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# Interactivity as Media Reflection between Art and Science

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**Abstract.** This article describes the evolution of interactivity in the media arts ranging from immersive virtual reality to intuitive interfaces for real-time installations, to online archives and tools for knowledge discovery finally unfolding in networked environments for public space. This development is exemplified by the authors' own works and compared with selected media art works in the field.

## 5.1 Introduction

The importance of the so-called new media for society appears to be so all embracing, that several theoreticians already talk about "the digital" [1] in the sense of an epoch. Here, above all, they mean the decade of the 1990s. "The digital" is a revolution, which will have global consequences. It will lead to worldwide-networked communication and production structures. The media theoretician Vilém Flusser saw in computer supported communications the opportunity to free ourselves from traditional structures. "He searched for new possibilities for human cohabitation, not determined by abstract authorities, but by fast and efficient exchanges of knowledge; to form the relationship between the foreign and one's own, so that the homeless and the stranger are respected in their dignity. That can happen with the help of the new media." [1]

Our understanding of computers changed in the 20th century. We first saw them as codeable calculating machines, then as functional tools, then as interactive and "artificially intelligent" information, communication and production medium. From the end of the 1980s, media artists have worked with the phenomenon – interactivity, " Never before was it possible to operate within the thoughts of others", commented Derrick de Kerckhove, the media theoretician, on one of the first interactive virtual environments.[2] Nietzsche analysed the way "pen and ink" affect our thoughts. Kleist said that

[1] As quoted by Nils Röller, who oversaw in 2001 the "Flusser Archive" at the "Kunsthochschule für Medien" [Art College for Media Studies] in Cologne, and who wrote an essay for the 10th anniversary of Flusser's death – "Vilém Flusser: Medientheorie mit ethischen Anspruch" [Vilém Flusser: Media theory with ethical pretentions].

[2] Derrick de Kerckhove in discussion with Fleischmann & Strauss following the lecture "Virtual Walk Through Berlin – Visiting A Virtual Museum" by Monika Fleischmann at the Imagina 1992 in Monte Carlo, Monaco.

C. Sommerer et al. (Eds.): The Art & Sci. of Interface & Inter. Des., SCI 141, pp. 75–92, 2008.
springerlink.com 

language and one's counterparts are responsible for the step-by-step manufacture of thought during speech. Similarly, de Kerkhove was convinced that our consciousness is formed by the materialising of our imagination and its translation into algorithms, and that therefore interactive media shape our thoughts.

As artists we translate this subject matter into virtual mental spaces, into reflection metaphors and interfaces, which touch a nerve because they remind us of well-known archetypes. Our projects, "Liquid Views"[3] and "Rigid Waves"[4] (1992/93), in which we made associations with the mirror stories by Ovid and Lewis Caroll, show this most clearly. Only the digital medium offers the possibility of the reversible, which assimilates human thinking and plays it back as calculated thoughts. This reflection arises through interactivity. It opens a framework of action, which changes the status of the work and allows the creation of new knowledge. The interface is the key.

## 5.2 The Cultural Discourse

The international competition for media art, the "Prix Ars Electronica", introduced in 1990 the category "interactive art". In that year, the first work to receive the golden Nica was "Videoplace" by Myron W. Krueger and Katrin Hinrichsen.[5] This installation highlights the relationship between people and machines in its aesthetic, rather than its technical dimensions. "Videoplace" aimed to elevate interactivity itself to an artistic medium. In the following years, interactivity became the lynchpin of Ars Electronica. However, it took nearly 10 years, before traditional arts and humanities became interested in the phenomenon – interactivity, which embraces code, network, interface design and technology.

A cross-disciplinary discourse began at the end of the 1990s. Sibylle Krämer (1998), Professor of Philosophy, proposed that we talk of interactivity instead of interaction between people and machines. "When one speaks of "new media" then we are talking about this text, image and sound simulating networked computer." [2] […] "Digitisation, virtualisation and interactivity are therefore those phenomena, which we must study, when we see the computer within the perspective of a media. The media concept, which lets such a perspective be accentuated, moves away from the idea, that media just serves to communicate messages. […]. Media bring across not only messages, but unfold an operating power, which influences the modalities of our thought, perception, experience, memory and communication." [3] Whilst Krämer puts this essential phenomena as the focus of her considerations, the artist and theoretician Lev Manovich, looked for further categories and proposed a code oriented definition for new media: „Rather than focusing on familiar categories such as interactivity or hypermedia, suggest a different list. This list reduces all principles of new media to five – numerical representation, modularity, automation, variability, and cultural transcoding." [4]

Since the late 1980s, teams of artists, designers, information technologists and theoreticians have established interactive media art. With self-developed participative

[3] <http://netzspannung.org/database/liquid-views/en> Rev. 2007-06-17.
[4] <http://netzspannung.org/database/rigid-waves/en> Rev. 2007-06-17.
[5] <http://www.aec.at/de/archives/center_projekt_ausgabe.asp?iProjectID=11224> Rev. 2007-06-17.

tools – the interfaces – they have tested the possibilities of interaction between people and machines.[6] However, as late as 2004, the Jury of "Ars Electronica" saw no theme focus in the concept of interactivity. In 2004 a prize was awarded to "Listening Post" by Ben Rubin and Mark Hansen. This installation made Internet communication observable and audible, but it was not interactive. The Jury statement indicated that interactivity was no longer a premise. With that, the definition of the category "interactive art" changed significantly.[7]

The media archaeologist, Erkki Huhtamo described this change as a crisis in interactive art. In his essay "Trouble at the Interface"[8], he proposed, either to do away with interactivity, or to introduce a new category for projects such as "Listening Post", such as for example "database aesthetics". Although only fragmentarily researched, interactivity no longer stood at the focus of attention. With Web 2.0 and the possibilities it offers for active participation, interactivity has now become part of everyday experience.

