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Viewing Zone

The Volumetric Image, Spatial Knowledge and Collaborative Practice

Volumetric Images

James Cameron's *Avatar* (2009) is undoubtedly not the most original contribution to science fiction cinema – think of the stereotypical the-good-indians-against-the-evil-capitalist-plot. Nevertheless it was hailed as a major contribution to cinematic techniques because of its use of stereoscopy. While the use of stereoscopy might be quite conventional in Avatar, there is a sequence, which is quite interesting and convincing (fig. 1a–c).

The sequence shows a kind of control room, a "center of calculation"[1], as Bruno Latour would have pointed out, or a "center of coordination" as Lucy Suchman notes:

> *Centers of coordination are characterizable in terms of participants' ongoing orientation to problems of space and time, involving the deployment of people and equipment across distances, according to a canonical timetable or the emergent requirements of rapid response to a time-critical situation.*[2]

1 Bruno Latour, *Science in Action. How to Follow Scientists and Engineers through Society*, Cambridge, MA: Harvard University Press, 1987, Chap. 6.

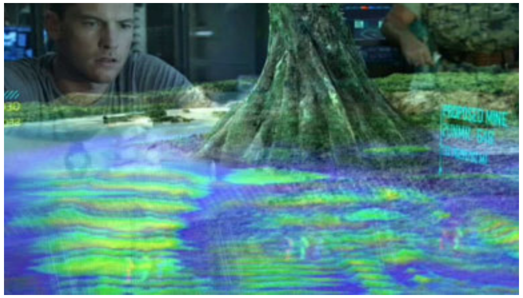
2 Lucy Suchman, Centers of Coordination. A Case and Some Themes, http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.627.4590&rep=rep1&type=pdf (accessed September 19, 2017).

Information from the outside is collected and processed to generate strategies for action – in the case of Avatar: the *evil capitalists* trying to convince the native species on the planet to leave their village, which is located in a very big tree, because of the deposit of a demanded material with the funny name *Unobtainium* in the ground. The scene in fig. 1a–c shows a visualization of a landscape based on fictional (or nearly fictional, I will come back to that) display technologies, which render an image space even more convincingly by the stereoscopic presentation of the film. However, the shown fictional images are not stereoscopic: they are *volumetric*, no glasses are needed to see a spatial image, which can be seen from all sides, is colorful and half-transparent. It has several properties:

1. It represents space not only like an image based on linear perspective, it is itself spatial. That means it is a post-perspectival image: it does not need to represent the scenery with the aid of perspective because it does not render the scene on a plane. It is a *transplane image* (this is similar to holography, but volumetric displays are normally not holographic).[3] Thereby it avoids the spatial problems of perspectival representation: By foreshortening, perspective

3 See Jens Schröter, *3D. History, Theory and Aesthetics of the Transplane Image*, New York, NY: Bloomsbury Academic, 2014.





1a–c Screenshots of Avatar, TC: 00:47:49, 00:48:03, 00:48:10.

changes the relative length of all lines to each other and it changes all angles – and in this sense a perspectival image is not a very reliable representation of space (except under very controlled conditions). That's why technical and architectural drawings made for the construction of objects (and this is still true for the images in the instruction manuals which accompany IKEA furniture) are not in linear perspective but in different forms of *parallel perspective*.[4]

Another way to avoid the distortions and misrepresentations of perspective is to make the image itself spatial, which of course already begins with sculpture or scaled models made from wood or clay used by engineers and architects for example. The fictional volumetric computer display in *Avatar,* designed by the special effects company Prime Focus, stands in a long tradition of images which avoid perspective to represent a situation undistorted and therefore in a more efficient and operational way.[5] It is not surprising that we see military personnel in the scene. Military decision-making requires representations, which allow immediate understanding of spatial situations and structures.

