



CHALMERS

A Poetics of Virtuality THOMMY ERIKSSON

Department of Applied IT
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2016

THESIS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

A Poetics of Virtuality

THOMMY ERIKSSON

Department of Applied IT

CHALMERS UNIVERSITY OF TECHNOLOGY

Gothenburg, Sweden 2016

A Poetics of Virtuality
THOMMY ERIKSSON
ISBN 978-91-7597-320-3

© THOMMY ERIKSSON, 2016.

Doktorsavhandlingar vid Chalmers tekniska högskola
Ny serie nr 4001
ISSN 0346-718X

Department of Applied IT
Chalmers University of Technology
SE-412 96 Gothenburg
Sweden
Telephone + 46 (0)31-772 1000

Cover:
Rendition of William Gibson's cyberspace,
created by Thommy Eriksson.

Printed by:
Chalmers Reproservice
Gothenburg, Sweden 2016

Abstract

How is virtuality represented in fiction, and what does that say about our anticipations and fears about what the virtual is and will be? This text, a poetics of virtuality, explores fictional representations of virtuality, primarily in movies and literature, but also in media productions done by the author. The aim is to study the *dream* of virtuality. What are we promised? What do we anticipate? What do we fear? This is why the study has focused on fictional virtualities, where the storyteller is somewhat free to represent the virtual, and let cultural ideas emerge, untethered by the technical constraints that govern real-life virtuality technology.

The study has two methodological approaches. One is the analysis of a large number of fictional narrative texts representing virtuality, primarily movies but also a few novels and short stories. The other is the study of the author's own work producing media products involving virtuality. The chosen research design utilizes the author's position as both an academic and a computer graphic artist. The studied fictional narratives have been analyzed using semiotics, a method to study signs and sign production. A self- and auto-ethnographic approach has been used to observe the author's media productions.

The contribution of this study is a deep and detailed understanding of how virtuality is represented in fiction, presented as a poetics of virtuality. Seven topologies of virtuality are presented: #surrealism, #containment, #engineered space, #artificial light, #immateriality, #control, and #virtual artificial intelligence.

In summary, the results show that:

- It was advantageous to combine film studies with auto-ethnographic observations, but also highly time consuming
- Fictional representations of virtuality are largely based on real-life technology, especially older computer technology
- Fictional representations of virtuality are quite highly constrained by production circumstances and storytelling requirements
- Volumetric displays are highly anticipated, but the need to use augmented reality to implement the vision might surprise us
- Virtuality is often thought of as being in opposition to the real and the natural; it is also often thought of as being a lesser copy of the actual
- A major theme is breaking out of the virtual, and this falsely promises that there can be an escape from the virtual, and from technology.

Keywords: augmented reality, computer games, computer graphics, movie making, production culture, science fiction, Stephen Baxter, virtual reality, virtual worlds, virtuality, William Gibson

For the users

Acknowledgements

Even though research is a solitary endeavor, it is likewise a continuous collaboration, and my own work have found nurturing soil in a number of team efforts and group environments.

It is a pleasure to truthfully give my first big thanks to my supervisors Sven Andersson and Karin Wagner, for eight years of encouragement and guidance. I have not only needed your help, but I have also enjoyed it. Magnus Bergquist helped me truly appreciate ethnography, and Mats Björkin, Lena Israel, Eija Timonen, and Susana Tosca were excellent opponents at the four seminars that were my checkpoints along the way.

Thank you for all discussions at the seminars in the Digital Representation research group; Arne Kjell Vikhagen, David Crawford, David McCallum, Magali Ljungar-Chapelon, Marco Muñoz, and my brother in arms Josef Widedström. I would not have been a part of this without Sergei Muchin; thank you for having me back at Chalmers, and for introducing me both to research and production cultures.

Even though I have never designed an actual, physical house, I nevertheless have daily use of what I learnt when studying architecture. I might not have been paying as much attention as I should have, but the teachers gave me one lifelong lesson; *I fight for the users!*

The Department of Applied IT at Chalmers University of Technology is a truly cross-disciplinary and exciting work place, thanks to many many people, and I especially think about wonderful colleagues such as Beata Stahre Wästberg, Christian Stöhr, Daniel Sjölie, Dick Stenmark, Elisabeth Saalman, Eva Eriksson, Linda Bradley, Mattias von Feilitzen, Mohammad Obaid, Morten Fjeld, Olof Torgersson, Palle Dahlstedt, Staffan Björk, Sus Lundgren Lyckvi, and Tom Adawi. I am, naively, looking forward to having more time to talk to you now when I close the chapter on my PhD thesis!

A very important part of my study of virtuality have been my project clients and co-workers. Thank you for trusting my work and giving me of your time; Alan Chan, Helen Rundgren, Jonathan Westin, Michelle Evans, and Rick Dunbar. A very special project was the Environmental Science Investigation; I am grateful for our time together and for keeping in touch, Bengt Petersson, Cammy Huang-DeVoss, Göran Karlsson, Maria Spante, Maria Sunnerstam, and Michael Axelsson. Another outfit of fun people is the Audiovisual Thinking editorial board; Inge Sørensen, Oranit Klein Shagrir, Petri Kola, and Sanna Marttila. Thank you for a wonderful idea that asked intriguing questions about visual storytelling, and for hunting down hip restaurants in London and Copenhagen. I don't think we are done yet!

Three people stand out, really helping me out during the long last stretch of my doctoral studies. Jonas Landgren, thank you for creating time. Pär Meiling, thank you for sorting out administration. Anthony Norman, thank you for a tremendous and professional work with proof reading. All remaining errors are on me.

Pappa and mamma, thank you for everything, I think about you often.
Gunilla, thank you for the book that changed my life (hint, it was not the Bible).
Maria, Elias, Samuel, Jonathan and Sofia, thank you so very much for being my family.

Table of contents

On the use of copyright protected images	1
ASKING FOR A POETICS OF VIRTUALITY	3
How is virtuality represented in fiction?	5
Poetics as an exploration of theory and practice	7
Virtuality and the anticipation of transcendence	7
BACKGROUND DESCRIBING THE ORIGIN AND ESSENCE OF VIRTUALITY	11
THE VIRTUAL EXPLAINED	13
Almost as if	13
Virtual but with an actual effect	14
The etymological roots of virtual and cyberspace	15
Virtuality – a definition	16
Previous studies of virtuality	17
THE FIRST VIRTUALITIES	19
A history of illusions – from cave paintings to virtual reality	20
The development of computer graphics	22
The development of virtual reality	24
POPULARIZING CYBERSPACE	26
Cyberpunk – a dubious movement	29
The end of cyberspace and the future of the Internet	33
CHARACTERISTICS OF TECHNICAL VIRTUALITY	37
Immersion and presence	37
Presence and interaction	37 • Immersion and richness
Avatars and the subject/object boundary	40
Worldliness – the virtual as a world to inhabit	41
Virtual as representation or (post-physical) existence	44
Information, space, and place	46
Almost virtual – Baudrillard’s simulacra and simulation	48
Opposing or supplementing the actual	49
The virtual as a lesser copy or beyond the actual	50
Freedom, empowerment and frontier spirit	53
STRUCTURING FICTION, ACTUALITY AND VIRTUALITY	56
Examples of how virtuality and fiction are structured	59
METHODS FOR INVESTIGATING VIRTUALITY	63
Studying media using hermeneutics, semiotics and ethnography	65
Authoring – studying media productions	65 • Reading – studying narratives
Analyzing media – production, text and reception	66
HERMENEUTICS – A THEORY OF TEXT INTERPRETATION	68
The death of the author and her resurrection	68
The author as shaman	69
Managing tradition and the hermeneutic circle	70
A SEMIOTIC APPROACH TO FILM STUDIES	72
The semiotic sign	73
Symbol, icon and index	74 • Super-sign structures
Visual semiotics and the semiotics of cinema	77

Cinema as mediation or representation 77 • The image as monolith or conglomerate 80	
Cinema as language 81 • Reading cinema as a text 82	
My study of virtuality in fiction 85	
Selecting the narratives and understanding science fiction 85	
The selected narratives 87 • Analyzing the narratives 94 • Interpreting super-sign structures 96	
STUDYING MEDIA PRODUCTIONS WITH SELF- AND AUTO-ETHNOGRAPHY	98
Approaches to conducting ethnography 98	
Why self- and auto-ethnography? 98 • Ethnography, self-ethnography and auto-ethnography 99 • Achieving credibility – the critical debate on self- and auto-ethnography 100 • The study of me – narcissism, self-disclosure, vulnerability and censorship 101 • The study of others – achieving rapport and caring for informants 102	
Influence from the research agenda 104 • Creating distance 105	
My observations of production culture and virtuality 107	
Taking field notes and analyzing observations 107 • My context as a researcher and media producer 107 • Achieving access to observe media productions 108 • Observing externalized and internalized design processes 111 • The observed media productions 112 • Interviews with media producers 115	
Reflections on production culture and my own work process 117	
Working as a computer graphic artist 117 • Pragmatic creativity 118 • Serendipity in movie production 119 • Shaman or auteur – freedoms and limitations in design processes 120 • “Hollywood” – breaking down the monolith 122	
THE POETICS OF VIRTUALITY	125
SURPRISING COMPLEXITY – A THOUSAND SIGNS.....	126
The most frequent signs 128	
A tapestry of intratextual signs – the case of Life on Mars 129	
Building a world that represents itself 132	
Sound signifying virtuality 134	
Production culture and representation of virtuality 136	
The computer graphics and live action divide 137 • When the virtual becomes a spectacle 139	
Signs of virtuality and their relation to the plot 140	
MIMESIS – SHOW, DON’T TELL.....	142
Mise-en-scène, cinematography, and production design 142	
Semiotic inertia - the green flickering screen 145	
Flaunting artificiality via mediation 149 • Flaunting artificiality via electricity 150 • The green and the other colors 152 • The Cartesian construction kit 156 • The glowing line 157 • The grid 160 • The wireframe and the polygon 162 • The voxel and the pixel 166	
Scan lines and flickering outside of the TV screen 167	
DIEGESIS – TELL, DON’T SHOW	170
Verbal and textual references 170	
Interrupted narrative and surrealism 172	
The jump versus the transit 174 Specific references to Oz and Wonderland 174	
Jacking-in – the techno-transcendence into the virtual 175	
THE ANATOMY OF SUPER-SIGNS.....	180
Ejahja – building a female Virtual 180	
The grey surface and the Virtual Gas Lab 185	
The immateriality of a flickering candlelight 189	
The world that is sick 190	

Virtual death – how to die without the flesh	192
BREAKING THE SCREEN – HOW THE VIRTUAL BLEEDS INTO THE ACTUAL	197
Holograms and volumetric displays	197
The first fictional volumetric displays	200
Augmented reality – projecting virtual objects	202
Augmented reality and heads-up displays in fiction	203
The transparent screen	206
Backtracking the transparent screen	209
Environmental Science Investigation – interfaces within interfaces	212
TOPOLOGIES OF VIRTUALITY	216
Topology #surrealism	217
Topology #containment	220
Topology #engineered space	224
The vacant world 226 • Reduction through abstraction 227 • Emphasizing engineering – the rotating display 228	
Topology #artificial light	229
Topology #immateriality	231
Ghosts and the haunted house 233 • Floating 234	
Topology #control	235
Breaking space-time 237 • Power struggles 238 • Surveillance, power and control 240	
Topology #virtual artificial intelligence	243
The god-like control of the maker 243 • Enslaved artificial sentience and the zombie crowd 246	
END OF LINE	255
Combining autoethnography and film studies	256
Technology and science fiction – crossbreeding fiction and real-life	257
Connecting fictional and real-life technology 258 Science fiction is not free 258	
Foreclosing the future	259
The Princess Leia hologram and Stephen Baxter’s Virtuals 260 • Signs of the contrary 260 • Tell, don’t show 261	
Hopeless dreams and misguided fears	262
The revolt of the virtual artificial intelligences 262 • The perfect simulation and the complete immersion 263	
A post-physical existence	264
The virtual as a lesser copy 264 • Breaking out stories 265 • There is no escape 266	
THINGS I WOULD LIKE TO KNOW MORE ABOUT	267
APPENDICES	269
APPENDIX 01: A PRIMER TO COMPUTER GRAPHICS IMAGERY	270
Introduction to image manipulation concepts	270
Concepts in computer graphics	271
Computer-generated Imagery (CGI) 271 • 2d graphics (2D) 272 • 3d graphics (3D) 272	
Virtual cinematography	273
APPENDIX 02: EXAMPLES OF COMPLETE SUPER-SIGN STRUCTURES	274
The Thirteenth Floor 274 • Avalon 274 • The Matrix 274	
APPENDIX 03: ADDITIONAL PUBLICATIONS	275
BIBLIOGRAPHY	277
REFERENCES	278
FICTIONAL MOVIES	306
FICTIONAL LITERATURE	309

On the use of copyright protected images

This research text, being a PhD thesis analyzing and discussing commercially produced movies and other media, is complemented with still images from the studied movies. These images are used to facilitate the discussion of the visual aspects of the movies, aspects that are critically analyzed and reflected upon. It is the author's interpretation that the use of these images is legal according to the Swedish limitation to Copyright called "right to quote" (citaträtten), see the Copyright Act 22 §. It covers the right to quote both text and images. This is similar to but not the same as the American "fair use" doctrine. For an overview of the similarities and differences between right to quote and fair use, see (Eriksson, 2013).

ASKING FOR A POETICS OF VIRTUALITY

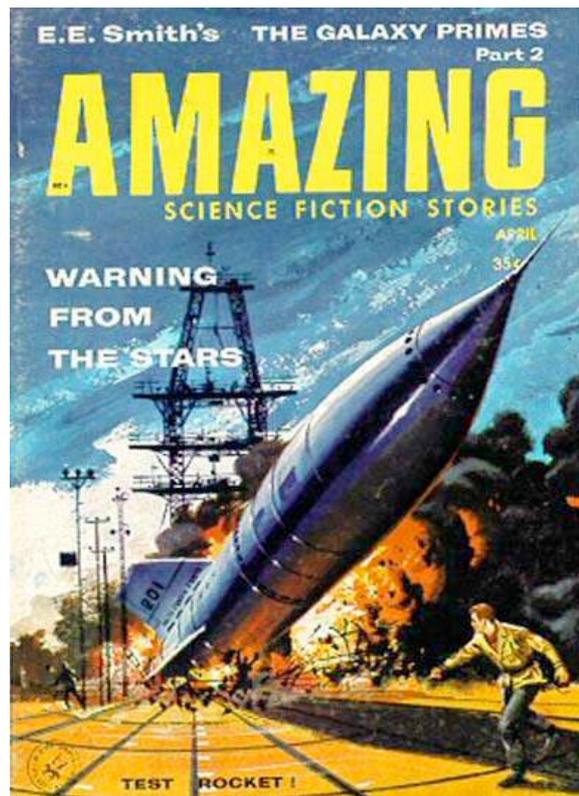


Figure 1. A science fiction pulp magazine cover.

Yuri Gagarin became the first human to enter outer space on April 12th 1961. Space travels had been part of Western culture's dream about the future since the start of the twentieth century, and after Gagarin's orbit around the Earth the dream went into overdrive, not to lose momentum until the culmination of the Moon landings in 1969. Look at Figure 1 above, showing a science fiction pulp magazine cover. This was the dream we were sold. Exploration. Drama. Winged Buck Roger space ships. This dream helped to justify the cold-war Moon race, the space shuttle, and the ISS space station, all prohibitively expensive. The Russians built their Buran shuttle, so expensive that it helped bring the Soviet Union to its knees. It flew once. The dream of space was fueled by narratives such as H G Wells 1865 novel *From the Earth to the Moon* and later by the fiction of Robert Heinlein, Arthur C. Clarke, and many others. Would we have spent all these resources without the alluring dream of space conquest?

This illustrates how fiction influences real-life technological development. The summer of 1969 will be remembered for the spectacular finale of the Moon race. The same year a computer was quietly brought into service as a part of the ARPANET project. It was the first router of what would become the Internet, and gradually the dream of outer space gave room for a new dream of another space, cyberspace. Now, in the dawn of the twenty-first century, we live much of our lives online, on the screen, but the vision of virtuality beckons us to go further. Are these visions driving us down blind alleys, yet again? It is time to stand back and reflect over what we anticipate from this new space. This is my aim and my contribution: to investigate our dreams and our anticipations for this virtuality we

are building around us. This is what makes this poetics of virtuality necessary, the need to investigate the clash between dream and deception. Dreams of technology can be misleading, as illustrated by Mark Stefik's (1996) analysis of the information superhighway metaphor and Laura Watts' (2012) investigation of the failed videophone idea.

The virtual that we are building – worlds, environments, and objects – is a new kind of reality, and the dreams about the virtual are exciting, fresh and spectacular. Are we using huge resources yet again without thinking it through properly? Are we even building artifacts that are based on erroneous design ideas? We shape our tools, and then they shape us.¹ We shape our stories about who we are, our views of the world, and then they shape us. Building the virtual is a design project, just like building cities. Design choices are often done in haste, and ad-hoc. No matter how haphazard the choices once were, they soon become “seemingly self-evident” (Benedikt, 1991, p.132), built on “absent paradigms and hidden assumptions” (Heuser, 2003, p.196). The future becomes “foreclosed” (Watts, 2006, p.35). Jaron Lanier (2010) warns against the tendency to take for granted the design choices and worldviews on which virtuality is built. He writes that “these designs came together very recently, and there’s a haphazard, accidental quality to them. ...there’s a danger that you will become entrapped in someone else’s recent careless thoughts” (p.22). Hayles (1999) express a similar warning, and emphasizes that “the best possible time to contest for what the posthuman means is now, before the trains of thought it embodies have been laid down so firmly that it would take dynamite to change them” (p.291). My aim is to study these recent careless thoughts. How we dream about virtuality manifests in our representations of the virtual. Therefore, a poetics of virtuality becomes vital, a treatment of the form and aesthetics of the virtual.

This is not the first analysis of the virtual. Important research has been done by, for example, Michael Benedikt (1991), Howard Rheingold (1991), Michael Heim (1993), N. Katherine Hayles (1999), Sabine Heuser (2003), Lisbeth Klastrup (2003a), and André Nusselder (2009). Several of these investigations belong to a first wave of academic treatments on virtuality, mainly focused on understanding the cyberspace and virtual reality hype of the 80s and 90s. Much has happened since then. We have left the concept of cyberspace behind. Instead we have seen the establishment of other implementations of the virtual, and indications of things to come. A revised poetics of virtuality is needed.

How is virtuality represented in fiction?

Not only is there a need for a general poetics of virtuality, but earlier work has also not given enough attention to *fictional* representations of virtuality. Larry McCaffery (1991), Brian McHale (1992), Sabine Heuser (2003), and Svante Lovén (2010) have made interesting contributions, but they are mostly limited to cyberpunk literature. A wider look at virtuality in mainstream culture and visual culture is needed.

¹ A phrase formulated by Father John Culkin, when he was writing about Marshall McLuhan (Culkin, 1967).

Therefore, I have studied how virtuality is portrayed primarily in fictional movies. The primary focus of my study is not real-life virtual worlds (such as computer games, virtual realities, or for example *Second Life*). Rather, the focus is on fictional representations of virtuality. A canonic example would be the virtual worlds depicted in movies such as *The Matrix* (Wachowski & Wachowski, 1999) and *Tron* (Lisberger, 1982). I have primarily studied movies, but included some literary texts as well. I have studied virtuality in fiction because in fictional narratives storytellers are more free to represent the virtual, and let cultural ideas emerge, untethered by the technical constraints that govern real-life virtuality technology. Fictional narratives are not “bound by technical difficulties” (Heuser, 2003, p.70). My aim is not to study virtuality per se; my aim is to study the *dream* of virtuality. What are we promised? What do we anticipate? What do we fear? The primary purpose of science fiction is not prediction (Määttä, 2010). On the contrary, the visions of the future in science fiction usually get it wrong, and that is interesting – in what way they get it wrong. In this poetics of virtuality, I will use science fiction studies as a means to an end. It is not a study of science fiction per se. It is a study of the dream of virtuality.

Media and popular culture can be regarded as a mirror, reflecting our views, thoughts on and relationships to real life. By looking in the mirror, we can see how it reflects aspects of society and ourselves; what do we tell in our stories? What do we look at? Our cultural expressions – myths, arts, popular culture, and so on – can highlight our fears and our expectations. The mirror that we see through also changes while we are looking, through the act of looking through it. The interplay between fictional depiction of technology and real-life technical development is complex, and even though specific cases rarely can be identified, more subtle examples of inspiration are often claimed (Butz, Endres & Schmitz, 2008; Disch, 1998; Flichy, 2007; Holmberg, 2010; Nilsson, 2010; Noessel & Shedroff, 2012). Oliver Grau (2001, p.227) claims that

the history of technology has always included a history of its utopias and myths that reveal human desires, and serve to express proto-rational points of reference. Myths do not lose their relevance by virtue of being ancient. They are about how we view the world, and as such may be outside of ordinary time. They drive history.

Specific influences are often illustrated by examples from mobile phone development (Butz, Endres & Schmitz, 2008; Watts, 2006; Watts, 2012) and how William Gibson’s vision of cyberspace inspired Internet visionaries and virtual reality developers (Flichy, 2007; Godhe, 2010a; Hayles, 1999; Laurel, 1993; Lovén, 2010). Flichy (2007) mentions the “ideological framework within which emerging technologies evolve” (p.6) and Kearney (1998) describes how utopian visions can first disrupt traditional thinking and then our thinking “relaxes its critical guard, ... its future images becoming just as dogmatic as the ideological images of the past it ostensibly seeks to dismantle” (p.167). My intention is to study these frameworks and ideological images, and my **research question** is therefore:

- How is virtuality represented in fiction, and what does that say about our anticipations and fears about what the virtual is and will be?

Poetics as an exploration of theory and practice

The result of my work should be read as a poetics of virtuality. A poetics could be described as a theoretical treatment on a specific creative genre or art form, such as a poetics of poetry, drama, film or photography (Klastrup, 2003a; Laurel, 1993). The first and most influential poetics is the approximately 2 300 years old *Poetics* by Aristotle. Poetics relates to aesthetics (Bordwell, 2006; Klastrup, 2003a), and even though poetics and aesthetics are set apart they still tend to supplement each other, when one falls out of grace and becomes unpopular the other seems to take over (Hansson, 2004). The author of a poetics speaks about rules, forms and conventions, not in a prescriptive way (it does not tell you how to do movies, for example) but rather in a descriptive way, describing how a specific creative or artistic way of expression works (Bordwell, 2007; Klastrup, 2003a; Laurel, 1993). A poetics can be seen as an interface between theory and practice, and between art and craft. It is production focused, investigating processes as much as it investigates artifacts. The production process is studied, with a focus on the “choices within a craft tradition” that are made (Bordwell, 2007, p.15). The construction principles of media productions are analyzed, and not only the final artifact (Bordwell, 2006; Hansson, 2004). Practice is discussed from a theoretical and historical perspective (Bordwell, 2007). Aristotle’s *Poetics* was, as with most of his writing, quite practically oriented (House, 1956). However, it is not an account of how media artifacts are made. Rather, it is a theoretical reflection on the relationship between production and product (Russell, 2000). It “studies the finished work as the result of a process of construction” (Bordwell, 2007, p.12). Aristotle’s *Poetics* had the intention to see poetry as an integrated part of society, an art by which we are “educated and controlled” (House, 1956, p.21). The aim with a poetics of virtuality is to describe this educating and controlling connection.

The delimitations of a specific poetics is often related to a genre, acknowledging the idea that each genre or each kind of artistic expression has a specific nature that can be described (Hansson, 2004). But a poetics can also relate to a specific media or mode of expression. For example, David Bordwell wrote a *Poetics Of Cinema* in 2007, Tzvetan Todorov wrote *The Poetics of Prose* in 1971, and Boris Eikhenbaum edited the Russian formalist anthology *Poetika Kino* in 1927. Poetics does not deal with individual texts primarily; rather, it concerns “what literature can be rather than what it is” (Todorov, 1977, p.33). According to Bordwell (2007), a poetics can have three different objects of study: stylistics, narrative form, and thematic. The later “considers subject matter and themes as components of the constructive process”, and the researcher may study themes “as effects of constructive principles” (p.17). This poetics of virtuality is primarily thematic.

Virtuality and the anticipation of transcendence

Why is it important to study the virtual, and why now? It is important because it is a central part of an ancient and nowadays intense trend to rebuild both our environment and us. There are visionary discussions about the posthuman and the post-physical, ranging from skeptical sobriety to implausible futurism (Clark, 2003;

Haraway, 1991; Hayles, 1993a; Hayles, 1993b; Hayles, 1999; Moravec, 1988). A common premise in this debate is that technology enables us to reshape ourselves, to evolve into something more or other than the traditionally human. Posthumanism anticipates a physical reshaping of the body by means of mechanical and electronic augmentation of the biological body or through rewriting our DNA code. But posthumanism can also call upon technologies that extend our mind non-physically. This non-physical extension anticipates our gradual move into the virtual, the post-physical. Are we re-building our environments and ourselves in profound ways, gradually removing ourselves from physical, material, actuality? One important aspect of this re-construction is the development of more and more advanced virtual environments and virtual representations of ourselves (Badmington, 2004; Hayles, 1999; Heuser, 2003; Hurley, 1995; Toffoletti, 2007). A posthuman viewpoint can be used to argue that our construction of a post-physical existence is one of the most profound steps in human evolution. Therefore, it seems reasonable and relevant to investigate our dreams and fantasies in relation to this post-physical existence.

The following quote from Michael Benedikt (1991, p.131) illustrates a typical stance towards what is at stake in such an investigation, and the ideas that need to be critically investigated.

The design of cyberspace is, after all, the design of another life-world, a parallel universe, offering the intoxicating prospect of actually fulfilling – with a technology very nearly achieved – a dream thousands of years old: the dream of transcending the physical world, fully alive, at will, to dwell in some Beyond – to be empowered or enlightened there, alone or with others, and to return.

BACKGROUND

describing the origin and essence of virtuality

This chapter gives a background to the concept of virtuality and its history, as others have described it.

The virtual explained

Virtuality is an elusive concept with multiple interpretations. Nowadays, virtuality has a distinct connection to computer technology, but virtuality also has deep historical connections to representation, philosophy and religion. Digital virtuality is related to cyberspace, virtual reality, digital, online, and virtual environments. Some of these concepts partially overlap; others have almost the same meaning. Others have fallen out of grace. The term cyberspace stands out specifically – once a hot promise of the future, now left behind, outdated (Guynup, 2002).

Almost as if

The word virtual, as well as the concept, has a complex origin, predating the current technological virtuality by hundreds of years. In everyday usage, the virtual is often opposed to reality, so that something is either real or virtual. But a more accurate description is needed where the virtual is a sub-set of the real. The modern literary meaning of the word virtual is *almost as if*. The American philosopher, logician, and mathematician Charles Peirce writes, “a virtual X ... is something, not an X, which has the efficiency (virtus) of an X” (Peirce, 1902, p.763). Michael Heim (1993) defines virtual as “a philosophical term meaning ‘not actually but just as if’” (p.159). The virtual is not actual, but it has the essence of the actual. A virtual button on a touch display is almost a button. It looks like a button. It has the same function as a button. But it is not a button in the same sense that a material, physical button is. Even though this poetics of virtuality will discuss technical virtuality, the general concept of virtuality is an ontological property, and not a media or technology specific property (Friedberg, 2006).

The essence of the virtual comes in different flavors, as in the example of a virtual button. A virtual button holds two aspects that mimic the actual: function and appearance. Turkle (1995) suggests that one step towards technical virtuality was the early development of graphical user interfaces (GUI's) and the WIMP interaction (Windows, Icons, Menus, Pointer). Particularly the launch of the Macintosh interface introduced the concept of hiding the earlier, code-based command line interface behind an illusionary system of button, icons, sliders and such. The Macintosh interface introduced the desktop metaphor to a wider audience in 1984, and even though it was a flat representation of a simple desktop it can be seen as one of the first technical virtualities. The use of windows and how they could overlap created a partial depth for the virtual desktop (Friedberg, 2006; Mossberg, 2006). The digital transformed from lines of code to a spatial place. The virtual gave abstract code the appearance of something that it actually was not – a space.

The virtual can be regarded as a model of the actual. A model is an abstract, simplified cutout of a segment of the actual (Johansson & Winter, 2009). Virtual reality and computer graphics started out as a simple simulation of the actual (Nusselder, 2009), and have since then radically evolved into more and more advanced virtual worlds, worlds in which complex models simulate gravity, collisions, perspective, light and shadow. But the model still only holds what we put

into it, the slice of the actual that we choose (Lanier, 2010). Gelernter (1992) compares a typical virtual world to a Zen garden, since the Zen garden is also conceived as a model of the real landscape. The model's slice of the actual can have different scope. It can be monolithic, an object, such as the virtual button that has been discussed previously. You walk *around* such an object. The model can be a small environment, a worldlet, such as a single room or a building. You walk *through* an environment. And finally, it can be a full world, with a spatial extent that cannot be overviewed in its entirety and a complexity that mimics a universe. You walk *in* such a world.

Virtual but with an actual effect

The example with the virtual button illustrates that even if the virtual is mimicry to some degree, it can nevertheless have substantial effect. Failing to realize that the virtual can have actual effect was a common misunderstanding when the public started to explore simple virtualities such as MUD's and online discussion forums. A general idea was that online was not real and therefore you were allowed to do anything; it was a lawless country, and whatever you did could not hurt people. The understanding of the contrary has slowly settled in, even though contemporary public debates about online harassing suggest that there is still an amount of unpreparedness concerning the fact that the virtual has a real effect.

The way the virtual has actual effect is complex. As Jaron Lanier (2010) puts it: "guns are real in a way that computers are not" (p.27). A virtual bullet can't kill you, but a hacker can empty your bank account. It is not that causality is missing between the virtual and the actual, but that causalities are different. Michael Heim (1993) goes quite far in claiming that the virtual has real effect, even using it as one of the characteristics of virtual, writing that "virtual reality is an event or entity that is real in effect but not in fact" (p.108). One reason why the virtual has an effect is that it is experience related, and that it concerns how people relate to each other. If someone behaves offensively or dismissively online, the experience is similar to being offended or dismissed in a face-to-face situation. This is related to the phenomenological stance provided by Merleau-Ponty (1962, p.337) that our experience is always true from an internal viewpoint.²

Everything is, then, truth within consciousness. There can never be illusion other than with regard to the external object. A feeling, considered in itself, is always true once it is felt.

He illustrates this with the emotion of love. Lisbeth Klastrup (2003a) and Sherry Turkle (1995) discuss the phenomenological experience of love and sex as well, but in relation to events in the virtual, and they bring up the matter of abuse and infidelity. Can you be raped online? Can you be unfaithful online? Is cybersex similar to actual, physical sex? Janet Murray (1997) discusses kissing and infidelity in the context of the fictional holodeck virtuality in the TV series *Star Trek: The Next*

² Phenomenology is a philosophical movement that emphasizes that we experience the world while being embodied in it, and that we can never analyze the world from an outside.

Generation. Turkle describe the different attitudes concerning this based on her interviews with early online users of chat rooms and online forums. It seems clear that most people experience an actual effect – an actual sense of being cheated – when their spouse has engaged in online infidelity. Turkle asks if infidelity is an event “in the head or in the body” (1995, p.225)? Knudsen (2004) reports “a symbolic kiss between two physically separated extended bodies was found to be perceived as having the same significance as a real kiss by the participants” (p.44). This illustrates how the virtual has an effect on the actual. The observation that abstract and immaterial models or concepts can have strong effects on the actual is not unique for the virtual. Consider for example economics. Even though most of the world economy is an abstract game of moving representational values back and forth it nevertheless has very severe effects on our lives. Several academics have suggested that economy can be regarded as a kind of virtuality (Bryant & Pollock, 2010; Baudrillard, 2002; Brind, McKenzie & Sutton, 2007; Nusselder, 2009), but economics is quite different from the technical virtuality that I will discuss. Most importantly it lacks the interaction with a user and the simulated spatiality, and if we included economics in the discussion the scope would be heavy-handedly broad and confusingly diffuse.

The etymological roots of virtual and cyberspace

The contemporary meaning of *virtual* is quite new. The word and the concept have come together quite recently, but both the word and the concept have roots that stretch far back into antiquity. The word *virtual* has its origin from the Latin *virtus*, meaning skills, power, agency, and efficiency (Friedberg, 2006; Klastrup, 2003a; Mossberg, 2006; Willim, 2006b). The word *virility* shares the same origin.