## 5.3 Interactivity as Aesthetic Experience

Notwithstanding, interactive structures remain the basic principle of digital media. Visitors should be in a position to relocate and to challenge themselves to the interactive projects to make an experience that moves over and beyond the usual contemplative observation of a work of art. Clearly, the projects should not only bring the visitors' bodies, but also their thoughts into motion. Erkki Huhtamo described the challenge "please touch" as the corner stone of the interactive art aesthetic, an echo of Marcel Duchamp's "Prière de toucher".[9] Touching an interactive work is not only allowed, but necessary. Whether with mouse, trackball, touch screen, tangible objects, video camera, responsive workbench, virtual balance, the touch less PointScreen [5] or other interfaces[10], the observer first brings the process into motion. This is very

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[6] Such teams include: Art & Technology Labs such as "Art+Com", the „Future Lab" of "Ars Electronica", the Fraunhofer MARS – Exploratory Media Lab, the Dutch "V2" as well as "De Waag", the Polish "WRO", the Hungarian "C3", the Indian "Sarai Media Lab", "Videotage" in Hong Kong amongst others.

[7] Interactivity would from now on be interpreted and extended, so that 1. Computer are no longer a precondition, 2. the borders between real time and direct interaction would be relaxed and 3. the concept of passive interaction should be allowed. Therefore, active participation was no longer demanded as a necessary component of the category "interactive art". http://www.aec.at/de/archives/prix_archive/prixJuryStatement.asp?iProjectID=12807 Rev. 2007-06-17.

[8] Huhtamo, Erkki: Trouble at the Interface or the Identity Crises of Interactive Art. Revised version of an essay first published in Framework, The Finnish Art Review, 2/2004 <http://www.mediaarthistory.org/Programmatic%20key%20texts/pdfs/Huhtamo.pdf> Rev. 2007-06-17.

[9] Duchamp's text in the exhibition catalogue of the Surrealists from 1947, was designed by him, on the wrapper of a foam rubber breast. Media artist Ken Feingold, alludes to Duchamp with the installation "The Surprising Spiral (1991). The name "Pierre de Toucher" was given as author for his "book". See Huhtamo 2004.

[10] The interactive projects of the MARS Lab and its interface inventions are documented at netzspannung.org. http://netzspannung.org/about/mars/projects Rev. 2007-06-17.

different to the appreciation of a traditional work of art. Simon Penny differentiates the difference in perception as follows: "A painting is an instance of representation. A film is a sequence of representations. Interactive artworks are not instances of representation, they are virtual machines which themselves produce instances of representation based on real time inputs." [6]

Duchamp and others already discussed the active participant[11] in the first half of the 20th century, and so a new dimension of reversible works was introduced. In addition to the mental reception and bodily activities of observers, came a level relating to other visualised perceptions and processes. [7] The levels of activity and reception overlay each other. Those doing the interacting, influenced to a certain degree the appearance and therefore also the object of their aesthetic experience. Interactive art creates a situation or an environment, which the observer confronts, and through which they enjoy an experience, which arises only first out of the participatory process itself. It is this, repeatable, process, which first gives the work its distinguishable identity. Interactive art thus means, the experimental exploration of artwork and tool.[12] Interactive art is artistic research and interactivity an aesthetic experience.

Reviewing the history of media art, Söke Dinkla reflected on the concept of "knowledge arts", to which we devoted our exhibition in 2006 in the "Neues Museum Weserburg", Bremen[13]. "It's not about just one, but different forms of the arts. The plural "arts" qualifies our understanding of art, but at the same time extends it. … "Knowledge arts" – in the 1990s we described them somewhat more categorically, but also less openly as media art – are the result of the many coups, which visual arts in the course of the 20th century had undertaken."[14] Interactive concepts are based on an altercation with forms of human interaction, with communication technologies and with the possibilities of networked activity. Artistic practice creates situations, which encourage forms of communication and interaction, and in this way it changes the modes of coming-into-contact-with-one-another. Participants can extend the possibilities of interpersonal exchanges. We find ourselves today in a culture of active participants, of interactivity, in which the digital media "become identity giving machines. Thus the current challenge is to comprehend digital media as cultural technology," as Söke Dinkla points out. [8]

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[11] Walter Benjamin and Berthold Brecht in the 1920s, with the advent of radio, also bemoaned the poor programming, which the National Socialists, above all misused for propaganda purposes. They made proposals on the possibility of new formats being experimented with, and in Brecht's "radio theory" the participation of the listener is schematised: listeners should be made into participants.

[12] We called the results of our experiments in the EU project eRENA, [electronic areas in art and entertainment, in which the MARS Lab, the ZKM, Nottingham and Stockholm, Lausanne and Geneva Universities, as well as Illuminations London took part], „Tools for the arts of tomorrow". <http://www.erena.kth.se/> Rev. 2007-06-17.

