales at the Biennale of Sydney, Australia in the summer 2008. Suddenly the concept of an actual, physical mental landscape made complete sense to me. Abstract though evocative in its immediacy, he had preserved a fleeting moment in time, filled with doubts about post-War German identity.

Beuys' scribble, while grandiose due to shear size of the imposing blackboard, in and off itself a relic of the past because hardly anybody uses a chalk board for wri-

1 The online version of the Biennale catalogue, still accessible on the web, explains about this particular work of art: «Joseph Beuys was one of the most revolutionary artists of the sixties and seventies. For Beuys, art and activism were inseparable. According to his radical notion of free democratic socialism and ecology, every person was potentially an artist able to transform society creatively. In 1970 he founded the Organization for Direct Democracy by Referendum in Dusseldorf, Beuys became a charismatic leader. The transformation of society itself, and the set of relations between people to achieve that, was a new form of sculpture, a ‹social sculpture›. When he was invited to Documenta in Kassel in 1972, Beuys transferred the Organization's office to the museum gallery for the duration of the three-month exhibition. During these meetings/performances, Beuys would annotate his thoughts through diagrams on blackboards. Today, these blackboards are among Beuys' most important works, as they illustrate formally and conceptually his revolutionary thought processes and the importance of dialogue and discussion as an artform». Biennale of Sydney, June 18 to September 7, 2008. Art Gallery of New South Wales.

ting at the university anymore – we replaced this archaic form of representation and note keeping with a so-called «white board» and erasable markers – , and verbose in some way also seemed very teutonic, riddled with issues of self consciousness and angst, and a certain dull linearity that is familiar to the Western mind, trained to read from left to right and functioning within the structure of an alphabet. This particular version seems also strangely detached from the «real» from nature and environment.[2] It is the world of an enclosed mind, aggressive, angry, evocative because it is supposed to visualize possibly community oriented «direct» democracy but not an orderly version, a complicated, still unintelligible one. If leading statesmen had this idea in their minds when designing the future of post-War Europe, I would find that quietly worrisome. I wanted more. I was dreaming about an array of completely different and unfamiliar visual maps ... I was interested in the way A Beautiful Mind worked as in the famous film by Gus van Sant about Nobel Prize winning Mathematician John Nash, a plot where a genius lives in his own psychotic/schizophrenic world and keeps writing on surfaces to document what he is thinking about. Nash played by Australian actor Russell Crowe attempts to crack the codes of governmental agencies but gets lost in his own brilliantly imaginative fantasies and delusions.[3] I wanted to bring this idea home to evoke a form of discussion or dialogue among colleagues in academia.

2 The *National Geographic* published a special issue on neuroscience and brain surgery in March 2005. It showed a serene looking buddist monk on the front cover whose head is covered with what looks like a helmet of electrodes to catch brainwaves. The actual article by James Shreeve with photographs by Cary Wolinsky provides a fascinating look into the increasingly sophisticated accomplishments of brain science. They explain: «Mapping brain functions requires innovative tools. With an electroencephalograph researchers analyze electrical currents to trace brain activity at blazing speed» (p. 14). In the context of this special issue on science and nature, one could certainly contribute an entire essay on the fascinating visual depictions of brain surgery and research. Interestingly enough, the 30 page essay on the brain in this special issue of the *National Geographic* is followed by an in-depth photo essay on the spiritual visions of landscape architect Frederick Law Olmsted who developed the concept of Central Park among many other sites across the United States. The first image shows a birds' eye view of Central Park with the subtext: «Sunbathers catch the last rays of the day in New York's Central Park, a vale tranquility amid the metropolis. Here and in hundreds of public spaces across the country, Olmsted helped bring the soothing beauty of nature to rich and poor alike». In: John G. Mitchell: Passion for Parks. In: *National Geographic* 3, 2005, pp. 32–51. The *National Geographic* concludes the article with a little inserted box: «Oasis in the City. Frederick Law Olmsted's magestic contributions continue to inspire awe and offer respite to city dwellers. Witness the beauty of his landscapes at nationalgeographic.com/magazine/0503. »

3 German film scholar and journalist Maurice Lahde has written about the film by Ron Howard, A Beautiful Mind (2006) as well as David Cronenberg's Spider to articulate the difference between cinematic depictions of mental health and hallucinations compared with the «real» medical occurrences of the same condition. Lahde explains in the second footnote of his essay: «das Erscheinungsbild von Halluzinationen im Film hat zumeist nur wenig mit der klinischen Realität zu tun. Die meisten Filme zeigen sie als äußerst komplexe audiovisuelle Erscheinungen. Tatsächlich treffen visuelle Halluzinationen bei psychotischen Erkrankungen weitaus seltener auf als akustische und sind weit weniger spektakulär, als man es sich allgemein vorstellt; größtenteils handelt es sich um flüchtige Erscheinungen (Blitze, undifferenzierte Lichter, Farben etc.), nicht um szenarisch ausgestaltete Bilder, wie sie im Film meist anzutreffen sind.» In: Maurice Lahde: Den Wahn erlebbar machen. Zur Insze-

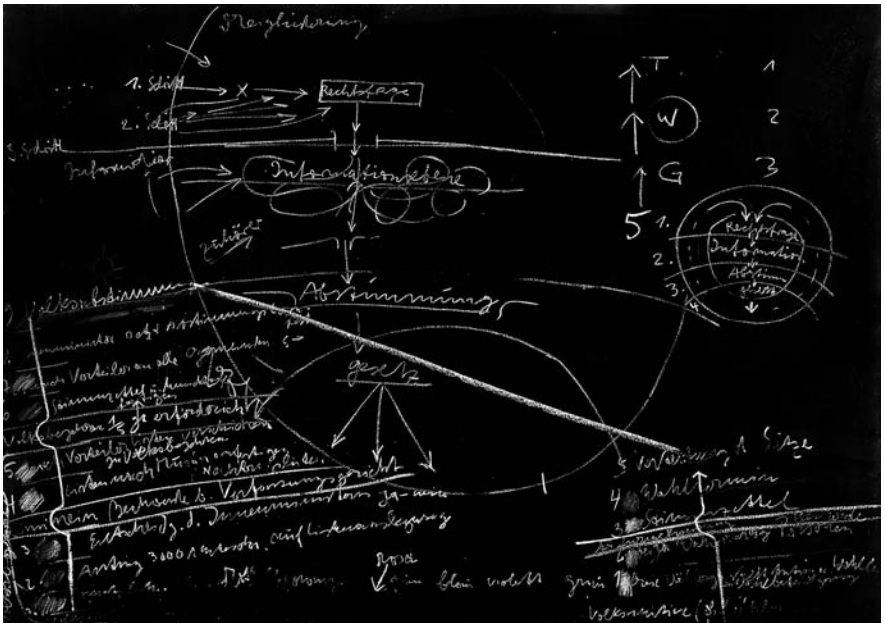

Fig. 1: «Black board from the Office of Direct Democracy»

If we were able to capture how our minds theorize and grasp concepts (every educator encounters the challenge to have to translate his or her views so they become intelligible to students in an act of learning), I dreamed, maybe we could communicate better. Or cherish our differences. An additional challenge: the responses to the concept of mental landscapes would have to be evoked in one's own creative mind, not in dialogue with a given mental or visual landscape which seemed much more ambitious at the time but turned out to be far less daunting in the long run.

Whereas in our daily lives we seldom experiment with our mental images, several mainstream and independent Hollywood feature films, documentaries and even international films, have described the challenge of evoking creativity in children and young adults. The films, although greatly different in the way they depict the creative process, deliver often a similar message: they frequently conclude that children of different means and sometimes lower economic status are capable of outstanding performances but that cultural challenges in the understanding between facilitators and the students cannot be underestimated. An example for the latter point is the emotionally riveting French feature film: La Classe (2008) about a group of teenage students, mostly with North African immigrant background, in an urban suburb of Paris who will drive their well meaning French literature teacher over the edge, actually the very

nierung von Halluzinationen in Ron Howards A Beautiful Mind und David Cronenbergs Spider. In: Jörg Helbig (Ed.): *Camera Doesn't Lie. Spielarten erzählerischer Unzuverlässigkeit im Film*. Band 04. Trier 2006. p.2.

same teacher who facilitated, shot and post-produced the film that gained worldwide distribution. Other feature films that evoke the challenge between innovative pedagogy and the educational status quo are: Mister Holland's Opus (1995), Music of the Heart (1999), Goodwill Hunting (1997), Dead Poets Society (1989), Stand and Deliver (1988), Lean on Me (1989) or the documentary Mad Hot Ballroom (2005) about children in urban New York who succeed in ballroom competitions. Films that describe the complexity of the human brain are Goodwill Hunting, A Beautiful Mind but also a new documentary by director Petra Seeger, In Search of Memory about the American-Austrian Nobel Prize winner Eric Kandel who is a neuroscientist at Columbia University. The film will be released in 2010. I would like to thank German Neuro-Scientist Martin Theis from the University of Bonn who alerted me to the work of his post-doctoral advisor Eric Kandel, the (shared) Nobel Prize winner for Medicine in 2000, at Columbia University. Eric Kandel as well as Nobel Prize winner John Nash have written memoirs about their creative life journeys. Kandel's In Search of Memory (2009) has been adapted into documentary as well as the fiction film, A Beautiful Mind, attesting to an enduring interest in the origins and generations of creative processes.