2. This shows another important aspect: Such a trans-plane image is ideally suited for collaborative work in which decisions often have to be made. People stand around the representation, see the scene from different angles, point to specific aspects and discuss what to do. Of course this can be done (and is done) with flat images as well, and normally these are preferred for the simple reason that they are more available, but the technical arrangement (in *Avatar*) is especially helpful in situations where the structure of space plays a central role. In this sense the display shown is in the tradition of, what in German is so beautifully called, a *Lagebesprechungstisch* or a table for discussing the situation. There is for instance a long tradition of planning and education in the military done with sand tables (fig. 2–3).[6]

One important point that connects with the aforementioned aspect is that a spatial representation of this kind does not align viewers in the same way a screen (or a linear-perspectival representation on a screen) does. Linear-

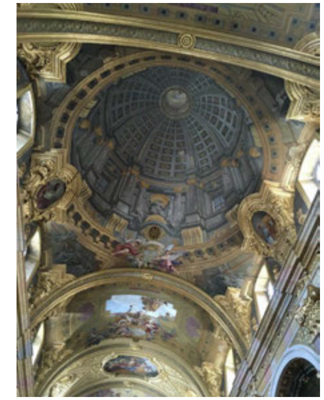
4 See Jeffrey Z. Booker, *A History of Engineering* Drawing, London: Chatto and Windus, 1963.

5 Prime Focus World, http://primefocusworld.com/projects/ (accessed September 30, 2017).

6 See Hans Hemmler, *Die Arbeit am Sandkasten*, Aarau: Sauerländer, 1942.

2 Sand table (conventional).

3 Sand table (virtual).



4–5 Jesuit church in Vienna.

and even more central perspectives, with one vantage point, position the viewer at the eye point – at least in principle: Extreme cases are, for example, the remarkable trompe l'œil dome in the Jesuitenkirche in Vienna, executed by Andrea Pozzo in 1703, which looks correct only from one standpoint. And that point is explicitly marked on the floor (fig. 4–5).

Screens usually direct the attention in the direction where the screen is. Spatial displays like a sand table or the fictional strategic volumetric display in *Avatar* do not prescribe any specific positions for the viewer (except of course that you have to look towards the display). The representation can be seen from different perspectives – in the literal, and that's the point, also in the metaphorical sense. It does not privilege any position but rather opens up a viewing zone (the direct positioning of the viewer is also avoided in parallel perspective, which is used in, e. g., simulation games, like Sim City, and is often called god's eye view, because it prescribes no position. The gaze comes from no specific place at all).[7] The representation in *Avatar* can be scaled up and down, it is enriched with further information, and it can be scrolled and rotated and therefore allows differentiated analysis. As it was put in one review of *Avatar*:

> *The Holotable was a lovely way of displaying an interactive map. As opposed to being displayed on a screen, the 3D hologram allows people to view the map from all angles and have a better sense of scale. It's also much better than a physical model, as it allows users to see the internal structure of the terrain and to point inside the model, it's also more movable, updatable, can be endless and takes up less room. There's countless ways this can be used to display information.*[8]

7 On different forms of parallel perspective see Benjamin Beil, Jens Schröter, Die Parallelperspektive im digitalen Bild, in: *Zeitschrift für Medienwissenschaft* 4 (2011), pp. 127–137.

8 HUDS+GUIS, The Design of Avatar UI, https://hudsandguis.com/home/2011/01/16/the-design-of-avatar (accessed September 20, 2017).

The display in *Avatar* is purely fictional, but that makes it no less interesting: The fictional representation in *Avatar* is a projection of a futuristic technological practice intertwined with real developments. Often there is an immediate connection, like when technology developers become film consultants. Kirby uses the notion of the "diegetic prototype" to designate fictional technologies that operate "normally" in the diegetic world of a film.[9] Some people explicitly connect the displays in *Avatar* to real developments: As a technician discussing the possibilities of realizing such a "holo table" puts it in a blog post, beautifully titled "holo-tables-avatar-style-are-cool": "The solution, both hardware, software and computer power, seems pretty expensive. An elliptic 3D display used horizontally as a 'holo table', but price aside, it seems doable with today's technology unless I'm missing something."[10] And then he adds: "Zebra Imaging, a long-time producer of 3D holographic prints has been awarded a contract by DARPA back in 2005 to develop a real-time interactive holographic display map. The Urban Photoinc Sandtable Display (UPSD) is the result of that. It supports up to 20 participants, 360 degree view points, 12 inch depth and displays that scale up to 6 feet in length, enabling full Parallax without requiring special glasses or goggles."[11]

Sheila Jasanoff argues: "Science Fiction [...] is a repository of sociotechnical imaginaries, visions that integrate futures of growing knowledge and technological mastery with normative assessments of what such futures could and should mean for present-days societies."[12] Often movies show futuristic technologies that become central and driving metaphors for a certain line of technological development – as became the fictional "Holodeck" from Star Trek for the discourses in the development of virtual reality in the nineties.[13] This is an example for how an imaginary technology directly becomes part of a development process.