[13] Monika Fleischmann & Wolfgang Strauss, Wissenskünste aus der eCulture Factory. An exhibi-tion in Neues Museum Weserburg Bremen. 5.October-3.November 2006 <http://eculturefactory.de/wissenskuenste> Rev. 2007-06-17.

[14] Dinkla, Dr. Söke: Von der Medienkunst zur Wissenskunst. Zur Ausstellung „Wissenskünste aus der eCulture Factory" von Fleischmann & Strauss. Shown at eCulture Factory: <http://www.eculturefactory.de/eculturetrends/download/dinkla.pdf > Rev. 2007-06-17.

## 5.4 Interactive Media Art as Aesthetic Laboratory

Media artists explore the culture of active participants and with it the aesthetic potential of interactive art, process-related image worlds and generative processes. The Fundamental questions of media art are: the organisation and structuring of data and information; the orientation and navigation in virtual space; questions relating to interface and interactivity processes; and additionally, telepresence and immersion. Artistic research on digital media, functions as an aesthetic laboratory for societal development. In so far as future forms of communication can be anticipated, interactive art – rather unwillingly – becomes a driver of innovation, and positions itself between everyday, scientific and artistic experience.

At the beginning of the 1990s, media artists were working often in scientific research institutes with advanced virtual reality technology and were searching for extended and networked domains, telepresence and artificial life. By means of performance, sculpture, installation or environment they stage interactive projects and communicate playfully complex topics to the public. Expansive interactive environments were created, such as "The Legible City", 1991, by Jeffrey Shaw, where cyclist-visitors pursue various narrative threads on their passage through the virtual city; "Terrain 01" 1993 by Ulrike Gabriel, where robots are equipped with photocells reacting on light that is controlled by participants' brain waves activity; and "A-Volve", 1994 by Christa Sommerer & Laurent Mignonneau, where visitors can create artificial creatures and follow the artificial live process. They prove so far unknown forms of communication.

The art theoretician Oliver Grau describes the networked and interactive media art installation "Home of the Brain"[15] 1992 by Monika Fleischmann & Wolfgang Strauss, as media theory put into practice and new mnemonic theatre that anticipated the form of communication with networks. Grau writes: "Home of the Brain" already in 1991 was an early appearance of the epistemic innovation telepresence. As a consequence, the reception of the work of art lost its fixed position. The observers do not go to the artwork, panel, panorama, cinema film etc, the work however does not come solely to them."[16]

In "Home of the Brain" the visitor navigates with a data glove through digital rooms that are made visible with data glasses. Hand movements activate the citations of four scientists, who play an important role in the theoretical formation of media culture. They are represented by their individual thought buildings: Joseph Weizenbaum has the House of Hope, Marvin Minsky, the House of Utopia, Paul Virilio, the House of Catastrophe and Vilém Flusser, the House of Adventure. The work was designed, at the beginning of the 1990s, to give new impetus to a media discourse enshrouded by technophobia. The media theoretician Claudia Giannetti endorsed the "interdisciplinary nature" of media art, "which extends far further than

[15] "Home of the Brain" (1990-92) by Fleischmann & Strauss was developed in the context of their project: Berlin, Cyber City. It won the Golden Nica of Prix Ars Electronica 1992. <http://www.medienkunstnetz.de/works/home-of-the-brain> Rev. 2007-06-17.

[16] Grau, Oliver: Immersion und Interaktion. Vom Rundfresko zum interaktiven Bildraum. 2004 <http://www.medienkunstnetz.de/themen/medienkunst_im_ueberblick/immersion> Rev. 2007-06-17.

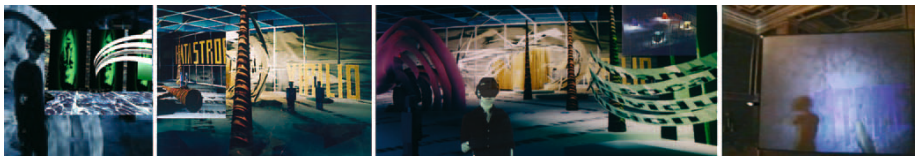

**Fig. 5.1.** "Home of the Brain", Virtual Reality Installation (1992)

the already known considerations on the relationship of art to technology".[17] The multi-faceted nature of digital media, demands interdisciplinary thought and work structures that bridge the chasm between analogue and binary language – the chasm between art and ICT[18] science.

## 5.5 From Virtual to Real Space

The question of how digital information can translate not only the metaphoric virtual, but also the physically real into accessible and understandable domains, marked the passage to media architecture. Here we understand an architecture, which connects people, space and data with one another. It creates an extended area of activity. The multi-user installation "Murmuring Fields" (1998) adresses the overlaying of physical and data space, which embraces the body with imperceptible interfaces. The performative sound installation is a recordable field of sound, managed by movement of the body.

Digital information - sounds and figures – are located in the space as if the room were furnished with data. [9] Every movement of the body is captured with an optical body-track-technique.[19] Movement is transferred from real space into data space, and translated into a sound collage. Spoken texts are broken up into words and syllables. Movement in space creates movement in the text. Two interactors produce text samples by Joseph Weizenbaum, Marvin Minsky, Vilém Flusser and Paul Virilio. "Politic-tic-tic", says Flusser's voice as a performer bows backwards and forwards and thus interprets a part of the text: "Youngsters at the terminals; they turn their backs to politics and turn to each other."[20] The dancer starts up syllables with her body and forms speech. She plays with the meaning of the concepts. Text is translated into a texture of sound and movement.