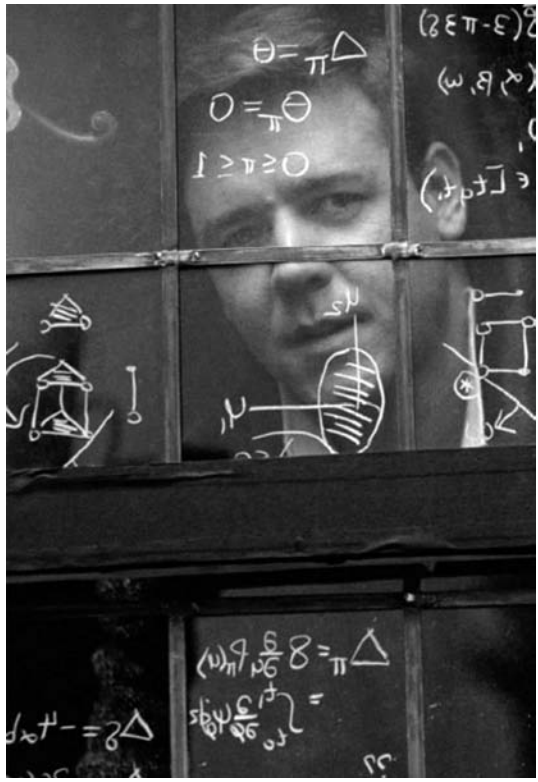

Fig. 2: Cracking the Code? Russell Crowe as Nobel Prize Winner John Nash in A Beautiful Mind by American director Gus Van Sant (2006).

Along the lines of visually depicting the machinations of the human mind, our plans to hand out chalk boards to individual members of different academic disciplines and have our colleagues respond in new and «outside the box» ways failed. But other unexpected results materialized in the next nine months and culminated in a flurry of events that is the basis for this essay.

What worked, though, was another move: we founded a triangular relationship between the University, Museum and Community and called it the UMC New Bri-

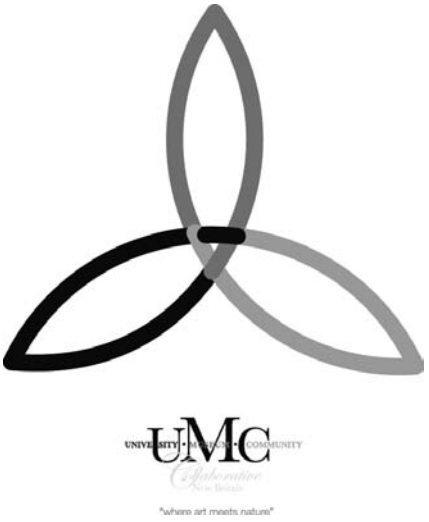

Fig. 3: Logo of the University-Museum-Community New Britain Collaborative. The three rings symbolize the intersecting strands of ideas.

tain Collaborative. Its goal was and continues to be to use the contained space of the New Britain Museum of American Art, a gem located two hours north of New York and two hours south of Boston on the American East Coast. In this place the unique «CCSU Night the Museum» took place in April 2009 and had the working title «Nature and Environment» to streamline our interdisciplinary activities with an international symposium on sustainability. 200 faculty and students were involved. About 1000 people attended a set of related events, concerts, exhibits, performances in a two day window that brought people across campus and the community together to celebrate the arts.

Apart from soliciting musicians, actors, artists and students with special skills from different parts of the university, we also put out a call for original responses by students, a so-called «student creative arts competition» where the winners would be getting prizes. In the end, we gave out a set of ten gift coupons to buy free books at our campus bookstore. About 120 students answered this call to choose a painting, sculpture, object or subject matter in the museum collections and translate their responses into their own media. The increased accessibility of video camcorders and editing software has allowed young adults (kids, teenagers, students) to participate in a global visual flow of information.

We had successfully tried an earlier «CCSU Night at the Museum» in November 2007 where the topic was less abstract because we focused on the murals by Thomas Hart Benton, housed in the New Britain Museum of American Art, and asked students to relate to the images and reenact any of the characters in the murals, in the tradition of social realism of the Thirties, living in the 21st century. What would he, she or they look like? Theater plays, poetry, paintings, photo collages, photography projects resulted in that earlier call, but the 2008-2009 student creative arts competition was more difficult because the theme was so broadly conceived as «Nature and Environment» (Our 2011 topic is «Water» which may also allow for more flexibility). In 2009, our students handed in videos, memory banks of photographs, paintings, drawings, sculptures, pottery, poetry, even a quilt and a dress sewn out of «Whole Foods» recycable bags. Maybe one of the most impressive responses came from an Italian visiting professor in the School of Engineering and Technology, Antonio Scontrino. He re-conceptualized the infamous 9/11 mural in the permanent

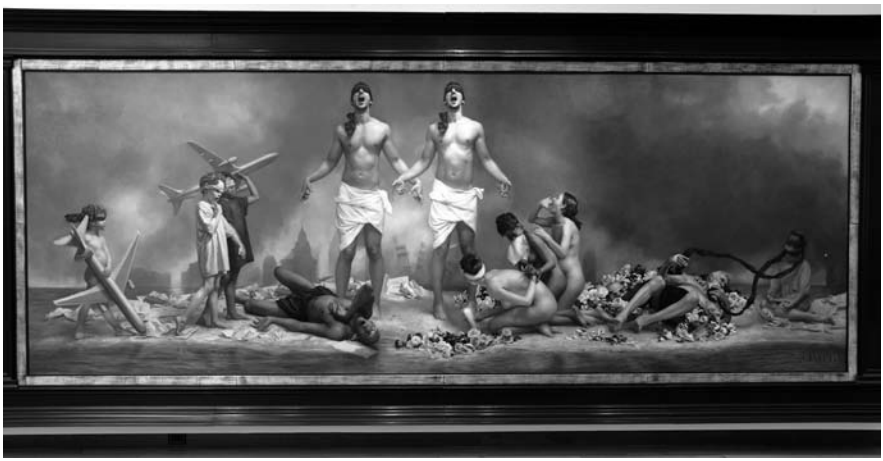

Fig. 4: Graydon Parrish «The Cycle of Terror and Tragedy: September 11, 2001»

Fig. 5a–f:
Details of Graydon Parrish's «Cycle of Terror and Tragedy

collections of the New Britain Museum of Art that had been commissioned by the museum's board in 2002 from a young and then quite unknown American artist, Graydon Parrish, who was asked to paint an allegory of the terrorist attacks on the Twin Towers on 9/11, a trauma for America. «The Cycle of Terror and Tragedy: September 11, 2001» is a huge work of art that fills an entire museum wall and comes

Fig. 6: Thomas Hart Benton's 1932 Mural

along with matching sitting banks, engraved with somewhat kitchy roses, to invite viewers to contemplate.

Parrish's work is a visual antidote to Thomas Hart Benton's mural in the adjacent room of the museum. Benton invites the viewer to become part of the flurry of activities that he represents with American people in different locales such as flimsy actresses, crooks, big bosomed opera singers and homeless people, a handicapped man, jazz saxophone player or common tart in front of a mirror all congregate in the metropolitan hotbed; then there is the idealized Western world, the religious, racially segregated South or scandalous and bigoted world of Washington politics (a depiction that caused much controversy for its supposed underlying anti-Semitism) as well as the romanticized American-Indian heritage. Graydon Parrish paints a rather flat picture, remiss of vibrancy or song. Its main aural feature are the wide open mouths of two Caucasian men, young and athletic whose exposed upper torsos are almost identical. These two men are allegories for the Twin Towers. They are well shaped, adherent to classic Greek body proportions, are covered with a white loin cloth (reminding the viewer of a religious depiction of Jesus' suffering on the cross) and their arms are contorted into an artificial pose of agony and pain. Their eyes are veiled with red shawls and their mouths wide open in screams of gaping terror. To their feet one can track two different sites: to their left, an African-American man stretches out with his eyes turned towards the sky, blinded by the sight. His hands are also opened and seem to resist reaching out to anybody even though Graydon Parrish explains in his own interpretation of his work that is available at the New Britain Museum of Art upon request that this person is supposed to stand

symbolically for all those people on the ground, the firefighters, medical support personnel and volunteers on the day of 9-11-2001, many of whom sacrificed their own lives when trying to rescue victims from the collapsing Towers. To his left are three children: their eyes are veiled with blue cloth. Two of them, one Caucasian and one African-American boy, hold hands. A little cherub behind them who is entirely naked also carries a large airplane that is pointing towards the sand where this entire scene is located, supposedly on a shallow bank in the middle of the Long Island Sound. The African-American boy points with a second huge toy airplane towards the left figure of the Twin Tower allegory. The children are not looking at each other but are directed physically in their poses towards the Twin Towers. There are opposing responses: some contend that these children stand for the terrorists who were misguided by ill-conceived violent ideology to want to commit heinous crimes not being fully aware of the consequences.[4] The other interpretation that Graydon Parrish himself seems to favor is that the children are representative of the innocent victims who were deeply affected by the tragedy because their parents and family members perished in the catastrophe.

To the right of the Twin Towers two more vignettes are visible. One entails three nude women, two of whom are clasped together with shackles. The woman in the middle is African-American, young and beautiful. She could be the mother of the little boy with the plane and/or the partner of the contorted figure on the ground. Immediately adjacent to her leans the nude body of a young woman who is nestled behind her; she is also cusping her right hand to shout out to the two young men who represent the Twin Towers. Her cheeks flushed, she yells, repeating the gesture of sound waves that emanate from the Twin Tower screams. Crouched on the bottom of the two other women is a slightly heavier female nude figure who holds a large white candle that is lit. While the left side of the painting is covered with ripped up pieces of the American Declaration of Independence, the right side of the mural is covered with lush pink and white roses. The last group in the picture is difficult to interpret. A young girl is sitting on the sand bank, slightly off the side, and looks down while her hands, too, are open and tensely contorted. Her eyes are covered with a long red deep dark piece of cloth that is being held, similar to an umbilical cord by an old man with a blue facemask. Next to the man who stretches out on the floor and whose bare legs face the viewer, is a skull, a dead bird and an isolated empty glass bottle that looks like an infusion container in an intensive care unit. The old man is looking at the hands of the young girl but there is no physical contact between the two other than the large waving ribbon. In the back, almost on the very edge of the frame, one can detect the Statue of Liberty, her flame lit, who is sinking into the water, similar to a sci-fi depiction of a drowning humanity, used as a visual clichee

4 Mural artist Prof. Mike Alewitz from the Department of Art at Central Connecticut State University provided this interpretation during a guided tour to students of an honors course on «Western Thought» in the fall semester 2009.