Fictional three-dimensional displays exist in popular cinema as well as in technical papers. But in both of these discursive fields they have different functions. In popular cinema the representation of future technology can work – as I analyzed in my PhD and as was discussed in the already mentioned text by David Kirby – as a means to produce the desire for potential new technologies in mass audiences, normalize them as parts of a potential future and in this way help developers to receive funding, which historically *has happened*.[14] In that sense Kittler once described popular cinema as an instruction manual for new media.[15]

In technological papers such fictional entities help to orient researchers towards a common goal and help to get funding too, think of the role of projected technological artifacts in patents. In this sense the fictional presentation of future technological practices is by no means external or secondary but rather an integral part of the development of

9 David Kirby, The Future Is Now: Diegetic Prototypes and The Role of Popular Films in Generating Real-World Technological Development, in: *Social Studies of Science* 40 (2010), pp. 41–70. See Jens Schröter, Das Holodeck als Leitbild, in: *Bildwelten des Wissens* 14 (2018), pp. 90–99.

10 Arie Tal, Augmented Reality Science-Fiction vs. Science-Fact: Are We There Yet?, http://augmentech.blogspot.de/2012/12/holo-tables-avatar-style-are-cool-and.html (accessed September 20, 2017). The author alludes to https://zebraimaging.com (accessed September 20, 2017).

11 Ibid.

12 Sheila Jasanoff, Imagined and Invented Worlds, in: Sheila Jasanoff, Sang-Hyun Kim (eds.), *Dreamscapes of Modernity. Sociotechnical Imaginaries and The Fabrication of Power*, Chicago/London: The University of Chicago Press, 2015, pp. 321–341, p. 337.

13 See Jens Schröter, *Das Netz und die virtuelle Realität. Zur Selbstprogrammierung der Gesellschaft durch die universelle Maschine*, Bielefeld: transcript, 2004.

14 Ibid.

15 See Friedrich Kittler, Synergie von Mensch und Maschine, in: Florian Rötzer, Sarah Rogenhofer (eds.), *Kunst Machen. Gespräche über die Produktion von Bildern*, Leipzig: Reclam, 1993, pp. 83–102, p. 101.

technology. In the next part I will analyze the steps in the actual development process of volumetric display technologies and how fictional representations of potential future practices are to be found in developer's accounts and other forms of *diegetic prototypes*.

History of Volumetric Displays

In 1948 a paper called *Three-Dimensional Cathode-Ray Tube Displays* by Parker and Wallis appeared, where they state:

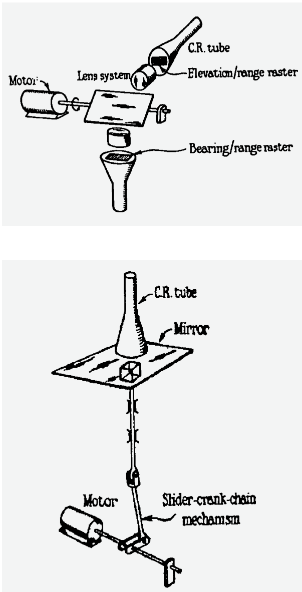
> *Since the screen of a c.r. tube [= cathode ray tube] is only two-dimensional, only two coordinates of the object's position can be thus directly displayed. This has until relatively recently been adequate, the radar set being called upon to scan in only a single angular coordinate, usually with a 'fan beam', but the modern set may scan in two angular co-ordinates with a 'pencil beam'. It is with these volume-scanning radar sets, where the object's position in three coordinates is derivable, that we are concerned here.*[16]

Obviously, the concern here is to represent spatial information in a three-dimensional way and – since we are dealing with radar – to achieve this as fast as possible in critical situations where decisions have to be made quickly. "When a human operator is involved in the loop, however, all the n channels have to pass simultaneously through the bottleneck of his senses, consciousness and movements."[17] The slow *human operator* thus has to get optimal information on space. This can also be seen in a paper published in 1963, regarded as an important early text: "A real need exists for a three-dimensional display in almost any spatial navigation problem, whether it is through water, air, or outer space. Faster and faster vehicle velocities have outmoded visual navigation, even when direct visual observations are possible. [...] The navigator's ability to react should not be limited by his position display."[18]