The thirteenth century philosopher and theologian Thomas Aquinas used *virtual* (*virtualis continentia*) as an equivalent to Aristotle’s potentiality, as in how a seed contains the essence, the potential, of a plant. The plant is so to speak *virtually* present in the seed. This usage of the word *virtual* opens up for the meaning it has today. According to Heim (1993), the contemporary meaning of *virtual* – *almost as if* – emerges in the thirteenth century in the writing of philosopher John Duns Scott. In 1938, the poet, playwright and surrealist Antonin Artaud combined the words *virtual* and *reality* for the first time in his essay *The Alchemical Theater*, forming the phrase “la réalité virtuelle” to describe the illusion of theater (Artaud, 1958). The phrase *virtual reality* appears again in 1982, this time in Damien Broderick’s science fiction novel *The Judas Mandala*. The phrase entered mainstream consciousness a few years later when *virtual reality* pioneer Jaron Lanier used it in the late 1980s to describe the then emerging technology with head mounted displays and data glows. This established the popular, contemporary meaning of *virtual reality*; the technology that is used to experience virtual environments through immersive projection and 3d tracking.

Another word that stretches back into antiquity is *cyber*. It comes from the Greek word *kybernan* referring to steersman, pilot or rudder, and today the term *cybernetics* refers to control of complex systems. Norbert Wiener introduced it in its contemporary meaning in 1948 in his book *Cybernetics: Or Control and*

Communication in the Animal and the Machine, where he formulated cybernetics and its theories on feedback and regulatory systems (he actually borrowed the word from the French mathematician André-Marie Ampère who used the term *cybernetique* a hundred years earlier, in 1845). In cybernetics, feedback between different parts of a system is seen as a flow of information, which means that information and communication become tightly connected to the control of information flows (Hayles, 1999). Cybernetics joins biology and technology since they both can be part of the feedback flow of information and control. William Gibson coined the term *cyberspace* in 1982, the same year that Broderick used *virtual reality*. Both of these phrases became catchwords during the late 1980s and early 1990s. Eventually they became inflated and started to dissolve into all sorts of pop culture connotations, and academics scrambled to escape from the overblown hype of the word itself (Laurel, 1993). Cyberspace became more or less equivalent to the Internet. During the 1990s, the need for fresh concepts (and a shift in focus to online communities and online games) initiated the emergence of new phrases such as *virtual communities*, *virtual environments* and *virtual worlds* (Guynup, 2002; Klastруп, 2003a; van Dijk, 1997).

The term *virtuality* is credited to Theodore Nelson who used it in 1980 to describe the design of interactive software. Nelson (1980, p.56) describes it as follows:

By the virtuality of a thing I mean the seeming of it, as distinct from its more concrete "reality," which may not be important. ... I use the term "virtual" in its traditional sense, an opposite of "real".

The “seeming of” is close enough to Peirce’s “almost as if” and the idea that the virtual has the appearance of reality. However, there are problems with how Nelson describes the virtuality. The virtual should be seen as a subset of reality, and not opposed to reality. Since Nelson first used the term virtuality, the meaning has diversified, and I will use it in the sense of meaning of a virtual environment or virtual object.

Virtuality – a definition

The general meaning of virtual as *almost as if* is the starting point for the definition I will use in this poetics of virtuality. The *technical* virtuality that I have studied could be defined as follows.

Technical virtuality is a technology-sustained simulation of perceptual and spatial presence.

In the following I will discuss different aspects of this definition, starting with a historical retrospect over non-technical proto-virtualities, eventually arriving at the modern technical virtuality.

Previous studies of virtuality

This is a short presentation of the scholars that I will primarily relate to in my poetics. They are ordered chronologically based on the publication year of their most important work concerning virtuality.

- Michael Benedikt, at the University of Texas at Austin School of Architecture, edited one of the first influential anthologies on cyberspace in 1991, *Cyberspace: First Steps*. He makes a theoretical proposal for building cyberspace architecture, claiming that cyberspace is a whole new universe to build and live in. Similar to Heim and Nusselder, he connects cyberspace to religion and an ancient desire of transcendence. My poetics of virtuality does not build directly on Benedikt; rather his work is included as a steppingstone in the evolution of our ideas of the virtual.
- Larry McCaffery and Veronica Hollinger edited *Storming the Reality Studio: A Casebook of Cyberpunk and Postmodernism* in 1991, a collection of writings about cyberspace and cyberpunk. Hollinger's *Cybernetic Deconstructions: Cyberpunk and Postmodernism* discusses science fiction studies, posthumanism and postmodernism. These texts have helped me understand the cyberpunk genre.
- Michael Heim's 1993 book *The Metaphysics of Virtual Reality* describes virtuality and its characteristics in a comprehensive manner, connecting virtuality to religion, transcendence, the city, and philosophers such as Leibniz and Plato. He lists seven essences of virtual reality, such as immersion and interaction. In the chapter *The Erotic Ontology of Cyberspace* he suggests that users of technology have a strong drive to merge with technology. My own poetics of virtuality builds on Heim's philosophical view of virtuality.
- Sherry Turkle does research on social and psychological aspects of our relationship with and through information technology. In *Life on the Screen* from 1995 she puts a human and social perspective on the virtual, partly based on interviews with people using MUDs. She pioneered the idea that the virtual is just another layer of reality, and that we inhabit the virtual and thereby construct stories together. Turkle's description of online communities and computer game worlds is an important track running parallel to my own more general poetics of virtuality.
- N. Katherine Hayles is an American postmodern literary critic. *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature and Informatics* from 1999 discusses the posthuman, cyborgs and our relationship to information technology, affording a general social context to my own writings on virtuality.
- Sabine Heuser, at Phillips University Marburg in German, wrote the book *Virtual geographies: cyberpunk at the intersection of the postmodern and science fiction* in 2003, presenting a thorough analysis of the cyberpunk genre in general and the idea of cyberspace specifically. She shares my focus on William Gibson's writings, and my poetics expounds upon her analysis of Gibson's fiction.

- Lisbeth Klastrup is a Danish scholar of new media, who studies the emergence of stories in multi-user game worlds. Similar to Turkle, Klastrup focuses on real-life virtual worlds and how they are used from a social and storytelling perspective, especially concerning online gaming and worldliness. In 2003, Klastrup defended her PhD thesis *Towards a Poetics of Virtual Worlds – Multi-User Textuality and the Emergence of Story*, a work that parallels my own poetics.
- André Nusselder is currently at the University of Amsterdam, and in his book *Interface Fantasy* from 2009 he uses Lacanian psychoanalysis to investigate virtuality. I will not follow his psychoanalytical investigations, but similar to Heim he connects virtuality to religion and an ancient desire to create illusions, and he also discusses the virtual as an immaterial, mental realm.
- Svante Lovén has been at the University of Gävle, Sweden. In his 2010 book, *Also Make the Heavens: Virtual Realities in Science Fiction*, he thoroughly analyses illusion and virtual reality in science fiction literature. He deals with twentieth century science fiction up to and *including* William Gibson's *Neuromancer*. Lovén's work and my poetics complement each other well, since I have mostly focused on science fiction *from* William Gibson and later, and on science fiction movies.

The first virtualities

Before discussing modern *technical virtualities* we will look back more than two millennia and consider the long history of proto-virtualities. To a big extent this is the history of visual illusions, since these technologies and concepts eventually evolved into contemporary full-fledged virtuality. It is also the history of a long period of striving for a post-physical existence.

In his Allegory of the Cave, Plato envisioned that the material world had an underlying mechanics, the perfect world of forms and ideas.³ The idea is that material objects are mere shadows of the perfect forms that exist at another level of existence. Some aspects of this theory of forms remind us of our contemporary virtuality, a level of existence that is immaterial or intangible, and based on forms and ideas.⁴ Plato's theory of forms is just one example of a range of similar ideas. Pythagoras, predating Plato (he lived circa 570-495 BC), reasoned that mathematics governed material reality, and that the essence of reality lay in immaterial numbers (Wertheim, 1999). Such ideas developed into the concept of the music of the spheres and fueled Johannes Kepler's fruitless attempts (two thousand years later) to describe the structure and movements of the solar system by imagining celestial spheres and other geometrical shapes as the underlying structure.

Erik Davis (1998) has described what he calls *techgnosis*, a general connection between religious myths and information technology concepts. The connection between virtuality and an ancient desire for post-physical transcendence has been emphasized (Benedikt, 1991; Crang, Crang & May, 1999; Farnell, 1998; de Fren, 2009; Grau 2001; Hayles, 1993b; Klastrup, 2003a; Laurel, 1993; Nusselder, 2009; Pope, 2008; Rheingold, 1991; Wertheim, 1999), and cyber-gnosis, the idea of escaping into cyberspace, is the latest incarnation of this desire. Benedikt (1991) claims that cyberspace is the continuation of thousand of years of magic, myth and legend – our “desire to will the world into action” (p.226). Characteristics that are shared by both religious transcendence and posthuman transcendence are immortality, hostility towards the body and the longing for another existence (Fielding, 2009). Christianity has had a strong tendency to “deny the world and denounce the body”, just as some cyberspace evangelists do (Slouka, 1995, p.21).⁵

³ In his dialogue *The Republic* from around 380 BC. Lovén claims this is “the first fictional text that explores the notion of an artificial or virtual reality” (Svante, 2010, p.32).

⁴ It is common to connect Plato's cave with virtual reality. However, Plato was highly skeptical towards poetry imitating and rivaling the actual, and would probably have been highly skeptical towards virtuality. According to Plato, the actual world is a copy of the world of form, and therefore poetry (representations) is two steps removed from truth (House, 1956). Plato's cave concerns the nature of reality, suggesting that there is a hidden mechanism we don't see. Many similar ideas of hidden mechanisms have been suggested, from Renee Descartes evil demon (Erion & Smith, 2002) to Hilary Putnam's brain in a vat (Putnam, 1981). Indirectly these ideas connect Plato's cave with the plot of movies such as *The Matrix*, where the hidden mechanism proves to be a simulated virtual world, pretending to be the actual world, thus imprisoning humans.

⁵ However, Wertheim (1999) claims that medieval Christianity did not hold contempt towards the physical body.

In religion, the belief in the supernatural offers the promise of an immortal soul and a heaven. In technocratic posthumanism, the hope is justified by the belief that a perfect scan of our brains would provide us with digital souls that could live forever in the virtual.

Michael Benedikt (1991) has expounded on the concept of the Heavenly City, connecting it with cyberspace urbanity and conceptual architecture. The Heavenly City has become “a religious vision of cyberspace” (p.16). His argument is that there has been an established image of the radiant city in Western culture, first in religion, then in science fiction, and conceptual architecture. Thus he envisions how a cadre of cyberspace architects will scramble to build visionary and conceptual post-physical architecture in cyberspace. He claims that the image of many religious or fictional cityscapes share common attributes: weightlessness, radiance, cleanliness, and palaces upon palaces. Wertheim (1999) also mentions weightlessness and radiance as common attributes for both the Heavenly City and cyberspace. With the help of 3d modeling and virtual reality, we can now create buildings that are truly immaterial. The facades of such buildings literally have no thickness and construction details such as nails and joints are not needed (Mitchell, 1998). But, cyberspace architects have not shown up to the extent that Benedikt predicted. Designers of online computer game worlds came instead, and in most cases the landscapes and cityscapes of these worlds are surprisingly conventional, as pointed out by Frances Dyson (1998), Andrew Vande Moere (1998), Margaret Wertheim (1999), as well as Janet Murray (1997). From the medieval towns of *World of Warcraft* to the American city clones of *Grand Theft Auto* there is an apparent lack of imagination. A minority of computer games step away from this pattern of merely exaggerating real world architecture (Klastrup, 2003a). The game environments in *Iomilo*, *Fez*, *Volume* and the Time Trail mode in *Mirror's Edge* are examples of abstract environments with geometrical, floating structures. In the fictive short story *True Names*, Vernor Vinge (1981) writes about the “romantic convenience” of using magic spells instead of computer code commands in the virtual world of the story. This fantasy inspired aspect of the virtual world becomes a representation for the different actions that can be taken. The familiar and old-fashioned (magic spells) are pulled in front of the new and foreign (computer code), as an interface. Similar romantic conveniences are often seen in real-life software, referred to as skeuomorphism (Hayles, 1999). Virtual objects such as buttons, knobs and surfaces imitate the look of the actual objects, even though their function might be to send a command, change a value or filter data output. Our design of post-physical existence seems to have a tendency to re-create conventional, physical existence.

A history of illusions – from cave paintings to virtual reality

Technical virtuality has two foundations: the technical construction of illusion as well as simulation, and the philosophical framework that describes this simulation as another existence. Both foundations have deep roots. The desire to create illusions, especially the illusion of presence, is ancient (Biocca, 1997; Mossberg, 2006; Murray, 1997; Nusselder, 2009; Robinett, 1992; Svante, 2010). The

development of computer graphics was instrumental in enabling the immersive technologies we have today, but the first steps were analog. Making images is a truly ancient technology, stretching back at least 30,000 years. During most of these 30,000 years, our ability to generate images and illusions was highly limited, and it was only recently that our abilities to create advanced and realistic imagery really came unbound.

Renaissance painting saw extensive development in our image making capabilities, largely helped by the invention of methods to construct perspective in images. Wertheim (1999) mentions Giotto di Bondone as one of the most important painters who tried to simulate physical space. It became very popular in the fifteenth and sixteenth century to create trompe-l'œil paintings, and the intent was often to convey technical mastery (Brind, McKenzie & Sutton, 2007). The invention of perspective enabled the trend of constructing painted architecture, an early imaginary, virtual architecture (Liljefors, 2006). The walls of physical rooms were decorated with paintings that created the illusion of false portals into other imaginary rooms, or windows looking out across imaginary landscapes. One of the most well known examples is the Sala delle Prospettive painted in 1515 by Baldassare Peruzzi, in the Villa Farnesina. A common type of illusionary painting in more public spaces is the ceiling panorama of Baroque churches that were popular in the sixteenth century. One of the first ceiling panoramas is the faked oculus (circular opening) in the Camera degli Sposi, in the Italian Ducal Palace, painted between 1465 and 1474 by Andrea Mantegna (Grau, 2003).

These painting techniques eventually evolved into the 360-degree panoramic murals of the nineteenth century, which became especially popular in the 1860s. The first such panorama display was opened for the public at Leicester Square in London, 1793. An ingeniously constructed room with walls covered by realistic paintings gave the impression of being *surrounded* by an actual environment, based on a perspective drawing technique patented in 1787 by Robert Barker (Grau, 2003; Liljefors, 2006; Lovén, 2010). These panoramas attracted a large number of visitors, and poised as they were just before the invention of cinema it was a way to experience art “from within” (Ljungar-Chapelon, 2008, p.34).⁶ The panoramas were usually public entertainment facilities since the panoramas and the buildings that housed them were expensive to build. The military showed some interest in the capability of depicting landscapes, and this military interest for convincing depictions continued during the twentieth century and into the development of computer graphics. After the panoramas of the nineteenth century came astronomical planetariums, and planetariums later evolved into Omnimax theaters. Planetariums and Omnimax theaters provide immersive illusions, but it is nevertheless unreasonable to consider them to be proper virtual reality. The interaction is severely limited, and this as well as the seating arrangement makes for

⁶ The idea of enclosing the viewer in an illusion actually predates the nineteenth century panoramas, going back to examples such as Villa dei Misteri in Pompeii from about 60 years B.C., and to Chambre du Cerf from 1343, with its painted scenery covering the walls of a whole room (Grau, 2003).

a lean-back, cinematic experience, and not the lean-forward, interactive experience of virtual reality.

The gap in time and technology between the panoramas of the nineteenth century and the virtual reality of the twentieth century was bridged by different constructions that gradually pushed the capabilities of immersive simulations. Examples include the Stereopticon (1894), Cineorama (1900), and Cinerama (1939), all being different attempts to project still images or moving images in an immersive environment (Grau, 2003). Parallel with these practical construction attempts, theoretical proposals were published in the early twentieth century, asking for an evolution of theater into a more immersive and interactive form. The futurist painter and scenographer Enrico Prampolini suggested a polydimensional stage in 1924, the photographer and Bauhaus professor László Moholy-Nagy suggested a Totaltheater in his 1924 essay *Theater, Zirkus, Variete*, and Walter Gropius, one of the founders of Bauhaus, suggested a similar idea in 1927. Another parallel development towards immersive illusions came via the camera – when the recording media of the photosensitive emulsion was invented, photography and then cinema were born. However, even if cinema shares some illusionary aspects with virtual reality, it is a different cultural phenomena (Lavery, 2001). Both simulate events and experiences, but the virtual offers levels of interaction and immersion that surpass that of cinema.

The Sensorama by Morton Heilig was a mechanical, analog simulator built in 1962. As early as 1955, Heilig had published plans for this experience theater, as he called it (Grau, 2003; Rheingold, 1991), acknowledging the task theater has had for centuries in providing “multisensory illusionist effects” (Svante, 2010, p.13). Heilig also patented, in 1960, an idea for a head mounted display with small TV screens for each eye. The Sensorama resembled an arcade game with its seat, handles, and a canopy enveloping the head of the user. Inside, a stereographic movie projection was combined with sound, smell and touch in an attempt to create an experience of, for example, taking a bicycle ride. It was intended as an entertainment device for arcade halls, contrasting with the military application that the first actual virtual reality displays would have. Rheingold has speculated (1991) that if Morten Heilig had succeeded, virtual reality could have been entertainment driven decades earlier. But Heilig was not skilled in computer technology, which might have contributed to Sensorama becoming a dead-end. The development of computer graphics in general and virtual reality specifically during the twentieth century instead came to be mostly driven by the military industry, with occasional alliances with art and entertainment (Grau, 2003; Lovén, 2010; Rheingold, 1991).

The development of computer graphics

The pre-digital attempts to construct analog virtual reality were clumsy and limited in their capabilities. It was digital technology, computers, which put the development of technical virtuality on a fast track. Virtual reality is strongly dependent on the visual, and thus on the development of computer graphics. Much of the early research – from the 1950s to the 1980s – on computer graphics and later on virtual reality was funded, just as the Internet, by the American military via

DARPA, the Defense Advanced Research Projects Agency (Croghan, 2010; Rheingold, 1991; Taylor, 2004). This militaristic background comes in contradiction to the idealistic development of the personal computer and its associations with counterculture. These three paths of development – computer graphics, the Internet and the personal computer – were to a large extent taking place in San Francisco, the city that also became the apex of the counterculture movement. Early work in interactive computer graphics and virtual reality was also taking place at the University of Utah (Hafner & Lyon, 1996), and on the American East coast, primarily at Massachusetts Institute of Technology, where Ivan Sutherland wrote Sketchpad, a revolutionary graphical drawing software (Grau, 2003; Rheingold, 1991). The developments in computer graphics and virtual reality were quite militaristic and utilitarian and it was not until much later – one milestone being when Pixar launched *Toy Story* in 1995 – that the engagement between entertainment and computer graphics became solid. Despite this, artists-in-residence and technicians-turned-into-artists performed early experiments with computer art. They used mainframe computers that they were granted access to (Kerman, 1992), establishing a troublesome alliance between “capitalistic instruments of war” and art (Montfort et al., 2012, p.139). Charles Csuri – maybe the most influential of the early computer artists – started his computer graphics work in 1964. During the 1960s, many others artists and technicians experimented with geometrical shapes, procedural processes and linear art using computers, for example John Whitney, Pierre Hebert, Herbert Franke, and William Fetter. Early computer art was conceptualized as an exploration of a new frontier, a new world (Taylor, 2004). Computer artists saw the virtual as a frontier even before the Internet opened up what came to be thought of as a lawless, frontier land similar to the Wild West of North American history. These artists also expressed a rather anti-authorial stance. The experimentation with randomness that several early computer artists engaged in can be thought of as a reaction against the industrialism, rationality and empiricism they saw in modernism, the Industrial Age and in the two World Wars (Montfort et al., 2012).

Another development was the first computer games. These were the fruits of creative spare-time work in the military funded computer graphics research labs, just as early computer art was. *Spacewar!* was made in 1962 by Stephen Russell, Martin Graetz and Wayne Wiitanen at MIT (Klastrup, 2003a).⁷ A decade later – in 1972 – the well-known and likewise ultra-stylized *Pong* was built by Nolan Bushnell and it is now heralded as the ancestor of modern computer games.

Yet another development was the first usage of computer graphics in movies. A precursor was the title sequence of *Vertigo* from 1958, which used analog computer graphics – a kind of oscilloscope effect made by Saul Bass and John Whitney. The first use of digital computer graphics came in *Westworld* from 1971 and the first three-dimensional computer graphics in *Futureworld* from 1976. One year after, *Star Wars* premiered (1977) and stylized computer graphics – glowing lines on black

⁷ Klastrup (2003a) brings up a claim from Steven Poole (2000) that William Higginbotham had created a two-player tennis computer game in 1958.

bottom – illustrated the rebels’ attack on the Death Star space station. The movie was a milestone in applying computer graphics in movie making. Gradually, graphic rendering capabilities evolved and enabled shaded surfaces, self-shadowing and more complex and organic shapes. *Tron* (1982) was a tour de force for several of the largest companies in the budding computer graphics industry with its lengthy and numerous 3d animation sequences (Montfort et al., 2012). Commercial applications of computer graphics at the start of the 1980s were otherwise highly geared towards short commercials and in 1985 the seminal *Sexy Robot* commercial was broadcasted, boosting character animation using a rotomation technique, smooth shadows and shining specular highlights (Flueckiger, 2008). The future of modern, spectacular 3d animation could be glimpsed in the feminine movements of this gleaming robot.

The development of virtual reality

The development of virtual reality – interactive, immersive computer graphics – was initiated in the late 1960s by Scott Fisher and Ivan Sutherland at MIT, and by Tom Furness at the US Air Force (Benedikt, 1991; Grau, 2003; Rheingold, 1991). Another pioneer was Myron Kreuger, who also did work as a computer artist specializing in interactive installations. Kreuger experimented with wall projections that immersed the user and the concept was later developed into the CAVE virtual reality system. Sutherland took another path: the head-mounted display (HMD). The head-mounted display have its roots in the 1960 proposal, by cinematographer and multimedia specialist Morten Heilig, to put small TV monitors in front of both eyes of the user. A fundamental component, missing in Heilig’s proposal, was added in the late 1960s; head tracking was developed, which made it possible for the user to look around in different directions in the virtual reality environment. Sutherland realized this idea as actual hardware in 1968 when he led a team of researchers at MIT in the construction of the gangly Sword of Damocles. A competing head-mounted display was first used in 1970, at the University of Utah by Daniel Vickers, who claims that the first virtual object he displayed was a wireframe cube (Marenka & Watkins, 1994; Rheingold, 1991).

Since these early steps, virtual reality has remained mostly confined to research labs and advanced product development, initially deemed as being too expensive and with a quite narrow range of applications. Not even gaming applications have caught market shares, but it might be that the launch of the low-price Oculus Rift will change this and bring virtual reality goggles to the broad public. In the 1990s, different attempts were made to implement a simpler version of virtual reality: desktop VR. Desktop VR uses conventional computer screens and allows only limited movement through a spatial environment or the rotation of an on-screen virtual object. The typical application was a display of merchandize at web shops, ranging from wristwatches to cars. In the 1990s, desktop VR was usually displayed using web browsers with browser plug-ins such as QuicktimeVR, Shout3D and Cult3D. At this time, the VRML mark-up language was developed and promised to be for 3d Web what HTML was for the Internet, a common protocol for constructing virtual environments. The primary application of the first

environments built on VRML was educational or social, and even if the VRML language became quite abandoned, the early worlds eventually evolved into *Active Worlds* and *Second Life*, and finally the computer game worlds of today. Advocators of VRML envisioned how the World Wide Web would become a three-dimensional environment, the 3d web, transforming the flat sheet of web pages into spaces, and places, essentially the cyberspace that William Gibson described. But, this has not yet come to be. From a usability and interaction design viewpoint there are good arguments for why the user in most cases do not need the third dimension, and why it usually makes the interface more difficult to use (Nielsen, 1998; Nielsen, 2006). It might be that the vision of a 3d Web will remain confined to the science fiction stories of William Gibson for a long time.

Popularizing cyberspace

On June 25th, 1982 the feature film *Blade Runner* was released in the US. William Gibson went to the cinema to see it. Gibson was then an upcoming writer, having succeeded in getting a few short stories published, and he was working on his first novel. Allegedly, he leaves the cinema without seeing the movie to the end. The claimed reason is that the fictional world he saw in the movie reminded him so much of the atmosphere and settings of his coming novel, that he was afraid of being too deeply influenced by this competing vision (Heuser, 2003; Landon, 1992; Tatsumi, 1986).

Gibson continued working on his novel, and at the Armadillo Con in October 1982 he read the opening chapter of his work-in-progress. The novel *Neuromancer* was published almost two years later, on July 1st, 1984. It became one of the canonical works of the cyberpunk genre, and became widely known for being the novel where Gibson popularized cyberspace. The first occurrence of cyberspace was actually in Gibson's short story *Burning Chrome*, published two year before *Neuromancer*. The word cyberspace is used only once, describing the console that the hackers use as a "cyberspace seven", and the virtual environment itself is referred to as "the matrix". The canonical status of *Neuromancer* gives the appearance that Gibson's ideas were unprecedented, but of course he built on previous works and real-life technologies. In an interview (Gross, 1989) he describes his influences.

So that rather than having to look at a television set and put on the earphones, you simply plug yourself into something that makes you feel that you're in the environment that the media producer has generated. So taking that as a given, and that's an old idea from science fiction, in the fifties they called that 'feelies' in science fiction. Taking that as a given, I've coupled that with computer technology to try to imagine a world in which computer operators enter into what I've only ever been able to describe as a 'consensual hallucination'.

The feelies he refers to comes from Aldous Huxley who vaguely hints at an immersive, multisensory recording technology in his *Brave New World* (1932). That novel was published in 1932, fifty years before *Burning Chrome*.

In interviews, Gibson has also claimed that he was inspired by watching teenage gamers at arcade halls (Csicsery-Ronay, 1992; McHale, 1992; Turkle, 1995), as well as a poster advertisement for an Apple IIc, and a conversation he had heard about "something ... called the Internet" (Wallace-Wells, 2011, p.217). Turkle (1985) offers the following description from Gibson of how he was inspired into creating the concept of cyberspace (p.265):

Video games weren't something I'd done much, and I'd have been embarrassed to actually go into these arcades because everyone was so much younger than I was, but when I looked into one, I could see in the physical intensity of their postures how rapt these kids were. It was like one of those closed systems out of a Pynchon novel: you had this feedback loop, with photons coming off the screen into the kids' eyes,

the neurons moving through their bodies, electrons moving through the computer. And these kids clearly believed in the space these games projected.

Here the concepts forming the word cyberspace – cybernetic (feedback loop) and space – connect to the arcade hall. The arcade hall was also the inspiration that director Steven Lisberger has claimed he had for the movie *Tron*. Gibson has also mentioned *The Shockwave Rider*, a 1975 novel by John Bruner about a computer hacker, as inspiration (Whittle, 1996).

Science fiction has a “long tradition of questioning the fundamental nature of reality” (Gunn, 2003, p.73), and the concept of cyberspace actually had precursors in different stories, especially in the short story *True Names* by Vernor Vinge (1981) (Hayles, 1993b; Wertheim, 1999), in *Web of Angels* by John Milo Ford from 1980, and *The Veldt* by Ray Bradbury (1950). The latter is mentioned as predecessor by Gibson himself in an interview (Wallace-Wells, 2011). Svante Lovén (2001; 2010) thoroughly accounts for three sets of precursors to Gibson’s cyberspace narrative.

- Dystopias investigating the implications of magical artificial realms – Torquato Tasso’s *Jerusalem Delivered* from 1575 and Edmund Spenser’s *The Faerie Queene* from 1589.⁸ Lovén describes *Jerusalem Delivered* and *The Faerie Queene* as “the first texts in Western literature which consider the multi-sensory illusion or imitation as inherently problematic” (2010, p.43).
- Physical counterfeit environments – J. K. Huysmans’ *À Rebours* (*Against nature*, from 1884), and Frederik Pohl’s *The Tunnel Under the World* from 1955.
- Virtual environments assumed to be created by if not computers then at least some electronic device – E.M. Forster’s *The Machine Stops* from 1909, Laurence Manning and Fletcher Pratt’s *City of the Living Dead* from 1930, James Gunn’s *Name Your Pleasure* from 1954, Daniel Galouye’s *Simulacron-3* from 1964, and John Varley’s *Overdrawn at the Memory Bank* from 1976.

Philip Dick is best mentioned on his own due to his extensive investigation of political, religious and philosophical implications of simulations and simulacra. Dick is often vague with technical explanations, sometimes referring to drugs as a means of creating the illusions, which emphasizes that the simulated worlds he describes are a plot device, and not a theme in itself. These stories by Dick include *Eye in the Sky* from 1957, *Time Out of Joint* from 1959, *The Three Stigmata of Palmer Eldritch* from 1964, *UBIK* from 1968, *A Maze of Death* from 1971, *Flow My Tears, the Policeman Said* from 1974 and *I hope I shall arrive soon* from 1979. Most of these predate public awareness of computers, and therefore their depictions of simulations are mostly inspired by television (Lovén, 2001).

Many of the stories mentioned by Lovén – most notably *À Rebours*, *City of the Living Dead*, *The Machine Stops*, and *Name Your Pleasure* – feature more or less explicit warnings about being trapped in illusion and rejecting nature and body, themes that still prevail in modern texts (Willim, 2006a). Movies such as *The Matrix* borrow

⁸ Note how these artificial realms are explained by magic, since at the time of these writings there existed no technology to create them, not even imaginary technology.

many themes and tropes from these pre-cyberpunk novels and short stories. However, two aspects that made both *True Names* and *Neuromancer* revolutionary at the start of the 1980s were how they depicted a computer network as a spatial environment, and how the artificiality was neither an imprisonment nor an attempt to simulate the actual world. The cyberspace that Gibson envisioned instead “announces its artificiality” (Lovén, 2010, p.189).

What is cyberspace? In the short story *Burning Chrome*, Gibson explains it as

an abstract representation of the relationships between data systems. Legitimate programmers jack into their employers' sector of the matrix and find themselves surrounded by bright geometries representing the corporate data. Towers and fields of it ranged in the colorless non-space of the simulation matrix, the electronic consensus hallucination that facilitates the handling and exchange of massive quantities of data.

The explanation is essentially the same in Gibson's novel *Neuromancer*, repeating the term “consensual hallucination”. This fictional cyberspace was gradually reconceptualized when academics and the general public started to adopt the concept (Grau, 2003; Klastrup, 2003a), and Gibson's fictional ideas inspired real-life work on virtual reality and the Internet (Hayles, 1993b; Hayles, 1999; Willim, 2006a). Benedikt (1991) reformulated Gibson's description into a less poetic, more precise interpretation of what cyberspace became: “a globally networked, computer-sustained, computer accessed, and computer-generated, multidimensional, artificial, or ‘virtual’ reality” (p.122). Nusselder (2009) calls cyberspace “the mental realm of the human-computer interface that turns us into cyborgs” (p.5), and continues to define it as “the ‘electronic space’ that came into existence during the 1960s through a joining together of various computer networks” (p.11). It is characteristic that these cyberspace descriptions emphasize the network, thus including both the Internet and virtual reality. This echoes the anticipations for the 3d Web that were apparent during the 1990s. Gibson's fictional cyberspace was adopted as a term for the budding Internet (Flichy, 2007). This is an important difference between cyberspace and virtuality. Virtuality is not directly associated with the Internet, even though the Internet plays an important factor in some virtual worlds such as in massively multiplayer online role-playing games.

Gibson himself has described the term cyberspace as an “evocative and essentially meaningless” buzzword (Neale, 2000, at 55:07) and claims that its actual invention was quick and serendipitous. He started out with the term infospace but tried other variants since he wanted a catchier phrase (Heuser, 2003; Wallace-Wells, 2011). In the poetic essay *Academic Leader* (published in Benedikt, 1991, p.27), Gibson writes:

Assembled word cyberspace from small and readily available components of language. Neologic spasm: the primal act of pop poetics. Preceded any concept whatever. Slick and hollow-awaiting received meaning. All I did: folded words as taught. Now other words accrete in the interstices.

He seems to suggest that the word was an empty container later filled with meaning by others.