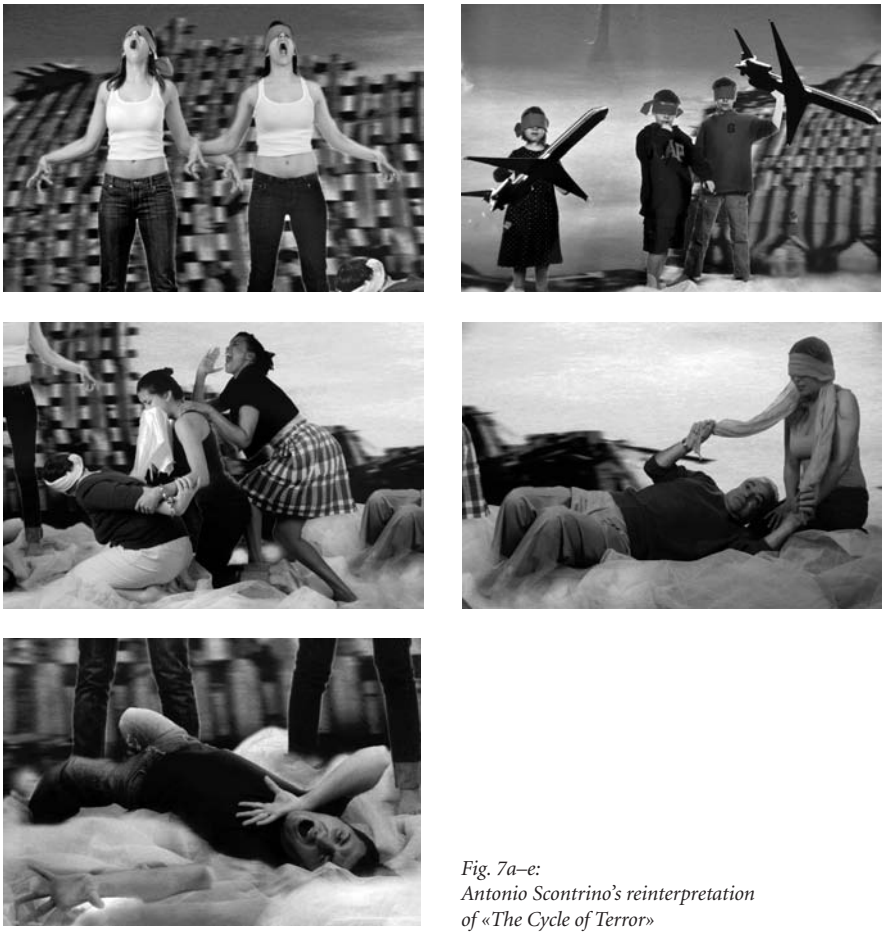

Fig. 7a–e:
Antonio Scontrino's reinterpretation of «The Cycle of Terror»

in several dystopian Hollywood productions.[5] The silhouette of a broken city similar to the bombed shells after an air raid during a war, is displayed in the background. There is no connection between the figurines and the backdrop of the destroyed cityscape that evokes the skyline of Manhattan. Scontrino uses elements of the visual landscape to interpret it with a new set of players: children (the author's three kids), faculty, his African-American partner at the time, and two female theater students who are fraternal twins and majors in Communication. All figures in Scontrino's reinterpretation of «The Cycle of Terror» are fully dressed and he uses scarce props to recall the visual particularities of the Graydon Parrish mural.

5 Examples are: The Day After Tomorrow (2004) or the recently release 2012 (2009), both directed by Roland Emmerich.

Fig. 8: Scontrino with his «players» in front of the 9/11 mural

This response to the 9/11 mural allows for several speculations on the role of art in evoking reflection and possibly interpretation. In some ways, Scontrino also translates the large canvas in a set of visual codes that were accessible to him: he is teaching graphic design as well as photography in a skills oriented program within the School of Engineering and Technology at Central Connecticut State University and has worked on his own photo exhibits parallel to his then full time employment at the college. Different from our students, Scontrino cannot be considered a lay-person since he is a highly trained photographer in his own right. But he also offered his own reading of an already mediated event. In this way, choosing photography, video or powerpoint presentations as a visual means to contemplate on communication offers new and exciting ways of stretching the concept of our academic field of inquiry. Similar to the call by Angela Krewani and Astrid Schwarz who would like their electronic database on images of science be used by students and fellow researchers alike, the possibility for pedagogical applications when allowing students to dive into their own repertoire of visual images and representation seems endless. Our University-Museum-Community New Britain Collaborative has decided to cut loose from replicating established art interpretations and thoughts and encourage students instead to explore their own creativity. In a century where manual labor and skills can easily be accomplished with less money and cheaper labor in post-industrialized societies overseas, American industry seems to appeal to human creativity again as a uniquely American force and passion.[6] One of

6 Microsoft has launched an advertisement campaign for several years now where young people with creative inclinations are being depicted, while painting, designing, making music. Behind their

the enduring charm (if you may want to call it like that) of American ingenuity is the dismissal of established norms such as historically correct thinking, for example. Instead of begging for an authentic art historical interpretation of an image or sculpture, we encouraged students to search for answers and responses that did not have to be measureable by standardized conventions of representation, evoking a flurry of activities, some of them very successful and compelling, others less so. The less convincing ones were also displayed during the «CCSU Night at the Museum», just not as well exposed as Antonio Scontrino's oeuvre that was placed next to the original 9/11 mural.

One of the key elements that Scontrino evokes in the background of the 9/11 mural is the devastation caused by human hands. In the original panel by Graydon Parrish heavy dust seems to have settled over a lifeless skyline. Just between the twin men, a sort of empty shell has cracked open and split in two. The skyline looks as if it is going to drown in the water that has already covered the pedestal of the Statue of Liberty in the back. Whereas the key scene of the mural is set on a thin stripe of sand that is reaching out of the sound, the figures are also surrounded by water, more like a puddle than dangerous waves who could engulf this group that has survived the tragedy. Graydon Parrish has called the painting a «cycle of terror and tragedy» because it is supposed to be interpreted as a cycle where the ends on the left and on the right connect. Similar to a flat world map where one is supposed to imagine that the edges connect to form the globe. This evocation of roundness is an abstraction that is difficult to imagine, especially since Parrish has painted the idealized beautiful bodies of the human subjects all in the foreground, like the figurines in a Christmas nativity scene, they are simply placed next to each other. Even though there is contact among the sets of people (the two boys are holding hands, two women are shackled together and the third woman has placed her lower arm and hand on the back of the woman in the middle), the vignettes themselves are detached. There is a suggested bond with the red ribbon between generations because the old man is holding on to a cloth that winds around the young girl's head, but there is no contact between any of the figures that would provide some kind of resolve. And there is no evident contact either to the world behind these people who do not wear visual markers that would indicate them belonging to the Twin Towers such as suits, ties, briefcases etc. The fact that all of them are more or less nude, suggests some kind of essentializing

backs, white drawings of potential software icons are super imposed. The text of one such ad, for example, featured in the same issue of the *National Geographic* that includes the article on brain science and the national parks by landscape architect Olmsted reads: «Your creativity may someday thrill the world. Start by finding your talent, developing it, then expressing it. The point is we all have the potential to do new things. A song, a drawing, a story, wherever your talent takes you, you inspire us to create software that helps you reach your potential. Microsoft.com/potential». (Microsoft ad. Your potential. Our passion. *National Geographic* 3, 2005). The idea of this ad is that American corporations can help you develop your individual skills because that is their «passion». A similar strategy is used when marketing electronic devices such as the blackberry. The marketing message is that great individualization allows for greater productivity and creativity.

gesture to depict the human species at the end of time… or as one of the trailers in Roland Emmerich's newly released dystopian science fiction action film *2012* (2009) says «The end is just the beginning», a banal truth to describe the fact that even if humans destroy themselves, something will emerge out of the rubble.

As fierce as the film critics bolted into Roland Emmerich's visualization of social angst, it may be useful to take a quick look at his «Endzeitvisionen», his visions of the end of the world. Of course, the main reference in a movie that spends 2.5 hours showing the end of the world in the year 2012 is the anxiety that built up after the major 21st century trauma for Americans, the fall of the Twin Towers. Roland Emmerich imagines a world that cracks open, where the surfaces break apart, similar to the cracked skyrise between the twin tower allegories in Graydon Parrish's mural. In the Hollywood blockbuster version of the end of the world, only a family can be saved, and a few lucky ones who are managing to board planes that the United States' government has supposedly built like the Arch Noah because they anticipated the end of the world coming. And decided to not tell anybody outside Washington about it. «So when will you tell the people», asks one of the government aides and gets shushed off. What is significant for this paper is the fact that Roland Emmerich does not employ aliens this time as in the first of this dystopian trilogy *Independence Day* (1996). It is nature itself that does the destruction of the human race, not an outside force. While tidal waves are crushing into Nepal where a lone Buddhist monk is trying to warn mankind of the coming disaster and his diminished figure gets simply washed away – his monastery on the tip of a mountain is being crushed like a house of matches – other parts of the earth are also breaking apart. Fireballs fall from the sky, the crust of the globe is ripped open by natural forces and the world erupts with one big lasting bang, wiping out years of civilization, including Saint Peter's Dome in Rome where tightly assembled catholics are desperately trying to pray the end of the world away. The icons of American superpower status such as a sophisticated aircraft transporter (yes, the same kind where George W. Bush announced theatrically the success of the Iraq Invasion on May 1, 2003 in his «Mission Accomplished» speech on the aircraft carrier USS Abraham Lincoln) is tossed around by approaching waves and is assisting nature in destroying Washington where the White House and other key icons are tumbling like a house of cards before getting swooped up in the ferocious forces of destructive nature.