The solution to the problem of the ineffectiveness of the human operator could be to develop a real three-dimensional display: "A truly three-dimensional display is one in which the echoes appear as bright spots in an actual volume of light, at points representing the spatial positions of the corresponding objects."[19] This is the decisive point in volumetric displays. The image is not being created on a plane, nor on two, as in stereoscopy; it is created in a volume. As a result the image is perceived as spatial. How can this be done? According to the authors,

> *[t]he echoes are displayed in the volume of light as bright spots, by an intensity modulation of the c.r.t. spot. The deflections must be suitably synchronized with the scan of the aerial beam, in order that the echoes may appear consistently at points representing the objects' spatial positions. The deflection produced mechanically can be either 'real' or 'apparent'. An example of the former would be obtained if the c.r. tube itself were moved axially. This is, for mechanical reasons, undesirable. A similar effect can be obtained, however, by projecting the c.r.t. picture on to a moving*

16 E. Parker, P.R. Wallis, Three-Dimensional Cathode-Ray Tube Displays, in: *Journal of the IEEE* 95 (1948), pp. 371–390, p. 371.
17 Ibid., p. 379.
18 R.D. Ketchpel, Direct-View Three-Dimensional Display Tube, in: *IEEE Transactions on Electron Devices* 10 (1963), pp. 324–328, p. 324.
19 Parker, Wallis 1948 (as fn. 16), p. 372.



6 Early Diagrams for a *Moving Screen* and a *Moving Mirror* Display, Two Fundamental Forms Of Volumetric Display Of The *Swept Volume*-Type.

> *screen. An 'apparent' deflection can be obtained, for example, by observing the c.r.t. picture in a mirror which is moved in a suitable manner.*[20] *(fig. 6)*

Here, Parker and Wallis describe two fundamental types of the class of volumetric displays that create the volume of the image with movable parts ("swept volume"). In the first case the screen is rotating and the light-points are projected onto it. In the second case the plane is multiplied into a volume through a translational moving mirror. This means that similar to film, volumetric displays function on the basis of the series of physiological optics with the addition of the third dimension. Human perception visualizes a three-dimensional image produced by the fast succession of projections onto the rapidly moving planes. It can (in principle) be viewed from all sides without additional glasses. Contrasted to geometrical optics, this plane is being moved, thereby becoming transplane. The image then appears in the volume, described by many authors as image-space or image-volume. Obviously, these are very primitive concepts to realize a volumetric image – at least compared with the presumably computer-generated smooth image in *Avatar. Avatar* shows that technological progress is, of course, unavoidable – and so we are in the midst of the discursive level of these imaging technologies.

Even though (or maybe because) volumetric imaging technologies require extensive funding, fictional, phantasmagorical ideas are surrounding this topic even in research projects. In a text on volumetric displays from 2004 Rieko Otsuka and others state:

20 Ibid.

> *The motivation for this work is the dream of realizing real stereovision images in space. Most of us remember the scene in the 1977 movie 'STAR WARS' in which the robot R2-D2 projects a three-dimensional image of Princess Leia, who begs Obi-Wan Kenobi for help. Besides 'STAR WARS,' there have been many movies that contain scenes in which holograms appear [...]. These films indicate a desire or a premonition in many of us to see this kind of technology brought to life.*[21]

Even though the "desire for 3D" does not have to be hyped into an anthropological constant, it seems that it is an actor in this matter.[22] Here we can already glimpse that fictional representations do play a role in orienting research towards certain goals to be achieved. Fig. 7 shows a (fictional) representation of a volumetric display from a text published in 1989. This sort of centralized traffic control room is remarkably similar to representations of futuristic displays in *Star Wars Episode III – Revenge of the Sith* (USA 2005, George Lucas) (fig.8).

Specific institutions subject a distant place to analysis and bring it under control with the help of volumetric displays. Bruno Latour has argued that the "simple drift from watching confusing three-dimensional objects, to inspecting two-dimensional images which have been made less confusing" is a central technique of producing knowledge.[23]

21 Rieko Otsuka, Takeshi Hoshino, Youichi Horry, Transpost. All-Around Display System for 3D Solid Image, in: *Proceedings of the ACM Symposium on Virtual Reality Software and Technology*, Hong Kong, 2004, pp. 187–194, p. 187.