Cyberpunk – a dubious movement

In the November 1983 issue of *Amazing Science Fiction Stories*, the short story *Cyberpunk* by Bruce Bethke was published. The story – about a gang of teenage hackers – had been written in 1980 and is credited as being the first to use the term cyberpunk. Bethke claims that his intention was to illustrate the juxtaposition of punk attitudes and high technology with a memorable word, a word for the criminal and computer skilled youngsters that he saw coming (Bethke, 1997; Bethke, 1998; Collins, 2005). Gardner Dozois popularized the term and was the first to describe it as a new literature sub-genre (Collins, 2005; Heuser, 2003; Olsen, 1992; Schneider, 1996). The delinquent of Bethke's short story symbolically takes his father's online life by erasing all traces of him (including his certificate of employment and bank savings) in a rebellion mimicking the murderous children in Bradbury's *The Veldt*, the proto-cyberpunk short story from 1951.

William Gibson's *Neuromancer* is a central work in cyberpunk, along with the sequel novels that make up the so called Sprawl trilogy (*Count Zero*, 1986 and *Mona Lisa Overdrive*, 1988), and the novels of the Bridge trilogy (*Virtual Light*, 1993, *Idoru*, 1996, and *All Tomorrow's Parties*, 1999) (Benedikt, 1991; Crang, Crang & May, 1999; Csicsery-Ronay, 1992; Disch, 1998; Godhe, 2010b; Gordon, 1992; Guynup, 2002; Hayles, 1993a; Heuser, 2003; Hollinger, 1991; Kerman, 1992; Lacey, 2000; McCaffery, 1991; Rheingold, 1991; Lovén, 2010; Turkle, 1995). As described by Olsen (1992), William Gibson was viewed as “the godfather of cyberpunk” and academics spun a “critical industry around him” (p.1). There are other writers that are important as well, especially Neal Stephenson, Bruce Sterling, Rudy Rucker, John Shirley and Pat Cadigan (Heuser, 2003; McCaffery, 1991; Olsen, 1992; Smith, 2014), and cyberpunk also included movies such as *Alien* (Scott, 1979), *Tron*, and *Videodrome* by David Cronenberg (Bukatman, 1997; Collins, 2005; Crang, Crang & May, 1999; Hanson, 2005; Kerman, 1992; Lavery, 2001; Olsen, 1992). The most central cyberpunk movie, rivaling the importance of *Neuromancer*, is the feature film *Blade Runner* (1982), directed by Ridley Scott, written by Hampton Fancher and David Webb Peoples, and based on Philip K. Dick's novel *Do Androids Dream of Electric Sheep?* (Boşnak, 2001; Bruno, 1987; Bukatman, 1997; Godhe, 2010b; Hayles, 1993a; Heuser, 2003; Lacey, 2000; Landon, 1992; Marder, 1991; McCaffery, 1991; Neumann, 1999; Schroeder, 2001; Lovén, 2010). With its visual aesthetic of dense urban sprawl, a narrative that combines the world-weary and the romantic, and with its themes on human identity and the dissolving border between man and machine, *Blade Runner* is the epitome of cyberpunk. It has the archetypical film noir style (Heuser, 2003; Crang, Crang & May, 1999), but it is a cyberpunk movie without the cyberspace (Clute, 1995; Lacey, 2000). Computers have a presence, and the Esper machine that can deconstruct a two-dimensional photograph into a three-dimensional reconstruction evokes both Google Street View and Adobe Photoshop, but the computers are just screens. There is no space behind the screens, and there is no hint of a global network. The contrast between *Neuromancer*

and *Blade Runner* in this respect is striking. But considering *Blade Runner's* focus on human identity, and considering the novel was written the year before the birth of Arpanet, 1968, it is not strange that Dick and subsequently Scott used computers as devices rather than environments.

When William Gibson talks in interviews about what have influenced him, he summons the movie *Escape from New York* (Carpenter, 1981), and the writing of William Burroughs (McCaffery, 1991; Olsen, 1992; Tatsumi, 1986), as well as the dense and complex writings of Thomas Pynchon (Olsen, 1992; Wallace-Wells, 2011). McCaffery suggests that the novel *Naked Lunch* by William S. Burroughs is a predecessor to Gibson's cyberpunk texts, and emphasizes that the collage writing style – “cut-up methods and quickfire stream of dissociated images characteristic” (ibid, p.264) – is similar for Burroughs and Gibson. Another author with a similar style is J. G. Ballard, mentioned by several academics as an influence for cyberpunk (Disch, 1998; Hollinger, 1991; Kerman, 1992; Lacey, 2000; Olsen, 1992). One of Ballard's most well known novels – *Crash* from 1973 – definitely has themes similar to cyberpunk in its violent clash between eroticism and car crashes, and between yearning flesh and disrupted machinery. Disch (1998) compares Ballard's writing to surrealism, especially in the juxtaposition of the banal and the highly iconic, which is noteworthy since surrealistic juxtaposition is one of the topologies of virtuality I will discuss in my own findings. There is also a tendency to think of Philip K. Dick as an important influence to cyberpunk (Lacey, 2000; Lovén, 2010; Olsen, 1992), much because *Do Androids Dream of Electric Sheep?* is the novel that was adapted into the movie *Blade Runner*, and because of Dicks' obsession with the blurred line between reality and illusion. But according to McCaffery (1991), Olsen (1992), and Wershler-Henry (1989), Gibson has claimed that he did not read Dick before he wrote *Neuromancer*.

Cyberpunk has occasionally been referred to as a movement. However, its popularity as a sub-genre grew quickly during the 1980s, and its key storytellers eventually denounced it as a silly marketing strategy (Collins, 2005; Csicsery-Ronay, 1992; Gordon, 1992; Hollinger, 1991; McCaffery, 1991; Olsen, 1992; Siner, 1992; Tatsumi, 1986). Gibson is one of the writers that are dubious about the cyberpunk label. In an interview he says “all that really happened was that a bunch of work by some new authors landed on some publishers' desks at the same time. People didn't know what to make of us, so they gave us this tag” (McCaffery, 1990, p.145). Farnell (1998, p.462) describes how

the novum of cyberspace had moved from potent narrative device to cynical marketing technique and commodified hyperreality, thereby attaining an escape velocity which transported it from the realms of sf and text and into the mainstream media-hype of techno fetishistic desire.

However, it remains an effective label for a specific sub-genre of science fiction, collecting a range of themes and aesthetics under one roof. One advantage with the cyberpunk label is that it signals a break from previous tradition in science fiction. Previous science fiction was often optimistic, set in far of futures and among the stars. William Gibson has claimed the following concerning his own writing:

“When I write about technology, I write about how it has already affected our lives; I don't extrapolate in the way I was taught an SF writer should” (McCaffery, 1990, p.140). Granted, previous science fiction had had its share of dystopia – *1984* by George Orwell, *Brave New World* by Aldous Huxley and *The Time Machine* by H. G. Wells being prime examples – but cyberpunk was special in its method of setting its stories in a close dystopic future (McHale, 1992). The newsletter *Cheap Truth*, edited by Bruce Sterling, was an informal outlet for the early cyberpunk movement, and Sterling and others writing under pseudonyms expressed vehement critique towards the stale state of science fiction in the early 1980s. An important contrast between earlier utopian science fiction and cyberpunk is that cyberpunk thematises the actual state of our own society, and not what might happen eventually (Bruno, 1987; Diggle & Ball, 2014; Olsen, 1992; Siner, 1992). A focus on electronics and bio-technology pervades the genre. Characters are described as cyborgs, humans augmented either by physical, mechanical extensions such as artificial camera eyes and extendable metal claws, or by virtual, cognitive extensions of the mind into cyberspace (Gordon, 1992; Heuser, 2003; Springer, 1996). This “technological transcendence of human limits” (Grant, 1990, p.45), this breakdown of the dichotomy between the artificial and the natural, is romanticized, and at the same time often depicted as grotesque. According to Siner (1992), the cyborg theme in cyberpunk goes deeper than just a superficial merging of flesh and metal. Gibson's stories usually have a humanistic and emotional aspect going in parallel with the futuristic transcendence through technology; Gibson's characters often have a drive to transcend the self (Grant, 1990), to become someone else, to re-program their own wiring. These ideas parallel Donna Haraway's cyborg manifest (Haraway, 1991) proclaiming that by seeing ourselves as constructed entities we can reprogram ourselves and our culture. This and other postmodern cultural commentaries reverberate in cyberpunk, suggesting that cyberpunk is the literary expression of postmodernism (Landon, 1992; Lovén, 2010; Olsen, 1992; Springer, 1996).

But where does the *punk* in cyberpunk come in? The sub-culture and music genre punk emerged in the mid-1970s and it seems obvious that cyberpunk strived to become the science fiction equivalent of punk music. Bruce Bethke was a wannabe musician in the early 1980s when he coined the term cyberpunk. William Gibson has acknowledged that cyberpunk “certainly wanted to be” (Diggle & Ball, 2014, p.99) the literary equivalent of rock music, and in an interview (Wallace-Wells, 2011) he claims that Bruce Springsteen's album *Darkness on the Edge of Town* from 1978 was an influence when he wrote *Neuromancer*. Gibson describes the album as “very noir” and he wanted Case, the protagonist of *Neuromancer*, to have the same “American hopelessness” (p.219). However, what makes cyberpunk a punk style genre is its fierce criticism of technology and society from within. In another interview, William Gibson claims that he made a union between the “personal computer and Bohemian attitude” (Belkom, 1998, p.142). Counterculture proposed leaving the city and technology behind, and engaged in colorful and joyful aesthetics. Cyberpunk writer Sterling characterizes counterculture as “rural, romanticized, anti-science, anti-tech” (Sterling, 1991, p.3); counterculture dreamed

of a better world. Punk, on the contrary, has given up without giving up. Punk accepted the city, the darkness, the hardness, and the technology, but then used it for its own aesthetic. It was as if the 1960s contradictory divide between technology and counterculture – contradictory since counterculture supported the personal computer and embraced the aesthetic of the electric guitar – finally closed on itself to form punk in the late 1970s, and this integration between counterculture and technology surfaced in cyberpunk narratives and aesthetics (Olsen, 1992; Smith, 2014). Punk – literally meaning rascal, bad boy, good-for-nothing – became the representation of a working class betrayed by the failure of technology. Punk rose from street culture and embraced the socially marginalized (Hollinger, 1991). Punk used anger in the form of noise and destruction to assimilate dystopia and make it cool. Cyberpunk worked in the same way (Heuser, 2003; Lovén, 2010). The typical cyberpunk protagonist is an outcast, a working class man or woman trying to make it, trying to get a break (Gordon, 1992), like the hackers in Gibson's *Burning Chrome*.

Punk is explicitly about revolt, and cyberpunk criticize centralization, industrialization, technology and large-scale solutions. Punk also sport an anti-system, anarchist stance favoring a do it yourself attitude (Collins, 2005; Heuser, 2003; Schneider, 1996). *Cyber* relates to control and to technology invading our body, mind and lives. *Punk* “refers to a protagonist seizing the tools of this invasion to fight back against the invasive forces” (Pope, 2008, p.9). Punk fashion exhibits a cyborgian fascination with reshaping the body, piercing it and adorning it with sharp metal. The music is aggressive, disharmonic and characterized by amplifier dissonance and electric guitars. Cyberpunk parallel this with its violence in the form of dense visual or textual chaos (Gordon, 1992). Aesthetically, cyberpunk overlaps with punk fashion: black leather clothes, mirrorshades, neon lights, rain, and surfaces of chrome and concrete are all features of both punk and cyberpunk (Heuser, 2003).⁹

When comparing counterculture and punk, it is interesting how well the differences in aesthetics reflect the differences in essence. Where counterculture used soft shapes, gaudy colors and bright flowers, (cyber)punk uses chromed sharpness, black leather and neon lights. Counterculture wanted to escape technology, to rewind the technological civilization. Cyberpunk celebrated technology, in a way (Gordon, 1992; Hollinger, 1991). The vistas painted by *Neuromancer* and *Blade Runner* are scary and cruel, but presented in a way that was exciting and luring, a kind of “Pop Despair” (Disch, 1998, p.220). The message is that the apocalypse has come, but it is livable, at least for the individuals that have the right skills. It shows, in the words of Sterling, a “boredom with the Apocalypse” (1987, p.xi). William Gibson explains it as the result of an ambivalence towards technology, a feeling of “ecstasy and dread” at the same time (Diggle, 2014, p.133). Another characteristics of cyberpunk are its locations; dystopic cityscapes and electronic, virtual spaces (Bukatman, 1997; Crang, Crang & May,

⁹ Karen Collins (2005) also describes close connections between cyberpunk and another musical genre; industrial. She mentions bands such as Einstürzende Neubauten, Ministry, Prodigy, Rammstein, Front 242, and suggests that William Burroughs influenced both cyberpunk and industrial music.

1999; Hollinger, 1991; Schneider, 1996). This is archetypical for cyberpunks approach to science fiction storytelling – it does not invent a new and utopian future, but it extrapolates the present day situation into a dystopic future. This showcases an “aesthetic of decay, exposing the dark side of technology, the process of disintegration” (Bruno, 1987, p.210). The city portrayed in cyberpunk is not an ultramodern city; instead, it is the postmodern city.

Cyberpunk has been criticized for being too stylish and self-aware. Nicola Nixon (1992) suggests that cyberpunk is not radical at all and that “its slickness and apparent subversiveness conceal a complicity with” conservatism (p.1). It is also noteworthy that the anti-authoritarian stance in cyberpunk generally engages issues related to capitalism, surveillance and such, primarily targeting criticism at governments and corporate structures. Patriarchal power hierarchies and other gender issues are seldom addressed. There are strong and capable female characters such as Molly in William Gibson’s literature and Trinity in the Matrix franchise, but these characters merely offers a quite superficial approach to highly complex gender issues. It can also be argued cyberpunk it did not bring anything new to the debate on technology and society – as suggested by Svante Lovén’s extensive survey of pre-cyberpunk works (2010) – and that cyberpunk swiftly became a bloated marketing device before collapsing when real-life technology surpassed the typical ten-minute-into-the-future cyberpunk settings. After all, William Gibson’s cyberspace seems outdated when we now look back, and standard cyberpunk themes such as hacker attacks, global surveillance, climate change saturate everyday news reports. However, the questions that hide under the glossy-gritty surface – the critique against systems from within these systems, and the investigations of the human/technology boundary – are still important. Thus, cyberpunk is both of historical importance – it marked a point of increased awareness about the benefit and hazards of technology – and a stance that still asks questions.

The end of cyberspace and the future of the Internet

In May 1994 the First International Conference on the World-Wide Web was held at CERN in Switzerland. At this time, a typical web page was a light grey, flat sheet filled with long lines of mono-space text, occasionally adorned with not so successful graphics. But Gibson’s cyberspace vision had reverberated through society, and dreams of a more visual and spatial web ran high. At the conference a paper entitled *Extending WWW to support Platform Independent Virtual Reality* by Dave Raggett was published (1994), and it outlined the markup language VRML (Virtual Reality Markup Language, later Virtual Reality Modeling Language). VRML was used to display 3d models and 3d environments in a 3d web browser. The dream was obvious; the Web would be transformed into a spatial environment. The fusion of the two spawns of the cold war, the Internet and virtual reality, was highly anticipated.

But, the Internet did not become cyberspace. Instead the 3d web vision would develop in another direction; a direction started already in 1969, the same year that ARPANET was founded. This year Rich Blomme rewrote the game *Spacemar!* into a version that could be played over the network on the PLATO computer system at

the University of Illinois (Klastrup, 2003a). Online gaming continued to develop on the PLATO platform during the 1970s, with titles such as *Star Trek*, *Airflight* and *Avatar* (an early dungeons and dragons game), as well as a budding online community. These two trends, online gaming and online communities, would co-evolve. Online communities developed further via CommuniTree (a computer network accessible for the public via telephone modems, launched in 1978 with a name referring to the ecological tradition of counterculture) and The WELL (an acronym for The Whole Earth Lectronic Link, and launched in 1985 by two former hippies, Stewart Brand and Larry Brilliant) (Flichy, 2007). The next vital step in online gaming was the text-based adventure game ADVENT, written in 1976 by Will Crowther (Klastrup, 2003a). This inspired Rob Trubshaw and Richard Bartle to write the first MUD (Multi-User Domains, or Multi-User Dungeons) in 1978. At the start, MUDs provided a virtual environment, albeit in textual form. They were online communities where the inhabitants described the environment, events and their own actions using typed descriptions and typed commands. They were narratives co-authored by the users, “a new form of collaboratively written literature” (Turkle, 1995, p.11), where “users are both authors and audience” (Flichy, 2007, p.147). The constructed events were part fictional, part real-life. MUD’s and MMORPG’s (Massively Multiplayer Online Role-Playing Game) are a combination of reading, acting and living (Aarseth, 2007). Concerning early online role-playing, Svante Lovén (2010) highlights that Rad Bradbury, in *Fahrenheit 451* (1953), very early foresaw a kind of fictional virtual reality that incorporates role-playing. This stands in contrast to other proto-cyberpunk stories that emphasized the degenerative passivity and imprisonment of counterfeit or virtual environments. The online game worlds of today are spawned both from VRML and virtual reality technology, and from text based online communities (Damer, Gold & Bruin, 1999). The historical description of the emergence of these – as well as the Internet – is strongly dominated by the US, and especially San Francisco. Parallel development did take place, most notably the Minitel network in France, launched in 1978 and in service as long as 2012. The available services included chat rooms and message boards.

The first visual and spatial, albeit two-dimensional, online community was Lucasfilm’s *Habitat* that launched in 1985 (Klastrup, 2003a). Ten years later, the three-dimensional *Active Worlds* was launched in its first beta version, *AlphaWorld*. *Active Worlds* is one of the first “massive multiuser online environments where millions of people live out a collective fantasy existence” (Castronova, 2007, p.5). The fascination and appeal of meeting other people online fueled the development of online communities, and is exemplified by Sherry Turkle’s claim that “when we step through the looking glass, other people are there as well” (1995, p.9). A series of virtual worlds were launched, with bigger and bigger populations; Blaxxun3D launched *Colony City* in 1997 (a population of many thousand users) and in the same year, *Ultima Online* was launched and would become the first large virtual world with 200 000 users (Klastrup, 2003a). *EverQuest* started in 1999 (400 000 users). *Second Life* started in 2003 and became one of the largest virtual worlds, but was soon rivaled by the massively popular *World of Warcraft*, launched in 2004 by game

developer Blizzard Entertainment. *World of Warcraft* is a MMORPG, a Massively Multiplayer Online Role-Playing Game. *Active Worlds* and *Second Life* were largely peaceful environments where the main occupation was text based chatting, building or just roaming the huge environment. Different institutions, such as governments and universities, have attempted to build a presence especially in *Second Life*, and there are numerous cases of higher education learning activities taking place in the virtual world (Educause, 2006). *World of Warcraft* is quite different. Here the users, or gamers, gang up into clans and make warfare on each other or enemies, emphasizing the game aspects of the world. This is what happened to cyberspace; it became online games and social habitats.¹⁰ This is the way in which William Gibson's consensual hallucination of millions of users actually turned out. The contrast with the cyberspace of *Neuromancer* is striking. Instead of a minimalistic environment intended to give access to humanities' accumulated knowledge and services such as banking, the real-life virtual worlds are visually dense simulations of environments with trees, mountains, clouds and skies, and they use role-play and narrative plots to engage the inhabitants in battles.

The diversity of game-based virtual worlds is broad. Just because a game is three-dimensional and can support simultaneous gamers, it is not necessarily a virtual world – not in the more strict definition used by for example Klasturp (2003a; 2003b). For example, a large number of First Person Shooters do not have persistent environments or characters. For each game session the environment opens up unaffected by what ever happened in the previous game session. Also, the line between simulations and games is confused, as pointed out by Louise Peterson (2011). She points to *The Sims* as an example of a virtual world that is marketed as a game, but without any clear stated goals. These sandbox games/virtual worlds are more focused on the simulation of a world and on allowing the user to explore and build the world.

Allucquere Rosanne Stone (1991) summarizes the emergence of virtuality back through the development of modern media, suggesting four epochs. The start of each epoch is characterized by a change in how humans communicate:

- Epoch One – text (mid 1600)
- Epoch Two – electronic communication and entertainment media (1900)
- Epoch Three – information technology (1960)
- Epoch Four – virtual reality and cyberspace (1984)

Online communities characterize epoch three, and the emergence of the epoch is symbolically marked by the first BBS (bulletin board systems), which eventually developed into newsgroups, discussion groups and today's social media. Stone characterizes epoch four by emphasizing the canonical importance of *Neuromancer*, and how it symbolizes the “three-dimensional inhabitable cyberspace” (ibid., p.95). We might be on the verge of a fifth epoch, characterized by the merging of virtual

¹⁰ A remark that also has been made by Margaret Wertheim (1999) and Svante Lovén (2010).

and actual, further discussed in the chapter Breaking the screen – how the virtual bleeds into the actual, page 197.

Characteristics of technical virtuality

After the previous chapters' framing of virtuality in a historical and cultural perspective, we will now consider different characteristics of contemporary technical virtuality.

Immersion and presence

An important aspect of the “almost as if-ness” of virtuality is the sense of being somewhere, the phenomenological experience of being immersed in an environment or standing in front of an object that almost is there. This is referred to as presence and immersion, two deeply entwined and overlapping concepts. Presence is the feeling of existing in environment other than the actual place that the physical body is, of extending, projecting somewhere else. The concept has its origin in research on telepresence, where mediating technologies such as video, audio and tactile feedback create the sensation of being in a remote, actual environment. Often the presence is two-way, so that the user is apparent in and has influence on the remote location, for example people at the remote location can see the user of the system on video screens, and the user can manipulate objects with waldos (remote manipulators). Immersion is the feeling of being surrounded by a responsive and high fidelity environment, giving the illusion of transcending into another environment. Immersion is a fundamental concept to describe virtual reality systems, and a main feature is the physical immersion of the user in a veil of sensory stimuli, such as fully immersive displays and surround audio.

Presence and interaction

Presence is the sense of projecting into an environment that seems believable, realistic and engaging (Daniel, 2013; Slater, 2002). According to Witmer and Singer (1998) presence is the “subjective experience of being in one place or environment, even when one is physically situated in another” (p.225). Further, presence can be defined as a “technologically mediated experience” (Robinett, 1992, p.230) and as “the experience of presence in an environment by means of a communication medium” (Campanella, 2001, p.27). It is a synthetic experience that makes it possible to perceive “a representation or simulacrum of something ... rather than the thing itself” (ibid., p.230). Limited telepresence has been provided by pre-digital technologies such as the telescope, the telephone, and television (Goldberg, 2001).

Even though presence often means *telepresence*, we can also speak about a virtual presence (Zeltzer, 1992), a “feeling like you are present in the environment generated by the computer” (Sheridan, 1992, p.1). The important difference is that telepresence is distal – it brings remote locations closer – while virtual reality is simulacral – it simulates locations as if they were actual (Goldberg, 2001).

Several attempts have been made to determine the components of presence. Robinett (1992) describes a number of dimensions, such as superposition, scale of time and space, and causality. Lombard and Ditton (1997) propose five aspects: social richness (intimacy and immediacy through self-expression and the presence of others); social actors (interactive agents); realism (seemingly accurate

representations); transportation (the feeling of being somewhere else); and immersion (perceptual and psychological). Steuer (1994) emphasizes two dimensions: vividness (“the ability of a technology to produce a sensorially rich mediated environment”) (p.10) and interactivity (“the degree to which users of a medium can influence the form or content of the mediated environment”) (p.11). Sheridan (1992) lists three determinants of telepresence: the extent of sensory information; spatial translation of sensors; and the ability to modify the remote environment. Finally, Zeltzer (1992) contributes three salient components: autonomy (a simulation’s ability to react to stimuli); interaction (the degree of control the user can have over the simulation); and presence as a bath of sensations. Clearly, there are many concepts that are repeated in different form in these listings – most notably different aspects of richness and interaction – and there is common ground to find among all these suggestions. Another aspect, the presence of other users, will be discussed further on as a component of worldliness.

Interaction is a fundamental aspect of virtuality, as well as for presence and immersion. Interaction means agency, and there are different levels of agency. One of the most basic is looking around. In a virtual reality environment the user can turn her head and this matches what the user can see, just as in an actual environment (Robinett, 1992). This, combined with the panoramic view, can be very powerful in order to achieve immersion (Grau, 2001). Secondly, the user can move through the environment, providing a spatial interaction between user and world, mimicking what we expect in an actual environment (Lovén, 2001; Murray, 1997; Robinett, 1992). Thirdly, the users’ agency in the world, the interaction with objects in the world, partly determines the level of immersion and presence. To what level can the user change aspects of the world, and get perceptual feedback confirming the change (Dreyfus, 2001; Goldberg, 2001; Lovén, 2001; Murray, 1997)?

Our sense of presence could also depend on the degree of synchronization between perceptions of the environment and the mind’s mental model of that environment (Sjölö, 2013). Recent research on cognition describes the brain as an organ that specializes in mental simulations (Barsalou, 2008) with the intention of predicting the (immediate) future; this is referred to as the prospective brain (Schacter, Addis & Buckner, 2007). If I grab an object, the brain predicts that my hand will sense the object I grab for, and when this will happen. If the subsequent perception of this projected outcome is missing, or out of synch, my sense of presence is lowered. This means that one way of regarding the experience of virtuality is that there are two simulations that interact and occur side-by-side; the brain’s simulation of what will happen to the user, and the computer’s simulation of what will happen to the user.

Immersion and richness

Immersion is a highly subjective experience, suggesting the feeling of being surrounded by the environment, as if it closes up around you like a shell.¹¹ Brooks (2009) and Murray (1997) compare immersion in a virtual environment with plunging into the ocean, and “the sensation of being surrounded by a completely other reality” which “takes over all of our attention” (Murray, 1997, p.98). Zeltzer (1992) also speaks about a bath of sensations, and divides sensorial input into two aspects: the number of senses involved, and the fidelity of each sensory stimulus. The extent of the sensory stimulus is also important, especially for vision. The goal is usually to cover the entire field of vision and dissolve the frame of the screen entirely (Grau, 2001; Lovén, 2001; Lovén, 2010; Nusselder, 2009). The desktop interface to virtual worlds such as *World of Warcraft*, *Minecraft* and *The Sims* can be conceptualized as a window through which we observe the virtual world, a window established by the WIMP interface (windows, icons, menus, pointer). When instead a semi-spherical or fully spherical display is used, physically and spatially enveloping the user, it becomes more than a screen; it becomes an environment. The user that wears a head-mounted display or steps into a CAVE based virtual reality is not looking into the world, she is looking around her at the world.

There are two types of immersion that are discussed in virtual reality: technical immersion and phenomenological immersion (Bricken, 1990). Technical immersion is largely quantitative and investigates issues concerning the fidelity of the sensory input. Phenomenological immersion is the qualitative, subjective sensation that is the result of technical immersion. It is described as the sense of “being in and of the world” (Campanella, 2001, p.29), “an impression suggestive of being there” (Grau, 2003, p.7), and by how it “takes us inside the world through the impact on the physical senses” (Klastrup, 2003a, p.46).

The implementation of immersion and presence range from the technically simple to the utterly complex. A low-tech approach is narrative immersion, where good storytelling gives a sense of being present in the events of the narration (Murray, 1997). As pointed out by Sheridan (1992), this has been “stimulated by authors and artists for centuries” (p.1), and Zeltzer (1992) agrees that “storytellers have sought to involve our senses and imaginations” (p.131). A compelling story can immerse us so deeply that the papers of a book or the cinema theater fades from attention. Brooks (2009) describes a double immersion in virtual reality; the user can be immersed both by the sensory display and by the narrative. The first is primarily technical and sensorial, while the latter is primarily phenomenological, even though the relation between these concepts is more complex than a one-to-one connection. For example, phenomenological immersion emerges both from sensorial stimuli as well as narration. Narrative immersion is technically very simple, printed words on a page or a well edited movie is all the technology you need, but it has its limitations of course; there is no sensorial immersion and there is no

¹¹ Even though immersion is subjective, it can be measured. Two popular methods are threat response and socially conditioned response (Sheridan, 1992). Do you duck for a virtual danger? Do you wave to a virtual character?

simulation to interact with. When attempts are made to achieve full immersion with advanced technology, the challenges eventually become daunting. Full audio immersion has been more or less accomplished, and full visual immersion with perfect visual fidelity is within our reach; algorithms for physics simulations and rendering are steadily reaching the goal of a visually perfect simulation. However, when it comes to the other senses, such as touch, vestibular sense and kinesthetic sense, technical solutions are still cumbersome and inefficient. A simple experience such as pressing your hand against a wall while you walk along the wall – including the irregularities of stone against your finger tips, the rigidity of the stone when you press against it, and the locomotion alongside it – is almost impossible to simulate well and feed as sensorial stimuli to the body/brain. A major obstacle is the nature of these senses; they involve the whole body, and not only small entrances such as the eyes or ears. Robinett (1992) suggests that a full-body exoskeleton might be the best we can do, and Zeltzer (1992) states that perfect immersion might be impossible without neural interfaces, circumventing the messy and cumbersome body of flesh and bone, and feeding sensory stimuli directly to the brain. However, the implementation of neural interfaces might face huge technical obstacles; interacting with the brain seems even more complex than interacting with the full body.

Avatars and the subject/object boundary

One aspect of presence and immersion, related to human and computer interaction, is the subject/object boundary. The subject/object boundary defines where the line between your actual physical body and the virtual environment is drawn. When using a head-mounted display, the line is drawn around your head since the helmet envelops your head. In the CAVE room you stand inside a room with walls covered by the projected virtuality, so here the line is the wall of the room. The most obvious difference is that in the first you do not see your actual body anymore (but you might be given a virtual avatar body), while in the latter you can see your actual body. In fictional scenarios, the line is often drawn more tightly around you; in movies such as *The Matrix*, the experience of the virtuality is implanted straight into your brain. You do not even use your eyes or ears. This is not possible yet, but it might be feasible in the far future considering technological development in brain-machine interfaces.

A related question is what to do with your body. In the CAVE virtual reality mentioned above, this is not an issue; you bring your meat body with you into the virtual environment. When accessing virtual worlds on a desktop, your physical body is cropped out, being situated outside the frame of the computer screen. In most virtual reality systems and online virtual worlds you are provided with a virtual body, the avatar. The avatar is important for achieving presence. You experience your avatar by actually seeing it in third-person perspective or you implicitly experience it by seeing from its viewpoint in first-person perspective. Michael Heim (1993) claims that virtual reality emerged when the first representation of a datagloved hand appeared on a computer screen, when the human was given digital form. It could also be argued that the human is given

virtual form even in MUDs, where the presence of players is signified by their screen name. Avatar is originally a Sanskrit word meaning the incarnation of Hindu gods, as a material manifestation. Incarnation literally means embodied in flesh or taking on flesh (Doyle, 2009; Nusselder, 2009). The modern use of avatar appeared in the 1980s, especially in the online role-playing game *Habitat* (Baxter, 2012), and this usage of the word was coined by Neal Stephenson in his 1992 novel *Snow Crash* (Lovén, 2010). The avatar can be of quite different qualities; it can be iconic, indexical or symbolic, it can be in 2d or 3d, and it can be a still image or a moving image. The image from your web camera in a videoconferencing system is for example indexical, 2d and moving. The typical avatar in online games such as *World of Warcraft* or *Minecraft* is non-indexical, iconic, 3d and animated.

An avatar is like a mask we take on, a role we act (Murray, 1997). The avatar splits us into two. The meat body is left behind, and we project our attention and our viewpoints to the virtual world (Canny & Paulas, 2001). This mimics Cartesian mind/body dualism, a dualism carefully disputed and dismissed by phenomenologists such as Martin Heidegger and Maurice Merleau-Ponty, and now frustratingly resurrected by technology (Dreyfus, 2001; Wertheim, 1999).¹² The avatar has a double nature (Doyle, 2009). In relation to the user's actual body, the avatar is an immaterial body, just as the rest of the virtual environment is immaterial. But in relation to the virtual world, the avatar is an embodiment, since it gives us a body in the virtual world. The avatar splits our lived, biological body and adds a phenomenological virtual body (Morie, 2008). Hayles (1999) emphasizes how our subjectivity seems capable of holding (at least) two coexisting foci, and describes us as cyborgs built by a biological, material body and an artificial, virtual body.

The avatar is personal; it is my body, but it also connects me to others, since I can be seen. Even if it is technically easy to have a user being presented in different ways for different co-users, practical and social reasons make it obvious that the user conventionally is represented in one coherent way. The ability to be seen by others takes for granted that there is a unifying concept of same time and same place, a concept tied in closely with the concept of worldliness.