In Graydon Parrish's allegorical painting one has to look for the culprits as well. There are no evil terrorists who have committed these crimes.[7] There are only props, two big toy airplanes that the children are holding. In Parrish's case of dysto-

7 When asked about the significance of the children in the 9/11 mural, students and faculty often disagree. Some see the children as being indicative for the lost innocence after the 9/11 trauma and the fact that children whose parents perished were left to carry the burden of the disaster. Others argue that the kids holding the airplanes are like the terrorists who did not know what they were doing when they flew the jets into the Twin Towers on 9/11 committing suicide in the cause of a fanatic idea and harming all passengers, woman, men and children while also destroying all those who happened to have entered the Twin Towers that morning.

pia, nature cannot be the source of evil because the waves in the foreground are as shallow as rain puddles. However, nature has also gone amok. The sky is filled with daunting reddish and grey powdery clouds (no chance of meatballs there!) that allude to dust. There is no sun or moon. This scenario is situated in a post-9/11 world where there is no more livable housing but where a small fraction of humanity has survived the tragedy, suffering from trauma and despair and unable to speak or share their experience apart from bewildered gestures of despair. One of the boys, the African-American man on the ground, the third Caucasian woman and the twin men themselves are all screaming in agony. But to whom? For what? They are reduced to essentials in their humanity like the human race before language? Their nudity confirms the suggestion that they are thrown back in time, even though the two boys and the young woman on the right are wearing t-shirts that belong there less so than the loin cloths of the male adults. However, the human beings are unscathed and there is not a drop of blood anywhere apart from the bandaged hand of the old man with a little blood stain that reaches up and visually helps to support the triangular composition of the painting where the Towers are the peak on top. The lighting on the bodies is perfect and there are hardly any shadows. It is not clear where this light is supposed to come from, given the cloudy-dusty background where not a single ray of sun can reach down to illuminate the grey facades of the broken human dwellings in the background.

Graydon Parrish's painting about «The Cycle of Terror and Tragedy» is a mental map, an artificial landscape to visualize what life after 9/11 or an even larger disaster (a la Roland Emmerich) could look like. In some ways it is rather cinematic because Parrish also deals with a screen, a flat surface that has little depth to it like a close-up on human kind in a lower end camera that does not produce good depth of field. It is similar to the depiction of a landscape in cartography as discussed in the article by Angela Krewani in this special issue because it takes stock of the world after 9/11 in an almost abstract way. This is not to say that the quality of the oil canvas with its lush colors of human flesh is not sophisticated but the composition of the remaining humans is very linear and artificial, almost naive. The cartouches of old world maps also visualize the inhabitants of the colonized countries in the foreground while developing a map of the continent in the background.

In Graydon Parrish's assembly of 9/11 survivors, race and gender are articulated because people with different colored skin are being shown. But the Twin Towers are white, young, athletic men and display no hint of cultural diversity. This fact was one of the driving forces behind Antonio Scontrino's re-articulation of the twins by choosing fraternal female students to represent the same idea but changing the sex of the towers and keeping them dressed in jeans and t-shirts to allow for a more contemporary adaptation. The twins now look like potential bystanders who were affected by the fall of the Twin Towers, not like young aspiring white professionals on Wall Street who have made sure that they are visiting their gym on the way back from work to keep in shape.

The scenario in «The Cycle of Terror and Tragedy» is obviously detached from reality and metaphorically evokes themes that are already burned into the memory bank, the databank of humanity. This is the fact that makes this painting appealing to a generation of students who were old enough to have experienced the fall of the Twin Towers although they are so removed from the period of the Cold War, the author of this article clearly remembers, that the fall of the Berlin Wall, celebrated in November 2009, does not mean anything to them. But 9/11 means everything to a society, deeply inflicted by a war in Iraq and Afghanistan that has not come to a foreseeable end. 9/11 is a turning point in American society when the sense of security and superiority was ripped apart. E. Ann Kaplan, one of several keynote speakers at the annual ANZASA conference in Sydney articulated this issue in her talk in 2008. She contends that Americans are haunted by a sense of having lost innocence, and are now paranoid by the idea of homeland security that is supposed to generate trust in government and the capacity of American intelligence again, pumping up hopes that the decrease of personal freedom and increase of surveillance strategies to detect signs of terrorism in civil society at its earliest stage would help guarantee a future to them and to their children. Kaplan describes this false hope as a form of paranoia, instigated by a government, eager to invade private spaces in the name of the public good. Of course, none of the figurines in Graydon Parrish's painting are holding a cell phone or are text-messaging to contact their loved ones in the falling towers. These humans are of a different time, pre-technology in a hypothetical age when people were not yet addicted to electronics, social networking and instant communication practices. The gutteral screams of the main protagonists would not work well when blasted in a cell phone receiver.

To whom do they call out? The position of the viewer is on the same level as the cracked tower in the background of the image. Spectators of the 9/11 mural are asked to look up to the towers and are drawn to the center of the image. As Mike Alewitz points out when he guides student tours, the viewer is not invited into the frame as Thomas Hart Benton does with his «Art of Life in America» from the 1930s. Benton appeals to the spectator to enter the painting by inviting the gaze to wander around the mural. Hands reach into the frame without a body attached as if those were the spectators' hands, for example (see Fig. 6). There are elements that are unfinished to invite the viewer to complete the thought. Graydon Parrish's highly artificial world, though evocative of thought, does not allow the viewer much wiggle room for interpretation. The actual scene is flat and gives little space – quite literally only a little sandbank surrounded by shallow water – to let the viewer wander. This lack of depth is similar to the dystopian fantasies of science fiction mainstream Hollywood directors: the world is coming to an end but there is no visible culprit. Ergo, we did it to ourselves. In 2012 nature has taken on the role of assassin and villain. Instead of seeking refuge in nature to recharge the batteries after a long day of work (before going to the gym to work out), the nature in Emmerich's sci-fi world is hostile, eager to divulge human kind with all its technological accomplishments (ie iconic buildings

such as the Vatican and St. Peter's Dome, the White House, downtown Manhattan etc) that crumble under its force like a house of cards. Graydon Parrish evokes such a detached relationship between humans and their environment as well. Half the floor of the painting is covered with shredded pieces of paper, the ripped up Declaration of Independence, a key document that constitutes and symbolizes American identity. It is also reminiscent of the millions of scattered pieces of paper that sailed like small paper airplanes down from the Towers when they went up into smoke. The other half of the ground is covered by lush, opened roses, the kind one would find on a Hallmark Sympathy card to indicate that the deceased person had a rich and fully lived life that had now come to a (hopefully) beautiful end. Rose pedals at the feet of the old man are alluding to decay and faded beauty but the other roses are still fully in bloom, despite the fact that they do not have a source of water and are therefore doomed as well. Empty hands of the twin tower allegories as well as the man on the ground and the old man as well as the young woman leave the question what they are trying to grasp? A reason for this disaster? Contortion of the hands is supposed to symbolize the artifice of suffering, similar to depictions of Jesus on the cross whose hands were nailed to the wood? But as mentioned before there is no blood apart from the hand of the old man.

In the end, Graydon Parrish's painting offers a postcard like snapshot of what he associates with 9/11. Commissioned in 2002, only a year after the Towers fell, it is an immediate response.[8] It provokes the question of what kinds of mental landscapes we produce when trying to capture a memorable event. Neuroscientists in Brooklyn and Brain specialists have just this year developed a substance, called «Skip» that has been successfully tested in mice.[9] When the material is entered into the brain mass, it makes traumatic memories evaporate. Mice who had experienced discomfort when approaching food, for example, forgot their previous experience and approached the same food again even though they were then subjected to electroshocks. As the *New York Times* reported, the neuroscientists who developed the new substance have great hope in the potential of the drug to either erase painful memory or bring back memory to the growing population of Alzheimer patients and the elderly with dementia. So, the idea of what kind of mental landscapes are remaining after humans have been included in the experiments is questionable.

8 Aimee Pozorski, an associate professor in the department of English at Central Connecticut State University, is writing a book-length study of representations of «the falling man» in literary and visual depictions of 9/11. In this work, she considers the sudden and impulsive criticism of 9/11 art (like Graydon Parrish's mural, The Cycle of Terror and Tragedy) as somehow failed in their perceived inadequacy to do justice to the event. Grounded in trauma theory, Pozorski's work recuperates these «failed» attempts to depict 9/11, particularly, figures of the falling man, by finding meaning in this crisis of representation. Rather than see these works as failures, she proposes that we consider them more carefully for what they can tell us about our own difficulties in imagining the traumatic impact of a fall.

9 For more information see the articles by Jim Dwyer: Memories: Good, Bad and Erasable. In: *The New York Times,* April 8, 2009 or Benedict Carey: Brain Researchers Open Door to Editing Memory. In: *The New York Times*, April 6, 2009.