22 Meaning the thesis, that there is a naturally given "desire for illusionistic images", which sometimes seems implied in positions like André Bazin's The Myth of Total Cinema, in: idem., *What is Cinema?*, Berkeley: University of California Press, 1967, pp. 23–27.

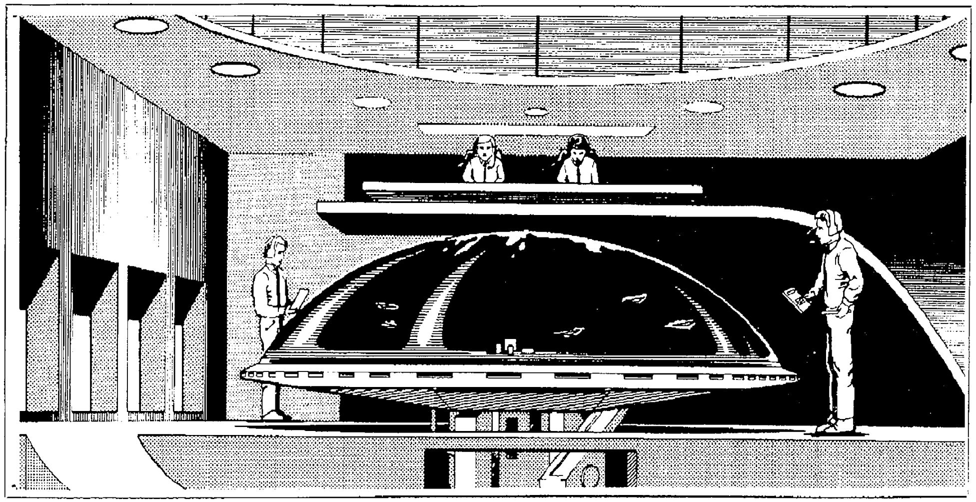
23 Bruno Latour, Visualisation and Cognition. Drawing Things Together, in: *Knowledge and Society. Studies in the Sociology of Culture and Present* 6 (1986), pp. 1–40, p. 15.

“No matter what they [the scientists, but one could also say: the military, J. S.] talk about, they start talking with some degree of confidence and being believed by colleagues, only once they point at simple geometrized two-dimensional shapes.”[24] However, as the above quoted discussions on volumetric displays have shown, it is at least problematic if, for locating something within an image, collaborative viewing as well as the discussions and the decision-making connected with it are perhaps more successful with three-dimensional representations. Through these display technologies space or spatial constellations themselves become “immutable mobiles”, in the sense of Latour.[25] In this way a spatial situation is opened up to discussions and control.

The literature on volumetric displays goes beyond our current discussion, but in these texts one can repeatedly find commentaries on the viability and necessity of volumetric display technologies:

> *With vendors lowering the barrier to adoption by providing compatibility with new and legacy applications, volumetric displays are poised to assume a commanding role in fields as diverse as medical imaging, mechanical computer-aided design, and military visualization.*[26]

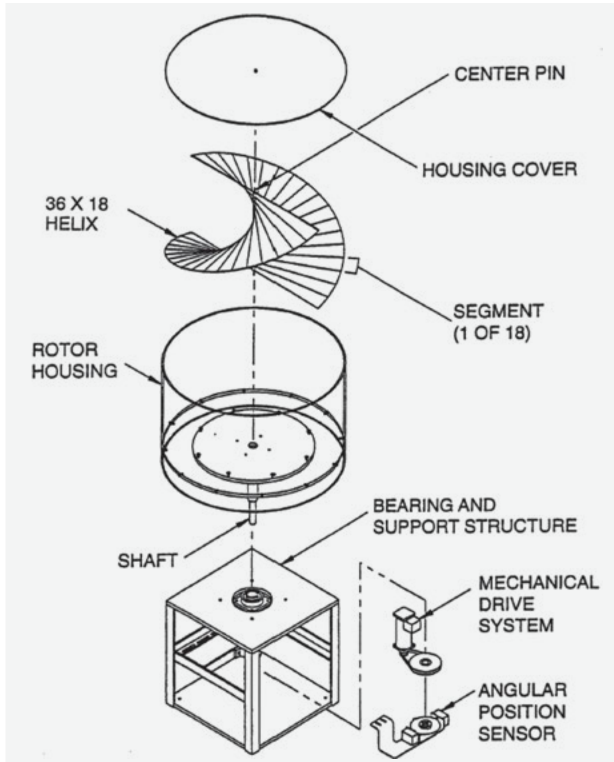
Military and medical visualizations are the most mentioned fields of applications. Most often the goal is to control spaces filled with people or to control the human body itself. According to Blundell and Schwarz the means of control is usually a god’s eye view in which the user either observes



7 Fictional volumetric display used in a sort of traffic control.

8 Fictional volumetric display from Star Wars Episode III – Revenge of the Sith.

24 Ibid., p. 15–16.
25 See Ibid.
26 Gregg E. Favalora, Volumetric 3D Displays and Application Infrastructure, in: *Computer* 38 (2005), pp. 37–44, p. 37.