Worldliness – the virtual as a world to inhabit

One of the most fundamental aspects of the virtual environment is whether it is spatial or not. Spatial environments are usually visual – images convey the experience of a space, either in two dimensions or three dimensions. Non-visual environments can also be spatial to some degree; tactile interaction via haptic displays as well as surround audio can give a sense of space, and text-based MUD's use verbal description of space. Video conferencing, as well as game environment where the movement occurs along a horizontal axis, are two examples of two-

¹² Descartes dualism originally split the world in *res extensa* (extended material reality, explained by rationality) and *res cogitans* (the thinking soul, explained by religion) in order to reconcile science and religion, but later merged with older Judeo-Christian ideas about body and soul, and was popularized as a mind/body dualism (Nordin, 2012; Wertheim, 1998; Wertheim, 1999).

dimensional spatial environments. A three-dimensional virtual world usually lets the viewer move through the world, which is highly important to give a sense of being in the virtual world.

When Michael Benedikt wrote about cyberspace he characterized it as being not a technology, nor a simulation, but an actual place (1991). Lisbeth Klastrup describes the worldliness of a virtual world as “the possibility of synchronous interaction between users and between user and world within the framework of a space designed as a navigable universe” (Klastrup, 2003b, p.101). In this description, the word interaction is central; there is a connection between interaction and worldliness. Interaction is characterized by causality – actions result in change – and that it is a relation between two agents, either a subject and an object (I open a door) or two subjects (I talk to you) (Klastrup, 2003a). We can watch a world and experience it with a certain level of immersion – that is what we do in non-interactive fiction – but interacting with the world gives us an active presence in a distinctly different way. We inhabit such a world. We are embodied in the world through our avatar and through our interaction with the world, creating an embodied narrative (Doyle, 2009), and participating in a theatrical and performative space (Klastrup, 2003a, Klastrup, 2003b; Murray, 1997). The presence of others gives the world even more worldliness, and once again interaction is a key word since it is the interaction with others that makes the world appear inhabited. A fundamental component of inhabitation is simply knowing that others are there as well (Gunnarsson, 2002; Klastrup, 2003a), and Lovén (2010) reminds us that this is reminiscent of the consensual experience that Gibson envisioned. Inhabitation of virtual worlds creates a narrative. The participants in online virtual worlds live and create and tell a story together (Klastrup, 2003a; Klastrup, 2003b; Turkle, 1995). Klastrup calls it “story-living rather than story-telling” (ibid., p.104), and Benedikt (1991) claims that “cyberspace is poetry inhabited” (p.229).

For a virtual world to have worldliness and not just be an environment, it needs persistence. Persistence means that the world has a continuous, autonomous history. When a user is not present the world nevertheless continues to evolve and change; the other users are persistent as well. You meet the same individuals next time you participate. The early text based MUDs were technically simple but they nevertheless exhibited this aspect of persistence. We can summarize the characteristics of different actual virtual worlds as follows.

Virtual world (persistent). A full-fledged virtual world is persistent in time and extended in a three-dimensional spatial space, with such a large scope that it cannot be explored at a glance. It mimics or simulates many aspects of the actual, such as gravity, sky, animals and plant life. Usually the participant interacts with both the world and the other inhabitants.

Virtual environment (impermanent). A virtual environment is a spatial environment but usually limited in scope, realism and most notably it is not permanent in time. Usually the participant only interacts with the environment itself, not other users.

Virtual community (social, not spatial). The typical virtual community is a metaphorical “place” without space, such as a chat room, newsgroup or discussion group. Usually the participant interacts only with other participants, and not the environment itself.

These categories are re-adapted from Lisbeth Klastrup (2003a; 2003b), and Klastrup defines a virtual world as an online representation that is persistent, inhabited, provides interaction with the world and its other users, and is navigable. Virtual communities – or online communities – are often characterized as a social space, an online, non-physical place where participants with a common interest meet repeatedly and evolve emotional ties (Agre, 1998; Gupta & Kim, 2004; Jones, 1998; Klastrup, 2003a; Lee, Vogel & Limayem, 2002; Rheingold, 1993; van Dijk, 1997).

There is a confusing similarity between the virtual and the fictional. If the virtual means almost as if, then could a feature film telling a fictional story be virtual? After all, the imagery on the screen looks very similar to the actual, almost as if what we see on screen is the actual. And, the virtual worlds that do exist are often fictional per se, and adapt typical fictional genres, such as the fantasy game *World of Warcraft* or the science fiction world of *Star Trek Online* (Aarseth, 2007). Many online virtual worlds and computer games are transmedial narratives, involving a diegetic world that also exists in non-interactive media forms such as movies and literature (Klastrup & Tosca, 2004), *Star Wars* and *Lord of the Rings* being obvious examples. Both fiction and virtuality make beliefs.¹³ But virtuality is more than a narrated sequence of events; it is a phenomenological, interactive experience. A parallel is the debate in game studies concerning whether computer games are narratives or something else, a debate that in the early 2000s was quite frantic between narratology and ludology (Heidbrink & Knoll, 2014). A few years later, the debate became less polarized and it was argued that some media artifacts could be both games and narratives. Bo Kampmann Walther (2003) has pointed out that games and cinema share several aesthetic attributes, such as movement, space, visual culture and characters. There are however two characteristics that distinguish virtuality and fiction: interaction and worldliness. With interaction, the virtual mimics the actual in a way that conventional fiction does not. As expressed by Sandy Stone (1991), the spectator becomes the participant and interaction is the modality “that distinguishes the computer from the cinematic mode of engagement” (p.192). The virtual usually mimics the causality we encounter in everyday life. We interact with the virtual (Heim, 1993; Moere, 1998; Nusselder, 2009). We create, move, change and delete objects. We interact with other inhabitants of these places. Concerning the debate between narratology and

¹³ Lana Wachowski, one of the directors of *The Matrix*, give voice to the claim that movies and virtualities are similar when claiming during an interview that “all movies are matrixes. You go in and you kind of plug-in, and they cuddle you and swaddle you and they tell you what to feel and what to think. They tell you where to be, where to be emotionally, they’re always constantly informing your understanding and belief of this world that is in front of you, that is projected in front if you on the platonic cave wall” (Hardwick, 2012, at 37:55).

ludology, Jesper Juul (2005) has suggested that computer games can be regarded as simulations happening *now*, while storytelling always look back at past events, separating the reading act from the diegetic acts inside the story. Narratives are realized actions, while games are framed events (Waltherm, 2003). Also, simulations, as well as computer games and virtuality, have multiple outcomes depending on the player/participant. A narrative is characterized by having a beginning and an end (Metz, 1974), something that a virtual world does not necessarily need; the inhabitation in and interaction with, for example a MUD, or a sandbox game, can run its course as long as the simulation plays.

Conventional fiction does not provide these levels of interactions. Fiction, in the form of literature and movies, always ends in the same way. There have been experiments with interactive fiction, such as hypertext both online and in paper form (where the reader jumps or switches between different threads of action), and the movie *Switching* by Morten Schjødt is one of the very rare examples of an attempt at creating an interactive feature film. But the complex, non-linear and palpable interaction with virtual objects and environments goes much further. There is no clear line between linear and interactive media; there are crossovers between games and movies, but interaction nevertheless, clearly separates a conventional feature film or novel from virtuality. Interaction not only separates virtuality from narrative, but it also separates technical virtuality from all the previous virtualities back to Plato. Virtuality is the first “interactive version of virtuality” (Nusselder, 2009), the first fantasy that can be inhabited. The worldliness through interactivity makes virtuality the first post-physical existence.

Virtual as representation or (post-physical) existence

Is the virtual representation or is it existence? Klastrup (2002) suggests that a virtual world both tells the story of a world, thus being a representation, and functions as a (virtual) world. Crang, Crang and May (1999) claim that “simulacra do not represent anything ... they are acts, events, and happenings” (p.266). One possible viewpoint is that the virtual is a representation that has become so powerful that it turns into a (simulated) existence. Such a simulation is no longer a representation; it has become a *post-physical existence*. A house built in a virtual world is not a representation of a house; it is a house (Lanier, 1992). Another viewpoint is that the virtual can be viewed as both existence and representation, balancing between these two (Flichy, 2007). Janet Murray (1997) described virtual reality as “foremost a representational medium” but also “a theater” (p.284). We inhabit the virtual as if it exists, at the same time we watch ourselves perform the events of the virtuality (Heidbrink & Knoll, 2014; Klastrup, 2003a). Consider a virtual laboratory used in chemistry teaching. The virtual lab has an immaterial but albeit real existence. Its high level of realism and interactivity gives it an existence that is fundamentally different from a drawing in a textbook. But since the virtual lab mimics an actual laboratory exercise, it can be said to represent – stand-in for – the actual laboratory. There are many such examples in educational applications of virtual worlds, for example in *Second Life* where study visits are arranged to virtual replicas of actual places, or where role-playing is used to create situations and scenarios that are

difficult or dangerous to perform in actuality (Educause, 2006; Educause, 2008). The same reasoning can be applied to other virtual environments that mimic actual environments, such as the sandbox game *Grand Theft Auto*. The game *Minecraft*, however, does not represent any particular reality; it is a computer game world that has a different aesthetic and logic than the actual world. If *Grand Theft Auto* is a hyperreal representation of Los Angeles – a copy that occludes its original – then *Minecraft* could be seen as a simulacrum, a copy without an original. Granted, there are levels of representation in *Minecraft*; things like trees, the sun and pigs behave *partially as if* they are actual objects, but the correspondence with the actual world is weak. The low fidelity aesthetics and the surreal logic of the world suggest that this is a copy that does not need to glance at an original, at least not as much as, for example, *Grand Theft Auto* does.

The concept of simulation is brought up frequently when we discuss the virtual. It relates to many different facets of the virtual: the virtual as existence or as representation, the virtual as a game, and the virtual being based on the actual. A simulation is a dynamic model of a slice of actuality, predicting some of the behavior of this slice; it is a system that predicts the behavior of another system (Frasca, 2003; Grau, 2003, Lovén, 2001; Robinett, 1992). The different parts of the model and the interaction between these parts mimic the corresponding aspects of the actual world. Superficially, this is reminiscent of representation, where the signifier stands for the signified. However, a simulation acts out processes and events, predicting an outcome that corresponds to what happens in actual processes. These are then represented for the viewer (Zeltzer, 1992). A car crash in a computer game or a simulation of an exploding star illustrates this; objects such as cars and roads are mathematically defined in the model, and interaction such as gravity is calculated between objects. The outcome – a crashed car or a supernova remnant – is then visualized, represented, for the user. According to Aarseth (2007) this separates a computer game from a narrative, and simulation from representation. A narrative is only representation, while a game is a dynamic model *and* its representation. The virtual is also based on a simulation (Rheingold, 1991), and the same argument can therefore be used to differentiate between virtuality and narratives. Benjamin Wooley (1992) claims that the virtual is “a mode of simulated existence resulting from computation” (p.69).¹⁴ He stretches the concept far, describing how a computer simulates a wide variety of tools, from a drawing pad to a movie studio. It is a valid point; because of algorithms and programming, the computer can be seen as a universal tool simulating and replacing other tools, and in everyday language we talk about virtual cinematography or a virtual bank. However, this makes the concept so broad in scope that it tends to lose its meaning, and therefore I do not stretch the concept of virtuality as far as Wooley. Everyday language seems to mirror this, since we tend to use the word *online*, and not virtual, for services such as online shops, online banks and online communities.

¹⁴ Note that a simulation in itself does not have to be based on digital technology or computers. As Frasca (2003) points out, scientific models in general are simulations, as are some toys and board games.

Online then means *available on the Internet* while virtual means an environment or object that is characterized by a *simulated, interactive* existence.

Information, space, and place

MUD's are an interesting example of virtual worlds that can be considered either spatial or non-spatial. They are completely text based, so there is no direct perception of actual space. The user does not see a world. But the text nevertheless describes a space. Opening up this concept, we see that online forums in general are social places/spaces (Benedikt, 1991), places to go to that have limited and post-physical spatiality. Our concept of space has evolved from primarily being a Cartesian, Newtonian geometrical space, to a much more fragmented concept of space, involving different mathematical spaces, as well as social spaces (Lefebvre, 1991). Cartesian space is now supplemented with a multitude of information spaces of varying size, varying solidity, varying entanglement with the actual world, and different numbers and kinds of dimensions.

Newtonian space is material in the sense that we see it as an empty box stretching eternally in all three dimensions, and that we can fill this box with physical objects; physical objects move through this space, defining it. Virtual space is post-physical. It lacks the material physicality of actual space; instead it is based on information; data move through this space, defining it. It has an existence, but it is a space that does not reside within the Newtonian space (Wertheim, 1999). The overlap between actual and virtual space is complex. Virtuality can be seen as a dematerialization of material actuality; the materiality of the actual is reduced to information. Virtuality is also a materialization of mental space; information is given shape and spatial extension. The Cartesian coordinate system is a conceptual bridge between geometry and algebra, between space and data. Descartes both "algebraized" geometry and "geometrized" algebra" (ibid., p20). The reason why space can be used in this fluid and flexible way is that space is fundamentally based on relations, at least according to seventeenth century mathematician and philosopher Gottfried Wilhelm Leibniz who perceived it as a relational system, a mathematical structure (Nusselder, 2009). Space is not necessarily physical. Space is created when different objects or data values are related to each other, but separated. If there is no relation between objects or data values then space does not appear. Borgmann (2001) suggests that in virtuality "distances are irrelevant, but connections and continuities matter" (p.94), and Wertheim emphasizes that both on the hardware level and the community level, "the very essence of cyberspace is relational" (p.299). Note that William Gibson emphasized this relational aspect of space in his first explanation of his fictional cyberspace; in *Burning Chrome* he writes that cyberspace is "an abstract representation of the relationships between data systems".

The concept that there is some kind of space behind the computer screen has become ingrained in our conception of the computer (Kerman, 1992; Nusselder, 2009; Turkle, 1995). The graphical user interface of a conventional desktop computer is clearly a space, even though flat and abstract. Novak claims that cyberspace is "a completely spatialized visualization of all information ...

processing systems” (Novak, 1991, p.225). The idea that information can be manifested as an information space has been further emphasized by work in information visualization that often employ spatial aspects, for example the influential work of Muriel Cooper who combined graphical design, architecture and information visualization. Nevertheless, many academics emphasize that virtuality can be, but does not need to be, spatial. Heim (1993) writes that cyberspace only “seems to take place within the framework of real space” (p.131). Nusselder (2009) describes cyberspace as a mental realm and later he claims that “the mind does not have an extension” (p.57) – therefore cyberspace should be fundamentally nonspatial, but spatiality can be added at will. Media theoretician Lev Manovich (2001) has used the term spaceless space to describe cyberspace.

Virtuality is essentially a post-physical information structure. It is not only information, and not all information structures are virtual. Rather, the virtual is an effect of a particular kind of information structure. Information is claimed to be separate from materiality. In 1948, Claude Shannon defined information mathematically, describing it as a pattern without dimensions or materiality, separated from any substrate that carries it (Hayles, 1999). In 1994, Alvin Toffler and others (1994) made the hyperbolic claim that “the central event of the 20th century is the overthrow of matter” (p.1). However, N. Katherine Hayles (1999) contest this, claiming that all information structures are in some way grounded in materiality. We must remember that even virtuality is grounded in physical materiality; there is always hardware that scaffolds the software, and we experience the virtual through our material bodies (Cleland, 2009; Hayles, 1996; van Dijk, 1997). Maybe we should see information, and thus the virtual, as a pattern that even if materially grounded, can, with modern information technology, swiftly and with little effort move and transform. This ease gives the impression of immateriality. There has been a major shift from technology that primarily manipulates matter to technology that primarily manipulates mathematical algorithms and coded data (one illustration of many is the move from editing movies by cutting and pasting strips of celluloid to changing time-code data in a computer file). This shift to a technology that manipulates immaterial information and not matter, opens up for the ability to perform transformations (Murray, 1997; Nusselder, 2009). Since the virtual is based on information and algorithms, the presentation of objects is not pre-determined; information and its form are separated (Grau, 2003). The separation of form and content is a prevailing concept for the interaction with computers in general (Bardzell, Bolter & Löwgren, 2010). Virtual objects are, in the word used by Manovich, liquid (2001). As Nusselder (2009) asks rhetorically, “what is supposed to be the right form for a ‘package’ of zeros and ones” (p.48)? Computers use algorithms to manipulate information. As long as something can be broken down into a sequence of procedures, it can be programmed. This aspect of the computer – it being an almost indefinitely flexible multi-purpose machine – is so taken for granted that we tend to forget it, but it is what makes computers capable of producing such deep changes as the ones we see in society. Thus, one of the characteristics of the virtual is plasticity.

Almost virtual – Baudrillard’s simulacra and simulation

The connection between Baudrillard and virtuality seems obvious, it has even manifested in mainstream popular media; the movie *The Matrix* famously include a scene where the protagonist Neo hides cash in a hollowed out copy of Jean Baudrillard’s book *Simulacra and Simulations*. This inclusion has been debated at length – see for example Rovira (2005), Lovén (2001), Constable (2006), Merrin (2003), Chan (2008) and Zagorac (2009) – and it might be that it has been given too much attention. The reference to Baudrillard is brief and not dwelled upon in the movie (even though the character Morpheus later uses the term “desert of the real” which is a direct quote from the Baudrillard text).

A simulacra is as a copy without an original (Brind, McKenzie & Sutton, 2007; Hayles, 1993b), an apparent representation that is not really a representation because “the original no longer even exist” (Baudrillard, 1981, p.99). Baudrillard’s thoughts on simulacra are initially described in *Symbolic Exchange and Death* (1993a) and in *Simulations* (1983). Baudrillard’s further claims that when a mediation becomes too perfect, and especially too dominant, then it replaces the original, and becomes hyperreal (Brind, McKenzie & Sutton, 2007), a “self-referential system of signs and images” that dominate our understanding of the world (Lovén, 2001, p.9). The hyperreal develops “its own referential process” (Chan, 2008, p.5), so that it primarily refers to itself instead of its original, circulating “in an endless play of simulation” (Kearney, 1998, p.7). Famous places, such as Los Angeles, the Grand Canyon or the Eiffel Tower, make excellent examples of hyperrealism. Media consumers in the western world are continuously exposed to images of, for example, Los Angeles. This image becomes more important for us than the actual Los Angeles, and if we eventually go there, we compare the actual to the hyperreal, and the latter might feel more real, even if it is not. Baudrillard primarily refers to images, television and movies. This suggests that hyperrealism is the result of a quite traditional mediation.

Baudrillard is far from being the only one or the first to describe how representations shadow the actual (Kearney, 1998; Lovén, 2001; Lovén, 2010); rather, “the history of the simulacrum is the history of the image and its reception” (Merrin, 2001, p.91). Janet Murray (1997) reminds us that storytellers have been giving similar dire warnings, for example in the fiction of Huxley and Bradbury. As outlined previously, Svante Lovén (2010) provides an extensive overview of fictional dystopias related to media technology. The common prohibition in many religions of images depicting God clearly demonstrates skepticism towards images, grounded in the fear that the imagery will be worshipped instead of the deity behind it. Aristotle’s stern judgment of spectacle and imagery still influences the elevation of text over images. Svante Lovén (2010), as well as Liljefors (2006), describe how painted imagery, especially trompe-l’œil has been attacked for its attempt at creating illusions. These attacks often refer to the myth about Zeuxis’s painted grapes, so lifelike that birds tried to eat them. As much as 500 years ago, Marsilio Ficino and Sir Philip Sidney argued, in 1482 and 1580 respectively, that poetry and painting demonstrated man’s power over nature, and our self-divinization and hubris (Lovén, 2010). The invention of photography and cinema

brought even deeper concerns than those previously targeted at paintings and sculptures. Daniel Joseph Boorstin wrote in his 1962 book *The image: a guide to pseudo-events in America* that the Grand Canyon had been transformed to “a disappointing reproduction of the Kodachrome original” (p.14). Also during the 1960s, Guy Debord wrote *La Société du spectacle* (1967) where he argued that social life gradually is replaced by the representation of social life, so that “everything that was directly lived has moved away into a representation” (p.1). Umberto Eco wrote about hyperreality in his 1973 essay *Il costume di casa*, later reprinted as *Travels in hyperreality*, discussing the desire for fake reproductions of American history.

Neither simulacra nor hyperrealism deals with virtuality per se. Rather, both concepts deal with representation on a more general level (Friedberg, 2006; Gordon, 2002; Heuser, 2003). Virtuality can be either mimetic (a copy of an actual original) or a simulacra (a copy without an original). The conclusion is that Baudrillard is of some peripheral interest in a discussion about virtuality, but he does not bring any deeper insights related to virtuality specifically.

Opposing or supplementing the actual

It lies out of the scope of this poetic of virtuality to define, characterize or discuss the concept of reality at any length. However, an understanding of the concept has much importance as a counterpoint for virtuality, so it cannot be dismissed completely, even if, as Brind and others (Brind, McKenzie & Sutton, 2007) write, it is a word “so volatile that it must be handled with the linguistic equivalent of radiation-protection gloves” (p.5). A pragmatic approach to reality is the straightforward suggestion formulated by Philip Dick, the pre-cyberpunk writer that occupied so much of his writing career and private life with questions concerning authenticity and reality. Dick writes that “reality is that which, when you stop believing in it, doesn’t go away” (Dick, 1978, p.2). Dick then chose a fundamentally phenomenological stance, differentiating between the inner mental world and the perception of the external, consensual world. Consider a virtual world such as *Grand Theft Auto*. The game is not actual, but it is real, in the sense that even if I stop believing that there is a game called *Grand Theft Auto*, that will not stop others from playing the game, or me from seeing ads for the game in the newspaper. In everyday language, it is easy to make the mistake of opposing reality and virtuality (Nusselder, 2009; Skagestad, 1998). However, virtuality cannot be opposed to reality; it has to be considered being a sub-category of reality. Instead it makes sense to oppose virtuality and actuality, as proposed by several academics (Brind, McKenzie & Sutton, 2007; Bryant & Pollock, 2010; Deleuze, 1968; Doyle, 2009; Nusselder, 2009).

We have a tendency to structure everything in dualistic pairs. This is certainly the case when it comes to issues around virtuality, as illustrated by the polarity reality/virtuality, and also by other polarities such as actuality/virtuality, material/immaterial, nature/technology, fiction/non-fiction, and body/mind. A postmodern stance tends to reject such polarities, and according to Veronica Hollinger, cyberpunk “is about the breakdown of these oppositions” (Hollinger, 1991, p.205). Samuel Weber argues that the complex relationship between the

actual world and virtual worlds “can hardly be reduced to the relatively simple form of a mutually exclusive opposition” (Weber, 2010, p.65). There are instead different ways to relate the virtual to the actual, emphasizing that “the virtual is its own reality” (ibid., p.69), and that it supplants (Heim, 1993) and juxtaposes (Nusselder, 2009) the actual. It can be thought of as a “a new layer of reality” (Heim, 1993, p.117). Sherry Turkle quotes one of her interviewees explaining that “RL [real life] is just one more window” (Turkle, 1995, p.13); the quote describes the situation of using a computer with many windows open. The different windows on a personal computer metaphorically illustrate the complexity of virtualities and realities. One window might be the view into *Grand Theft Auto* or *World of Warcraft*, worlds in the form of interactive, habitable fiction. Another window might display the word processor Microsoft Word, a digital tool with traces of virtuality in small icons that look slightly like buttons that can be pressed. And, finally, glancing to the side of the screen, there is the rest of reality.

The virtual as a lesser copy or beyond the actual

Imagine a day at the beach. Sand. Water. Sun.

Imagine a day in *Minecraft*. Hardware. Screen. Pixels.

Why is it that we shy away from the idea of replacing a beach with a virtual world? Why do we tell our kids to shut down and walk out? Why is the virtual worth less than the actual? Some academics take strong positions concerning these questions. Michael Benedikt (1991), Howard Rheingold (1991) and Sherry Turkle (1995) have been mostly optimistic in their writing. Turkle makes the non-judgmental statement that “we are moving toward a culture of simulation in which people are increasingly comfortable with substituting representations of reality for the real” (Turkle, 1995, p.23). Mark Slouka is rhetorically critical in his book *War of the Worlds* (1995), while Jaron Lanier gives a sobering account in his *You are not a gadget: a manifesto* (2010). Both Slouka and Lanier warn us against letting the virtual take too much precedence over the actual. Our desire is split between nature and technology. Nature developed humans, but humans developed technology. So which is our most natural environment? The screen or the beach?

No matter how alluring the virtual is, it nevertheless disappears when power drains. This illustrates a fundamental aspect of the virtual; it is sustained by technology (Lovén, 2010). The actual and natural have, compared to the virtual, completely different underlying set of causalities and underlying support structures (Irwin, 2002). So the virtual worlds might be worth less because they are our construct; they are fleeting, and they are possible to shut down. N. Katherine Hayles (1993a) soberly reminds us that “as we rush to explore the new vistas that cyberspace has made available for colonization, let us also remember the fragility of a material world that cannot be replaced” (p.49). Our value assessment of the virtual also depends on how we see the virtual in relation to the actual. Either we can regard the virtual as a pale imitation of the actual, a faulty duplication, or we can argue that the virtual does not try to fruitlessly mimic the actual. Rather the virtual carries a potential that is ready to be actualized, ready to be a supplement to the actual (Levy, 1998; Ryan, 1999). Our ability to see the virtual as a duplicate or

supplement depends on what we actually do with virtual technology. A virtual laboratory that does not manage to faithfully mimic the tactile handling of chemicals and equipment is a copy that lacks in comparison to the original, at least if the intention with the lab is to let students learn specifically how to handle chemicals and equipment. As a contrasting example, an educational game that simulate how virus pandemics could spread across the world and kill all of humanity (such as the game *Plague Inc.* by Ndemic Creations) could be seen as an extension of the actual, since it allows you to learn by doing things that would not be allowed in the actual.

Cyberspace evangelists saw the virtual as a way to correct different flaws in the actual, a way to fulfill the broken promises of the real world. In the typically large and evocative words of Doel and Clarke, “priority is not given to the fallen first; it is withheld for the full second” (1999, p.268). They suggest there are three kinds of virtuality:

- Virtual reality 1: Simulation
- Virtual reality 2: Suppletion
- Virtual reality 3: S(ed)uction

Doel and Clarke give the interesting example of landscape gardening. The English garden with its idealized nature is a simulation. The French garden is an abstract extension of the actual; it does not try to be a forest, instead it makes nature into its opposite. It converts organic chaos to geometrical perfection – a suppletion. The Zen garden might be close to their third kind of virtuality – s(ed)uction, a “final resolution of the fault-ridden world” (ibid., p.272). If s(ed)uction is a virtuality so sublime and alluring that we choose it instead of the actual world, then we might say that one example of this s(ed)uction is sandbox game worlds such as *Grand Theft Auto*. Thus, the third level of virtuality is not a lesser copy, nor an enhancing add-on, but a new world into which we are seduced.

Michael Heim (1993) makes more direct connections between virtuality and sexuality, using not the term seduction, but the term erotic. He illustrates how strong our urge to enter the virtual can be, an urge similar to a sexual desire not in function but in strength. William Gibson was quite explicit in *Neuromancer* where he lets his protagonist Case compare the sexual orgasm together with Molly to his existence in cyberspace (Nusselder, 2009; Turkle, 1995). Heim also mentions Case’s erotically obsessive desire to return to the matrix. One intention Heim has with the term erotic is to emphasize that our desire for cyberspace is not only “utilitarian or aesthetic”, but goes further, becoming “a symbiotic relationship and ultimately a mental marriage to technology” (Heim, 1993, p.85). In other words, the virtual can be regarded a limited copy of the actual, a copy that in certain aspects extends the actual. This copy, even though limited, nevertheless seduces us effectively.

A standard trope in cyberpunk is that of the hacker who strongly rejects the body. The body is an “outer shell” that is left “behind upon entry into the immaterial realm of cyberspace” (Heuser, 2003, p.33). Hayles points out how *Necromancer’s* protagonist Case “regards his body as so much ‘meat’ that exists primarily to sustain his consciousness until the next time he can enter cyberspace”

(Hayles, 1999, p36). In *Ready Player One*, (Cline, 2012) the protagonist chooses to indulge in the computer game world of the novels narrative, and rejects actuality by covering the windows of his apartment with black paint. This is indeed a harsh rejection of the actual. The word meatspace is typical cyberpunk terminology, meaning the actual world, as opposed to cyberspace. It is telling how the word meat is used instead of body or flesh. Meat brings an association to consumption, something that exists purely to be consumed. Meat does not have any value on its own. It is non-erotic and does not evoke desire, as does body or flesh. Cyberspace evangelists saw meatspace as a prison from which you needed to escape. It is also seen as the opposition between the heavy body of meat and the ethereal body of information (Dery, 1996; Lavery, 2001; Lovén, 2010; Nusselder, 2009). Barbara Flueckiger (2008) points out the “dissonance between body cult and disembodiment” (p.3); while the body is seen as disposable in typical cyber-evangelism, there is a likewise strong body cult in marketing and entertainment, continuously repeating imagery of perfect bodies and turning the individual body into a project to manage.

As Doyle (2009) has pointed out that the immaterial body of the avatar is the first step towards a post-physical, disembodied experience of cyberspace. But, the avatar is simply a visual representation of a body. We are far from being digital angles in an online heaven. Futurists dream of going much further, of discarding the physical body and uploading the mind, achieving technological transcendence (Csicsery-Ronay, 1992; Hayles, 1993b; Hayles, 1999; Wertheim, 1998; Wertheim, 1999). This idea of a post-physical existence belongs to posthumanism, and posthumanism asks theoretical questions about what we eventually will develop into as a species. This has been a commodity in science fiction for a few decades, but scientists such as Hans Moravec and Rudy Rucker have also seriously considered whether our minds can be stored and executed as software on computers (Wertheim, 1999). As early as 1950, the mathematician and philosopher Norbert Wiener played with the idea that a pattern of a human could be telegraphed (Hayles, 1999). This assumption requires us to see ourselves as patterns of information and not embodied creatures. It requires that we regard the body as a machine that we use, and not something we are. If our mind and consciousness is information, then we might be stored in another physical substrate than our organic brain. So far there is no evidence that it is even theoretically possible to scan the human brain in sufficient detail, nor that a simulation of such a scan would be self-conscious and have an identity comparable to that of what our biological brain exhibits. The idea of posthuman transcendence has been harshly criticized from many directions, referred to as simpleminded Gnosticism (Davis, 1998). For example, Margaret Wertheim cannot “imagine a worse fate than being downloaded into immortality in cyberspace” (Wertheim, 1999, p.265). Jaron Lanier harshly criticizes what he refers to as the new religion of post-physicality, a religion that wants us to believe that “information is real and alive” (Lanier, 2010, p.29). His argument is that information cannot be elevated to the same status as biological and physical entities, because information needs to be executed, and information is nothing without an interpreter. Hayles proposes a rather down to earth view of

posthumanism, emphasizing that our identity depends on embodiment; she rejects the utopian posthumanism that sees our bodies as exchangeable “fashion accessories” (Hayles, 1999, p.5). Britt Farstad (2010) suggests in a similar vein that posthumanism is based on a misunderstanding of the Cartesian mind/body dualism, the erroneous idea that mind and body can be seen as separate from each other. This dualism is also strongly contested by phenomenology, which emphasize our being in the world (Merleau-Ponty, 1962).

Freedom, empowerment and frontier spirit

In cyberpunk fiction, the cyborgian enhancement of the body is usually associated with empowerment, and achieving control (Bukatman, 1997). The history of the personal computer and the Internet is associated with a striving for personal freedom and empowerment, as illustrated by the rebellious claim that “you have no sovereignty where we gather”. John Perry Barlow, an American poet and political activist, wrote this in 1996 (p.1), in *A Declaration of the Independence of Cyberspace*, addressing it to the governments of the industrial world. He claimed that cyberspace could be seen as a governance-free space. The Internet was seen as a lawless country, a country to be explored and tamed, in a parallel strikingly similar to the mythology of the frontier spirit of the Wild West. Today we have a more mature stance towards the Internet – much of the frontier romanticism is gone, but the Internet can still be seen as a vehicle for freedom, exemplified by citizen journalism and at least some aspects of social media. It is as if the Internet is the new café where revolutions are spawned. John Coate (1992) refers to the Internet as a Third Place, adapting Ray Oldenburg’s idea where the First Place is the home, the Second Place is at work, and the Third Place is a commons, a neutral space where people can meet and conversation is the primary activity. Wertheimer (1999) has also drawn parallels from the Internet to both the (seemingly) open and democratic space of ancient Athens, the so called *agora*, as well as the European coffeehouses of the seventeenth century. However, it has been disputed whether the Internet is such a neutral space, and whether online communities are as free from hierarchies and judgments concerning gender, race and class, as initially anticipated (Borer, 2002; Kolko & Reid, 1998; Wertheimer, 1999). Power hierarchies do break down online, but new ones seem to re-emerge just as easily (Jones, 1998; Klastrup, 2003a). Members of online communities do experiment with identity – especially in role-playing games – but more often we bring our actual class, gender, name and personality into the online environment (Baym, 1998; Cody et al, 1997; Danet, 1998; Joe, 1997; Jones, 1998), especially in social media environments such as Facebook and Twitter.