The concept of accessible knowledge space has its correspondence in the concepts of David Rokeby. With "Very Nervous System" (1982) he schematised interactivity,

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[17] Claudia Giannetti: Ästhetische Paradigmen der Medienkunst. In: Medien Kunst Netz. 2004 <http://www.medienkunstnetz.de/themen/aesthetik_des_digitalen/aesthetische_paradigmen/scroll> Rev. 2007-06-17.

[18] ICT = Information and Communications Technology.

[19] Body-Track is part of the eMuse-Systems, which were developed as production system for ``Murmuring Fields". In: W. Strauss, M. Fleischmann: Imagine space fused with data. In: Cast01 Proc.2001. <http://netzspannung.org/version1/cast01/proceedings/index.html> Rev. 2007-06-17.

[20] Sentences from an interview with Vilém Flusser in 1990 in Austrian television are built into the sound collage.

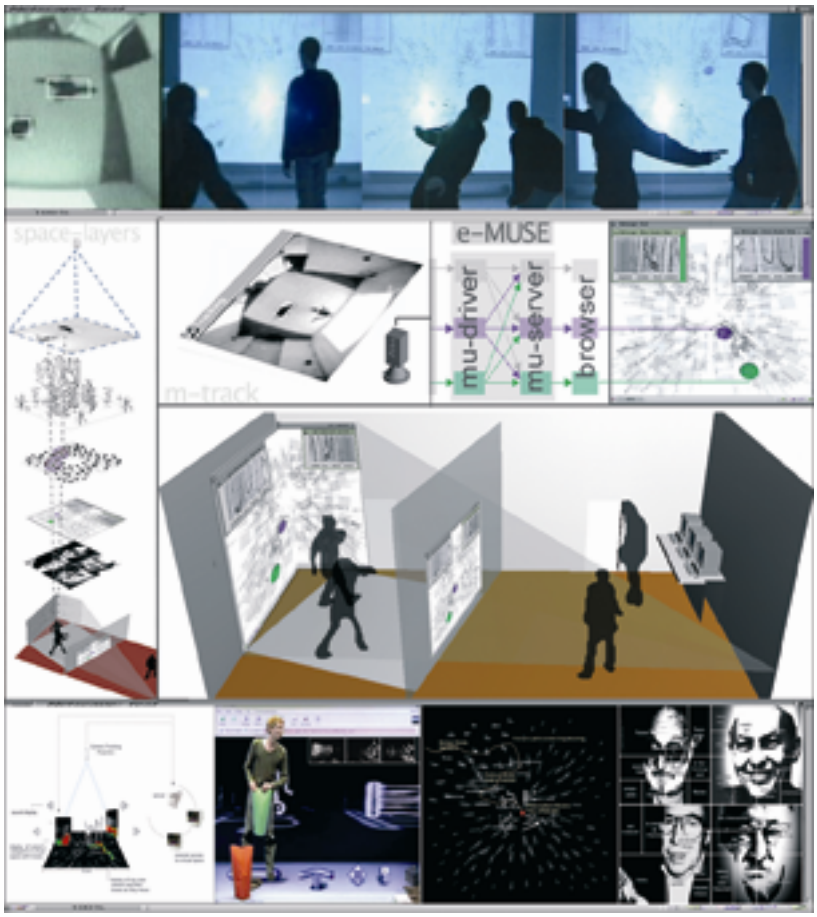


**Fig. 5.2.** Assembling the interactive stage: "Murmuring Fields" (1998/99)

with the aim of putting computers and people into an intuitive, bodily, expansive and intimate relationship.[21] Whilst Rockeby focuses on audiovisual interaction, we deal with the communication of the participant and the acquisition of knowledge. Both activities start with the premise of sensory perception. Knowledge here is not acquired by reading, but through the body. The theorist of cognition George Lakoff, emphasized again and again the importance of the body and its entity for thought processes. Sensory experience and reflection combine together in "sensory thinking of the body", he wrote. [10] The psychoanalyst Maurice Merleau-Ponty described the body as the centre of the spatially and temporally mediated world. For him, thinking is

[21] Very Nervous System is one of the first audiovisual interaction systems, that was introduced variably into installations. In the system, a computer analysed the image created by a video camera in motion. The result is an interactive space, in which those interacting use their bodies as the active element of the interface. <http://www.medienkunstnetz.de/werke/very-nervous-system> Rev. 2007-06-17.

based on experience, which arises from bodily perception connecting to everyday activity. Oliver Grau determined, that with "Murmuring Fields" a new type of space of mind was created.[22]

## 5.6 Knowledge Art as Cultural Technology

Interactive knowledge structures and digital archives are current themes in media art research.[23] Under the title "Explore Information – Create Knowledge"[24] projects are presented on the media art platform netzspannung.org, which concern themselves with the structuring of unmanageable amounts of information. The online archive netzspannung.org also offers ever more amounts of information material concerning the theme digital culture.[25] To find one's way around the over 1.500 lectures, workshops, study series, scientific texts and artistic projects of the online database, innovative visualising tools have been developed for accessing the digital archives. Fundamentally, there are two different types of access to electronic data: the "precise" search and the "imprecise" browsing.