9 Volumetric Display in which a transplane image is projected onto a rotating plane in form of a helix.

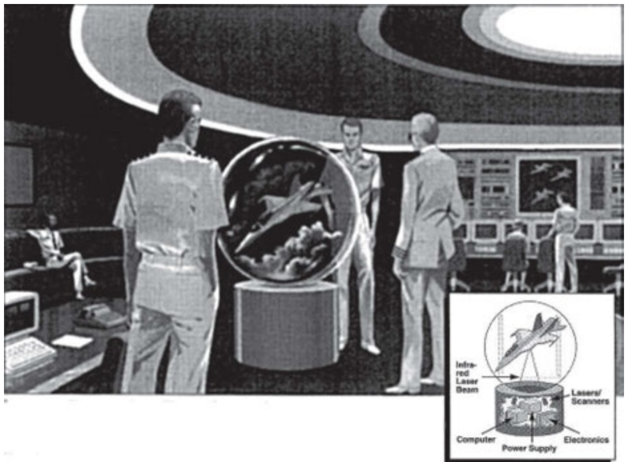
a space from outside or is able to effortlessly penetrate the body: "In the case of all volumetric display systems known to the authors, the generation of images occurs within a containing vessel from which the [observer] is excluded. Volumetric systems therefore provide a 'God's-eye' view of any image scene."[27]

To conclude I will discuss a paper on a military development of a volumetric display, which is rich in fictional projection. Fig. 9 shows a volumetric display in which a transplane image is projected onto a rotating plane in form of a helix.

In the paper the authors discuss possible usages of this display: "A logical application for the 3-D volumetric display is for control and management of air traffic in a volume of aerospace for the FAA, Air Force, or Navy."[28] It should be noted that in this military setting that only men are watching the display and thereby direct their controlling gaze on the targets (be they hostile or friendly), although women are not excluded from the military in the USA (fig. 10). The corresponding text explains:

> *The Department of Defense Science and Technology Initiative identifies seven thrust areas. One of these is Global Surveillance and Communications, a capability that can focus on a trouble spot and be responsive to the needs of the commander. A three-dimensional display of the battle area – such as the LaserBased 3-D Volumetric Display System – will greatly facilitate this capability. Tactical data collected for command review can be translated and displayed as 3-D images. The perspective gained will contribute to quicker and more accurate decision-making regarding deployment and management of battle resources.*[29]

27 Barry Blundell, Adam Schwarz, *Volumetric Three Dimensional Display Systems*, New York, NY: John Wiley & Sons Inc, 2000, p. 4.
28 Parviz Soltan et al., Laser-Based 3D Volumetric Display System, in: Richard M. Satava et al. (eds.), *Interactive Technology and the New Paradigm for Healthcare*, Amsterdam et al.: IOS Press, 1995, pp. 349–358, p. 356.
29 Parviz Soltan et al., Laser-Based 3-D Volumetric Display System (The Improved Second Generation), 1996, http://handle.dtic.mil/100.2/ADA



10 Usage of a (Fictious) Volumetric Display for a Command-and-Control Situation.

11 Usage of a (Fictious) Volumetric Display for the Control of a Female Body during Birth.

This is quite explicit.

In fig. 11 it is a woman who is at the center – but in this case she is the object of the medical gaze via the volumetric display. It seems as if there is a gendered bias of the space-controlling gaze.

This is only a very small fraction of the rich literature on volumetric display technologies, but some elements are clearly visible: These displays aim to produce truly three-dimensional and therefore post-perspectival images. These images render scenes and situations, in which the spatial structure is of paramount importance, without the distortions of perspective. Because the images do not prescribe and situate viewers in any strict sense, they are ideally suited to be seen, discussed and used by a group of people in collaborative work.[30] And the discourses on these images are full of fictionalized projections about their possible future uses especially in military and medical practices, centered on control and surveillance. These potential image technologies are understood as assembling and situating people in a situation room or a *center of calculation* to control a situation.