The early development of the personal computer involved a distinct anti-authoritarian and pro-decentralization stance, and some of the rhetoric was more or less directly targeted towards companies such as IBM and their mainframe computers. In Apple’s 1984 commercial, introducing the Macintosh, director Ridley Scott metaphorically depicted IBM as the Big Brother of Orwell’s novel *1984*. About ten years earlier the organization People’s Computer Company had started a computer café in Redwood City (situated between San Francisco and what would

later be known as Silicon Valley) where terminals could be booked for programming or for text-based games, and on the front of their newsletter they stated that “until now computers have been used against people, now it’s time for a People’s Computer Company” (Markoff, 2005). The design and development of the personal computer had its roots in the revolutionary working prototype NLS developed by Douglas Engelbart at the Stanford Research Institute. The NLS was capable of combining different sorts of visual and text display, using mouse and keyboard as input devices, and of connecting with other computers (via leased telephone lines). The NLS was demonstrated on December 9th, 1968. During the demo “every significant aspect of today’s computing world was revealed in a magnificent hour and a half” (Markoff, 2005, p.148). The name of the department that Engelbart had founded at Stanford – the Augmentation Research Center – reveal its connection to a strong movement towards using computer technology to augment the individual, a shift from technology and organization towards democratizing processes. This shift was related to the development in general of the counterculture of the late 1960’s. Douglas Engelbart was one of the advocates of this development. As summarized by Markoff, “computing went from being dismissed as a tool of bureaucratic control to being embraced as a symbol of individual expression and liberation” (ibid., p.xii). In both hacker culture and counterculture, there is a shared resistance against centralization and commercialization (Flichy, 2007).

There are also suggestive associations between freedom, computers and drug use. Nusselder as well as Tatsumi point at the symbolic equivalence between drug use and computers (Nusselder, 2009; Tatsumi, 1986). Metaphorically, both drugs and computers have been associated with escapism, as a way to break out of reality and at least momentarily and illusionary achieve empowerment in order to fulfill different kinds of fantasies that give exaltation. Heuser points out that in Gibson’s description of cyberspace, he uses the term “consensual hallucination”. In *Neuromancer*, Gibson’s anti-hero Case is addicted both to chemical drugs and cyberspace, exemplified by the following passage.

Because, in some weird and very approximate way, it was like a run in the matrix. Get just wasted enough, find yourself in some desperate but strangely arbitrary kind of trouble, and it was possible to see Ninsei as a field of data, the way the matrix had once reminded him of proteins linking to distinguish cell specialties. Then you could throw yourself into a highspeed drift and skid, totally engaged but set apart from it all, and all around you the dance of biz, information interacting, data made flesh in the mazes of the black market...

There is a historical connection between drug liberalism and the personal computer via the people involved, as well as the intentions to augment the human mind. Myron Stolaroff is one example of a researcher that during the 1960s saw the same possibilities in LSD as others saw in the personal computer; the possibility to augment the human mind and its consciousness, both intellectually and creatively (Markoff, 2005). Timothy Leary, well-known drug evangelist, became enthusiastic over digital technology, proclaiming that the PC is the LSD of the 1980s. In 1995 Brand wrote an essay tellingly titled *We Owe It All to the Hippies*, where he puts

forward the idea that “counterculture’s scorn for centralized authority provided the philosophical foundations of not only the leaderless Internet but also the entire personal-computer revolution” (p.1). Counterculture, as well as emerging computer technology, found fertile ground during the 1960s in the city of San Francisco, a city characterized by an environment of freethinkers, stretching back to the gold rush and the 1860s.

The frontier mythology of the quite recent American settlements, and especially the conquering of the west coast, has been adopted as a metaphor for the building of cyberspace and the Internet (Gunnarsson, 2002; Lovén, 2010). William Gibson’s tendency to refer to hackers as *cowboys* is a way of relating to frontier romanticism (Borer, 2002; Godhe, 2010a; Lovén, 2010; Murray, 1997; Olsen, 1992). In the rhetorical essay *Cyberspace and the American Dream: A Magna Carta for the Knowledge Age* from 1994, the authors Esther Dyson, George Gilder, George Keyworth, and Alvin Toffler vividly claim that “cyberspace is the latest American frontier” and that “there are as yet no rules – just as there were no rules on the American continent in 1620” (p.5). Similar attitudes were frequently pronounced when the first multi-user virtual worlds started to appear, especially in the descriptions of *Active Worlds* (Schroeder, Huxor & Smith, 2001; Castronova, 2007). Ethnographers such as Andrew Hudson-Smith (2002) studied *Active Worlds* in order to “fully document the development of a virtual environment from beginning to end, as a plot of virgin virtual land” (p.1). These early virtual worlds seemed to satisfy a romantic longing for finding new land, building anew, and nostalgic dreaming of escaping authority and achieving freedom (Lovén, 2010; Olsen, 1992). It gave escapists and visionaries a new frontier to pursue while the space frontier gradually crumbled in the long slow death of the American space program. Bryant and Pollock (2010) point out how the dreams of both the space frontier and the digital frontier allude to a deep and spiritual yearning to escape the bonds of Earth and dirt. Nineteenth century frontier mythology instructed the mindsets of the early development of the Internet (Epperson, 1995; Schroeder, Huxor & Smith, 2001). Built into the concept of the frontier is the idea that this frontier needs to be explored and tamed (Heuser, 2003). Some of the early computer artists worked under the assumption that the “computer became a micro-universe, an ‘unimaginable new world’ ready for tireless exploration” (Taylor, 2004, p.158). But can virtuality really be explored? Is it reasonable to conceive of our own artifacts as untamed virgin territory? Taylor (2004) describes how – in making computer art – the computer was reconceptualized in the 1980s from a frontier world to a tool for personal expression. Baudrillard (2002) argues that in cyberspace we only “interacts with known elements, pre-existent sites, established codes” (p.179), and Csicsery-Ronay (1992) agrees that cyberspace “cannot be conquered for humanity because it is an aspect of humanity” (p.224). There is nothing truly unknown in the virtual.

Structuring fiction, actuality and virtuality

In this chapter I start with a brief overview of how other academics have structured the actual and the virtual, and then describe the model I have used for structuring actuality and virtuality, as well as fictional narratives.

There are several models for conceptualizing the virtual, such as Popper's *Worlds* 1, 2 and 3 (Popper, 1979), Nusselder's (2009) *domains* matrix, cyberspace and interface, and Stone's (1991) four *epochs*. However, the models from Popper and Nusselder are general and abstract, and therefore not of much help for structuring a poetics of virtuality with focus on fictional representations of virtuality. Stone's four epochs are primarily a device for structuring a historical perspective.

In his essay *Cyberspace: Some Proposals*, Michael Benedikt (1991) attempts to use geometrical and mathematical arguments in order to suggest a framework for how to construct cyberspace. He grounds his arguments in "natural, physical space" and loosely organizes his reasoning under the "essentially topological rubrics" (p.132) Dimensionality, Continuity, Curvature, Density and Limits. Benedikt also formulates seven design principles. Some of these are relevant, for example the Principle of Indifference, stating that the perceived realness of the virtual world partly depends on how indifferent the world is to a particular user. The Principle of Transit suggests that it should take time and effort to move from one point to another. Both these principles are based on the belief that cyberspace should mimic the limitations of actual space. However, much of Benedikt's reasoning is more relevant for information visualization than virtuality; he investigate different methods for mapping data to spatial and non-spatial dimensions, and what he writes about the virtual is nowadays outdated and irrelevant. Writing in 1991, he was still trapped in the Gibsonian idea of a three-dimensional Internet, and his proposals circled around that vision.¹⁵

Michael Heim (1993) proposes seven *essences* of virtual reality that summarize different aspects of the virtual.

- **Simulation** – primarily the simulation in form of realistic computer graphics
- **Interaction** – the interaction is often based on real-life logic
- **Artificiality** – the virtual is artificial, but Heim warns us from using artificiality as a definition, since artificiality covers everything ever constructed by man.
- **Immersion** – primarily the hardware and software aspects of immersion
- **Telepresence** – the user's virtual presence in an actual or virtual environment
- **Full-body Immersion** – immersion provided by head-mounted displays or a CAVE system
- **Networked Communication** – networked computers make it possible to meet in the virtual environments

¹⁵ Moere, Neuckermans and Heylighen have documented an attempt to build a VRML based search engine interface based on Benedikt's principles (1998).

Several of Heim's essences are relevant for a poetics of virtuality. However, the proposed essences do not say much about the ontological structure of virtuality.

What now follows is my own model for how virtuality is ontologically constructed, with a special focus on how it can be inserted into the framing narrative of fiction. This is the model upon which my own poetics of virtuality is built.¹⁶ The terms used throughout this poetics are highlighted in upper case in the following discussion. Typical for the studied narratives are that they hold both a framing narrative and an insert narrative. The framing narrative often is the actual world ("reality"), while the insert narrative is the events taking place inside one or more virtual worlds. In for example *The Matrix*, the framing narrative is the dystopic world where humans and machines battle for survival, while the insert narrative is the virtuality, the simulation, where most human minds are imprisoned and where the heroes of the story use super-natural abilities to fight artificial intelligence programs. The distinction between framing and insert narrative is not always clear-cut. In for example *The Thirteenth Floor* we only see the actual world during the last few minutes of the whole movie, while in *eXistenZ* and *Avalon* it is not clear if we ever see a glimpse of the actual world.

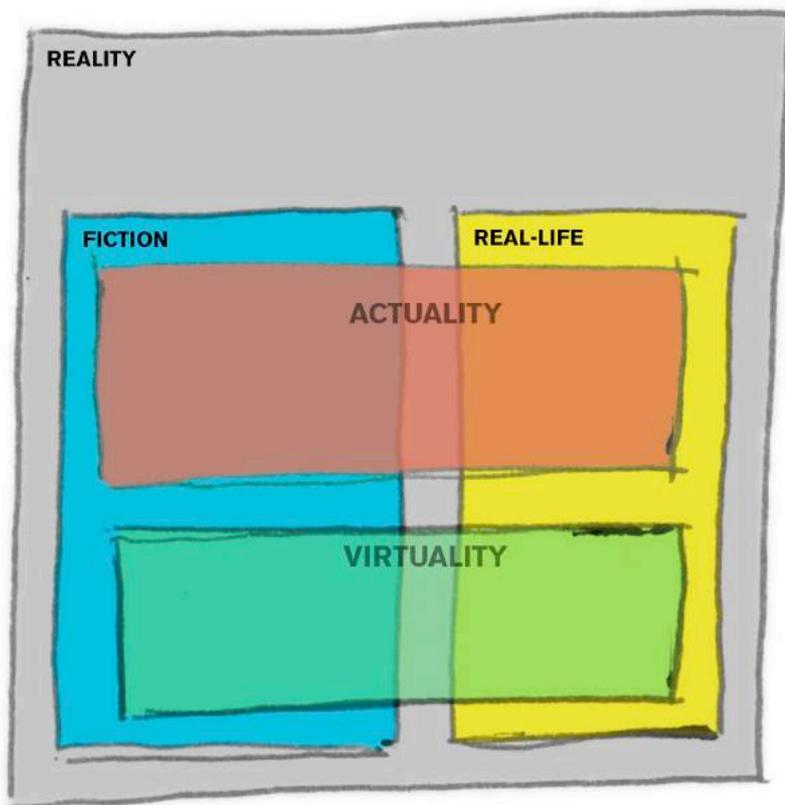


Figure 2. The general topology of how virtuality relates to fiction and reality.

¹⁶ Note that this description concerns movies where the virtual is a part of the plot, the diegetic world of the movie. The concept of virtual cinematography is not related to this, since virtual cinematography is a production method where much of the footage of the movie is shot within a virtual environmental.

Figure 2 on the previous page schematizes the general topology of actuality, fiction and virtuality. REALITY is the total sum of everything that is, including all mental constructs we create such as fantasies, illusions and so on. Reality encompasses both truth and lie, because even if a lie is untrue it still exists in the form of a lie. In the same way fiction is included in reality.¹⁷

In this reality the world is split up in different ways. One is FICTION, for example stories, tales, and other fictional accounts in literature, movies and games. The term diegetic means the “fictional world of the story” (Bordwell, 1985, p.22), the world of the narrative (Dudley, 1984). For example, music can be diegetic (being played in the fictional world and heard by the fictive characters), or non-diegetic (added as a layer outside the fictive world, only for the audience to hear). However, fiction and diegetic are not the same thing (Genette, 1980).¹⁸ The opposite of fiction is often referred to as reality, the real world and so on, but in my model I use the term REAL-LIFE as the opposite to FICTION. Real-life and fictional characters, events or places can co-exist inside the diegetic world of a narrative, as illustrated already in the title of for example *The Hunchback of Notre-Dame*. The hunchback is fictional, while Notre-Dame is a real-life cathedral. The Saturn V rocket booster is an example of real-life technology, while the light saber is fictional technology. Note that the boundary between fiction and real-life is blurred. Real-life humans such as Abraham Lincoln can be used in fictional stories, for example portraying him as a vampire hunter.

Another sub-set of reality is VIRTUALITY. In everyday speech virtuality is often opposed to physical reality or the real world, but I see virtuality as a subset of reality, and instead oppose virtuality with ACTUALITY. It is important to note that FICTION and VIRTUALITY are parallel sub-sets of REALITY, free to separate or combine in different ways.¹⁹ Also, REAL-LIFE and ACTUALITY normally collapse into each other, but it is still important to consider them as two separate concepts when discussing different combinations of fiction and virtuality. The separation of real-life and actuality, for example, explains how the fictional character Neo in *The Matrix* can escape from the virtual to the actual, without you having the chance of running into him in the street (since he is fictional and you are real-life).

By forming a 2x2 matrix with the opposing pairs actual–virtual and fiction–real-life, a model is constructed that can hold all the sub-sets of reality that will be discussed in this poetics. The combination REAL-LIFE / ACTUAL is the ordinary world around us. From this position you can go one step in either two directions.

¹⁷ The reality that is discussed here can be an external, physical, independent reality, or an inner mental construct. The reality concept we employ does not matter for the model.

¹⁸ The alignment of fiction and diegetic break up in for example a documentary; a documentary movie holds a diegetic world but the story is considered non-fictional.

¹⁹ An architectural virtual reality model of a planned building is virtual, but not fictional, just as an architectural drawing is not fictional. A romantic comedy is a fictional story, but without the virtual (usually). However, a romantic comedy could be narrated in a virtual reality world or in a game world – this would be a virtuality with a fictional story inside.

You can enter fiction, where narratives move in a fictional version of the actual. This is FICTIONAL / ACTUAL, or just ordinary fiction – for example, Robinson Crusoe is actually shipwrecked in his diegetic world, but the story is made up, a fantasy. You can go the other directions and immerse yourself in a virtuality such as a computer game world or a virtual reality display. This is the REAL-LIFE / VIRTUAL, that is, virtual worlds that we actually can enter, experience and interact with. The fourth combination, two steps away from the REAL-LIFE / ACTUAL corner is what I will be focused on in the poetics of virtuality, the FICTIONAL / VIRTUAL. These are virtual worlds that we can not enter because they are part of a fictional account. The Matrix in the movie *The Matrix* is such a virtual world. It is a virtuality wrapped in a fiction.

This is a general model and it can be expanded and made more complex, as will be illustrated by a few examples.

Examples of how virtuality and fiction are structured

The model described in the previous section is generalized. For a specific narrative a specific model can be drawn. There are a variety of different configurations in the narratives I have studied and worked with. The following is an illustration of how the different variants can be modeled. The movies that I mention are introduced more extensively in the chapter 'The selected narratives', see page 87.

Tron – the overt virtual world

The relation between actual and virtual is straightforward in this case. What we see is a fictional feature film, and in this fictional (but actual) world, a (fictional) virtual world is created by computers. From the viewpoint of the audience the virtual is inside the fiction. Other examples similar to *Tron* are *Johnny Mnemonic*, *The Lawnmower Man* and *Tron Legacy*.

Tron

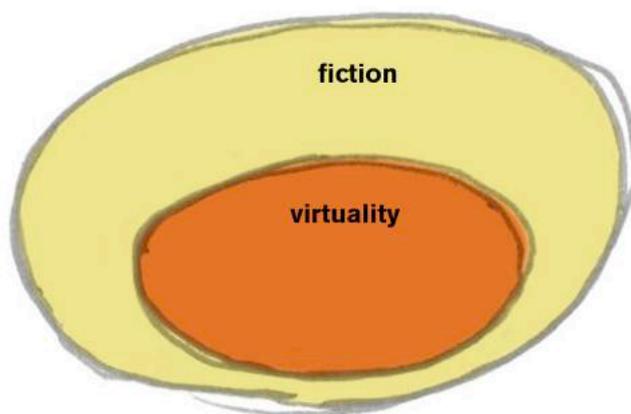


Figure 3. The virtual / actual structure of the feature film *Tron*.

The Thirteenth Floor – the covert virtual world and the virtual within the virtual

This is similar to the previous example – a virtuality inside a fiction – but it is complicated by two additional aspects. First, the virtual world is deceptively similar to an actual world, initially fooling both the audience and the diegetic characters. The virtual appears to be cloaked as an actual world. Other examples of this are *The Matrix* and *eXistenZ*. Second, there are several levels of virtual worlds within each other. Inside the virtual world there is a computer simulating yet another virtual world. Such levels of virtuality can also be seen in for example *Avalon* and *Inception*.

The Thirteenth Floor

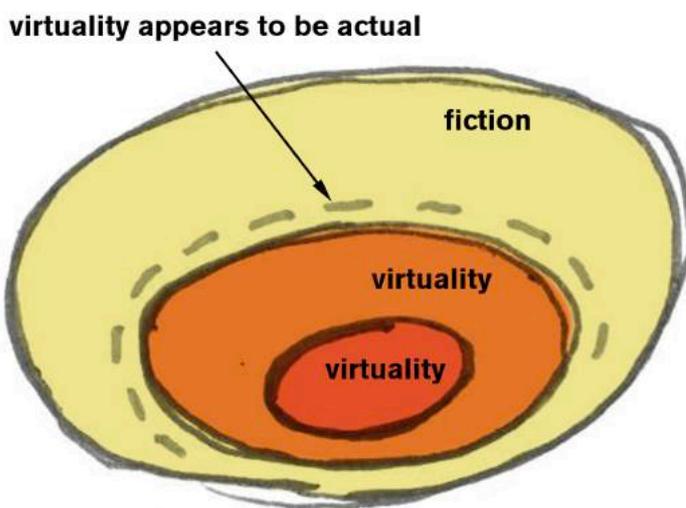


Figure 4. The virtual/ actual structure of the feature film *The Thirteenth Floor*.

Mirror's Edge – real-life virtual world

The primary focus of this poetics of virtuality is fictional virtualities. However, real-life virtualities cannot be ignored. Real-life and fictional virtualities inspire each other to a large extent. A real-life virtual world such as *Mirror's Edge* (or *Minecraft*, *World of Warcraft*, *The Sims*, *Grand Theft Auto*, and many more) is not a virtual inside a fiction; it is just virtual, available to us in real-life. We do not have to contend with watching fictional characters experience this virtuality, but instead we can experience it ourselves. The virtual world can mimic a real-life world – the city in *Grand Theft Auto* pretending to be New York – or it can indulge in and acknowledge its virtuality, foregrounding that it is virtual, as for example in *Minecraft*. This relation between virtuality in computer games and the actual can be compared to similar relationships in fictional narratives. The fictional virtuality in for example *Tron* is clearly virtual, whereas the virtual world in *The Matrix* hides that it is virtual. While the virtuality of, for example *The Matrix* is wrapped in a fiction, the *Mirror's Edge* is rather a fiction wrapped in a virtuality, because the virtual world

in *Mirror's Edge* is clearly fictional. Other games, such as *SimCity*, simulate real-life, although they always have some degree of fiction.

Mirror's Edge

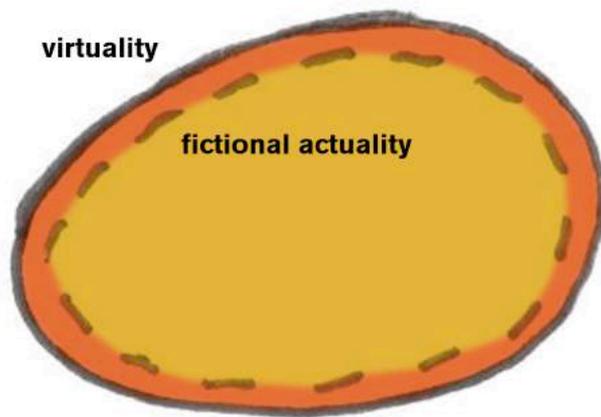


Figure 5. The virtual / actual structure of the computer game Mirror's Edge.

METHODS FOR INVESTIGATING VIRTUALITY

This chapter explains the research methods and interpretational framework chosen for the study, and how they have been used.

Studying media using hermeneutics, semiotics and ethnography

When formulating this poetics of virtuality I have used two approaches: analysis of professionally produced media artifacts, and analysis of my own work with producing media artifacts.²⁰ As mentioned previously, a poetics connects the process of production and the form of the final artifact, and it bridges practice and theory. Therefore I have chosen to analyze media artifacts from two directions, as an author and as a reader. I have used hermeneutics and semiotics for this analysis and for the interpretation it involves. Note that a poetics does not aim to interpret the meaning of individual works (Bordwell, 2006), but rather I have used interpretation in order to analyze how virtuality is represented.

Authoring – studying media productions

My own media productions have mostly been small-scale visualization projects related to public understanding of science or related to teaching. For the study of my own productions, I have used *autoethnography* and *self-ethnography*, two approaches based on ethnography. These are primarily tools for conducting observations, but these tools can also partly inform the analysis and writing. The analysis of these observations has been done with a *hermeneutic* approach, with support from the theoretical framework of *production culture studies*.

Reading – studying narratives

The professional media artifacts I have studied are primarily feature films depicting fictional virtualities, but also include short films, TV series, computer games, art works, novels and short stories. These narrative texts need to be interpreted, and analyzed. For this work, I have chosen *hermeneutics* (text interpretation) and *semiotics* (sign analysis) as my analytical framework, supported by theories on virtuality and production culture studies. I have used a general semiotic approach to study the different aspects of the narrative texts, and furthermore visual semiotics have come to play a dominant part since the representation of virtuality has proved to be highly visual.

In her own poetics of virtuality, Lisbeth Klastrup (2003a) argues that the study of online virtual worlds requires a cross-disciplinary approach because the phenomena itself is so complex. Roland Barthes (1977) acknowledges that the different aspects of communication (producer, message and reception) “do not call for the same method of investigation“ (p.15). There can be an advantage in using triangulation, and thus having different methods support each other, providing a deeper understanding as well as a more holistic overview (Campbell & Fiske, 1959; Creswell, 2003; Denzin, 1978; Flick, 2009; Iversen, 2005; Jick, 1979; Seale, 1999). This is not to say that one methodology can explain the results of the other. The intention is to achieve a deeper understanding, and a more complex theoretical

²⁰ I use the term media artifacts in order to include both narratives (movies and literature) and other products such as the interactive visualizations I have been working on.

understanding, by letting different approaches inform each other on equal terms. When the results from different approaches converge they confirm each other, and when they diverge they highlight areas that need alternative and richer explanations (Jick, 1979). My two approaches – the autoethnographic study of production processes and the semiotic study of fictional narratives – cover different ends of a continuum, ranging from high-end Hollywood productions (the study of existing narratives) to semi-professional small-scale productions (the study of my own productions). Even though the scale and production value of these different productions diverge to a large extent, they still share similar aspects when it comes to production processes and the representation of virtuality.

Analyzing media – production, text and reception

Media artifacts can be studied from very different viewpoints. These viewpoints can be sorted roughly based on the chronological life-cycle of media artifacts. First, media artifacts are produced, and this can be studied. The field of *production culture studies* is mostly occupied with issues concerning the production itself, such as for instance gender issues in the production crews. Second, the finalized media artifact can be studied, in order to investigate meaning and meaning making. Different readings can be applied to the text, using the text to illustrate and shed light on external conditions in society, for example by doing a feminist or socio-economic reading of a text. Interviews and other documentations from the production can also be used to shed light on the media product itself. Finally, the reception of the media artifacts can be studied, investigating how the audience responds to and interprets a text, a genre or a media.

My study is primarily an analysis of the different narrative texts, supported by observations of production cultures. It is not a reception study, nor is it a production culture study per se. Likewise, it is not a study of semiotics, neither general nor film semiotics. Rather, production culture studies and semiotics are used as a means to an end. My analysis of fictional representations of virtuality results in a poetics of virtuality, a poetics that sheds light on how we think about virtuality.

The concept of theory is fundamental in research, and so also in this study. Theory is used in film theory, semiotics, hermeneutics, ethnography, and a poetics is a treatise on theory and practice. However, theory is a multifaceted concept. A narrow and strict definition of theory is well described by Sutton and Staw (1995) – theory answers the question “why”? It explains empirical observations with “causal arguments that are abstract” (p.4) and which can be generalized; that is, they can be applied to other settings than the one observed. Theory is a model to be tested (Brannick & Coghlan, 2014). Usually the theory is able to predict the outcome of a situation, and this often means that an experiment – the intentional arrangement of a situation to test the prediction – can be conducted. The experiment or the observation of other similar settings is guided by a hypothesis, and if the hypothesis is proved correct, then it becomes a theory verified by empirical observations. This view on theory is highly positivistic and dominates natural sciences. However, it is

also quite well spread in psychology, pedagogy, sociology, as well as in other domains.

A more general view on theory is that it is concept driven. Therefore, theory offers descriptions, but not predictions (Andrew, 1984). This is common in film theory and other media studies. Andrew refers to film theory as “a verbal representation of the film complex“, an accumulation of “ ideas and attitudes clustered around concepts” (p.3). Theory is then a symbolic system used to organize and interpret culture (Brannick & Coghlan, 2014).

Theory as it is used in ethnography, is also concept driven and primarily concerned with descriptions and interpretations. When coding and analyzing ethnographic observations, theory sometimes emerges in the form of explanatory models. But falsifiable theories are generally not possible to formulate, mostly because of the impossibility of controlling all variables (Atkinson & Hammersley, 1989).

The theory that is offered in this poetics of virtuality should be thought of as an abstract description of the observed practices.

Hermeneutics – a theory of text interpretation

The death of the author and her resurrection

Hermeneutics is a method for and a theory of text interpretation. Hermeneutics “proceeds from history, desire, and value” (Andrew, 1984, p.176), thereby being opposed to structuralist methods of text analysis and what Andrew describes as mechanical attempts at interpretation. In *Historical Poetics of Cinema*, Bordwell (2006) launches a rather fierce attack on what he claims to be the doctrinal, political and rhetorical work in cultural studies where the interpretation of a movie or other narrative is used as an illustration of an assumed viewpoint. He asserts that a poetics should be based on open-ended questions, an approach that aligns well with a hermeneutic method. A major development of hermeneutics has been a move towards a radical standpoint – to more or less exclude the author from the analysis. When employing a hermeneutic approach, the text is assumed to stand apart from the author; the text has meaning in relation to other texts, not in relation to the author. When using hermeneutics, we see “interpretation as a dialogue between the text and the interpreter” (Prasad, 2002, p.16).

This standpoint towards the author is referred to as the death of the author, this being the title of the French literary theorist, linguist, and semiotician Roland Barthes’ essay on the subject (Barthes, 1977). The exclusion of the author was a reaction against the earlier hermeneutic idea that when reading you should try to become the author, and try to achieve her viewpoint. The problem with trying to understand the author’s viewpoint is that it is difficult or even impossible to attain. Interpretation should not be an attempt to “mind-read” the author, because we can not (Prasad, 2002). We do not have access to the author, and we do not have access to the author’s context. The author had one horizon of understanding; as readers we have our own horizon. We end up constructing an author that did not exist (Lye, 2000). If I write a book, and you read it, I do not want you to put words into my mouth, saying that this is what I meant. I want you as a reader to find your own meaning, and to know that it is your own meaning and not mine.

Interpretation is always open for negotiation and discussion; it should never be considered final (Ödman, 2007; Barthes, 1975). That was the fear that Barthes had, “to give an Author to a text is to impose upon that text a stop clause, to furnish it with a final signification, to close the writing” (Barthes, 1977, p.5). We must allow for some width of interpretation. But, we are not free to interpret a text in any way. The spread of possible meanings has limitations. The German philosopher Hans-Georg Gadamer wrote that “meanings represent a fluid multiplicity of possibilities... but within this multiplicity of what can be thought... not everything is possible” (Gadamer, 1989, p.281). Stuart Hall wrote about a “preferred reading” and how codes guide the reader towards a dominant meaning (Hall, 1980). To illustrate, we can consider the representation of virtuality that we will investigate in this poetics. In the movie *The Matrix*, it is quite obvious that the virtual world is supposed to be regarded as such; it is expressed literally in the dialogue. As a comparison, in the movie *eXistenZ* it is suggested that the final shot still takes place

inside a virtual world, but it is quite unproblematic to choose the opposite interpretation, that the convoluted narrative has finally arrived at the actual world.

The distanced stance towards the author also means that explanations, for example from interviewing the author, are not valid as truth or final interpretations. Interviews are to be regarded as just more texts to be interpreted. When studying media, it is relevant to study trade magazines, interviews, and such, since they give insights into the production cultures of the media industry in general – but as Caldwell (2009a) has made clear, we should not regard these documents as revealing a final truth; they are just texts to interpret, alongside other texts created by these authors.

Observing myself as a media producer – an author – seemingly contradicts the hermeneutic distancing from the author. To paraphrase Barthes; I am an author, and I am not dead! When studying my own work process I see both perspectives; I see the implosion of meaning when I put down words or choose signs for an image, and I see an explosion of meaning at the other end of the singularity. The author is not dead in the sense that we can completely ignore her. But the author – even myself – is still dead in the sense that the author's own explanations are only new texts to interpret (Ödman, 2007). This includes my own observations of my work process. Conscious reflection, self-criticism and keeping different viewpoints separated but related is vital in sorting this out.

The author as shaman

Not only did Barthes consider the author as symbolically dead, he also considered the author an empty vessel. The idea is that what the author says not only comes from her, it also comes from her tradition, her culture. Barthes illustrates this by describing how the storyteller in primitive societies is regarded as a “mediator, shaman or speaker” (Barthes, 1977, p.1). The German philosopher Heidegger formulated the idea that “humans do not speak language, language speaks us” (Lye, 2000, p.2). To use language is to wield the power of words, while also being under their control. All words and their meaning are given to us, and we have very limited possibility to invent new words or change their meaning. This is obvious in spoken language, where the repertoire of words is finite and the words have meanings and connotations that cannot be ignored. The situation is similar when working with visual and cinematic signs. If, for example, a movie maker chooses to shoot a scene with a handheld camera, this is a design decision that brings a whole set of meaning, connotations and conventions. Seeing the movie maker as a shaman suggests that the sign choices she makes is semi-conscious, semi-intuitive. The choice is based as much on a conscious, intentional decision as on earlier influences.

Each individual has access to just a limited part of our shared culture. In hermeneutics this is referred to as the *horizon* – “the range of vision that includes everything that can be seen from a particular vantage point” (Gadamer, 1989, p.313). Anyone's interpretation can only be based on the individual's previous experience. Understanding what others say requires some overlap of horizons, that we at least partly have the same set of collateral experience.

Language is a system of conventions. When we as an audience see a shaky handheld shot in a movie, we interpret it based *on all other* handheld shots we have seen previously. These earlier acquaintances are what give the sign meaning. The sign itself, standing alone, would not mean anything. A standalone sign is empty, like the singularity of a black hole. When a word is put down on paper, all the intentions of the author are lost. After all, the word is just shapes of black on white. Meaning then explodes forth when readers interpret the word. The singularity is a fitting metaphor; when matter falls into a black hole, all structure and information is lost. French philosopher Paul Ricœur (1971) writes that “the book divides the act of writing and the act of reading into two sides, between which there is no communication” (p.107). Nothing passes through the singularity. The word a reader reads is disconnected from the word that the author wrote. Only the word itself passes through, and the belief that words possess their meaning is false (Ricœur, 1978). Barthes captures it beautifully when writing “literature is that neuter, that composite, that oblique into which every subject escapes, the trap where all identity is lost...” (1977, p.1). What gives the sign meaning on the interpretation side of the singularity is the intertextuality with all other texts that use the sign. A “text is a tissue of citations, resulting from the thousand sources of culture” (Barthes, 1977, p.1), and “it is because it has been used in various contexts that the word gradually accumulates a significance” (Merleau-Ponty, 1962, p.346). The motifs from visually influential movies such as for example *2001: A Space Odyssey*, *Blade Runner*, *Tron* and *The Matrix* are picked up by other filmmakers, so even if you have not seen those movies yourself, you nevertheless have been soaked in the visual culture they have created. Peirce refers to this as *collateral experience* or *collateral acquaintance* (Ransdell, 2003).