Graydon Parrish's dystopic vision, contrary to Roland Emmerich's movie that will soon be distributed on DVDs before disappearing altogether, has a fixed space in the New Britain Museum of American Art. Its role as having been elevated to the status of a painting in an art museum may not protect it from being eventually discarded. That happened to Thomas Hart Benton as well. The mentor and teacher of Jackson Pollock was deemed unfashionable in the 1950s and the Whitney Museum in New York wanted to get rid of the large tableaus quickly and forever. The then director of the New Britain Museum, a muralist himself, seized the opportunity, grabbed the panels of the Benton mural and drove them back to Connecticut in a moving van, following in a cab behind. This is how «The Art of Life of America» made its way to New Britain. There, it is now in dialogue with its dystopic but equally idealized twin in the adjacent room in a beautiful new addition to the museum that has been opened for four years. Whereas Benton visualized the ideal of the good American in the 1930s who could pull him or herself up again by the shoestrings, Graydon Parrish has a less optimistic view of the future of mankind. Either allegorical vision of the world in 1932 or 2001 allows observers to ponder how his or her mental landscape is similar or differs from these artistic visions. This is why the idea of creating one's own mental landscapes in response to art is at the core of this article on applied responses to nature and environment.

Our students who voluntarily participated in the 2008-2009 student creative arts competition looked for themes and motives in existing paintings in the holdings of the museum to respond to them. Their goal was to find «nature and environment» in the objects/subjects. Of course, the many and frequent paintings of lush landscapes and see-scapes, reaching back to the sophisticated strokes by internationally famous American members of the Hudson River School, dominate the museum holdings.[10] Students were drawn to a contemporary installation by Lisa Hoke who is a New Britain artist. She assembled a large amount of colorful paper-cups in the hallway of the staircase that leads up to the contemporary and temporary exhibits on the second floor of the NBMAA. Students are mesmerized by Hoke's idea to have the paper-cups explode in rainbow colors from a center and mixing the everyday material of party goods with a larger idea of recycling or waste. It is also a response to the American everyday life but with innovative and different means. Hoke provokes the question, for example, how an average American family celebrates key moments in a year – St. Patrick's Day, Superbowl Sunday, Thanksgiving, Christmas, Children's Birthday Parties, Graduation Parties etc. All these events are being represented by party goods that hold images and visual references (smiley faces, glover, Santa Claus etc). Instead of using familiar icons that belong to our repertoire of language as Joseph Beuys did in 1971, Lisa Hoke develops a new visual language, equally as fleeting as the vanishing scribble on Beuys' blackboard. Hoke's paper-cups are already collecting dust (and are certainly a challenge to clean because they are mounted high up) but they

10 To get a better idea of the museum collection you can visit the website of the New Britain Museum of American Art at www.nbmaa.org. There is a virtual tour available online.

Fig. 9: Middletown Bridge. Photo collage by Amy Roy

are a rather impressionistic view of contemporary American culture. Students found the fact to have an installation with the retail value of about $300 Dollars in papercups mounted in an art museum fascinating and amusing. They started building similar responses, one student even replicated the entire installation with little colorful beads that he glued on a folding surface. We exhibited his work and interpretation on the balustrade of the second floor to show that he invoked some of the same ideas. When the student saw that we had found a special exposed spot for his work, he immediately called his parents and grandparents on his cell phone to ask them to join us during the «CCSU Night at the Museum» to admire his success.

Several other student responses were placed adjacent to the work of art that had inspired them: The painting of a large bridge in Middletown, CT, inspired Amy Roy to a photo essay where she visited the site and photographed the bridge from different angles.[11] The large painting of a Chinese geisha that has been purchased by the NBMAA after a temporary exhibit by Chinese-American contemporary artists was re-interpreted by a visiting undergraduate student from China. She crafted a box that opened up to reveal icons such as butterflies that she was able to understand and decode contrary to her American classmates who were not familiar with these

11 Amy Roy also contributed a well edited music video on nature and environment. She was also the lead editor of a short videotape on the environmental musician Michael Pestel from Wesleyan University whose unusual work was on display in the CCSU university art galleries in March 2009. Another exhibit on «Sustainable Art» followed concurrently to the exhibits at the New Britain Museum of American Art in April, 2009, curated and facilitated by CCSU art historian Elizabeth Langhorne.

Fig. 10: Chinese Geisha with little treasure box

allegories of goddesses and beauty. The Chinese student also edited a power-point presentation with flowing images of flowers and butterflies as well as depictions of goddess figures to capture the sense of the mental landscape laid out before her by the young Chinese-American original artist.

Even though the original idea to ask faculty to draw on their own imagination to come up with a visual depiction of their mental landscapes in their respective disciplines did not take hold (not yet at least!), we succeeded with the second «CCSU Night at the Museum» on nature and environment to ask our students to reflect on their immersion into environment and their own (at times marginal) relationship to nature.[12] At the outset of the semester I asked all of my students in four classes if they recalled having been in nature for the last time and how many hours, mi-

12 In his 2008 National bestseller book *Last Child in the Woods. Saving Our Children From Nature-Deficit Disorder*, Richard Louv's analyzes the correlation between attention deficit disorder in many American children and relates those phenomena of increasing mental health issues in children to the lack of exposure to nature. The insight that many children in contemporary society do not have opportunities for unstructured free and imaginative play in the woods, encouraged us to launch our most ambitious idea, namely building a NatureScape in an urban New Britain elementary school as one of the activities surrounding the «UMC New Britain Collaborative» on nature and environment. Chez Liley was the spark that set this idea in motion and coordinated the efforts (including writing grants, contacting builders as well as providing free wood and materials from her large farm in rural Connecticut). Her reflections are included with an essay in this volume as well. Chez Liley is a writer and artist. She has been married to Paul Winter, internationally famous jazz saxophonist for fifteen years. Due to her involvement, Paul Winter was available to play a public solo concert in April 2009 to conclude our UMC events in mid April, 2009.

nutes they had spent there? The responses were devastating to hear, especially for somebody of German descent who still holds on to the ritualized elaborate Sunday outings and hikes in nature. Some had been skiing or snowboarding, some recalled having been on a beach in Florida during spring break, but most students claimed not to have any time left in their busy schedules to dwell in nature. I warned them that they would have to spend some time in the outdoors in the coming semester to help us build a so-called «NatureScape», a natural playground made from all natural materials to build a refuge for elementary aged children in the New Britain public school system. Very few followed that call to so-called community engagement.[13] But many students actively participated in our celebration of the arts during the «CCSU Night at the Museum» and were impressed by the level of professionalism their fellow students showcased in their artistic work as well as their performances. Contrary to Graydon Parrish's dystopic vision of speechless humans who are only thrown on an island as a remnant of the human race, the New Britain Museum of American Art allowed us to meet in a safe and rich environment to reflect and learn about the way artists have conceptualized our world and everyday life as well as dare to participate in this creative dialogue actively ourselves.

One can successfully ask lay people and, of course, children, as non-artists to produce responses to art! They will begin to translate their concepts of reality into unexpected new visions (like the one female student, Aril Grain, an outspoken environmental activist, who handed in a self made dress!). This process of re-envisioning can be regarded as a contemplative form of communication but no less creative than researching and writing an academic paper, for example, the more traditional film review or visual analysis of an advertising image that we assign in classes in mass media such as «visual communication», «women and film», «images of gender» and «intro to mass media». Our concept of the University-Museum-Community Collaborative tries to cut loose from containing thoughts and allows free association. Instead of being physically in nature, students were engaging with the reproduced artistic responses to nature and environment that they encountered in the museum collection. These images had been filtered once already in the artistic process and were filtered once more by our own students. Allowing students a productive space to express their creativity (like the Microsoft ad suggests) evokes passion – not only in the instructors but also in the students. It allows for a creative way of applied pedagogy, a form of ubiquitous learning to use a more fashionable term. Not only through powerpoints can students engage with a visual language that they are so increasingly comfortable with but also via video production and creative projects like puzzles, photography and photo collages. The creative arts competition provoked participatory responses, similar to those envisioned by the

13 A 30 minute documentary about the building of the NatureScape and the UMC New Britain Collaborative, entitled «Where Art Meets Nature: The NatureScape Project», is available upon request. It was produced, shot and edited by Ryan Wark with the assistance of Chez Liley, Willis Bowman and Karen Ritzenhoff. For a free copy contact: Ritzenhoffk@CCSU.edu

editors of this special journal with their digital database on scientific images. In our case, the museum holdings provided the so-called database. In a world where manual labor and manufacturing are quickly outsourced to developing countries in a renewed version of colonization, encouraging creativity in our children and youth gains increasing weight.

Maybe this is the key to understanding the value of this case study of applied art education: mental landscapes can be cracked and re-envisioned into new visual landscapes. And that process seems a whole lot easier than getting this generation of twenty-some-year olds back into the woods.

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Chez Liley

No Child left inside

A NatureScape Playground as A Community Engagement Project

In April, 2009, concerned about «nature-deficit disorder» in children in the US and the lack of opportunities for kids to experience nature, a group of volunteers gave their time and efforts to build what they dubbed a «NatureScape». This natural playground was built at Jefferson Elementary School in New Britain, a major industrial city of approximately 70,000 people, about two hours north of New York City, in Connecticut, on the east coast of the United States. In the following article, Chez Liley, project manager, describes why the NatureScape was important, and what it took to make this «out-of-the-box» idea a reality. The NatureScape was part of an initiative «Where Art Meets Nature», by the so-called University-Museum-Community (UMC) New Britain Collaborative formed between Central Connecticut State University, the New Britain Museum of American Art (NBMAA), and the local community, coordinated by CCSU faculty member Karen A. Ritzenhoff (for more information see Ritzenhoff's article in this issue).