Such projections of futuristic medial practices are of course more revealing about the present than about any future to come. Obviously, all the different extrapolations on volumetric display technologies converge in that they are mainly used for strategic planning, control, surveillance,

306215 (accessed August 30, 2007), p. 17.

30 Of course: In difference to flat images, where everyone sees the same image (even if not standing on the position prescribed by the perspectival construction), while watching volumetric images everyone in a group of observers sees a different image – as would be the case with real three-dimensional objects. That the image does not prescribe a certain viewpoint opens up the space for several viewpoints, which can be brought into discussion.

analysis – in *Avatar* to plan the exploitation of Pandora by the military-industrial complex. *Avatar* is explicitly about anthropocracy, about humans trying to establish their control over the resources of a foreign world by, amongst other things, three-dimensional displays. The following part will analyze the cultural imaginary of anthropocratic power as sedimented in the discursive history of volumetric displays – be they real or fictional.

Volumetric Display as Symbolic Form

Erwin Panofsky's famous paper *Perspective as Symbolic Form* ends with the sentence: "It is thus no accident if this perspectival view of space has already succeeded twice in the course of the evolution of art: the first time as the sign of an ending, when antique theocracy crumbled; the second time as the sign of a beginning, when modern 'anthropocracy' first reared itself."[31] Here anthropocracy is directly connected with (central-)perspectival representation. Panofsky's argument is, put simply, that perspective shows the world *as seen* or at least: *approximately as seen by a human observer*, man becomes the center of the shown world: "This view of space [...] is the same view that will later be rationalized by Cartesianism and formalized by Kantianism"[32] – and, as we all know, in Descartes the cogito is the only secure knowledge and in Kant the world appears only according to the transcendental structures of consciousness. Man is in the center. Panofsky argued that perspectival representation is an expression and/or one performative realization of an anthropocentric worldview.

First there is the obvious problem that it might be too big an argument to correlate a certain form of representation with a certain anthropocentric episteme. Might not the anthropocentrism of perspective be more gradual and depend on different practices with perspectival images? These were arguments already made to criticize so-called *apparatus theory*.[33]

Closely connected with this is, secondly, a more fundamental problem with Panofsky's argument. Perspective was invented in the renaissance. But it was only decades later, namely in the 19th century, that industrial modernity had its big takeoff, an anthropocracy if you will, resulting nowadays in ecological disaster. And here is the central point: Very important forms of representations to be used in this upheaval for the constructing of technologies, for increasing the effectiveness and speed of individuals in decision making etc. were not at all structured by linear or central perspective, but were, as I said, parallel-perspectival or material 3D models or maps – e. g. in engineering drawing, meaning the transfer of technological knowledge or architecture. Although parallel perspective and maps on the one hand and real volumetric representations on the other are of course different in that the former two are still forms of projection, where the latter is not (it is more a scaling and filtering), they are similar in that they do not imply a positioned viewing subject.[34] Does that mean, when we follow Panofsky's argument, that they are not anthropocentric because they do not imply a viewing (although one-eyed) body? Yes, perhaps that is what it means – but in a very special sense: The forms of power relevant during the renaissance

31 Erwin Panofsky, *Perspective as Symbolic Form*, trans. by Christopher S. Wood, New York, NY: Zone Books, 1991, p. 72.

32 Ibid., p. 66.

33 See Hartmut Winkler, *Der filmische Raum und die Zuschauer. 'Apparatus' – Semantik – 'Ideology'*, Heidelberg: Carl Winter, 1992.

34 An exception may be the implied position of potential observers in sculpture.

were mostly feudal forms, implying personalized forms of power, e. g. peasants in serfdom to their landlords or power concentrated in the two bodies of the king, according to Kantorowicz.[35] Panofsky's perspectival anthropocracy is a personalized form of power, the world made to conform to the gaze of an idealized person. One shouldn't forget that in some types of baroque theater architecture the emperor or another type of king had the only place from which the perspectival scenery on the stage was completely coherent – here the body of the emperor and the eye point of central perspective were *literally* matched.[36]

But in modernity, as has often been noted, personalized power disappears and new objectified, anonymous forms of power took its place; a power we describe as *Sachzwänge*, factual constraints, the subject of deep analysis by Marx, Weber, Schelsky and others.