Managing tradition and the hermeneutic circle

In *Truth and method*, Hans-Georg Gadamer (1989) describes the “historically effected consciousness” (*wirkungsgeschichtliches Bewußtsein*), a concept that emphasizes that we should accept and put to use the experiences we have of being embedded in culture, the prejudices we have. In hermeneutics, these prejudices and pre-knowledge are referred to as *tradition*, and they are regarded not as errors to eradicate, but as necessary in order to understand anything at all (Ödman, 2007).

What to do with *tradition* is one of the big debates in hermeneutics; the Habermas-Gadamer debate on tradition. Habermas was very skeptical about tradition; he claimed that the interpreter must become aware of her tradition, and free herself from the distortions they inflict on the interpretation (Negru, 2007; Piercey, 2004; Prasad, 2002). Gadamer, on the contrary, said that tradition is important, and he thought it was impossible to escape your tradition. As Merleau-Ponty wrote in *Phenomenology of Perception* (1962), “we are condemned to meaning” (p.x), and we must take into account that we are “perched on a pyramid of past life” (*ibid.*, p.350). You can never be free from tradition, but you are free to take it into consideration; this is the hermeneutic circle Gadamer mentioned many times. It is the “back-and-forth movement between the preconceptions one brings to inquiry and the theoretical insights one takes away from it” (Piercey, 2004) and

tradition is our starting-point in this circular movement (Andersson, 1986; Piercey, 2004). The initial meaning we interpret from a text is constantly revised when we encounter more and more of the text (Gadamer, 1989). Ricœur suggests a kind of middle-path between Gadamer and Habermas. He claims that we must be self-aware of our tradition, that we must accept it, but also distance ourselves from it, and be critical towards it. “Good readers” have the “ability to distance oneself from oneself” (Piercey, 2004, p.267). One important aspect to derive from this when doing media studies combined with practice-based research (as I do) is that it is necessary to carefully separate the roles of consumer and producer. These are inevitably intertwined, but what we can do is to consciously oscillate between these two viewpoints.

Fundamentally, hermeneutics emphasizes openness towards the texts, proclaiming sensitive listening before intense analysis (Ödman, 2007) and rests on a “concern about the relativity of judgment” (Andrew, 1984, p.173).

A semiotic approach to film studies

Semiotics is the study of semiosis – the process of production and interpretation of signs – and of the structure of signs (Sebeok, 1999; Silverman, 1998). It was established in the beginning of the twentieth century, mainly by Charles Sanders Peirce and Ferdinand de Saussure (Silverman, 1985). It is both a technique to analyze signs and texts, and a field of research. In a semiotic study we are not primarily interested in what the text actually means, but in how it is constructed. As philosopher, psychoanalyst, and sociologist Julia Kristeva (1998) describes it – “the point is not what the text means, but how it means” (p.112). The focus on construction and production connects semiotics with the intentions in formulating a poetics, and Bordwell (2006) emphasizes how semiotic studies can give “splendid contributions to poetics” (p.4). In semiotics, we study the cultural process of communication as a system of signification (Carravetta, 1998; Silverman, 1985) where relations between signs convey meaning, since a sign obtains its meaning from “its difference from other signs in the same language system” (Silverman, 1998, p.2). Instead of using a simplified and linear sender/receiver model, a semiotic study investigates communication as a “structure produced and sustained through the articulation of linked but distinctive moments” of production and consumption, writing and reading (ibid., p.128). When analyzing and discussing my study, I will use a general semiotics. However, the visual representation of virtuality has proved to play a dominant part in my study of fictional narratives; therefore, there will be much emphasis on a visual and cinematic semiotics.

Semiotics deals with representation. From a semiotic viewpoint, a sign *represents* something, stands for objects, feelings, events among other things (Sebeok, 1999), such as when a company logo is used instead of trying to show the whole company, or when someone draws an image of a dog instead of bringing the dog. From a semiotics point of view, it could be argued that virtuality is not represented; it is itself. When we engage a virtual environment, the virtual environment is not represented; it just is. A virtual world is designed; it is given a shape, and thus the German word *Gestaltung* could have been used, meaning forming, to give a shape. However, this poetics is not primarily a study of the shape of actual virtual environments. This is a study of how we represent virtuality, primarily in fictional narrative texts. In this context, when a storyteller wants to speak about the virtual, it is the *idea* of the virtual that is *represented*. The written descriptions of cyberspace in *Neuromancer* or the images showing the matrix in *The Matrix* are not virtualities – they are representations of virtuality, and as such can be analyzed with semiotics.

According to Gunning (2007), the idea of cinema as a language originates from “the Soviet theorists in the twenties, who established that film could function not simply as a mode of mechanical reproduction but that it could create a poetics and a rhetoric that resembled a language”(p.37). The Soviet film theorists did not use semiotics to discuss film theory, but they could be said to have paved the way for the semiotic study of moving, narrative images. A pioneer in using semiotics to study representations in popular culture was Roland Barthes in the 1950s, when he started to analyze popular culture.

The semiotic sign

We can define a sign as something which has meaning for someone, and which stands instead of, represents, something else. A sign is created when we invest meaning in something, when we decide that it stands instead of something else. Or, as Charles Sanders Peirce puts it, “nothing is a sign unless it is interpreted as a sign” (Peirce, 1931-58, vol. 2 p.172). The meaning of a sign is not contained within the sign. The sign does not determine, decide or force a specific meaning. The meaning arises in the interpretation, usually an interpretation that we have culturally agreed upon. It is not the Nazi swastika that has forced itself upon the Nazi ideology; it is the Nazis who invaded the swastika with their meaning.

There are two common models for the structure of a sign: the two-part sign described by Ferdinand de Saussure and the three-part sign described by Charles Peirce (Sebeok, 1999). I will primarily use the terminology of Peirce’s three-part sign since it is theoretically more complete and thus more useful, but I will occasionally use Saussure’s two-part sign when the clarity of the discussion would benefit from a more simple terminology.

The two-part sign consists of the signifier and the signified. It is often emphasized that the parts are inseparable (Silverman, 1998), as are the two sides of a coin. Barthes (1999b) even suggests that the sign is the *relation* between signifier and signified. The signifier points to the signified, but the signified is not the thing that the sign represents; it is rather the concept of that object. Saussure described the signified as being purely psychological (Saussure, 1983). A word is a signifier, and the concept that the word evokes is the signified part of the sign (Barthes, 1999b; Silverman, 1985; Silverman, 1998). One advantage with Saussure’s two-part sign model is the easy to grasp structure (where *this* points to *that*) and how the two words signifier and signified are quite self-explanatory.

Peirce’s triadic sign is structured into the representamen, the object and the interpretant. The representamen is equivalent to the signifier. The object is the concept of the thing that is represented (equivalent to the signified), while the interpretant could be seen as the sign’s connection to all other signs, opening a door to language at large (Sebeok, 1999). The object is what the sign denotes, a quite (but not fully) fixed, literal meaning. The interpretant is the connotations, associative and transforming, and an area where ideologies surface (Hall, 1980). The difference between object and interpretant, denotation and connotation, is a matter of degree rather than a categorical separation. The denotation can be viewed as “the last of the connotations” (Barthes, 1975, p.9). The triadic sign has the advantage of emphasizing that a sign can have both explicit and implicit meanings, opening up for a more complete discussion concerning the structure and meaning of the sign.

At a first glance it could be understood that the interpretant is the interpretation of the sign. However, it would be more correct to say that the interpretant is the result of the process of interpretation, the effect that the process of signification

inflicts on the mind.²¹ The interpretant is the ideas that the sign generates. These ideas can be regarded as new signs. Thus, any sign spawn additional signs, perhaps perpetually in what Umberto Eco has called an unlimited semiosis (Eco, 1976). Peirce wrote that “the meaning of a representation can be nothing but a representation” (Peirce, 1931-58, p.171).

Semiotics describes language as a *code*, with combinational rules for how signs can be organized into different structures (Eco, 1976; Hall, 1980). New codes can, of course, appear. Eco describes this emergence of new codes as a dialectic process between sign production and sign consumption, an interaction between “rule-governed creativity” and “rule-changing creativity” (Eco, 1976, p.161). He continues by suggesting that a new code emerges within a very limited group of people and then spreads through our culture (ibid., p.272).

This new code is apparently spoken by only one speaker, and understood by a very restricted audience; it is a semiotic enclave which society cannot recognize as a social rule acceptable by everyone. Such a type of private code is usually called an ‘idiolect’.

When a particular code spreads, it becomes a *sociolect*, a code used by a particular social group. The new code is a convention that is established through repetition within a group of people communicating (Carravetta, 1998). This pattern is easily recognizable in popular media. For example, a particular aesthetic invention is used in a movie that achieves success and the sign is then copied, spreading. A well-spread sign can become a trope, a stylistic code, a successful “actualization of an aesthetic ideal” (Eco, 1982, p38).

Symbol, icon and index

There is yet another triad structure concerning the sign; the characteristics symbols, icons and indexes (Sebeok, 1999).

- A **symbol** is a sign in which the meaning is decided by a convention; it has been culturally agreed upon. Therefore the meaning of a symbolic sign must be learnt.
- An **icon** is a sign in which the meaning is decided by resemblance. The representamen shares some quality, some topological similarity, with the object. Images are to a large extent iconic, but other signs such as diagrams and sound effects should not be forgotten.
- An **index** is a sign in which the meaning is decided by some kind of physical and/or causal connection. Photographs are highly indexical since they have a direct connection to what they represent.

Peirce has emphasized that these are not mutually exclusive; “it would be difficult if not impossible to instance an absolutely pure index, or to find any sign absolutely

²¹ Roland Barthes (1981) elaborately illustrates this when he at length describes the Winter Garden photograph of his now dead mother, and eventually concludes that he can never show the photograph he is seeing for us, because for anyone else it would not be the same sign. Thus the representamen which he perceives is the result of his personal interpretational process.

devoid of the indexical quality” (Peirce, 1931-58, p.306). A sign is all three types at the same time, but in different proportions. For example, a photograph is indexical because of the causality between the photograph and the photographed (Sebeok, 1999). Through the indexical sign, the object “will touch me like the delayed rays of a star” (Barthes, 1981, p.81). A photograph is also iconic since it resembles what it represents. It possesses some of the attributes of the object it signifies (Eco, 1982). An iconic sign has some similarities with the thing it represents, but more or less limited; a dog in a film “can bark but it cannot bite” (Hall, 1980, p.131). A photograph also has a symbolical quality because we have agreed by convention that the photograph represents something, despite the fact that the photograph is a flat, thin piece of paper with colored patches on one side. At least part of the realism in photographs stems from symbolic conventions and not only the indexical and iconic nature of photography (Geimer, 2007). We have agreed to regard image artifacts such as motion blur and film grain as realistic aspects of a photograph, even if they do not resemble the scene that we see with our eyes.

Super-sign structures

Saussure writes that “normally we do not express ourselves by using single linguistic signs, but groups of signs, organized in complexes which themselves are signs” (Saussure, 1983, p.127). Barthes (1977) and Eco (1976) describe similar ideas, speaking about a “pyramid of functions” (p.103), super-signs that are built of sub-signs. Eco only provides fleeting descriptions of these super-signs, claiming that an image is a super-sign, and that super-signs are “signs whose content is not a content-unit but an entire proposition” and that they are “non-verbal sentences” (p.231).²² An image is a text, a conglomerate of signs. In this text there is a structure, with signs working together as words do in a sentence; these are super-signs formed by sub-signs. For example, a lens flare can be thought of as a coherent sign, but it can also be split into its components: individual signs such as the color of the lens flare, its size, the number of iris reflections, and so on. The example of a lens flare is deludingly simple. A lens flare can easily be extracted from the rest of the image. We could even actually cut it out of the image if we had scissors and the image was a hard copy. But signs in images can just as well be on a more conceptual level, for example, related to the visual style of an image, and not any particular geometrical region of the image.

My approach to working with super-sign structures can be exemplified by investigating Figure 6, on the next page, a computer graphics visualization I made for a X-15 book project together with Michelle Evans. It shows a winged spacecraft, a rocket plane, in space above the Earth. How do we know that? If [winged spacecraft in space above Earth] is seen as a super-sign, what are the sub-

²² In *Articulations of the Cinematic Code* (1985), Eco outline another model for hierarchical levels of signs, calling these levels *semes* (equivalent to super-signs), *signs* and *figures*. According to Eco figures have no independent meaning, which makes them equivalent to what he earlier (1976) referred to as the structural properties of the sign.

signs?²³ The NASA name logotype on the tail is obviously a sign, connoting space travel. The blue horizon haze, the black sky and the blue-white surface of the Earth are three signs that denote a position in space far above Earth. These four signs combine to form the sign [in space above the Earth]. Note how these sub-signs correlate to specific areas of the image – they could literally be outlined with a pencil – while the super-sign to which they belong is not directly correlated to specific parts of the image. The wings, the cockpit and the height above ground are signs that together form the super-sign [aircraft]. Note how the first two again correlate with specific image areas, while the latter does not. The latter also connects to the [in space above the Earth] super-sign. Finally, the two super-signs [in space above the Earth] and [aircraft] form the top-level super-sign [winged spacecraft in space above Earth] (Figure 7). Note how this last combination changes the meaning so that the meaning becomes *winged spacecraft* rather than *aircraft in space*. This is, of course, my interpretation, which can be negotiated. Also, note that sub-signs are not just a matter of identifying image parts. Consider the details of the wings for example. I argue that the individual rivets and the shape of the wing are structural properties of the [wings] sign, and not sub-signs. Why? Because the sub-sign [wing] denotes aircraft both on its own and together with the other sub-signs, while each individual rivet does not denote aircraft; they could just as well have been rivets on a ship at sea.



Figure 6. Visualization of the spacecraft X-15, exemplifying a super-sign. Computer graphics by the author.

²³ An uttering, such as the X-15 visualization discussed here, can also be viewed as a text, not a super-sign. One of my points is to illustrate how a conglomerate of signs can be explored either as a text or a super-sign. I prefer to see it as a super-sign if the particular structure of signs is quite stable and repeated, thus forming a coherent entity.

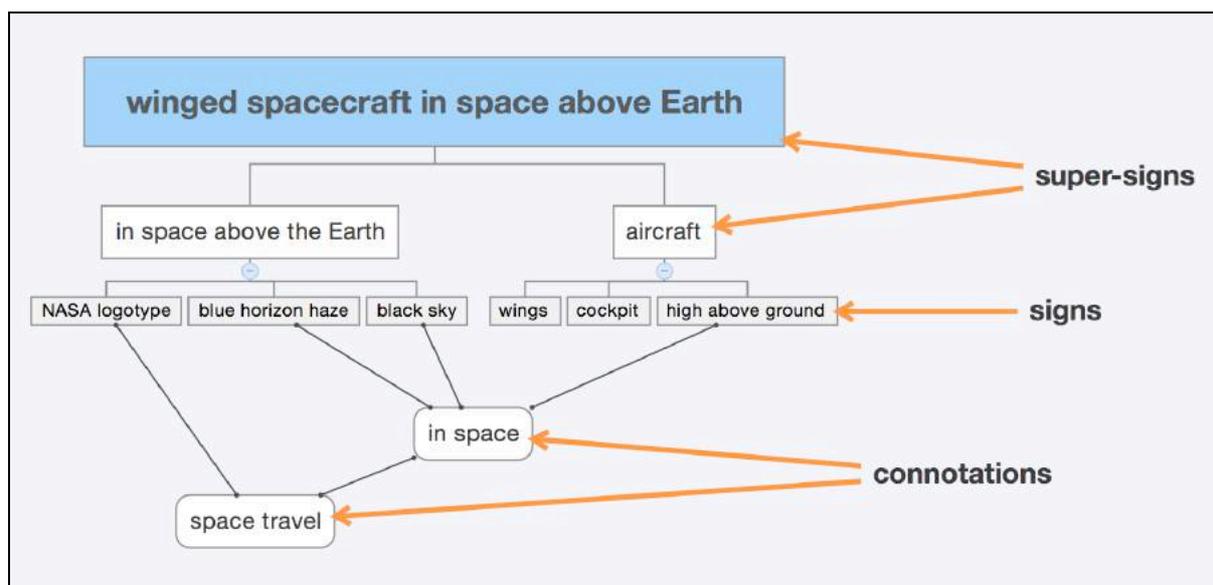


Figure 7. The structure of the [winged spacecraft in space above Earth] super-sign.

Visual semiotics and the semiotics of cinema

General semiotics is essentially enough for analyzing fictional representations of virtuality. However, since I have primarily analyzed movies, a deeper understanding of the specific circumstances of cinema and visual storytelling informs my work. Visual semiotics and the semiotics of cinema involve a discussion about the nature of photography and cinema as a communication tool and a language, and what separates them from other modes of representation. As Jessica Evans and Stuart Hall (1999) emphasize, visual representations are distinctly different from other forms of texts such as written text, and, within the umbrella term visual, there is a wide diversity of images, photographs, cinema and such.

Cinema as mediation or representation

Understanding photography and cinema as texts has troubled semioticians and film theorists during the twentieth century. Other means of representation are so obviously a representation. A word cannot be mistaken for being what it refers to. But the high visual fidelity of photography and cinema gives them the false impression of being an unaltered mediation of direct reality, illustrated by the questions that arises when comparing a video image to a mirror. Is a mirror representation or presentation? And what is then a live feed from a video camera? Is the shot of a street a representation, or “are we looking at the street itself” (Andrew, 1984, p.52)? When we look through the viewfinder, it seems absurd to say that we do not see the street itself. But when the shot has been taken, and the street is seen again (this time in the acquired shot), is it then a representation?

An iconic sign reproduces some of the conditions of perception (Eco, 1982), and photography and cinema appears to reproduce almost all conditions of perception. Cinema gives the *impression* of reality, partly due to its actual *perception* of reality; the motion on the screen of the cinema is actual motion, and the light is

actual light (Metz, 1974). It appears as if the photographic image is purely indexical and iconic, with no hint of it being a symbol. Photography “has often been described as a trace, impression, or index of the real” (Geimer, 2007, p.1). However, the photograph is also symbolic. Consider a photographic image with highly pronounced image artifacts such as excessive motion blur and film grain. Maybe the photograph is also framed so that we see only parts of the objects that were in front of the camera. Such an image could be so chaotic and jumbled that it could be impossible to actually see what it depicts. We might see a shape in the resemblance of a shoe... but it could also be a part of a guitar, or something else. Nevertheless, such an image could be an expressive representation of a chaotic and jumbled event, such as a rock concert or sports event. Thus, in order to understand photographic images, we do need to learn a code. Geimer (2007) claims that at least part of the realism we see in a photograph stems from symbolic conventions and not only the indexical and iconic nature of photography; we have learnt that a photograph is realistic. Even if the photograph is heavily color graded – as in blue tinted night images – we perceive it as realistic, even if the darkness of the night is not blue-tinted when we see it with our eyes! But how does the indexicality “functions within a fiction film, where we are dealing with a diegesis, a fictional world, rather than a reference to a reality” (Gunning, 2007, p.47)? What kinds of indexical links do we have between the image and the profilmic event, what was in front of the camera at the shoot? Let us say we have a shot of the actor Sean Connery playing the fictive character James Bond. Does the shot represent Connery or Bond? If the shot represents the actor Connery, then the sign should be indexical; Connery was actually standing in front of the camera. If the shot represents the character Bond, then the sign should be symbolic. Actually, in the latter case, the sign cannot be indexical at all, since the character Bond is fictive and does not exist. We could say that the shot represents both Connery and Bond depending on the context.

Andrew writes about the realist and the formalist positions in film theory. The realist arguments “differentiate cinema from the other, purely conventional artistic systems like painting and literature”. The formalist argument “redeem cinema from the servile task of mere reproduction” (Andrew, 1984, p.20). With this, Andrew emphasizes that cinema can be seen as both representation and actuality. This can be illustrated by inserting a highly emotional stake into the argument. Consider a nude photograph of someone, or a video of someone having his throat cut. In the first case, you would say that you have seen the person naked. In the second case, you have seen someone die. Then consider the photograph and the video being replaced, line by line, frame by frame, by a cartoon drawing and an animation. Much of the emotional investment disappears. Nowadays it is possible to create a number of in-betweens, for example mapping photographic texture to a 3d model. However, this does not change the claim that the high degree of iconicity and indexicality in photography and cinema inserts a sense of reality into these representations. Does this mean that, as Lotman asks (1976), the cinema text “is simultaneously the object itself and a model of the object” (p.16)? Andrew (1984) further claims that this double nature of cinema is necessary to acknowledge in

order to understand cinema, that our understanding of “movies is incompletely described unless this tension between perception and signification, between the cinematography and the cinema is maintained” (p.22). Considering how cinema is used to telling stories, it is “obviously a message” (Metz, 1974, p.40), and thus cinema is “not life, it is created spectacle” (ibid., p.43). If then cinema can be seen as representation, it falls into the domain of semiotics; “cinema is a seductive, but ultimately conventional language” (ibid., p.21). The sense of realism should “no longer be thought of as fragments of reality” (ibid, p.58), but rather a reconstruction of actual experience. Then, cinema is not a copy of life; rather it is an edited re-creation. When we become aware that cinema is something we learn to read, it also becomes easier to distinguish the different tropes, the ready-made signs that are re-created in movie after movie (Lotman, 1976). When we discern the intricate weave of codes that builds a movie, we have to think of it as a text and not mediated reality; “never again can we accept this picture as the ‘seamless garment of reality’ when we have now been shown the seams, the threads, sometimes even the weave itself” (Metz, 1974, p.64).

Thus, cinema both mediates and represents, and the construction of signs often starts with setting up the sound stage or location in front of the camera. The profilmic arrangement of objects in front of the camera become signs in the movie (Barthes, 1977). Production design works toward filling the frame with objects that become signs. The “profilmic event, function narrationally” (Bordwell, 1985, p.12) and construct the diegetic world of the movie. When we experience cinema, our interpretation sequence what we experience into distinct parts, the flow of images and sound is broken up into signs. However, before that, during *production*, the images and sounds was likewise brought together from separate parts, shots, audio clips, and so on. Even the apparently monolithic moving images in a separate shot are often split up into layers of imagery, this being one of the most important tools enabling the work with computer graphics and visual effects. This production work breaks the image apart spatially, but it also breaks apart the image temporally. An image seems to be a moment in time, frozen at the instance of exposure. However, the production of an image occurs before the exposure, and continues afterwards. The photograph, as well as cinema, is constructed before the shutter releases – when setting up the scene or at least the camera – and after, in post-production. Photographs are *made*, not *taken*. Granted, there is a certain degree of automation in taking a photograph, of unavoidability in the photographic process. Peter Geimer (2007) has discussed the balance between accidental versus intentional in photographic images. He claims that at the moment of exposure “something happens in the picture, or something slips into it” (p.19). He exemplifies this with a photograph where a fly accidentally was captured in the image (Antonio Beato’s photograph from 1870 of an archaeological site outside Cairo), and contrasts this with the intentionally inserted fly in Georges Seurat’s painting *Un dimanche après-midi à l’Île de la Grande Jatte*. His argument is that small details such as an insect can by accident slip into a photograph since such a large portion of the production process is purely mechanical-optical. Such details do not appear accidentally in a painting; if they are there, they are created intentionally. Apparently accidental

details can be inserted intentionally in any kind of imagery, but the point is that it is more common that details slip into the image in photography compared to painting. This special characteristic of the photograph occurs at the moment the shutter releases – when the picture materializes (Geimer, 2007). Even if the photographer is free to create and manipulate the scene before the camera captures the image, and even if the photographer is completely free to manipulate the photograph afterwards, there is still some serendipity in that very moment when the shutter releases. When making a photograph, my freedom as image-maker is yielded during that short moment when light flows onto the recording device of film emulsion or the CCD. I regain my total freedom as soon as the image is captured, but for a short moment I surrender to nature.

The image as monolith or conglomerate

An image, especially a photographic image, seems to be a continuous, indiscrete mess of shapes, colors, textures and patterns. How can we discern distinct signs in this analog multitude, when it all appears to be locked into itself (Barthes, 1999a)? Bill Nichols (1985) is highly skeptical towards cutting up cinema's flow of images into signs (p.609):

The standardized units of an arbitrary code are absent. Instead of arbitrary units (phonemes) with 'nonsense' gaps (noise) that can be coupled to produce second-order units (words) cinema has no alphabet of phonemes. It has no dictionary of monemes. Instead it has a continuum of images which it frames and punctuates with gaps (cuts, dissolves, fades, etc.).

Nichols further claims that Umberto Eco and others “make the fatal error of inserting binary choices and oppositions where they don't belong” (ibid., p.614). However, Eco (1985) is comfortable with breaking down the image into a complex text of signs. From a semiotic viewpoint, cinema is both discreet and indiscreet (Barthes, 1977; Lotman, 1976); the image can be reduced to discreet units, binary choices (Eco, 1985). Photography and cinema give the impression of continuity, hiding the discrete units they actually use (Metz, 1985). Eco (1976) acknowledges that an image seems to be more continuous, monolithic and difficult to split up: “in a painting the signal looks ‘continuous’ or ‘dense’, without distinguishable units” (p.181). Eco claims that when using spoken language the speaker can choose “among a repertoire of established types” (p. 152) that “can be codified and listed” (p. 214), while making a drawing requires “extra work... to invent a new type” (p. 152). When working with images there is huge flexibility when designing new signs, to reshape existing, and to combine signs in different ways. However, signs in an image are indeed based on a code of “ready-made elements of signification” (Barthes, 1977, p.22). Despite the flexibility and freedom in creating images and cinema, there is still a structure to discern; the codification and listing of established signs that Eco connects with spoken language can be done for cinema as well.

Cinema as language

Is cinema a language? In order to answer that question we need to know what a language is. Silverman (1985) writes that language is “a system of signs that express ideas, a network of elements that signify only in relation to each other” (p.6).

Lotman (1976) describes it as an ordered communication sign system, a system of signs. Metz (1974) suggests that language either refers to a system with a formal structure or to “everything that expresses”, and that cinema is “a language without a system” (p.65). A language system needs to be learnt and thus one characteristic of languages is that we need to learn them to understand them. The high degree of iconicity and immediacy of film makes us believe we do not need to learn it. It took time to understand that what appears to be direct reality, is rather a structured representation, a language; the “transformation of cinematographic authenticity into a means for cognition was a long and difficult process” (Lotman, 1976, p.12). At least part of cinema’s code needs to be learnt, in order to understand it. Conventions such as film grain, fades and cross-cutting are partly symbolic signs that need to be learnt.

One characteristic with language is that it can be used for direct communicative dialog. It appears that we cannot communicate using cinema in the same interactive, back-and-forth dialog as we do with spoken language. Movies give the impression of being stand-alone expressions (Metz, 1974; Metz, 1985). However, movie makers can engage in dialog, albeit much slower. Consider how Lars von Trier’s *The Five Obstructions* respond to Jørgen Leth’s *The Perfect Human*, or how separate feature films in extended franchises such as James Bond or Star Trek build on each other’s narrative. Also, consider how video-based memes swiftly spread on YouTube in response to and in dialogue with each other. Yet another important aspect of cinema as a language is that cinema is multimodal (Metz, 1985). It is a complex conglomerate of codes, visual and audial, spatial and nonspatial, “not so much as a system of signification as a place where various codes come together to create meaning.” (Andrew, 1984, p.68). Cinema is polyphonic; it absorbs and unifies different modalities (Lotman, 1976).

The structure of a language allows the combinatory nature of signs. It has been debated whether cinema and images have a grammar. For example, Nichols (1985) has claimed that cinema is “subject to no determinate grammar or code. We cannot construct an ungrammatical sequence as we can write a nonsense sentence” (p.609). This has been disputed by Eco (1985), who claims that there are codes that govern which details do I choose to use when I create a picture of, for example, a zebra or a cat. Using zebra patterns on a stylistic drawing of a cat, or drawing the cat’s pointy ears under its belly, might confuse the viewer, and could then be regarded as a grammatically incorrect image. Cinema and other visual texts have different structures than written language, but nevertheless there is a visual grammar, a code for how visual signs representing objects and events can “combine in visual ‘statements’ of greater or lesser complexity and extension” (Kress & van Leeuwen, 1996, p.1). What is the atomic unit of cinema? What is cinema’s equivalent to written language (Andrew, 1984)? Lotman (1976) claims that the shot can be

considered a phoneme. Nichols (1985) states that “the shot is not a word; it is at minimum a sentence” (p.612). Umberto Eco (1985) likewise claims that the frame is an utterance; the parts of the image are equivalent to the words of spoken language. Barthes (1977) also compares “lines, surfaces, shades” (p.16) in an image to words. Metz (1974) approaches the question from a narrative viewpoint and suggests “the event is still and always the basic unit” (p.24), and that film images are “like statements” (p.26), “never a unit of language” (p.67). When performing the analysis I have done, I have worked under the assumption that images and movies have a language, that an image is comparable to a written sentence, and that parts of the image is the equivalent to words.

The code that underlies sign production is based on conventions, and these conventions “rest on systems of choices and oppositions” (Eco, 1985, p.595); the author works with selection and combination (Ricoeur, 1978; Silverman, 1985). There are two combinatory structures that describe how signs can be arranged into texts: the paradigmatic and syntagmatic. The paradigmatic structure concerns selection. Signs along a paradigmatic axis are of same kind but different from each other (Sebeok, 1999), they either overlap or stand in binary opposition (Silverman, 1985), and they form a repertoire to select from, “a bounded set of alternatives which at some level serve equivalent functions” (Bordwell, 1985, p.151). A movie maker might, for example, choose from a range of colors; all colors are colors, but they differ from each other. An example of a binary paradigmatic pair would be a shot/reverse shot. A sign’s meaning is partly determined by how “it deviates from the other members of the abstract groups to which it belongs” (Silverman, 1985, p.103). Black would not mean the same thing without white, or any other color. And the selection of a particular sign at the same time signals the absence of the others; [black] means that [white] was not chosen (Bordwell, 1985). A paradigmatic analysis focuses on which signs were chosen from what repertoire.

The syntagmatic structure concerns combination, the arrangement of order. These signs can be chained together in a sequence, a syntagm, and the syntagmatic structure sets up rules for how these individual signs can be joined together (Bordwell, 1985; Lotman, 1976; Sebeok, 1999; Silverman 1985). The obvious example is a sentence in written language, or a sequence of shots edited together into a scene in a movie. However, the sequence does not have to be linear, even though the combinatory system of written language seems to be more flexible and powerful than any other mode of communication (Eco, 1976; Lotman, 1976). Silverman (1985) emphasizes that the spatial, two-dimensional disposition of signs in an image is also syntagmatic, and architecture (actual or virtual) should then be able to exhibit syntagmatic structures in all three spatial dimensions. A syntagmatic analysis focuses on which signs are combined and how.

Reading cinema as a text

According to Eco (1976), almost any part of an image or any aspect of the image can be a sign, if the audience distinguishes it from the rest of the image and attributes meaning to it; “...every object may potentially become a sign within the environment of a given culture” (p.166). Does this include signs that are not

intentionally added to an image? Especially in photographic images, the author partly loses control over the sign production, and much of the content of the image appears more or less outside intentional control, such as film grain, lens flares, the quality of shadows and so on. Would such content of the image be considered being signs? Eco (1976) gives us the following argument (p.17):

The first doctor who discovered a sort of constant relationship between an array of red spots on the patient's face and a given disease (measles) made an inference: but insofar as this relationship has been made conventional and has been registered as such in medical treatises a semiotic convention has been established. There is a sign everytime a human group decides to use and to recognize something as the vehicle of something else. ... In this sense events coming from a natural source must also be listed as sign.

According to this reasoning, signs that the author did not intentionally construct could be signs if the audience attributes meaning to them. Eco does not comment on the situation where the audience does not consciously notice the sign. Even though the viewer is not consciously aware of, for example, a lens flare, the lens flare and similar details in the image can nevertheless give the viewer an impression of, for example, strong light or photographic realism. I argue that such unconsciously noticed image details can be considered a sign, if the overall phenomenological impression – strong light in this example – is noted by the viewer. The impression of strong light comes from, for example, lens flares and beams of light. If the viewer perceives strong light, then she has on some level of consciousness perceived the signs that convey it. This is important for my work on representation of virtuality, because many signs of virtuality might express virtuality even though the audience does not consciously note them. The audience does not necessarily become aware of green colors or abstract geometrical shapes, but they interpret the environment as virtual anyway.