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In the US, in the space of a generation, the landscape of childhood has dramatically altered. Kids are spending more and more of their time indoors. New findings from The Nielsen Company, which measures media consumption, show kids aged two to five now spend more than thirty-two hours a week on average in front of a TV screen; ages six to eleven spend about twenty-eight hours per week, a little less time than the younger kids because they are more likely to be attending school for longer hours.[1]

When kids do go outside, it tends to be for time spent in structured activities – for example, playing organized sports. In his 2008 book, *Last Child in the Woods: Saving Our Children From Nature Deficit Disorder*, Richard Louv coined the term «nature deficit disorder» to describe kids' disconnect from the natural world and its impact on childhood development, including increased childhood depression, attention and learning disorders, and increased obesity and related health issues. (On average, one in three children in America are overweight or obese.) Why kids are spending so little time outside can be attributed to a number of factors, including increasing urbanization and the layout of neighborhoods, parental fears about

1 Blog on October 26, 2009 by Patricia McDonough, SVP Insights, Analysis and Policy, The Nielsen Company. These statistics by the Nielsen Report are also listed on the website of the «No Child Left Inside» Coalition. http://www.cbf.org/Page.aspx?pid=687 (Retrieved December 8, 2009).

safety, time pressures, and educational constraints, which are affecting the way children relate to and understand the world around them.

Why kids need nature has been articulated by writers such as Stephen Trimble and Gary Paul Nabhan in *The Geography of Childhood: Why Children Need Wild Places,*[2] and Mary S. Rivkin in *The Great Outdoors: Restoring Children's Right to Play Outdoors.*[3] But Louv's book has recently caught the attention of the national media and introduced these concerns to a larger audience. Louv's work brought together a range of research that shows how nature is important for healthy human development: direct involvement with the natural world fosters brain development, increases attention span and concentration, and promotes healthy physical, intellectual and emotional growth. Problem-solving skills, motivation levels, and self-esteem are all improved. Frequent interactions with nature give children the sense they are connected to something larger than themselves. Moreover, some immersion in wild nature nourishes people on some deep level scientists still can't pinpoint – perhaps because only nature engages all our senses.

Louv's book also gave momentum to the burgeoning campaign in states across the US, called «Leave No Child Inside». The No Child Left Inside Coalition (NCLI) is an alliance of environmental, educational, and public health organizations, and businesses, civic groups and other public enterprises, formed to alert Congress and the public to the need for US schools to devote more resources and attention to environmental education. The campaign intends to remedy effects of the «No Child Left Behind» Law, signed into effect by former US President George W. Bush in January 2002, which pressured schools to focus on high stakes test subjects such as math and language arts at the expense of other curricula, including science, field-based experiences and outdoor learning activities which were cut in order to spend more time on tested subjects, and to the detriment of outdoor playtime. According to NCLI,

> «The No Child Left Behind Act has fundamentally changed the way that education is delivered in this country. It has defined the core content that all students in the United States must learn to be considered proficient at each grade level.In many school districts, this has translated into teaching only those subjects and standards that are assessed.»[4]

A disconnect from nature is at the root of many of the grave challenges that younger generations will have to face, including global climate change and its repercussions. Children are becoming more aware of global threats to the environment at the same time that they have less direct contact and connection with nature. Learning about nature and understanding its processes and interconnections are educational tasks essential for creating an ecologically sustainable society. But current educational

2 Stephen Trimble, Gary Paul Nabhan, *The Geography of Childhood: Why Children Need Wild Places.* Boston, 1994.

3 Mary S. Rivkin in *The Great Outdoors: Restoring Children's Right to Play Outdoors.* New York, 1995.

4 http://www.cbf.org/Page.aspx?pid=687 and http://www.nwf.org/news/story.cfm?pageId=CA3BDF3E-5056-A868-A0A176C5FB74B49E (both retrieved December 8, 2009).

constraints under the No Child Left Behind Act – with the inevitably narrowed science curricula in response to stringent assessment criteria, limiting the amount and variety of environmental education as well as the kind of multidisciplinary teaching that it fosters – will leave the upcoming generation ill-equipped to deal with the future. The kind of attitude and involvement we will have towards nature in our later years – including our pattern of physical activity and interest in understanding the world and the larger community of life – is established in early childhood. Kids have to fall in love with nature or some aspect of it in order to grow into adults who care about the planet they live on.

So, given the degree of nature deficit in the US, what can a parent/school/community do to contribute towards a solution? Our institutions, including schools and our current consumer-model educational system that divides knowledge into specialized parts, is designed around this fundamental disconnect between people and nature, so only radical measures can affect the underlying issues. In this light, our response of building a new playground seems a very small and palliative remedial step. But this was going to be a playground with a difference.

Our plan was inspired by the Nature Action Collaborative for Children (NACC) – currently, around 1,400 architects, community planners, early childhood educators, engineers, environmental educators, environmental activists, health specialists, and landscape architects from six continents are members of NACC – and the work by these members to create environments for children that better facilitate a connection with nature.[5]

We aimed to create a little play area – we called it a «NatureScape» – with elements to encourage imagination, natural materials to provide sensory stimulation, and adjacent gardens to give pleasure as well as opportunities to learn about natural cycles and processes. The NatureScape was to be a community engagement project, part of a larger initiative, «Where Art Meets Nature», exploring ideas around nature and environment and sustainability. This took place in April 2009, under the auspices of a collaborative that linked Central Connecticut State University, the New Britain Museum of American Art and the city itself, called University-Museum-Community, or UMC, New Britain Collaborative.

We had contacts at Jefferson Elementary in New Britain, a major industrial city. The school is in a low-income neighborhood of mostly working-class/working poor families. We brought our idea to Nancy Sarra, Jefferson's bold and enlightened principal, who remembered playing outdoors as a child and knows that «being outside is good for children». She welcomed the idea for the project, and so did her colleagues. (2008-2009 was Sarra's first year as principal of Jefferson, and we had approached her in her first weeks on the job. Her predecessor, Meg Walsh, an administrator in the New Britain school system, had helped to facilitate the initial contact and also lent her support for the Naturescape project.)

5 http://www.worldforumfoundation.org/wf/nacc/index.php

Sarra and her colleagues favored a site for the NatureScape that was among a small grove of oaks, where the children were naturally drawn to play. The area was on a patch of level ground roughly thirty feet in diameter between the asphalt play area and a chain link fence, which had been ripped and curled back to create a gap where people could enter, and a well-worn path led up from the housing development at the bottom of the hFig.

Sarra did not want a manufactured playscape – one already existed at another nearby school, but she was intrigued by the idea of natural structures that called forth inventiveness and imaginative games, pointing out that her neighborhood kids have little background knowledge in different ways of play. (Jefferson has an ethnically diverse student body, many of whom are new immigrants.[6]) «To move forward academically, we need to look at social and emotional and other pieces, at the whole child, which in our education system is often neglected», said Sarra.

Ideas for the NatureScape moved in the direction of trying to offer the kind of exploration and adventure of a walk in the woods: tree parts to climb on and over, a «secret» place to discover and crawl through, and all the rich opportunities for the imagination those present. Kimberly Jackson, coordinator of the Family Resource Center located at the school, welcomed the NatureScape because «it allows hands-on learning with materials the children have perhaps not had a chance to play with», at the same time as encouraging hand/eye coordination and physical development in the younger children. Of course, the NatureScape had to meet safety regulations, be low-maintenance, and sturdy, since it would have to withstand a lot of use. (Jefferson has about 420 students as well as children in the after-school programs, and visitors to the Family Resource Center.)

As for the Naturecape's design, we knew of several renowned landscape architects in the field, including Robin Moore, Rusty Keeler, and the design team at the Arbor Day Foundation. However, their costs were prohibitive for our budget of about $10,000. (For comparison, in my town, twenty-five miles away, a new manufactured metal and plastic standard playground was installed for around $250,000.) Ironically, all-natural can be expensive: in a catalog of «Nature Explore Resources» by the Arbor Day Foundation and Dimensions Educational Research Foundation, which sells «field-tested natural components for outdoor learning», a set of three log edging sections, 24" high x 12" wide x 4" diameter, to add a rustic look to a structure, costs $ 129.99; a stool made of 12" red cedar stumps with the bark removed costs $ 109.99.

Ritzenhoff knew Willis Bowman, an engineer from St. Paul, Minnesota, and she had visited the University of Minnesota Arboretum's all-natural playscape he had created. In the fall of 2008, photographs of these whimsical structures were shown to Sarra and her staff, who were delighted, and they approved a design Bowman came

6 The New Britain school population comprises 65.1% minority students; 16.0% special education; 58.9% non-English home language; 50.2% economically disadvantaged. http://www.csdnb.org/about.html. (Retrieved Dec.8, 2009)

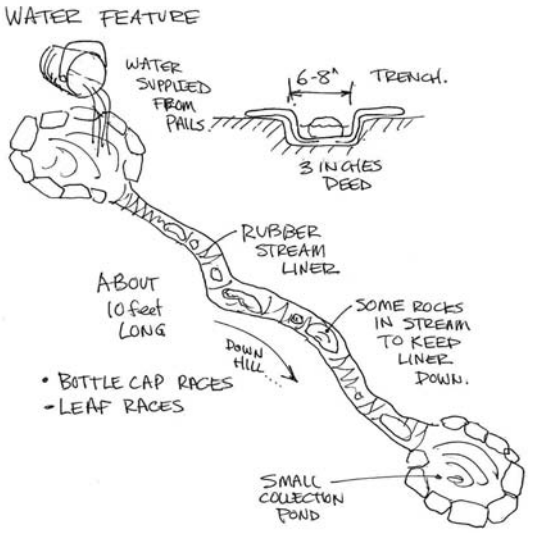

Fig. 1: Skizze Willis Bowman

up with for Jefferson, composed of elements that would be robust and fairly simple to make, but would look intriguing and pleasing: two climbing structures, a tunnel, a water feature for floating bark boats and experimenting with water flow, and a sorting table within an enclosure, all fitting within the space outlined by the standing trees.