The search presupposes that users know what they are looking for, that they can formulate their interests and, where necessary, can be more precise. Browsing, on the other hand, involves the user being inspired and prodded by that, which is offered. In the article "As we may think"[26] (1945), the American scientist Vannevar Bush already bemoaned that the problematic relating to the selection of information was located in the artificiality of its indexing systems. Data in archives were filed alphabetically or numerically. Information, if at all, could only be retrieved by sifting through, index for index. He observed, "The human mind does not work that way. It operates by association. With one item in its grasp, it snaps instantly to the next that is suggested by the association of thoughts, in accordance with some intricate web of trails carried by the cells of the brain."[27] Bush called for a new relationship between the thinking person and the sum of our knowledge. He proposed mechanising the selection of information using association – and not indexing. The idea of an associative net of concepts is also fundamental to the concept of "Knowledge Discovery Tools" of the netzspannung.org.[28]

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[22] Oliver Grau. Integrating Media Art into our Culture. Art History as Image Science. <http://www2.hu-berlin.de/grau/Grau.pdf> Rev. 2007-06-17.

[23] Thomas Goldstrasz: „Suchmaschinen – Sechs Kunstwerke und eine Suche zum Thema suchen - speichern – suchen lassen". In: <http://netzspannung.org/media-art/publications/digital-transformations/search-engines/> Rev. 2007-06-17.

[24] Wolfgang Strauss; Nina Zschocke: Explore Information / Create Knowledge. <http://netzspannung.org/media-art/explore-information/> Rev. 2007-06-17.

[25] From the beginning of 2001 netzspannung.org has recorded an ever-growing number of users. In 2007 the daily average figure is 3.300 and more that 100.000 visits per month.

[26] Vannevar Bush - As We May Think - The Atlantic Monthly,1945. Published in the Journal 'Form Diskurs', Nr. 2, I/1997, pp 136-147. <http://wwwcs.upb.de/~winkler/bush_d.html> Rev. 2007-06-17.

[27] Ibid.

[28] <http://netzspannung.org/about/tools/> Rev. 2007-06-17.

### 5.6.1 Navigational Map for the Data Domain

With the "Semantic Map", we developed a navigational tool for the digital data domain. It shows all the documents of the archive, organised into self-organising clusters. So, for example, a cluster with the label "virtual" includes all documents that discuss this theme. The first step is to identify the cluster labels, that is the genre terms, by comparing them with a list of keywords. This is done by an automated text analysis of the database entries. Then the relevant documents are assigned to the clusters. In the next step, semantic relationships between individual database entries are computed. According to these textual relationships, the individual database entries are sorted relationally to one another within the cluster, whereby the distance, one from the other corresponds to the relevance of their respective contents. [11] If the documents are close to one another, there is a textual relationship. On selection, a short description appears in a second window. In further zoom stages; the map is changed from a text based to a visual design.

As soon as new documents are entered into the archive, they integrate themselves according to an automatic text analysis. The archive is therefore not "stipulated" but because the documents "have knowledge of each other" they can automatically re-order themselves. With the "Semantic Map", hidden connections within the data stock are computed and visualised. A self-organising neuronal network is deployed for the computation of the data and the automatic graphic arrangement in the map, which is named "Kohonen Map"[29] after its inventor. The semantic knowledge map is prototype visual search and find machine.


**Fig. 5.3.** "Semantic Map": Dynamic zooming from simultaneous overview to detail (2001-04)

### 5.6.2 The Archive Domain of Netzspannung.org

The difficulty of orientation in online archives is due to contents only being viewable on hundreds of individual web sites. One is always looking for new methods of exhibiting and mediating information. Since 2006 we presented the numerous database entries of netzspannung.org, as publicly accessible archive, in the context of an exhibition.[30] Two

[29] Teuvo Kohonen, Dr. Eng., Emeritus Professor of the Academy of Finland <http://www.cis.hut.fi/research/som-research/teuvo.html> Rev. 2007-06-17.

[30] Several installations of Fleischmann & Strauss were shown in the exhibition „Kunst-Computer-Werke" [Art-Computer-Work] in the „Zentrum für Kunst- und Medientechnologie (ZKM) [Centre for Art and Media Technology] in May 2006 and until January 2009 in "YOU_ser – the century of the consumer" <http://www02.zkm.de/youser/> .2008-01-15.

installations show how digital information can be spatially staged. “Matrix” [12] with the “PointScreen” Interface and “Medienfluss” (Media Flow), offer a complete overview of the online archive, which allows a dynamic switch of criterion, from detailed overview, down to the individual artwork. Both applications can reach back to data, which is saved in the online archive. They are exported via an XML gateway and presented audio-visually as an installation in physical space.

Interfaces were sought out, which make clicking around on websites dispensable. It is always the same problem with online archives: how can great masses of information be structured, so that everyone can easily find what they are looking for? What can one offer an audience that enjoys playing with the modern media, and in the process wants to gain experience and to learn something?

The “Medienfluss”[31] [Media Flow] is an interface, which transmits an immediate impression of the contents and number of documents in the online archive. Two parallel media flows of images and words, stream as large format date projections through the room. The flow of words shows keywords, authors and titles of the archived documents. Text-based access is complemented by visual access. The images represent respectively an archive entry. The terms are spoken out by a computer voice using text-to-speech processing. The “Medienfluss” creates an atmospheric image and sound domain. A touch screen translates the flowing images into scrollable text bands, serving as an index for specific searching. On selecting a term or image, the relevant document is visually highlighted and presented in detail in the form of text, image or video. While the active user is immersed in detail, observers on site can follow the process of selection and display of the archive. Medienfluss [Media Flow] is a living database.