Signs are more or less arbitrary (Sebeok, 1999; Silverman, 1985), ranging from arbitrary symbolic signs such as the word *cat* which just as well could have had the sequence of words d-o-g as its representamen, to iconic and indexical signs such as motion blur, which are motivated by technical production circumstances. Iconic signs can often be mistaken as fully motivated because of their similarity with the represented thing, as if there is only one way to draw a cat. However, iconic signs are also, to some extent, arbitrary, allowing for many different ways to draw a cat (Hall, 1980). When it comes to images, the different aspects and details of an image are a complex interplay between arbitrariness and motivation. For one viewer it might seem obvious that a sign such as [strong light] is highly motivated, after all, we see strong light because there is a strong light. Another viewer might instead see that the strong light is created by signs such as [blown out highlights], [lens flare] and [sunlit haze], and she might regard these signs as quite arbitrary; the impression of strong light could have been created by other signs, and thus they are to some extent arbitrary and from a repertoire of available signs. The distinction between arbitrary and motivated signs is important to include as a factor when reflecting on how signs are constructed, since it is a way to become aware of the presumptions that might exist. An example related to signification of virtuality is the use of green

color. Understanding that this particular color might be motivated by the green tint of old CRT screens informs the analysis.

When does the form of the representation matter? When is green color just a color, and when is it a sign? Such questions will be raised repeatedly in this poetics. Saussure (1983) viewed language as a highly formal system, and he claimed that the form of the representamen does not matter; it does not influence the interpretation of the sign (p.118).

...the actual mode of inscription is irrelevant, because it does not affect the system...
Whether I write in black or white, in incised characters or in relief, with a pen or a chisel - none of that is of any importance for the meaning.

It might be correct that in order to play the game of chess, the form of the pieces does not matter. But, what if we consider not only the game itself, but the meaning of the game as a game? If the pieces were made of wood, then the interpretation could be that playing of the game is a sophisticated activity with a long historical tradition. If the pieces were shaped as soldiers with weapons, it would highlight that chess is a representation of bloody battles. Eco (1976) acknowledges that signs can be “charged with cultural signification” by applying “extra-coding” in this manner (p.267). An even firmer standpoint is that “the material expression of the text is always significant; it is a separately variable semiotic feature” (Kress & van Leeuwen, 1996, p.231). It can be argued that form or style, the material expression, is based on signs, signs that support other signs. Let us say that I get a note with a text on it. The text is “I miss you”. Assume that the text is written in the typeface Verdana: “**I miss you**”. Now, think of another note, with the same text in the typeface Mistral and a red color: “*I miss you*”. The latter would probably seem more inviting; the text would have quite romantic connotations. The typeface and the color are signs in themselves, signs affecting the meaning of the textual signs. The text is not only a text composed of the three words (signs) “I”, “miss” and “you”, but also composed of the signs [romantic typeface] and the color [red]. Thus, a text can be analyzed in different ways; and, this ambivalence is an important aspect of my semiotic analysis of virtuality in fiction, forming my approach to think about and analyze the signs I studied.

My study of virtuality in fiction

This poetics of virtuality is to a large portion based on an analysis of fictional representations of virtuality, using the semiotic framework outlined in the previous sections. In the following I will describe how this particular study was designed and conducted.

Selecting the narratives and understanding science fiction

The selection criterion that I used was that the narratives would have a plot that moves between a framing narrative portraying an actual world and an insert narrative portraying a virtual world. For a secondary selection, narratives involving virtual objects in an actual world were included as well.

There are of course movies that fit the selection criteria but have nevertheless been excluded. The estimated impact of each movie has guided the selection. Has it been frequently discussed in academic texts, in trade magazines, and in the fan discussions online and elsewhere?²⁴ The intention has been to include movies with rich and complex structures, thus opening up for an interesting study. A majority of the narratives come from western popular culture, with an addition of a few Japanese narratives. The reason is that the narratives that portray virtual worlds usually have that origin. Some attempts have been made to find texts from other parts of the world, but this endeavor has largely been without success.²⁵

Many of the selected narratives belong to the genre *cyberpunk*, a sub-genre to *science fiction*. I have also made attempts to include narratives that are more mainstream, or are at least not specifically cyberpunk narratives. Science fiction is a genre with a few misunderstandings attached to it.²⁶ The layman definition of what a science fiction film is would probably include movies such as *Star Wars*, *Avatar* and *2012*. However, *Star Wars* belongs to the sub-genre space opera, *Avatar* borders on being a fantasy, and *2012* is predominantly an action movie. Many of the studied narratives can be generalized as being *spectacular*. The experience of *sense of wonder* (Knight, 1956) is critical for many science fiction aficionados, comparable to the romantic notion of the sublime (Lovén, 2010), and the genre is often associated with both the spectacular and the speculative (Dahlkvist, 2010). Science fiction movies often involve extensive visual effects, and it is common to regard visual effects as opposed to and in conflict with good storytelling (Liljefors, 2006).

²⁴ The academic texts that have influenced my selection of narratives have been (Brind, McKenzie & Sutton, 2007; Bryant & Pollock, 2010; Collins, 2005; Heuser, 2003; Lovén, 2001; Lovén, 2010; Schroeder, Huxor & Smith, 2001). Trade magazines that have influenced my selection are primarily Cinefex and American Cinematographer.

²⁵ Svante Lovén (2010) notes a similar difficulty in locating non-western, even non-American, narratives portraying the virtual. Lovén brings up Stanislaw Lem's *The Futurological Congress* (1971) but also note that even if the author is Polish the setting for his story is nevertheless American. Disch (1998), Määttä (2006), as well as Godhe and Ramsten (2010b) claim that in general most science fiction is produced in the United States.

²⁶ The definition of science fiction is highly debated, and some choose to not regard it as a genre at all but rather a narrative strategy, a marketing device, a meta genre or a mega text (Broderick, 1995; Määttä, 2006; Määttä, 2010; Ramsten, 2010).

This critical stance towards spectacular visual effects seems to have connections to how cinema in its early history was showcased as a spectacle without narrative. One of the first examples of narrative cinema was actually a science fiction short film – *Le voyage dans la lune* by Georges Méliès, 1902 – as pointed out by Määttä (2006). Despite this, stories that rely on spectacle have traditionally been quite harshly criticized, and there is a strong tradition in positioning “realistic film” and “fantastic film” against each other, “as if they were the two great poles of cinema” (Metz, 1974, p.207). Aristotle discussed the spectacle critically in his *Poetics* (part VI).

The Spectacle has, indeed, an emotional attraction of its own, but, of all the parts, it is the least artistic, and connected least with the art of poetry. For the power of Tragedy, we may be sure, is felt even apart from representation and actors. Besides, the production of spectacular effects depends more on the art of the stage machinist than on that of the poet.

Lars von Trier (1995) took a firm stance in the rhetorical Dogma95 manifest (p.1).

Today a technological storm is raging of which the result is the elevation of cosmetics to God. By using new technology anyone at any time can wash the last grains of truth away in the deadly embrace of sensation.

However, even spectacular narratives can be useful to study, and science fiction as a genre is not defined by spectacle, or by depictions of future technology and space travel, even though the archetypical science fiction stories often cover all three characteristics. A need to justify science fiction is central in the debate about the genre, since even though recently it has gained some mainstream popularity the genre is still looked down upon as being commercial and popular genre fiction (Määttä, 2006), and when well-known authors write science fiction both critics and publishers avoid acknowledging it as science fiction (Disch, 1998; Godhe & Ramsten, 2010b; Holmberg, 2010).²⁷ The technology-oriented sub-genre Hard SF, in particular, is considered uninteresting (Pierce, 1993). Genre fiction in general is typically regarded as being of lower quality and value than literary fiction (Harold, 2015). However, science fiction should be seen as an arena for exploration of ideas (Holmberg, 2010; Russ, 1975). Fundamental to narratives in science fiction is the question, “what if?” This “what if” scenario is created by inserting a novum, a strange newness, into the plot (Godhe & Ramsten, 2010b; Holmberg, 2010; Lovén, 2010; Määttä, 2010). The novum – a term established by Darko Suvin (1979) – usually has a scientific or technological framework and justification (Godhe & Ramsten, 2010b; Määttä, 2006; Määttä, 2010). This would make Mary Shelley’s *Frankenstein; or, The Modern Prometheus* (1818) the archetypical science fiction story, since Shelley uses scientific reasoning to explain Frankenstein’s monster (instead of magic or divine interaction as in earlier depictions of artificial life). She also offers critique against the doctor’s hubris in playing with technological forces he cannot

²⁷ Ramsten (2010) gives a summary account of how the pulp era of science fiction (early low quality magazines such as *Amazing Stories* and *Astounding Science Fiction*) both helped define the genre and give it an unfavorable reputation. Määttä (2006) gives a highly detailed account of how science fiction and its reputation were established in Sweden.

control (Holmberg, 2010; Olsen, 1992). With the method of intentional estrangement, science fiction becomes a tool that helps us make sense of where we are heading, how we could manage major development in technology and knowledge, and what we are doing as a society (Benedikt, 1991; Lovén, 2010; McCaffery, 1991; Määttä, 2006; Määttä, 2010; Nilsson, 2010). Science fiction is then primarily used for *critique* and *reflection*, “providing possibilities for a diagnostic critique” (Kellner, Leibowitz & Ryan, 1984, p.2) and an arena for thought experiments that investigate moral implications in unknown situations (Farstad, 2010; Holmberg, 2010). However, these explorations are often done with limitations; most science fiction is produced in western society, and generally there is also a clear lack of normative criticism or feminism (Kramarae, 1998). Patriarchal power hierarchies are seldom in focus, nor gender issues such as equality and sexual orientation. However, there are exceptions, such as Anne McCaffrey’s *The Ship Who Sang*, Joanna Russ’ *The Female Man*, and Ursula K. Le Guin’s *The Left Hand of Darkness*.²⁸ Michael Godhe (2010a) brings into light a range of largely unknown feminist utopias from the seventeenth century and onwards, and in mainstream popular culture there are science fiction narratives with strong female leads such as *Alien* (1979) by Ridley Scott and *The Terminator* (1984) by James Cameron. Two movies that are central in my study and that do have strong female leads are *eXistenZ* (Cronenberg, 1999) and *Avalon* (Oshii, 2001). The TV series *Sense8*, created by Michael Straczynski, Andy Wachowski, and Lana Wachowski, have strong motifs related to different queer aspects, such as homosexuality and transgender. However, considering the creators of the studied narratives, the male dominance is striking. Out of the studied narratives, *none* were written or directed by a woman, except for *You’ve Got Mail* by Nora Ephron and the Matrix franchise by Lana Wachowski (together with Andy Wachowski). The first one is highly marginal in my study – it is only the title sequence that features virtuality – and the second one is of special interest concerning mainstream science fiction, normative criticism and feminism; Lana is a transgender person who made her transition during the production of the Matrix sequels.

Science fiction is a multifaceted genre – if it is a genre at all – and it has a complicated relationship with the rest of popular culture and society at large. For example, science fiction movies might appear marginalized but nevertheless they generate huge box office successes (such as *Alien* and *Avatar*), as well as acclaimed reflections on society (exemplified by *Blade Runner* and *2001: A Space Odyssey*).

The selected narratives

I have done full or partial readings of quite a number of narratives. A full reading has involved analyzing all observed signs of virtuality in the whole narrative. Occasionally, paratexts such as interviews and behind-the-scenes material have been included, and in such cases noted in the list of narratives below.²⁹ It has also

²⁸ Murphy (2008) discusses Stephen Baxter’s *Coalescent* from 2004, a novel describing the formation of a matriarchal posthuman hive colony. I have analyzed several of Baxter’s stories, however *Coalescent* is not included in my study since it does not deal with virtuality.

²⁹ See Genette (1997) for an introduction to the concept of paratext.

involved the drafting of a super-sign tree structure for all observed signs. A partial reading has *not* involved such an investigation of the super-sign structure, and I have then analyzed only a limited sequence of the movie, not the movie in its entirety. A full reading was often employed on movies where the portrayal of the virtual is central to the plot and/or style of the movie, while a partial reading sometimes concerns only one or a few scenes. In a full reading I have explored the world of the particular movie and how virtuality is situated and represented in that fictional world. In a partial reading I have contextualized the signs not so much in the movie where they are used, but more in relation to the intertextual fabric of signs used in other movies.

The following movies are my *primary selection* and have been subjected to a full reading. They are sorted according to release year.

- ***Tron* (Lisberger, 1982).** This was one of the very first movies where the story takes place partly in the actual world and partly in a virtual world. A computer game developer is digitized into a computer where he fights virtual characters, liberates the world from an oppressive Master Control Program, and returns to the actual world in order to win back control over his company. The movie was influential and groundbreaking in many ways. Since the computer graphics of the era was very simple, the virtual environments realized by computer graphics were correspondingly stylistic and abstract. It was not possible to animate complex characters, so actors were shot live action and then the footage was heavily color graded and manipulated in order to mimic the look and feel of the virtual environments. The production was an unwieldy combination of digital and analogue techniques, situated as it was in the early development phase of computer graphics (Patterson 1982; Sorensen, 1982; Montfort et al., 2012).³⁰ The commentary track of the 2002 DVD release was included in the analysis.
- ***Johnny Mnemonic* (Longo, 1995).** This is a screen adaption of a short story by William Gibson. The protagonist Johnny is a data courier who carries secret digital data in head-implants and the cure for a disease has been uploaded into his storage. His goal becomes to download the data and publish it free online before the hired killers of an evil pharmaceutical company catch him and take the data, including his head. The virtual environments he enters in order to achieve this goal are created by computer graphics which had been substantially developed during the thirteen years that separates it from *Tron*. The depiction of virtual reality is fairly realistic; characters don different sorts of virtual reality head-mounted displays (goggles) and data gloves in order to enter and interact with the virtual.
- **The Matrix franchise (Wachowski, 1999-2003).** *The Matrix* is a typical Hollywood high-concept movie with an excess of action, violence, and advanced visual effects. The two sequels (*The Matrix Reloaded* and *The Matrix*

³⁰ The color grading of the virtual characters was a highly labor intense and complex photochemical compositing process.

Revolutions) upped the ante with increasing levels of action, violence and visual effects, while suppressing the more philosophical issues brought up in the first installment. Also, nine animated *Animatrix* short films (*Final Flight of the Osiris*, *The Second Renaissance parts 1 and 2*, *Kid's Story*, *Program*, *World Record*, *Beyond*, *A Detective Story*, and *Matriculated*) were produced, investigating different aspects of the Matrix universe, and employing quite different visual styles. The Matrix franchise tells the story of Neo, a computer hacker who thinks he lives in the real world, until a band of rebels helps him break out of the virtual illusion. He learns that intelligent machines have enslaved humanity and hold most of humanity in a virtual prison. A battle against the machines rages both in the actual world and the virtual world. The climax gives a truce between men and machines, brought about by the self-sacrifice of the Messiah-like Neo. The Matrix franchise had good success in sales, received fairly good critical response, and has been discussed frequently by academics. I would even argue that it has gotten too much academic interest, casting an unfortunate shadow over the other movies mentioned here, many of which offer interesting readings well in parity with *The Matrix*. Virtual environments are realized with live action, occasionally enhanced with visual effects.

- ***eXistenZ* (Cronenberg, 1999)**. Compared to the dominance of *The Matrix*, Cronenberg's movie takes the form of a small quiet art movie. It offers interesting critical comments on our dependency on technology, and it tells its story with a limited arsenal of visual and special effects. Designers of a futuristic, very realistic computer game flee from an assassination attempt, and get increasingly lost in meandering levels of virtuality. The final dialogue line – "...are we still in the game?" – is an efficient summary of the issues raised in the story. All parts of the narrative were shot as live action.
- ***The Thirteenth Floor* (Rusnak, 1999)**. With simple means and few visual effects, this movie tells the story of three different levels of actuality and virtuality. It is a classical breaking-out-of-the-virtual story; characters who initially believe they live in a real world come to the conclusion that they are virtual characters living in a virtual simulation. The plot also involves a romance, murderous jealousy, and issues concerning authenticity when a real woman falls in love with a virtual man. The virtual worlds are not created with computer graphics but with tinted live action footage.
- ***Avalon* (Oshii, 2001)**. This is a story dealing with different levels of computer game virtuality, and characters trying to find new levels and break out into a supposed actuality. One interpretation could be that while *eXistenZ* anxiously reminds us to keep track of the actual, *Avalon* suggests that it might not be so relevant. The virtual environments are created with heavily color graded live action footage. The movie was produced in Poland and Japan, and directed by Mamoru Oshii who often juxtaposes violent action with highly contemplative sequences. The commentary track of the 2003 DVD release was included in the analysis.

- ***Life on Mars* (Graham, Jordan, Pharoah, 2006)**. BBC produced this fourteen-episode drama TV series about the Manchester police officer Sam Tyler who gets mysteriously caught in a slightly exaggerated version of 1973. The unanswered question of whether he is “mad, in a coma, or back in time” reverberates through-out the two seasons, and Sam reluctantly realizes that he prefers the intriguing characters populating the illusion instead of the actual world, which he desperately tries to get back to. The series is highly character and dialogue driven and set in a bittersweet rethinking of a 1973 that never was. It is an interesting counterpart to movies such as *The Matrix* and *Tron* since it is almost devoid of action, visual effects and computer graphics. The commentary track of the 2006 DVD release was included in the analysis.
- ***Tron Legacy* (Kosinski, 2010)**. A late sequel to *Tron*, this visual extravaganza tells the story about how Kevin Flynn from the first movie was again captured inside the virtual world of his own creation. The virtual character Clu runs amok trying to build “the perfect system” and eventually builds an army of virtual characters ready to invade the actual world. Kevin’s son Sam enters the game and saves the day. The first *Tron* movie was daring and overambitious, attempting to create imagery that had never been produced before, and barely succeeding in getting the vision to the screen. *Tron Legacy*, seemingly without effort, creates a beautiful and complex virtual world, wallowing in an excess of visual style, action and visual effects. In *Tron Legacy*, the boundary between indexical (live action) imagery and simulated (computer graphics) imagery breaks down. *Tron* established many of the tropes in a poetics of virtuality; *Tron Legacy* made them look gorgeous.

The following movies have been *partially analyzed*, and they are sorted according to release year.

- *The Wizard of Oz* (Fleming, 1939) – early depiction of volumetric display
- *Forbidden Planet* (Wilcox, 1956) – early depiction of volumetric display
- *2001: A Space Odyssey* (Kubrick, 1968) – a canonical, epic story about mankind’s place in the universe, our origin and future. The novel by Arthur Clarke and the movie script was written in parallel, in a collaboration between Clarke and Kubrick.
- *Star Wars* episode IV (Lucas, 1977) including commentary track from the 2004 DVD – one of the very first depictions of holograms, as well as the well-known computer graphics display of the Death Star
- *Star Wars* episode V (Kershner, 1980) – minor elaboration on the holograms and computer graphics displays used in episode IV
- *Escape from New York* (Carpenter, 1981) – early depiction of wireframes and other computer graphics
- *Blade Runner* (Scott, 1982) – canonical cyberpunk story about renegade androids, framing philosophical musings about the nature of being human

- Star Wars episode VI (Marquand, 1983) including commentary track from the 2004 DVD – holograms and computer graphics displays
- The Lawnmower Man (Leonard, 1992) – early depiction of virtual reality, including a cybersex scene created with computer graphics
- Magnetic Rose (Morimoto, 1995) – anime short movie investigating the border between real and illusion
- Ghost in the Shell (Oshii, 1995) – an often referred to and debated anime cyberpunk feature film
- Virtuosity (Leonard, 1995) – featuring virtual environments and virtual characters
- Contact (Zemeckis, 1997) – an enigmatic sequence that might be real, or a dream, or an illusion
- Abre los ojos (Amenabar, 1997) – the Spanish original to *Vanilla Sky*
- Skyggen (Nielsen, 1998) – maybe the only cyberpunk feature film produced in Denmark
- You’ve Got Mail (Ephron, 1998) – short usage of computer graphics and virtuality in the title sequence
- Sofies verden (Gustavson, 1999) – philosophical discussions and diegetic fictions nestled inside each other
- Star Wars episode I (Lucas, 1999) – the modern prequel to the Star Wars saga upgraded the classic hologram
- The Cell (Singh, 2000) – primarily surrealistic virtual dreamscapes
- Space (Turner & Campbell, 2001) – a fictional virtual cube used as a class room in a science show
- Vanilla Sky (Crowe, 2001) – a man caught in a virtual world
- Resident Evil (Andersson, 2002) – brief usage of a hologram virtual character
- Star Wars episode II (Lucas, 2002) – further updates of the Star Wars hologram
- Minority Report (Spielberg, 2002) – canonical transparent screen and brief views of volumetric displays
- Ghost in the Shell: Stand Alone Complex (Kamiyama & Tachibana, 2002) – episode 9 from season 1 of this cyberpunk TV series
- Star Wars episode III (Lucas, 2005) including commentary track from the 2005 DVD – the most complex version of the Star Wars hologram
- Storm (Mårilind & Stein, 2005) – Swedish, semi-religious cyberpunk story depicting a world of memories

- Renaissance (Volckman, 2006) – French animated cyberpunk with highly distinct, high-contrast black-and-white visual style
- X-men: the Last Stand (Ratner, 2006) – futuristic depiction of virtual reality simulation
- Sunshine (Boyle, 2007) – plausible depiction of a virtual reality cube
- Resident Evil Extinction (Mulcahy, 2007) – hologram virtual character
- Atom (Usborne, 2007) – visualizations in a science show, inserted into live action shots
- Iron Man (Favreau, 2008) – holograms and heads-up displays
- Life on Mars (US) (Katlman, 2008) – the American remake of the Life on Mars TV series
- Avatar (Cameron, 2009) – complex holograms
- District 9 (Blomkamp, 2009) – complex holograms and heads-up displays
- Terminator Salvation (McG, 2009) including commentary track – virtual character
- Gamer (Nevelandine & Taylor, 2009) – mix of mediation and virtuality
- Chatroom (Nakata, 2010) – text-based chatrooms metaphorically represented as spatial, virtual environments
- Resident Evil: Afterlife (Anderson, 2010) – brief usage of virtual environments
- Inception (Nolan, 2010) – artificial dream worlds nestled inside each other
- Total Recall (Wiseman, 2012) – palm-phone that projects a virtual display
- Man of Steel (Snyder, 2013) – hologram virtual character

The movie *Blade Runner* (Scott, 1982) has a clearly canonical status, and it has been much debated among academics (Boşnak, 2001; Bruno, 1987; Bukatman, 1997; Godhe, 2010b; Hayles, 1993a; Heuser, 2003; Lacey, 2000; Lovén, 2010; Marder, 1991; McCaffery, 1991; Neumann, 1999; Schroeder, Huxor & Smith, 2001). The plot concerns replicants, artificial humans, and it has been discussed with Baudrillard's concept of simulacra as a springboard (Bruno, 1987). However, these replicants are actual and physical artificial beings, not virtual characters, and therefore *Blade Runner* is not central to this poetics of virtuality, even though it will be mentioned occasionally.

Literary portrayals of virtuality from two writers have been included. These texts can be considered as *partially analyzed*. William Gibson's work was included due to its canonical status in the cyberpunk genre (Benedikt, 1991; Crang, Crang & May, 1999; Csicsery-Ronay, 1992; Disch, 1998; Godhe, 2010b; Gordon, 1992; Guynup, 2002; Hayles, 1993a; Heuser, 2003; Hollinger, 1991; Kerman, 1992; Lacey, 2000; McCaffery, 1991; Rheingold, 1991; Lovén, 2010; Turkle, 1995). His complete work related to virtuality, six novels and one short story collection, has been analyzed. Several novels and short stories by Stephen Baxter have also been included due to

his occupation with *Virtuals* and the rich and consistent descriptions he offers (these are volumetric display of an artificial intelligences, a sub-category of what is commonly referred to as Intelligent Virtual Agents). Baxter is not widely discussed by academics, even though Pierce (1993) and Bould (2003) refer to him as a hard SF author.

Texts by William Gibson.

- *Neuromancer* (1984) – Gibson’s first cyberspace novel, about a computer hacker who uses hacker attacks to free a mighty artificial intelligence
- *Burning Chrome* (1986) – collection of short stories, some of which take place in the same future as *Neuromancer*. The short stories *Burning Chrome*, *Dogfight* and *Fragments of a Hologram Rose* are discussed in this poetics. The title story was first published in 1982.
- *Count Zero* (1986) – Gibson’s second cyberspace novel describes how the artificial intelligence, *Neuromancer*, fragmentize into multiple sentient entities and populate cyberspace
- *Mona Lisa Overdrive* (1988) – Gibson’s third cyberspace novel, further exploring the characters and ideas from the previous novels
- *Virtual Light* (1993) – describes technology closer to real-world technology than the technology in his previous cyberspace novels. This novel concerns a hunt for a pair of augmented reality glasses
- *Idoru* (1996) – events circulating around the love story between a famous singer and the virtual character Rei Toei
- *All Tomorrow’s Parties* (1999) – a struggle between different agencies finally results in the virtual character from *Idoru* becoming physical by means of nano-replicator technology

Texts by Stephen Baxter; the Xeelee universe holds an epic story about far-future galactic wars, frequently describing virtual characters similar to Rei Toei in Gibson’s *Idoru*.

- *Ring* (1994) – epic novel in the Xeelee universe
- *Transcendent* (2005) – novel about the near and far future of the Xeelee universe
- *Phase Space* (2002) – short story collection with *Dante Dreams* and *Touching Centaury*
- *Traces* (1998) – short story collection with *Darkness*
- *Reality Dust* (2000) – metaphysical novella set in the Xeelee universe
- *Resplendent* (2006) – short story collection set in the Xeelee universe, with *The Siege of Earth*
- *Proxima* (2013) – space colonization novel

In addition to these texts, I will also mention a few additional texts from science visualization, computer art, computer games, and advertising.

Analyzing the narratives

When I started this research, I had seen all movies previously, at least once, sometimes twice before. When I re-watched the movies I made notes describing the signs I observed, considering what aspects of the movie might give me the expression of virtuality. Is it something someone said or did? Is it because of the way things look, or the way things are seen by the camera? The distinction between how things look and how we see them is an important one, highlighting the levels of denotation and connotation that often take place; for example, the image of a knife on a kitchen table represents a knife on the kitchen table, but the signification does not stop there. The fact that the movie editor has cut to the image of a knife on the table also means something; the knife is going to be used and probably not for dicing vegetables. The diegetic fictional world is loaded with signs – while real-life is comparably free of meaning (Sonesson, 2001). In real-life, rainy weather does not represent your sadness.

How do we know if a sign actually signifies virtuality? Peirce wrote, “nothing is a sign unless it is interpreted as a sign” (Peirce, 1931-58, vol. 2 p.172). The analysis has been done under the assumption that if *I* see a sign, it is a sign in the context of *my analysis*. This does not mean that the discussion is closed. No interpretation can be regarded as final. It is a pragmatic stance taken in order to make it possible to have a proper discussion. The signs that have been observed range from signs that might not be signs at all – such as a green tie – to signs whose signification of virtuality seems highly probable – as when Neo asks Morpheus; “are we inside a computer program?” (both examples from *The Matrix*).

After watching the movies my notes were imported into the qualitative analysis tool Nvivo (Figure 8). This tool was used to code the notes; that is, the written notes describing the observed signs were analyzed and a code was assigned to each unique sign (a type). A code is essentially a category, a short descriptive name such as [glowing outline] or [optical distortion]. These codes are re-used (by assigning the code again) for every occurrence of this particular sign (a token).

Name	Sources	References	Cr	Created	Modified On	Modified	
[CATEGORIZATION COMPARISON]	0	0	2	TE	2010-02-16 11:44	TE	
[TOP] arbitrary (might not represent virtuality at all)		0	0	2	TE	2010-0	TE
[S] Matrix Morpheus green tie	0	0		2010-02-25 1	TE	2010-02-25 16	TE
[S] sound; Matrix sliding blade	0	0		2010-02-25 1	TE	2010-02-25 16	TE
high complexity	0	0		2010-02-25 1	TE	2010-02-25 16	TE
layers of code within each other	0	0		2010-02-25 1	TE	2010-02-25 13	TE
sound; screaming scary	0	0		2010-02-25 1	TE	2010-02-25 16	TE
[TOP] artifact		0	0	2	TE	2010-0	TE
[TOP] complex		0	0	2	TE	2010-0	TE
[TOP] contrasting the tangible		0	0	2	TE	2010-0	TE
[TOP] elaborating the intangible		0	0	2	TE	2010-0	TE
[TOP] representational		0	0	2	TE	2010-0	TE
[CATEGORIZATION FREE]	0	0	2	TE	2010-02-16 11:44	TE	
[CATEGORIZATION PRODUCTION BASED]	0	0	2	TE	2010-02-16 11:44	TE	

Figure 8. Example of the Nvivo interface supporting the work to code and categorize signs.

When coding signs it becomes important to separate between what Peirce (1931-58) refers to as the *types* and *tokens* of a sign. The type of a sign is the sign on an abstract, general level, the “class of all occurrences of the sign” (Sebeok, 1999, p.41). The token is the instance of the sign, the actual usage of it, “a particular occurrence of a sign” (ibid., p.41). In my coding of signs, every code describes a sign type, while the coded occurrences point out the tokens.

Open coding was used, letting the codes emerge out of the observations. I did not start the coding with a pre-determined set of codes which I then made the observations fit. Instead, the necessary codes were created depending on the signs that were encountered in the list, making the codes fit the observations. The distinction between coding with or without a pre-determined set of codes has been debated in the Strauss-Glaser debate concerning emergence versus forcing of empirical data (Glaser, 1992; Glaser & Strauss, 1967; Kelle, 2005). Here, there are similarities with the conflict in hermeneutics between Habermas and Gadamer. Both conflicts concern how much you should use and acknowledge your tradition (a collective term for pre-knowledge, prejudice and such which you bring to any interpretation). Tradition cannot be exorcised or turned off; it is always there. This study of virtuality was primarily explorative; the existing models and frameworks for conceptualizing virtuality have neither been unified nor elaborated into detailed hierarchies. They have not been adapted to analyze fictional representations of virtuality either. Therefore, open coding was used, with the intention of fitting theory to the data and avoiding the reverse. Creating pre-determined codes would have been guesswork based on prejudices, and thus an unnecessary amplification of the unavoidable tradition. Of course, this does not mean that the coding process was approached with a completely blank mind. As both Strauss and Gadamer have pointed out in the two above mentioned debates, it is impossible to not have a tradition. My own familiarity with movie making gives me ready-made codes such as [color grading] or [dialogue reference]. We can never escape the categorizing prison of language itself.

After the signs had been coded, I explored the way they could be grouped with other signs that show similar aspects in some way. The point of making these higher level categories were to highlight themes, similarities, and differences in fictional representations of virtuality. I tried to formulate straightforward categories such as [color] or [dialogue reference], but the diverging nature of the signs sometimes called for more diffuse categories such as [conceptual properties of the world]. The categories are then arranged into further levels of top-categories, forming a hierarchy in order to create an easily reviewable structure that highlights themes, similarities and differences in fictional representations of virtuality. Creating relevant and revealing top-categories has been a difficult part of the analysis. In order to keep the analysis open and flexible I have allowed the structure to grow both top-down and bottom-up. Bottom-up means reviewing the existing bottom-level categories and considering relevant higher-level groupings. Top-down means theorizing potential high-level hierarchies – such as [visual style], [production design] and [plot] – and seeing if they can be used. On the middle-level

– where the different approaches so meet – there has been much negotiation between different structures.³¹

Super-signs were coded as well as signs. This illustrates the difference between the super-sign hierarchy and the category hierarchy; super-signs are not a categorization. A category goes across the whole sample of movies, while a super-sign can never traverse between the diegetic worlds of the movies. If we take the Matrix [curtains of green glowing code] as an example, the green color is categorized under the category [green color] alongside with all other usages of green color in other movies, while the [curtains of green glowing code] itself is a super-sign unique for the Matrix franchise, but categorized under the category [behind the scenes metaphor] and this category holds examples from other movies as well.³²

Interpreting super-sign structures

During the coding process the super-signs and their structure were identified. Signs' ability to form hierarchies results in the super-signs Eco (1976) describes.