The NatureScape's ground-breaking ceremony on April 16, 2009, involved the entire school, plus some mothers and their small children from the neighboring Family Resource Center. Vice President and Provost of Central Connecticut State University, Carl Lovitt; New Britain's mayor, Timothy Stewart; Kate Miller, of The Hartford Courant Foundation, which had supported the project with a grant of $8,000 Dollars; and Meg Walsh, former principal of Jefferson Elementary School, were among the dignitaries who lined up on the slope and ceremoniously touched their new spades to the earth. Alongside the adults were several student representatives. In contrast to the grown-ups' symbolic gesture of breaking ground, the kids went earnestly to work with post hole diggers, shovels, trowels and other tools, enthusiastically opening the soil and digging deep, long after the ceremony was over. They took the ceremony literally, believing they were making a real contribution to the project with their labor, never mind that the actual location for the NatureScape lay twenty feet behind them.

The following day was the start of the school spring vacation. All Jefferson families had received a flyer in both English and Arabic explaining the project and inviting their participation. Bowman arrived from Minnesota and worked on-site every day for the next ten days to implement his designs for the NatureScape. The wood came from my farm about thirty miles away in northwestern Connecticut. Saplings of beech and birch were cut to lengths and ferried to the site by Ritzenhoff's pick-up truck. A local forester donated lengths of cedar, known for its durability, and attractive, with its fragrant crimson inner wood.

Because there was no power outlet nearby, and the school was closed for vacation, all the construction work for the NatureScape and gardens was done by hand, with simple power tools, wheelbarrows and buckets. Holes were laboriously punched out of the rocky soil using muscle power and post hole diggers. The rocks probably added

20% more time to the entire playground creation process. First the fence was laid out. Originally Bowman had imagined an enclosure made of large tree limbs turned upside-down and fastened together. However, available materials dictated a new plan: a low wattle fence made of long saplings or branches interwoven around posts. Wattle fencing is fairly easy to build, strong, can be repaired and looks unusual. Inevitably, the final design of the playground was shaped by the materials, which dictated to a certain degree the ways they could be used. «I couldn't take the time to straighten out a big log, so instead I had to move, flip, or bend it to fit», Bowman said. «Building with natural materials meant I had to use all the wood to its maximum efficiency. My design had to be as flexible as the wood!»[7]

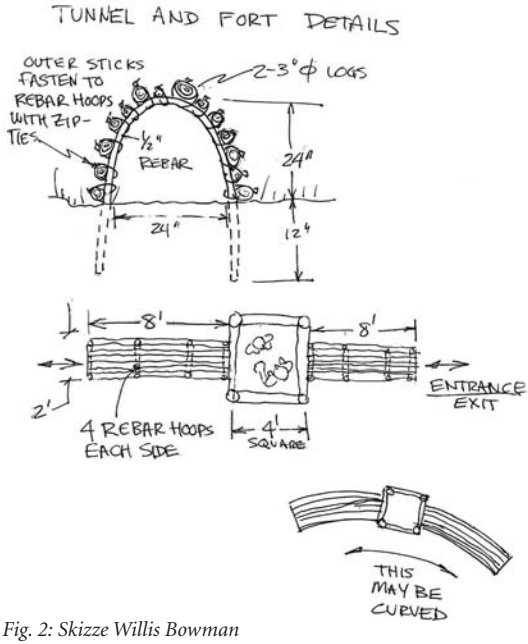

Fig. 2: Skizze Willis Bowman

Bowman's overall plan was based on the idea of movement along some sort of path to a small, intimate place where the kids could look out to a larger one. «Children love to play in these intimate spaces and be led there with fun paths (tunnel and steps). The result is very different from a typical steel, concrete and plastic playground where intimate spaces are eliminated.»[8]

In the first few days, a few children stopped by and were invited to help, under Bowman's supervision. They had never used a hand drill or carpentry tools, were proud to be entrusted with the responsibility, and enjoyed the work. In the following days, some parents came to help. One father was a construction worker and designed and built two teepee-like structures. Kids of all ages enjoyed making various sized balls of twisted bittersweet vines, which were to be hung like constellations from upper branches. To the kids' excitement, the local fire department arrived in a shiny engine and clambered up ladders to secure the balls at the desired heights. The balls swung gently and cast intricate shadows on the ground. Bowman wrote:

7 Willis Bowman, Write Up, April 2009, unpublished manuscript.
8 Ibid.

> I want the children who use the playground to appreciate the wood and how it can be used. There may be some kids who have never seen the inside of a branch or don't know that a row of simple limbs can make a deck or bridge. I hope that perhaps they can build something similar in their backyard. I tried to use as much natural material as possible, though I did have to make some concessions, as wood is not the ultimate material. I did employ some steel rebar for the arch supports in the tunnels, a rubber pond liner in the water feature, zip ties for the vine balls and wattle fence, and of course metal screws to hold the whole thing together. Still, the amount of non-natural material is minimal and the kids can appreciate the feel of wood and rocks. The use of a natural playground is different than a traditional steel and plastic one. I made this playground so that play would be fueled by imagination. Typical playgrounds dictate how the play will happen – for example, featuring pirate ships or space rockets… . My forms are somewhat non-descript, enabling the children to think of them in any way they choose. I'm a big fan of exercising the imagination muscle. I think this playground will help the kids do so.[9]

Alexis Brown, a landscape artist, designed the sensory garden, featuring mostly native perennials – low maintenance, hardy species that would provide shade and texture, color and fragrance, while creating the idea of an intimate space. Special education teachers at Jefferson were excited about the garden, which they believed would particularly benefit kids with special needs; Sarra and her colleagues also imagined students enjoying the space for picnics, and for quiet reading times. The garden was laid out beyond the NatureScape and the chain link fence, near a community softball field, with the plantings centered around the two mature oaks close on one side of the path into the school yard. Five yards of compost were a donation from a local supply company; Steven Kliger, Executive Director of the Center for Public Policy and Social Research (CPPSR) at the University, Andrew Clark from the Institute for Municipal and Regional Policy (IMRP), and Alexis Brown, helped purchase and donate plants. While we were working on the beds, a neighbor, an elderly man who had apparently complained to the school about the unkempt state of the grounds abutting his property fence, came over to watch us. After a while, he beckoned us towards him. He leaned as far as he could over his fence and wordlessly handed us smooth and flat rocks like a peace offering from his own yard to make paths in the new garden.

Every day, we picked up litter – a flotsam of candy and condom wrappers, plastic beverage containers, windblown drinking straws. A mountain of woodchips was delivered for mulch, and had to be dispersed by hand. While the adult volunteers groaned at the prospect of hauling wheelbarrow loads up and down the incline, the children set enthusiastically to the task, swarming over the mound with plastic buckets and little trowels. They delighted in seeing the pile diminish before their eyes. They were proud of their hard work, of getting the job done. Other children helped set in the plants. For most of them, it was the first time they had ever plant-

9 Willis Bowman, op.cit.

Fig. 3: Climbing Tower at NatureScape

ed anything. A boy took on the task of watering the plants, sloshing water from a bucket, since the large can was too awkward for him.

Adjacent to the asphalt, ground was dug for the butterfly garden. First a rototiller (donated by a hardware store) broke the sod; then by hand we raked and pulled out clumps of turf, which were hauled away in buckets. For the children who helped, sticking their hands in the soil, discovering worms and feeling the cool earth were new experiences. Sarra, her husband and a teacher, along with kids and other volunteers, spent a hot afternoon planting the prepared beds with perennial and annual species that would attract pollinators. Later, seeds were distributed to the teachers for classes to plant; the art teacher was going to have her students create their own unique stepping stones for paths between the plants. Sarra was keen to use the butterfly garden as a sort of outdoor science lab. She was hoping the upper grades would take on the opportunity and responsibility of caring for it.

The evening of the last day of construction, while we were clearing away tools, a couple of families wandered up from the development below, through the chain link fence gap, and asked if the kids could play. The children happily clambered on the structures. The parents examined the various elements, fingering the wood in its quirky shapes, and expressed approval. The surrounding fence gave the look of an African boma or a Stone Age settlement, filtering the hard spring light into an

intricate network of shadows. The stately entrance between two large straight oaks looked like a portal to a whimsical kingdom of knotted branches and twisted vines. The sorting table was stacked with supplies of building blocks of circular birch pieces with the soft peeling outer skin, and cool beech with its textured bark, and loaded with supplies of tiny hemlock cones and large spruce cones and a variety of acorns in their cups.

The next morning, at the official opening of the NatureScape, the entrance between two oaks was sealed with a red ribbon. The kindergarteners had been chosen to be the first class to officially play there. They sat on the grass while Sarra explained that accompanying the privilege of a new custom playscape came the responsibility of treating it respectfully. A voice cried «Help! There's a snake!» Sarra crouched down to look at the offending creature, and said, «No, that's a worm». A member of the class proudly cut the ribbon and the kids rushed in behind her with whoops of delight. At lunch break, the doors to the yard burst open and the entire school seemed to be charging out towards us, yelling «NatureScape! NatureScape!»

To tie in with the NatureScape, the project funded workshops[10] at the school by another local institution, the Eli Whitney Museum in Hamden, CT, which teaches experiments to encourage design and invention.[11] «We jumped on this opportunity», said Sarra, delighted by the chance for hands-on learning for all 420 pupils, grades K-5, over three days. «It's a challenge in education today to have hands-on learning», said Kimberley Jackson of the Family Resource Center, who thought the workshops were «outstanding». The children built models representing different cultures – for example, Yemeni dwellings with figures in ethnic costume, and dwellings with walls brightly patterned in designs reminiscent of the Ndebele culture of South Africa. The children's finished models were displayed at the New Britain Museum of American Art during the «CCSU Night at the Museum» on April 15 and 16, 2009, which the children visited to view their artwork. One of the models was chosen as the basis for a structure by the butterfly garden, featuring panels of art to be designed by the graduating fifth grade class as their «legacy» to the school for the year. Designed by Clifford Andersen of Central Connecticut University's engineering faculty, the Ndebele wall was begun by Andersen and the mayor of New Britain himself, Timothy Stewart, with his friend, Leo Camosci, owner of a construction company, who provided the power shovel machine.