With the “Matrix”[32] a browser was developed for exploring large stocks of data, which in combination with the gesture based PointScreen technology[33] can be implemented as a room installation. The interface takes up the “Matrix” theme[34] of the non-finite classification system. Each field of the “Matrix”, using an image icon, represents a media project. A virtual lens is steered, contact-free, over the “Matrix”. On rollover, the lens enlarges the image contents and, in addition, shows author and title of the respective project. The selected image enlarges itself and also shows a video on the project. The “Matrix” offers museums and archives the possibility, in compressed form, of accommodating a greater part, or even their complete, inventory. It also provides a tool for detailed examination. The “Matrix” supports overview browsing, whilst the lens offers a dynamic insight into the detail.

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[31] <http://www.eculturefactory.de/medienfluss> Rev. 2007-06-17.

[32] <http://eculturefactory.de/digital-sparks-matrix> Rev. 2007-06-17.

[33] With PointScreen technology one accesses a novel navigational medium, which allows a contact free, gesture-based interaction. PointScreen was developed at the MARS – Exploratory Media Lab of the Fraunhofer IAIS (former IMK) by Wolfgang Strauss, Monika Fleischmann, Yinlin Li. The PointScreen Technology is based on so-called “Electric Field Sensing” (EFS) and uses the human electrostatic field to control interactive applications. US-patent number is 7,312,788. The title of the patent is: Gesture-based input for a user interface of a computer (ECCO). See References: Strauss, W. et al: Information Jukebox ... [5]

[34] In Mathematics, the matrix (plural matrices) is an arrangement of numerical values in tabular form. One speaks of columns and lines of the matrix and describes that also as (line and column) vectors. The objects, arranged in the matrix one calls components or elements of the matrix.

**Fig. 5.4.** "Medienfluss" [Media Flow] as a visual interface (2006)

Browsing the "Matrix" occurs by touchless interaction. The "PointScreen"[35] allows to control digital objects on a screen just by body movement and energy like the Chinese Qigong, and it represents a new interface paradigm. PointScreen provides access to any digital system just by the move of the user's hand. Unlike touch-screens there is no need to get in contact with any surface. The person in front of the interface controls or manipulates the application by natural hand gestures, even from a meter's distance. It literally seems like magic and reminds of what can be seen in science-fiction movies such as minority report. The basic principle of PointScreen technology is the sensing of electric fields. People that engage with the system enter an electrostatic field that is established by emitting antennas. The person's body modifies this field, varying with his movement. These disturbancies are measured by the PointScreen antennas and mapped onto cursor coordinates. Hand and body gestures are tracked in the three dimensional space between the user and the screen and are interpreted to control the digital system. The PointScreen research and development was inspired by the Theremin, one of the first electric musical instruments. It gave us the idea of the virtual window control by movement and gesture. If there is nothing to touch interaction gets more direct and intuitive.

**Fig. 5.5.** The "Matrix" with "PointScreen" technology (2005 / 2003)

[35] <http://netzspannung.org/database/pointscreen/> Rev. 2007-06-17.

## 5.7 Interactive Art in the Public Domain

Together with knowledge media, the public domain is a current theme of media art. Interventions in the public domain are able to make a wider public aware of the current state of research in experimental media and Internet art. Since the middle of the 1990s, activists and artists have had great hopes of the Internet as "public domain" and means of democratisation. A series of town-like communities have developed since 1994, including "Digitalen Stad" [Digital Town] Amsterdam, and, in 1995, the "International Town" [International Town] Berlin in the then new World Wide Web. In the last few years, media façades and public spaces have become popular sites for media art. One is talking here mostly about participative projects, staged temporally in public urban space. One can observe and accompany such actions in public places, but also actively take part. In this way, the digital is situated, appreciated and discussed in the public domain.

The "Chaos Computer Club" in 2001 on its 20th foundation day, supplied an enthusiastic public with online tools for creating animations, which could be sent by email and projected onto a house façade – the "Haus des Lehrers [Teachers' House] in Berlin. Using mobile phone and special software, the façade became a media skin. The installation "Blinkenlights"[36] ran for five months and has found many imitators. The project opened a series of interactive façade projects, in which participants can contribute their own contents.

Likewise in 2001, Rafael Lozano-Hemmer presented with his "Body Movies"[37], and his concept of "relational architecture", another format to involve the public and public space. This installation also used the façade of a building as screen and access to information. Here though, people and their shadows become actors in a dramatic setting. Virtual passers-by, recorded in different towns and projected onto a house wall, integrate with shadows cast by real on-site passers by. Participation in a collective process transforms public spaces into places of public action.

A similar effect is shown by the project "Energie-Passagen" [Energy-Passages].[38] The stroll though the daily news, schematises public and private interest in information. Language is understood as intellectual energy, which shapes a city. "Energie-Passagen" is a location-specific installation, which transforms the daily flow of news into an audio-visual data flow, staged as a media reading, performed in city space. Starting points are texts from a mass-media newspaper. An automatic technique converts daily RSS Feeds, and analyses some 50.000 words of the current newspaper and reduces them to 500 most common keywords.