A question becomes unavoidable: Can we formulate the speculative thesis that the view from nowhere – in parallel perspective, material models and volumetric display technology – is the view of objectified power, which no one in particular possesses? Which is only to be found in abstract structures – as Marx, Luhmann and Foucault, for example, have shown in very different ways?

In parallel perspective it is more important that the relative length of the lines and the angles are preserved, that you can measure it: It is a representation of the object in itself and not as someone sees it, or as architectural theorist Robin Evans put it:

> *In orthographic projection the projectors do not all converge to a point, but remain parallel. Because this is not the way we see things, orthographic drawing seems less easy to place. It does not correspond to any aspect of our perception of the real world. It is a more abstract and more axiomatic system. […] The advantage of orthographic projection is that it preserves more of the shape and size of what is drawn than perspective does. It is easier to make things from than to see things with.*[37]

These abstract, measurable representations – think of how in *Avatar* the three-dimensional representation is enhanced by information – are the expression of modern power, which has always already transcended human standards and scale.[38] The combination of spatiality, the enhancement of collaborative work and the saturation of images with information is characteristic for a wide field of display technologies. Such display technologies are less the expression than the performative realization of modern power. The view is not a god's eye view – but it is the view of the successor of god, what was already precisely described by Benjamin in his beautiful fragment *Kapitalismus als Religion* – it is the view of Capital (or of capital and the military as one of its executive forces – as is shown in *Avatar*).[39] It is a view or a

35 See Ernst H. Kantorowicz, *The King's Two Bodies. A Study in Medieval Political Theology*, Princeton, NJ: Princeton University Press, 1957.

36 See John Peacock, Inigo Jones's Stage Architecture and Its Sources, in: *The Art Bulletin* 64 (1982), pp. 195–216.

37 Robin Evans, Architectural Projection, in: Eve Blau, Edward Kaufman (eds.), *Architecture and Its Image. Four Centuries of Architectural Representation. Works from the Collection of the Canadian Centre for Architecture, Montreal*, Cambridge, MA: The MIT Press, 1989, pp. 18–35, p. 20.

38 See Jens Schröter, Tristan Thielmann (eds.), Display I: Analog, in: *Navigationen* 6.2 (2006) and Tristan Thielmann, Jens Schröter (eds.), Display II: Digital, in: *Navigationen* 7.2 (2007).

39 See Walter Benjamin, Capitalism as Religion [Fragment 74], in: Eduardo Mendieta (ed.), *The Frankfurt School on Religion. The Key Writings by the Major Thinkers*, New York/London: Routledge, 2005, pp. 259–262.

gaze that makes something measurable and quantifiable as well as controllable and reproducible.

But isn't that too big a thesis too? Are all god's eye representations the gaze of capital? I guess that would indeed be too strong. But in certain practices these types of representations become operational for domination – and it's precisely their non-linear-perspectival character and their non-positioning of viewers that is their strength. And the least one could say is that the potentially subjectivist and anthropocentric linear perspective is not the characteristic expression and technology for modern power.

Figures

1a–c 20th Century Fox, James Cameron, *Avatar*, USA/UK 2009, TC: 00:47:49, 00:48:03, 00:48:10.

2 Cheryl Rodewig, US Army.

3 John Fischer, US Navy.

4-5 Jens Schröter.

6 E. Parker, P.R. Wallis, Three-Dimensional Cathode-Ray Tube Displays, in: *Journal of the IEEE*, 95 (1948), pp. 371-390, p. 373.

7 Rodney Don Williams, Felix Garcia, Volume Visualization Displays, in: *Information Display 5* (1989), pp. 8-10, p. 9.

8 Star Wars Episode III – Revenge of the Sith (USA 2005, George Lucas).

9 Reprinted from Parviz Soltan et al., Laser-Based 3D Volumetric Display System, in: Richard M. Satava et al. (eds.), *Interactive Technology and the New Paradigm for Healthcare*, Amsterdam et al.: IOS Press, 1995, pp. 349-358, p. 352, with permission from IOS Press.

10–11 Parviz Soltan et al., Laser-Based 3-D Volumetric Display System (The Improved Second Generation), http://handle.dtic.mil/100.2/ADA306215 (accessed August 30, 2007), pp. 16-20.