The work on this last part of the design was completed in winter 2009.

10 Additional funds for the building of the NatureScape, the «CCSU Night at the Museum» as well as the workshops at Jefferson Elementary School, facilitated by the Eli Whitney Museum in Hamden, CT, were provided by several grants, administered at CCSU: the UPBC Strategic Grant 2008-2009; a CCSU Community Engagement Grant 2008, administered by CCSU's Institute for Municipal and Regional Policy (IMRP); a grant by the Connecticut Commission on Culture and Tourism as well as funds provided by the CCSU Alumni Office, Student Activities, Institutional Advancement, the School of Engineering and Technology, the School of Arts and Sciences, and the Office of the Provost.

11 http://www.eliwhitney.org/ (Retrieved Dec.8, 2009)

Outcomes

At the end of the project, aside from the experience of the workshops, the school had the completed NatureScape, the planted butterfly garden, the planted and mulched sensory garden complete with benches, three cherry trees along the chain link fence to cast some shade and provide flowers and color, and shrubs planted to beautify a small section of the pathway. The school was also given tools, including sets of all-purpose buckets, children's work gloves, and children's and adult's gardening equipment. Three local papers had picked up the story and published positive articles.

The NatureScape project was an attempt to represent a different aesthetic, to show new possibilities. It was made on a comparatively humble budget, with generous donations and contributions of time and expertise. We felt some sense of triumph in that it was completed, and was beautiful, and pleased the children, parents and teachers. «It's neat. It's different», said Joseph Lweko, the father who had made the teepees, admiring the uniqueness of the NatureScape. «It's not commercialized, not like any other playground». Certainly, the project strengthened relationships and developed many new ones, especially between the university and the school. Meeting and interacting with university students gave Jefferson pupils «a beautiful example of what they might become», remarked Kimberly Jackson. «The kids and other volunteers were part of helping to make the community better – for others as well as themselves», said Steven Kliger – «The NatureScape will help the kids see what could happen when people from different parts of the community come together», said University Provost Carl Lovitt. Sarra, who considers that the New Britain public schools are often underestimated in what they can accomplish, was supportive of our multi-layered approach to serve her community.

The project partners – institutions and individuals – learned a good deal from the experience. Jefferson has plenty of challenges: test scores are low; many children are recent immigrants and are still learning to speak English. We found out how hard it is for a school with its few resources already overstretched to take on a new project, even if it is predominantly a gift.

At Jefferson, the grounds are open to the public after-hours, where older kids inevitably play unsupervised on structures designed for younger ages.

Vandalism had been a concern, and there was some damage: A couple of the NatureScape's wooden supports had been chopped; parts of the fence were beaten down; two of the cherry trees planted along the fence had been mutilated. But the vandalism was relatively mild and only highlights the underlying issues that prompted the NatureScape in the first place.

Some elements of the NatureScape turned out to be impractical. The water feature, for example, even though on paper it had been approved by the school, in reality had too many moveable parts that disappeared. We realized we needed to make modifications to the basic design of the NatureScape structures.

As for the gardens, it takes time to develop a gardening club, and the success of that undertaking depends on staff with gardening experience, let alone extra hours

Fig. 4: Opening Day of the NatureScape

and surplus enthusiasm. Ironically, the educational constraints and demands that had led to the lack of hands-on environmental education and field research for science also meant that there was little energy or time to make use of the resources when they were provided. By October, the butterfly garden had vanished. Apparently the weeds had been allowed to take over. Sarra said the ground had been too hard for the children to weed and they had grown discouraged. The larger shrubs had disappeared without trace. Maintenance staff had mowed over the rest and let the grass grow back. The sensory garden, however, had grown in nicely, and the cedar benches, which could easily have been carted off, were still in place.

Another lesson is how relationships created by the project have ripple effects we could have never anticipated. A surprise offer of help came from the CCSU girls' softball team. One member had been in Ritzenhoff's visual communication class in the spring semester of 2009, and had heard about the NatureScape. When her coach asked for suggestions for a community engagement project for the team, she recommended the playground. One afternoon, her team of volunteers arrived at Jefferson and raked leaves, weeded the sensory garden, and planted bulbs donated by Alexis Brown, who also showed up to help. And while the garden lies dormant this winter, the softball team has committed to come to Jefferson every Friday to help with the reading program.

The girls' softball team symbolizes the human relationships that, as part of the larger context of the UMC initiative, will give the project momentum and enable it to grow and change. After the winter, we will implement the lessons we've learned regar-

ding what works and what doesn't. We will hire a carpenter to modify the structures to be more durable; and the children will be playing on NatureScape again in the spring.

A video documentary of the making of the project was created by Ryan Wark from the CCSU Technology group in the Academic Technology Division. This DVD, «Where Art Meets Nature: The NatureScape Project», is available from Ritzenhoffk@ccsu.edu. Willis Bowman has been commissioned to create another NatureScape in Connecticut in the spring 2010.

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Abbildungsnachweise

Titelbild
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Stefan Aumann
Alle Abbildungen aus der Datenbank http://bildkulturen.online.uni-marburg.de

Astrid E. Schwarz
Alle Abbildungen aus der Datenbank http://bildkulturen.online.uni-marburg.de

Alfred Nordmann
Fig. 1: Matthaeus Merian (ed.): *Topographia und Eigentliche Beschreibung der Vornembsten Stäte, Schlösser auch anderer Plätze und Örter in denen Herzogthümern Braunschweig und Lüneburg, und denen dazu gehörenden Grafschafften und Landen*. Frankfurt 1654, pp. 31–33, 63.
Fig. 2: ©1997, Center for Innovative Computer Applications, Indiana University, Bloomington. http://inkido.indiana.edu/a100/handouts/Image116.gif (accessed Dec. 23, 2009).
As for Fig. 2, an effort was made to contact the copyright holder. The Center does not appear to exist anymore and it proved impossible to contact the copyright holder.

Angela Krewani
Fig. 1 & 3: NASA (www.nasa.gov/multimedia/imagegallery)
Fig. 2: Foto Marburg
Fig. 4: guimond.files.wordpress.com/2008/10/jan_provo...
Fig. 5: The British Museum, London
Fig. 6: Kupferstichkabinett, Dresden
Fig. 7: http://bildkulturen.online.uni-marburg.de/

Karen A. Ritzenhoff
Fig. 1: Adolf-Luther-Foundation, Krefeld
Fig. 2: Screenshot Gus van Sant A Beautiful Mind (2006)
Fig. 3–10: Bob Wessmann, Leroy Temples, Michael Ritzenhoff

Chez Liley
Fig. 1 & 2: Willis Bowmann
Fig. 3 & 4: Original photographs by Willis Bowmann

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Stefan Aumann, M.A. Studied History, and English Literature at the University of Göttingen and at Trinity College (Dublin). He finished with an M.A. in 1995. After that he worked as research assistant at the Max-Planck Institute for History in Göttingen and taught as adjunct professor in Moskau and Salzburg. He has worked at the Herder Institute Marburg and is momentarily research assistant at the computer centre of Philipps-University Marburg. His special research are computer sciences within history and data management.

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Chez Liley is a writer and mother who lives in Litchfield, CT.

Alfred Nordmann After receiving his Ph.D. in Hamburg (1986) and serving on the faculty of the Philosophy Department at the University of South Carolina (1988–2002), Nordmann became Professor of Philosophy and History of Science at Darmstadt Technical University. His historical interests concern the negotiation of contested fields of scientific knowledge such as theories of electricity and chemistry in the 18th century, mechanics, evolutionary biology, and sociology in the 19th century, nursing science and nanoscale research in the 20th century. In particular, he studied the scientific contributions of Georg Christoph Lichtenberg, Antoine Lavoisier, Joseph Priestley, Charles Darwin, William Bateson, and Heinrich Hertz. His epistemological interests concern the trajectory that leads from Immanuel Kant via Heinrich Hertz and Ludwig Wittgenstein to contemporary analyses of models, simulations, and visualizations.

Karen A. Ritzenhoff is an Associate Professor in the Department of Communication at Central Connecticut State University. She is affiliated as a faculty with the Women, Gender and Sexuality Studies Program (WGSS) as well as cinema studies and the honors program. Ritzenhoff teaches courses on women and film, Western Thought, global visual communication, mass media as well as television production. Her latest book on *Screen Nightmares: Video, Fernsehen und Gewalt im Film* (2010) is published by the Schüren Verlag in Marburg and was written in German. In the spring 2009 she co-edited a volume with Dr. Katherine Hermes on *Sex and Sexuality in a Feminist World* (Cambridge Scholars Publishing, 2009). Ritzenhoff has presented her work in a variety of interdisciplinary conferences, among them «History and Film», the German Studies Association, «Consoling Passions» and ANZASA in Sydney, Australia.

Astrid E. Schwarz was trained both in philosophy and biology. After finishing her diploma in experimental ecology and her PhD in the history and philosophy of ecology, she got a post-doc grant in Paris. From Paris she came to Darmstadt and joined the Institute for Philosophy. Between October 2006 and September 2007 she was a fellow at the Center for Interdisciplinary Research (ZIF, Bielefeld). Her main issues in the philosophy and history of science are the investigation of the status and power of concepts and images in the process of generation, stabilization and demarcation of scientific knowledge. Case studies might be drawn from ecology, the environmental sciences or nanotechnology.