These keywords appear as a large-screen projected flow of information in front of the "Literaturhaus" [House of Literature] in Munich. They are performed by an artificial computer voice. Passers by select terms over a microphone or touch screen. The computer voices react with a multi-voice echo to the selection. Simultaneously, the

[36] <http://de.wikipedia.org/wiki/Projekt_Blinkenlights> Rev. 2007-06-17.

[37] Projekte von Rafael Lozano-Hemmer <http://www.lozano-hemmer.com/eproyecto.html> Rev. 2007-06-17.

[38] In 2003, Monika Fleischmann and Wolfgang Strauss were commissioned with the implementation of their concept "Energie-Passagen" in the context of the competition for the exhibition "Ortstermine – Kunst im Öffentlichen Raum", Kulturamt [Cultural Department] of the city of Munich. <http://energie-passagen.de> Rev. 2007-06-17.

**Fig. 5.6.** The Energie-Passagen [Energy Passages]. Information flow shows computed keywords.


**Fig. 5.7.** Energie-Passagen [Energy Passages]. Electronic Reading in front of the House of Literature Munich, Germany (2004)

selected word appears in a concept grid of "friendly" words. This text movement allows connections between the terms to emerge. The associative reading of the newspaper encourages one's own thoughts. Through the selection of terms, the visitor "writes" a new newspaper. In the text montage, unexpected and new connections of meaning are created.

New meanings and relationships, which till then did not exist, are created in interaction with the text, because readers have at their command individual patterns of perception and behaviour. In the information flow of "Energie-Passagen" connected words build the site of the narrative. The process of reading becomes thought in action, through the interaction. The text space itself becomes a browser for the "search as process". The curator Christiane Paul describes the installation as public performance: "„Energie-Passagen literally re-inscribes the passages of energy that inform our daily life onto the street, allowing the passers-by to 'perform' the events of the day in multiple semantic connections."[39]

[39] <http://www.energie-passagen.de/presse2_eng.html> Rev. 2007-06-17.

A computer based tool for associative reading was developed, that became an information browser, by means of automated keywording. It also makes a contribution towards the development of accessible data archives. The sensory and cognitively experienced city space becomes, through algorithms, an electronic reading garden. The motif of the flow is embedded in city space. A connected and reactive text and sound domain, becomes through the light of the projection, a directly perceptible urban media domain: a materialised newspaper archive, which is situated directly on the way. Media art in public space reaches out to more and different visitors than in a museum. A contrast to the newspaper browser in urban space is the Internet browser 10 x10, which constantly refreshes, and presents the 100 most important news items from the whole world in an image matrix.[40] The result shows a daily updated snapshot of the images and words of the world.

## 5.8 Book Renaissance

The idea of the Virtual Book has its origin in artists' books. Our first example of a virtual book showed the electronic representation of the publication "Digitale Transformationen" [Digital Transformations] and described in over 50 contributions from authors, media art projects from the 1960s till the 2004. [13] The publication serves, with its individual texts in PDF-format, as entry point for a multi media presentation. The interactive work, which is described here, demands the presentation in a time-medium.

The virtual book presents video, audio and hypertext linking, and is an extension of the traditional book. It can thus be read in different ways. It can be browsed and managed, page for page, like a traditional physical book. Integrated into the virtual book are also hyper-textual navigation elements and multi-media components. The text is saved and indexed in a database. The book can be consulted, or searched chapter for chapter, according to keywords and terms, authors, images and videos, using a menu. The virtual browsing and the images, which metamorphose into video or animation, are impressing for the reader. The MP3 audio track, reads out the text using professional narrator voices, and at the same time, marks the relevant positions in the text.[41]

The "Reading Table"[42] presents another form of reading. Via a pneumatically controlled table, a so-called "swing table" – text flows can be temporally manipulated by lying on hands, and bending the projection surface. In Masaki Fujihata's "Beyond the Pages" (1995)[43], the contents of his picture book are moveable. Images of objects such as stones or printed characters make sounds or are made to ring. Touching the image of a switch turns on the writing-table lamp, which as in the real world, sits on the table next to the virtual book. Touching the image of a doorknob opens the image

[40] <http://www.tenbyten.org/10x10.html> Rev. 2007-06-17.

[41] The virtual book was first presented to the public at the Frankfurt Book Fair 2006 and the public reaction evaluated. <http://www.eculturefactory.de/virtual-book> Rev. 2007-06-17.

[42] Xerox Parc, Experiments in the future of reading. ACM 2001. <http://transliteracies.english.ucsb.edu/post/research-project/research-clearinghouse-individual/research-reports/tilty-tables> Rev. 2007-06-17.

[43] Masaki Fujihata, Beyond the Pages (1995) <http://on1.zkm.de/zkm/stories/storyreader$552> Rev. 2007-06-17.


**Fig. 5.8.** Virtual Book (2005)

of a door, projected onto the wall, which unexpectedly opens. Fujihata tests the limits of the media book, in so far as he combines real and virtual space in a particularly amusing way. The book becomes an interface to the environment.

## 5.9 Deep Storage

Whilst in traditional art forms, packaging, stacking and storing were discovered as artistic form of expression, "the ever present digital date storage in the 1990s," led to, "an artistic altercation with the freeing, or rather ousting of the human memory." [14] The irritation increases over the loss of memory that is given over to machines the more knowledge can be relocated on hard drives. The machine today is not a single computer, but a global network of computers. The knowledge lost to individuals by relocation to this storage is gained through the compensations from the collective and the exchange. With the work presented, we ask questions of this digital storage, relating to knowledge, memory and recollection. Our work is an answer to the challenge of the ever-increasing mass media flood of information. Since 1990, our thematic foci regarding interactive media have shifted. [15] At first, questions of body, recollection and memory stood at centre stage. Afterwards, the increasing floods of information and the theme -knowledge as stored information-, took on a greater meaning.

With "Home of the Brain", we reflected not only on the new medium, but the media discourse itself became an object of reflection. The interactive participants were enclosed literally in the discursive environment, their field of vision filled in completely with a 360° illusionary immersion room. This isolated immersion, is extended in "Murmuring Fields" into a space of mind through dialogic forms of play with other

participants. The data room of the sound archive is played like an instrument using bodily actions, and so experienced bodily. The new experience is discovered through the joint play of the participants. The theme of "Liquid Views" is the media related shaping of the body through the computer. In the mirror of this medium, the visual perception and recollection of the observer is addressed. Viewers become, at one and the same time their own observers.

We use the digital media, as Söke Dinkla established, "in order to newly structure available knowledge, to make it sensorally accessible, and so to feed it into the discourse on media culture". In much of the work of knowledge art, the contents communicated, are at least as important as the technology. Sometimes, the form and content consort together. One starts with the desire for a specific form, which bit by bit fills with content. The media art platform netzspannung.org has developed in a similar way. "Frameworks, in other words a criterion of regulations and rules, were made available, which then could be filled by the media art community with content and individual contributions. Netzspannung.org is at one and the same time a forum and an online archive".[44]

Communication and presentation formats such as "Energie-Passagen" or "Medienfluss" were developed under the umbrella of knowledge arts. With the image motif of the river, static and passive masses of information are transformed and flow out of the archive and around the visitor. In as much as the data appears animated as flowing movement, it is transformed into a time-based medium and can take up a narrative function. The "Medienfluss" as interface, embodies the psychological meaning of the term "flow".[45]

By flow, we understand a sort of intellectual elation, which leads to thought flow, uncoupled from current reality. Flow can be described as a state in which attentiveness, motivation and the environment come together in a form of productive harmony. Flow means, to forget time.[46] Knowledge maps such as the "Semantic Map", or "Matrix" widen out information, side by side. Whilst the "Semantic Map" orders the spatial closeness of documents according to textual similarities, the "Matrix" incorporates the principle of serendipity. This term describes a co-incidental observation, something not originally sought out, which proves to be a new and surprising discovery, such as, for example when surfing the Internet, one co-incidentally discovers useful information.

The "Virtual Book" allows new work techniques such as collaborative writing and participative reading. Text in the virtual book becomes hypertext. The examples presented on the future of the book, highlight a spectrum of artistic and scientific

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[44] Söke Dinkla, Von der Medienkunst zur Wissenskunst. Einführung in die Ausstellung „Wissenskünste aus der eCulture Factory" <http://eculturefactory.de/download/dinkla.pdf> Rev. 2007-06-17.

[45] The term "flow" means the pleasure oriented feeling of a complete merging in an activity, a creative burst, or burst of activity. http://de.wikipedia.org/wiki/Flow_%28Psychologie%29.

[46] In 1975, the psychologist Mihaly Csikszentmihalyi described the „flow-experience". He is though not the first to discover the concept, the writing of the educationalist Kurt Hahn (1908) with his extensive synonym on knowing "creative passion" and the doctor and educationalist Maria Montessori with "Polarisation der Aufmerksamkeit" (1909), describe the self-forgotten, playful, explorative activity of children as separation from the environment and the concentrated turning towards a certain immediate activity.

research on the future of reading. Through the comments of the reader, furthermore, the complete reading process can be documented. Thus the text becomes starting point for online discussion, or serves as first basis for collaborative writing techniques, such as the Surrealists in the 1920s described. In Cadavre Exquis, the Surrealists developed a continuous game with folded paper, in which many people, one after the other, could create a sentence or a drawing, without anyone knowing about the previous stage. Breton argued, that in this way one could have access to an infallible means to turn off critical thinking and to create a free path for the metaphoric capabilities of the spirit.[47]

The "Virtual Book" and its search profile, functions like glasses, through which the data domain can be contextually observed. Its surface is virtual, and is a window to the temporal space of textual connections.[48] The idea of books as active knowledge structures, is inspired by Marvin Minsky's provocative vision from the 1980s: "Can you imagine that they used to have libraries where the books didn't talk to each other?" [16] Attaining such interactive structures will occupy quite a few generations of artists and scientists to come.

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3. ibid., p. 14

[47] Definition by André Breton: Cadavre Exquis – Game with folded paper, which is about allowing a number of people to construct a sentence or a drawing, without a participant having knowledge of the previous contribution. The example, which has become a classic, which the game has given its name to, makes the first part of a sentence, created in this way: Le cadaver-exquis-boira-le-vin-nouveau. (fr="The delectable-corpse-drinks-the-new-wine").

[48] See also Michael Wetzel: Flüssige Datenströme. <http://www.freitag.de/ 1999/52/ 99522701.htm> Rev. 2007-06-17.

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