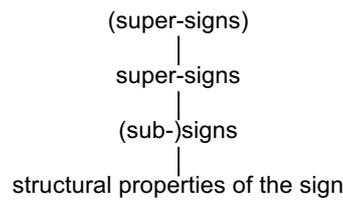
In order to identify possible super-signs, every individual coding was done with the questions: *does this sign consist of sub-signs? Does this sign aggregate with other signs, creating a super-sign?* For example, the Agents in *The Matrix* signify virtuality since they are supposed to be sentient programs inside the virtual world, and not really living humans at all. Thus, [Agent] is a sign. But what makes it a sign of virtuality? Are there details that discern the Agents from actual humans? Yes, for example their superhuman strength, their hive mind silent communication, and their similar, repetitive looks. Each and every one of these details is a sign in itself, combining into the sign [Agent]. This makes [Agent] a super-sign.

What about breaking down a sign such as [superhuman strength] into sub-signs? This sign could be broken down to the specific details of how a fist hits a wall, how the wall fractures, the thud of the impact, and how dust rises into the air. The sign could be broken down into such sub-signs, but I do not regard them as relevant for how virtuality is represented in our popular culture. These details are, in the words of Eco, “structural properties of the signal” (Eco, 1976, p.92). They could just as well signify the strength of Superman, and not the virtual world strength of Neo. Whether the details of a sign can be regarded as sub-signs or merely structure depend on the contexts and the intended meaning.

³¹ Also, I attempted to use the Semiotic Square – a method organizing oppositions in different configurations (Corso, 2014) – in my analysis. I came to the conclusion that the Square did not provide sufficient insights, partly because the different contrary oppositions did not form relevant implication pairs when contradictions were introduced. For example, in the [actual] / [virtual] opposition, the contradiction [not-virtual] collapsed with [actual]. Also, the concepts I have studied tend to form subsets and not opposing pairs. For example, virtuality is a subset of reality, and a fictional virtual world is a subset of the framing diegetic world.

³² The Matrix [curtains of green glowing code] is a recurring visual motif in the Matrix franchise, where lines of enigmatic computer code either falls like rain across the screen, or outline objects in the virtual world.

So, we have a hierarchy as follows (note that there can be more than one level of super-signs nestled within each other).



For each full reading of a movie, a model of the super-sign structure was constructed, using the software XMind. The structure is thus explorable as a tree hierarchy, and possible to overview at a glance. XMind is a mind mapping software, but the super-sign structures are *not* mind maps; they are semiotic structures showing relationships between signs, relationships that describe how signs signify together.

I have chosen to make as direct connections as possible between my watching of the movies and the final poetics, to be able to backtrack my thoughts and also to make a huge body of observations easier to grasp and navigate through. This does not mean that I believe the interpretation can be formalized or mechanized. The reading of a movie is vague, personal and subjective. I choose to foreground the methods I use, encouraged in this by the discussion within ethnographic writing concerning foregrounding of the analytical and interpretational process (McCloskey & Megill, 1987; Merton, 1968). The super-sign structures are a product of my interpretation, a property of *my reading* and not a property of the analyzed narratives. My work does not discover these structures; they are not fossils dug out of the ground. Just as in any interpretation of a text, they are negotiable readings grounded in the reader's own tradition.

Studying media productions with self- and auto-ethnography

Approaches to conducting ethnography

We could argue that an individual is best situated to describe his or her own experience more accurately than anyone else. (Wall, 2006, p.3)

The poetics of virtuality that I present is partly based on a study of my own work practice in a handful of media productions. The study of your own work practice is debated and to some degree controversial in scientific research. My comfort with it stems from my training as an architect, and my practice in creative and design oriented endeavors such as graphic design and media production. As an architect, I am trained in the iterative cycle of reasoning-designing-evaluating. Design processes are highly iterative, at least in theory (Lundequist, 1998; Rosell, 1990; Wählström, 1990). In practice, the iterations do not form neat, sequential loops, but rather a complex web of interacting back-and-forth movements of different time-scales (Winograd, 1996; Lundequist, 1998; Norman, 2002; Rosell, 1990). An important aspect of these iterative loops is the back and forth movement between different modes – between the whole and the details, and between intuitive, spontaneous sketching and rational, dialog-based evaluation (Branzell, 1992; Hileman, 1998; Lundequist, 1998; Rosell, 1990). A design process is a continuous movement between letting thoughts drift, and nailing thoughts in the interrogative light of conscious reflection. Methods of self-reflection and self-criticism are well-established work practices in many design areas. Can this work practice in which I am trained be turned into a scientific method? Can I explore the silent knowledge in my head by listening to what the mind whispers to my hand when I do my practice? It might be that self- and auto-ethnography is ideal for studying production culture and design processes, since these by default share the experimental, self-reflective and evaluative process of scientific research.

Why self- and auto-ethnography?

When deciding on a research method, it is not only a matter of fitting the best solution to the specific problem. It is also a matter of choosing a solution that accommodates and utilizes the actual and specific situation, context and circumstances. This results in an optimized research method, making the best of the available potentials for interesting observations (Brannick & Coghlan, 2014; Creswell, 2003; Riemer, 1977). As a researcher involved in actual media productions, I have access to my own work practice and production culture. This gives access to a reservoir of practice based empirical observations. Utilizing this connection between theory and practice works well when formulating a poetics, since a poetics traditionally stretches between theory and practice.

This particular combination of self- and auto-ethnography, production culture studies and design studies that is put to use here is quite rare. Studying your own design process is common practice, implemented in quite different manners, for

example in artistic research, in action research and design-based research.³³ John Thornton Caldwell and others have done ethnographic and even partly self-ethnographic studies of production culture in the movie industry, studies that are highly insightful.³⁴ Combining the different approaches, adding self- and auto-ethnography to practice-based research, creates an opportunity to make well-documented and orderly observations of real-life design processes.

Ethnography, self-ethnography and auto-ethnography

Ethnography is the study of social interactions, practices and events. The study is done as fieldwork; the ethnographer observes and participates in the everyday practices of the group of people that is studied. The observed social expressions – what people do and say – are described and to some extent interpreted and assigned a meaning (Atkins & Hammersley, 1989; Clifford, 1986a; Geertz, 1973; Hughes et al, 1994). Writing ethnography is a re-coding, a movement going from the decoding of that which is culturally coded, to a new encoding in the final theoretical writing by the ethnographer (Clifford & Marcus, 1986). Ethnography primarily provides descriptions and interpretations, rather than explanations or theories (Atkinson & Hammersley, 1989).

In most research it is generally taken for granted that the researcher is something to be exorcised out of the process, as if the researcher could infect and pollute the results. Ethnography embraces the presence of the researcher, as emphasized by Atkinson & Hammersley (ibid., p.19).

Once we abandon the idea that the social character of research can be standardized out or avoided by becoming a ‘fly on the wall’ or a ‘full participant’, the role of the researcher as active participant in the research process becomes clear. He or she is the research instrument par excellence.

However, we need thorough methods to use that instrument in the best manner, and we need to be skeptical towards the observations and interpretations that this instrument produces.

The methods of ethnography require us to turn ourselves as research instruments towards other groups of people, in some way external, foreign, alien. The ethnographer needs to break into this group of people, and to break into their practices. In *self-ethnography*, we turn ourselves towards a group of people where we already belong. Here, we need to break out of the group and to break out of our practices. In *auto-ethnography*, the observer turns herself towards the own self, and observes herself in a particular role, in my own case the role as computer graphic

³³ Action research and design-based research is often used in research on pedagogy or on usability and graphical interfaces, fields of study that I have previous experience with.

³⁴ As early as 1950 the anthropologist Hortense Powdermaker wrote the ethnography *Hollywood: the dream factory*, and in 1941 Leo Rosten published the sociological study *Hollywood: the movie colony, the movie makers*. More contemporary studies have been performed by Horace Newcomb, Robert Alley, Todd Gitlin, Elizabeth Traube, Barry Dornfeld, Arlene Davila, Laura Grindstaff, Vicki Mayer, and Georgina Born.

artist. In auto-ethnography the researchers need to break apart herself. When you are a stranger to a group, you need to do much work to observe and interpret practices and their meaning, because you have never encountered them before. When you are a part of the group, you also need to do work, but now it is a matter of discovering things that are so taken for granted that they might be easy to miss, or of opposing structures, explanations and interpretations that you have been indoctrinated to accept and take for granted.

In a self-ethnography, a group of others is studied while in auto-ethnography the researcher studies herself. The key difference is that in the latter the observer has direct access to the experiences, feelings and reasoning that floats through her mind. It is as if we could mind-read the informant, instead of just watching her from outside. There are dangers in regarding auto-ethnography as mind-reading. It is mind-reading in one sense – we actually do observe our own feelings and thoughts – but we have to acknowledge that this access is actually *mediated*. Even though we observe our own mind there is still a layer of mediation, of representation, of interpretation.

Achieving credibility – the critical debate on self- and auto-ethnography

Self- and auto-ethnography have been debated and criticized. Objections that have been raised are that the methods are too narcissistic, that they rely too much on one source, and that the closeness between the observer and the observed clouds judgment and analytical abilities (Brannick & Coghlan, 2014). Already in the late 1970s ideas on the acceptance of personal writing emerged and opened up for “experimental writing projects that blended the genres of ethnography, biography and autobiography” (Reed-Danahay, 2001, p.411). Much of the debate on personal writing played out in the journal *Current Anthropology* (Honigmann, 1976; Mandelbaum, 1973; Nash & Wintrob, 1972; Sangren, 1988; Strathern, 1987). The term auto-ethnography originated from Hayano (1979). In ethnographic studies of professional practices it is quite common to study your own work (Atkinson & Hammersley, 1989). In ethnography, there has been a general shift from colonialism, the conventional image of a white man studying estranged tribes, to insider accounts, where the study of your “own cultures offer new angles of vision and depths of understanding” (Clifford, 1986a, p.9). According to Reed-Danahay (2001) self- and auto-ethnography is the outcome of a general shift towards a focus on the personal narrative, influenced by different merging trends; trends towards social practice in social theory (Cohen, 1994; Giddens, 1991), towards social and cultural poetics (Fernandez & Herzfeld, 1998; Lavie, Narayan & Rosaldo, 1993), and towards a more reflexive ethnographic writing (Cole, 1992). Today, self- and auto-ethnography are established methods within an international community of researchers and universities (Bochner & Ellis, 2000; Ellis, 2004). There are a number of conferences and journals accepting publications based on self- and auto-ethnographic research, for example the conference *Cumulus 38° South* and the journal *Forum: Qualitative Social Research*.

The utilization and reliance on narrative – telling stories – is one of the criticized aspects of self- and auto-ethnography (Johannisson, 2002; Reed-Danahay, 2001).

Narrated accounts of real life events are often marginalized and devalued as being anecdotal. A core strategy in order to achieve credibility is to establish traceability; every claim and every account need to be connected back to the initial observation. Thorough and systematic field notes are vital in order to achieve traceability, so that every interpretation can be traced back to an observed behavior (Atkinson & Hammersley 1989; Holt, 2003; Wall 2006). This strategy relates closely to the concept of thick description (Geertz, 1973), an ethnographical method where not only the observed behavior but also the context is carefully explained. The intention is to make it easier for the reader to make her own interpretations of the behavior. However, the ethnographic researcher is always an interpretational link between the field setting and the reader (Brannick, 2014). The role of the ethnographer is to interpret, orchestrate voices, and do this within an analytical framework.

Another necessary methodological strategy in self- and auto-ethnography is self-reflectivity and self-criticism. Research in general demands a self-critical stance towards the results and claims we as researchers make, and even more so in self- and auto-ethnography. The hermeneutic approach to interpretation is very useful in this. Hermeneutics as a method is a “deeply self-reflexive and self-critical process” (Prasad, 2002, p.24). Teresa Brannick and David Coghlan (2014) suggest that through reflexive awareness we can articulate tacit knowledge and rephrase it as theoretical descriptions. They emphasize that there are two kinds of reflection that must be carried out: the epistemic reflection that challenges the researchers assumptions and tradition, and the methodological that monitors how the research is conducted and how it impacts the field setting and the informants.

The ethnographer must also avoid becoming rhetorical or political; ethnographic writing should not be an ideological projection (Clifford, 1986b).

The study of me – narcissism, self-disclosure, vulnerability and censorship

One danger in self- and auto-ethnographic texts is the risk of becoming too self-indulgent and egotistical, so that the actual issues of the research are veiled and instead dominated by observations and discussions associated with the researchers own person (Atkinson, 1997; Bruner, 1993; Charmaz & Mitchell, 1997; Coffey, 1999; Holt, 2003; Sparkes, 2000). Self- and auto-ethnography is not about the individual; it is a study of culture and humans through the individual, towards “the understanding of a social phenomenon” (Johannisson, 2002, p.8). This requires a very delicate balance in the work of the researcher, and careful attention to the different voices in ethnographic writing. If auto-ethnographic writing becomes too narrow, too specific, or too related to you yourself, the work no longer holds much interest to anyone beside yourself. If your writing becomes too broad, too general, and makes too many assumptions about your own role as a representative for everyone else, your observations and writings lose credibility.

Self-disclosure in ethnographic studies has been discussed quite thoroughly (Atkinson, 1992; Denzin, 1989; Friedman, 1990; Tedlock, 1991; Van Maanen, 1988). Many advocate that ethnographers should become deeply and emotionally

immersed in their field work. Geertz (1998) criticizes the cultural studies done by Clifford and his followers for being non-immersive, hit-and-run ethnography. It is argued that vulnerability gives authority (Ryang, 2000; Behar, 1996). Vulnerability could be seen as a verification of honesty, closeness and commitment. Making myself vulnerable, for example exposing the ugliness of my own doubts on my capability as designer, my lack of coherent reasoning, and so on – gives me the authority to say I have been there, this was how I perceived it. However, Behar (1996) cautions that self-exposure “has to take us somewhere we couldn’t otherwise go to. It has to be essential to the argument, not a decorative nourish, not exposure for its own sake” (p.14). Since there is a danger in revealing your own flaws, you have to be careful how you present yourself (Ellis, 2007). Can there be issues of vulnerability when I study my own work in media productions? In my role as a computer graphic artist, there are questions that I should not ask, but in my role as researcher questions are a way to oppose and deconstruct the seemingly obvious. For example, as a movie maker I cannot ask why suspension of disbelief is so important. But as a researcher I can ask this apparently “silly” question.

Exposing my deepest flaws might damage my own career, either as an academic, as a computer graphic artist, or both. It is therefore inevitable that I will adapt a layer of censorship. In my study, the sensitive issues concern my role as a professional media producer. The very usage of that phrase highlights that it is important for me to regard myself as a *professional media producer*. Since I am the authorial voice here, it becomes very easy for me to describe my work process and myself in favorable terms. I might intentionally or unintentionally “forget” less favorable design decisions. I might rationalize originally unmotivated decisions and dress them up in fancy language borrowed from rational and theoretical ideas about how media productions ought to work. I must make a conscious effort to be harsh on myself in a careful and systematic manner. Also, this poetics of virtuality is not hugely dependent on the degree to which I am a professional media producer. It might be that some of the design decisions are not as thought-through as I claim, but that is not highly relevant for a discussion about representation of virtuality.

The study of others – achieving rapport and caring for informants

The autoethnographers relations to others have different levels of closeness and commitment, and the study of these others presents different sets of problems depending on these levels of intimacy. Ellis (2007) asks “how can we act in a humane, nonexploitative way, while being mindful of our role as researchers?” (p.5).

A good example is the fieldwork observations I did in the Environmental Science Investigation project where a group of people collaborated on a daily basis for about one and a half years. Initially, I thought of myself as someone observing others; it was easy for me to think of the other participants as informants, and when talking or socializing with them I often thought of this as building rapport. Then, after about six months, I passed a line. I had started becoming friends with some of the participants, and I made a thought-through decision to not think in terms of rapport and informants. *I had gone native*. I came to this decision not as a

researcher but as a friend and fellow human. When you spend much time with the people you observe it is natural to get to know these people quite well and develop friendship, something that Ellis (2007) has been discussing thoroughly. I came to the understanding that my fieldwork “radically deconstructs the boundary between the researcher as a representative for the scientific community and as a responsible subject in the social context concerned” (Johannisson, 2002, p.6). It is interesting to note the importance of the word *informant*. Newton (1993) mentions the shock one of her friends had when being referred to as an informant, and Carolyn Ellis asks (2007, p.7):

Who wants to spend time with someone who is out to use you for their own purposes? And how pleasant can it be to spend time with people who feel you are intruding into their lives?

What Ellis is pointing out is the problem with the un-equal power-balance that is created when someone is studying someone else. The observations we researchers collect give us an advantage since we apparently know more about the other than vice versa, and we can potentially use this knowledge by telling it to others. Therefore, contemporary ethnography is often focused on polyvocality, different attempts at letting the voices of informants be heard, even though the ethnographer always needs to be the editor and interpreter of these different accounts (Clifford, 1986a; Clifford, 1986b; Atkinson & Hammersley, 1989). The study of others also has a more emotional component; we are in a position where we use the other for our own purposes of earning professional prestige (Brannick 2014; Lincoln, 1995). An idealistic way to compensate for this utilization of others is to use a care-giving approach (Bochner & Ellis, 2006), where the strategy is “to research from an ethic of care” (Ellis, 2007, p.25). This could minimize the power imbalance by emphasizing research and writing that are of use and interest not only for the research community, but also for the involved informants as well (Newton, 1993), perhaps even empowering the informants (Atkinson & Hammersley, 1989). How can you give care when studying media productions? One thing I have done is to always work as professionally as I can, treating each production as a production and not as a field for careless experimentation. I have also often been as clear as possible with my research questions, openly discussing them in detail with whoever has been interested.

There comes the final moment when the written academic text is published, and the answer is given to the disturbing question *What happens when they read what I write?* Not willing to hurt people creates a difficult balance between honesty and damage control. Any ethnographic study might involve negative criticism towards and judgment of the people involved. In conventional ethnography, this is at least partly resolved when the researcher leaves the field setting. The career related risks of self-ethnography are more difficult to flee from since the researcher acts in her natural setting. It is obvious that this might lead to self-censorship and very difficult situations in the writing and publication of research results (Alvesson, 1999). In response to such concerns, Carolyn Ellis (2007) points out a few useful strategies. One approach is to write a first draft of the text without any censoring,

in order to build a text that is as “nuanced and truthful” (ibid., p.24) as possible. Then, for the final version, the researcher should do her own private negotiation between this first draft and what is ethically and socially acceptable. Depending on the specific issues, different levels of censorship can be deployed; the researcher can “omit things, use pseudonyms or composite characters, alter the plot or scene, position your story within the stories of others, or occasionally decide to write fiction” (ibid., p.24). My own addition to these recommendations is that the text needs modality markers that comment on done omissions or alterations, otherwise the resulting text might lose much of its potential usefulness as an academic text.

Influence from the research agenda

Generally in ethnography, the presence of the ethnographer and the informants’ awareness of the research agenda in itself can have subtle influences on what is observed, and what is said and done (Atkinson & Hammersley 1989), with the assumed danger of creating “a self-fulfilling prophesy” (Johannisson, 2002, p.13) instead of actual research results. If I study my own decision process, and if I, for example, anticipate that my designs will be influenced in a certain way, how do I know where this idea originally came from? Did I perform the design decision because I as a researcher hypothesized that I would do it? Or did I hypothesize it because I already knew I would do it? The following unedited field notes illustrate how the research agenda was in play during design work.³⁵

The Americans are supposed to have done much of module 4; I hope not so much that a grey-room microscope is ruled out. I would like to have it, and I need it for my research.

When talking about salmon images (problems with copyright) I offered to do Maya images (seeing an opportunity to test visual fidelity levels) and he was mildly positive, but reasonably suggested to do good content first, then see if we need to draw our own salmon pictures.

These field notes illustrate that my research question had had impact on the productions I have been involved with; I have occasionally made design decisions as well as suggestions for further design work with the primary intent of providing additional empirical observations. The risk seems obvious; I might attempt to design stuff that is not needed, the research question could corrupt the design process. However, there are always many different agendas behind production decisions. Media productions are a competitive environment where personal preferences, personal promotions, and insubstantial ideas about the potential audience clash with practical circumstances such as lack of resources, technical problems and approaching deadlines. As an example, my suggestion mentioned above to 3d model salmons never reached acclamation. This illustrates that in most production environments, the influences from any research question are simply

³⁵ From the Environmental Science Investigation project (February 10th, 2008, Hotel California and February 11th, 2008, Stanford University campus).

outrivaled by other concerns, and therefore it is acceptable to let research questions be a part of the process.

On a few occasions I deliberately decided to try the usage of a particular sign I was interested in and that I hoped would work as a sign of virtuality. The key word is “try”. There is nothing in my field notes that suggests that I insistently forced the usage of a particular sign, to prove a thesis or to argue that it should work. The process has instead been highly investigative, so that I have tried to use a sign and then realized that it did not work. One example is the [flickering] that I experimented with in the *Via Tecta* production, but which I finally abandoned in favor of other more successful signs such as [semi-transparency] and [blur]. This means that my self- and auto-ethnographical study has been in some sense intervention based, in the sense of injecting change and observing what happens. This injection of change is an important part of action research and design-based research, and it is also how design processes normally work, with the iterative circles where ideas are tested, evaluated and rejected. Therefore, even if my research question influenced the situation, the productions can still be regarded as naturalistic field settings.

So, the solution to the issue of influence from the research agenda is that the problem is not a problem; it is part of the empirical data itself. Yes, as a designer I do come to the sketchpad with my head full of ideas; what I actually study are all this knowledge, prejudice and these anticipations. So, the observation is not a self-invented, self-sustaining illusion or fraud; it is a self-invented, self-sustaining observation.

Creating distance

In self-ethnography, can we be close but avoid closure (Alvesson, 1999; Brannick & Coghlan, 2014)? Going native is in direct conflict with conventional ethnographic approaches, as explained by Atkinson & Hammersley (1989, p.90).

The comfortable sense of being ‘at home’ is a danger signal. From the perspective of the ‘marginal’ reflexive ethnographer, there can thus be no question of total commitment, ‘surrender’, or ‘incoming’. There must always remain some part held back, some social and intellectual ‘distance’. For it is in the space created by this distance that the analytic work of the ethnographer gets done. Without that distance, without such analytic space, the ethnography can be little more than the autobiographical account of a personal conversion.

The fear is that by going native, the researcher loses her ability to see clearly; she achieves the same viewpoint as the natives themselves, and loses her bird’s-eye-view (Atkinson & Hammersley, 1989; Clifford & Marcus, 1986). Does the ability to observe and analyze break down when the distance disappears? What do we mean by being close? Being close is to have extensive tradition (pre-knowledge) as well as emotional attachment. This is both a curse and a blessing. The abundance of tradition gives us a wealth of interpretational clues. Considering my own study, someone less immersed in the production culture surrounding movie making would most likely have a limited ability to interpret experiences in that field, while my interpretational repertoire is wider and deeper (albeit also twisted and tinted by

tradition). The emotional attachment means that we have a complex connection to what we study. This not only influences how we see things but what we see; we see different things. Neither the outside view nor the inside view is more superior than the other. They are different; they complement each other.

It is possible to create an observational distance in auto-ethnography, since we have a capability to assume different roles. Ethnography holds a contradiction between two authorities: the personal subjective “within or down in the middle of things” and the scientific observer “on the edge of a space, looking in and/or down” (Pratt 1986, p.32). Alvesson’s (1999) metaphor of breaking out illustrates how we can create the distance needed to observe and analyze that which is very close. This is a process of defamiliarization (Marcus & Fischer, 1986) and creating breakdowns of that which is taken for granted (Alvesson, 1999) – challenging our own ideas of the setting we study. This concept of breaking down viewpoints is well supported by the hermeneutic method. Gadamer (1989) advocated that we must genuinely question, a questioning characterized by a willingness to repeatedly oppose your own viewpoints and to accept new insights, regardless of how they challenge our own deep tradition. Our standard mode of perception is seeing without really seeing, just knowing we have seen. Merleau-Ponty (1962) writes that “nothing is more difficult than to know precisely what we see” (p.51), and then he illustrates that it is nevertheless possible to a degree, describing the situation of watching mountains on the horizon. When we observe the horizon we can see both distance and blueness. We experience distance, but we can also consciously understand that this comes from the blueness we also see on distant mountains. Reflection and conscious interrogation of our own experiences can create at least some distance, so that we may actually understand what we actually see.

My observations of production culture and virtuality

In the following pages I will discuss how the self- and auto-ethnographic method was applied in my study of media productions, and make some comments on how the methods worked in this context.

Taking field notes and analyzing observations

The moments of observation that occur in the field setting are quickly dissolved, and all that remains besides fleeting memories are the field notes, audio recordings, and artifacts such as sketches, to name a few. Field notes become vital for later analysis and interpretation. Writing is a central activity in ethnography, present at all levels from sketchy field notes to the final ethnographic account, and this emphasis on writing highlights that all ethnographic accounts are to some extent a construct (Atkinson & Hammersley, 1989; Clifford, 1986a). Concerning field notes, Atkinson and Hammersley (1989) suggest that “one should aim to make notes as soon as possible after the observed action” (p.176). Finding a rhythm between observation and note taking is important. In my own fieldwork, I made extensive and daily notes. One problem was that sometimes I was very pressed for time while working, so the notes were short. In order to find time for extensive field notes I started recording them into an audio recorder, a method I came to use extensively.

These field notes were analyzed similar to how the film study notes were analyzed: with coding in the qualitative analysis tool Nvivo. The coding of the field notes was not fully open; the coding of the film studies was done before the field notes, and categories related to semiotic codes (such as [color], [glow], [pixels] and so on) were inherited from the film study coding to the field notes coding. But many additional codes were created specifically for the field notes, primarily ones related to production circumstances (such as [lack of time] and [design discussions]). The analysis was done by categorizing the coded notes, looking for similarities and dissimilarities, and employing the reflective and self-critical mindset discussed earlier.

My context as a researcher and media producer

As a researcher I am part of the Digital Representation group in Göteborg, Sweden. Sven Andersson, my main supervisor, formed the group and our research approach, using semiotics and hermeneutics to study digital media. About half the group is located at the Faculty of Fine, Applied and Performing Arts at the University of Gothenburg, doing artistic research. The other half, where I am located, is at the Department of Applied Information Technology at Chalmers University of Technology.

The researchers in the Digital Representation group are practitioners working with media productions in different forms. Personally, I have been involved in various media productions for some years. It started in 1986 when I joined the editorial of the Swedish non-profit astronomy magazine *Astronomi & rymdfart*. Here I filled various positions such as editor-in-chief, writer and illustrator. My first media related employment came in 1995 at the Chalmers University of Technology,

designing and building web sites. From 1997 I spent three years as a web developer at the company Akzo Nobel, and then came to Chalmers Medialab in 2000, with the clear intention to do more advanced media productions than web sites. Since then, I have been involved in small and large productions, ranging from one week to one year in full time equivalent. I have contributed in various roles, for example as project leader, production manager, designer, movie maker, computer graphic artist, and writer. The academic environment where I do my research has had several media related university courses, and I have been deeply involved as a teacher and course manager for many of these. The course Digital Movie Making is highly related to my research area. I have been course manager for this course for fourteen years and supervised over a hundred student movie productions. I have also been working with research and teaching concerning usability and graphical user interfaces. This brought me to the division of interaction design in 2011. Here, my fellow researchers, as well as the teaching I do at our Masters program, Interaction Design and Technology, have given me ample experience in areas that I will bring up in this poetics, such as game design and augmented reality. When I worked at the Chalmers Medialab we had a virtual reality CAVE system. That gave me valuable insights in real-life virtual reality.

I have a Masters in Architecture, and besides movie production, I have worked with other design areas, such as graphical design. Creative professionals often move between, for example, industrial design, architecture and (movie) production design (Neumann, 1999; Rosell, 1990; Wählström, 1990). Architecture and production design in movies are considered especially close, design-wise (Neumann, 1999). Both architecture and movies are spatial and temporal arts, in that they both stage different kinds of movements through space and through time.

Although I would not consider myself a professional movie maker, I have insight in movie production that informs my readings and interpretations. Any poetics must consider considerations such as technical limitations (some things are more costly in time and money to do), technical possibilities (some things are asking to be done since they are technologically possible), collaborative issues (the nature of the team work and the artistic leadership might result in success or failure to achieve organic unity), among other things.

Achieving access to observe media productions

John Caldwell and other researchers at the University of California, Los Angeles have documented the difficulties of studying media productions, especially high-profile ones (Caldwell, 2009a; Caldwell, 2009b; Malcolm, 2009; Ortner, 2009). Caldwell speaks about aspirational cultures – production cultures where a large potential work force is trying to get into the industry and wants to say they are a film maker, pretending to be a part of Hollywood (Caldwell, 2009b). These are cultures that traditionally have been highly hierarchical and where it previously took years to achieve any level of creative leadership. Caldwell highlights that these production cultures are changing when digital technology, hardware as well as software, makes it possible for anyone to make a movie. He emphasizes that amateurs and semi-professionals now have the potential to produce high quality

media, and he describes it as a porosity between consumers and producers (illustrated in Figure 9).



Figure 9. Porosity between Hollywood and independent movie making – Hollywood professionals and semi-professionals including the author formed the crew of the short film Postcards from the future.

For me, it was quite trouble-free in most cases to achieve access to do auto- and self-ethnographic observations in the different semi-professional productions I have studied. But my studies demanded more than just having me sit in and listening; they required me to actually work hands-on with the production, and to interact in a conventional manner with the other participants. This was not always such an easily achieved objective, and identifying the gatekeepers that provide access (Atkinson & Hammersley, 1989) proved challenging in some cases. In one of the productions – Environmental Science Investigation – I started out with a quite marginal role and I gradually gained creative leadership. Initially, my involvement in the project was not clearly defined and the result was that I was occasionally excluded from design work. I became increasingly firm in my requests for an actual decision on who would work on design and production. Eventually I got my formal approval to work on the design of the virtual laboratory. Thus, in this kind of semi-professional production, creative leadership can very well be achieved by simply deciding to “grab the keyboard and the mouse and write the texts and do the graphics”, as I described the process in my field notes.³⁶ As another example, getting access to the *Postcards from the future* movie production was

³⁶ Field note entry from April 11th, 2008

a gradual process. I got contact with the director, Alan Chan, via e-mail, and when he got to see some of my previous illustration work, I was asked whether I wanted to contribute to his projects. While accepting the offer I also suggested that I could make an ethnographic study of the collaboration, and was given a formal consent. Showing my work also gave me access to working on the Via Tecta project. My collaborator, Jonathan Westin, stated that the reason why he invited me to the collaboration was that he had seen my work on Environmental Science Investigation.

But even when I had achieved formal approval for taking creative leadership, there were problems with losing access. In the Environmental Science Investigation production, there were occasions where one of the participants sidestepped my communication with the Flash programmers who coded the Virtual Gas Lab. This was probably due to ambivalence concerning my role as creative leader and also due to misconceptions concerning proper production procedures. These experiences correspond well with how Brannick and Coghlan (2014) outline how you as an insider can quite easily get general, primary access to a setting, but the same role can stop you from getting secondary access to certain areas. My role as a team member gave me general access, but since other members occasionally did not see me as creative leader, I was sometimes excluded from creative decisions. Another observation is that my role as an observer is quickly forgotten in most of the media productions I have participated in, a common situation according to Atkinson and Hammersley (1989); informants will “be more concerned with what kind of person the researcher is than with the research itself” (p.83). This prompted me to remind the participants of my role as observer. This was primarily for ethical research reasons, and it did not lead to any notable comments. The clearest indicator of this was that the participants almost never mentioned it; there were exceptions, though. Jonathan Westin in the Via Tecta production, himself doing slightly similar research on his own work process, was highly aware of my research agenda and we discussed it frequently.

Wall (2006) as well as Moustakas (1990) speak of immersion and incubation; the time consuming long-term contact with the field and the authority this provides. The field study needs to be sustained until “themes and meanings emerge” (Wall, 2006, p.5). Wall divides immersion and incubation into separate phases. First there is fieldwork, when we engage in “sustained focus... total concentration... and a deep exploration” (ibid., p.4). Then there is reflection after fieldwork, “a period of retreat” (ibid., p.4) where theory emerges un-forced out of the data. My experience is that the study of media productions takes place in a working environment where these demands are met quite well. The media productions I have been involved with have typically been long projects where a slow-burning creative process is occasionally interrupted by short periods of intense activity.

Summarizing my experiences in getting access in semi-professional media productions for self- and auto-ethnographic studies, I can emphasize that it is often a matter of showing what you can do and that you are willing to do it. One drawback with semi-professional productions is that this does not give direct access to the more high-concept media industry; it does not give you Hollywood.

However, semi-professional productions such as *Postcards from the Future* can give access to the production culture of professional movie makers.

Observing externalized and internalized design processes

How can autoethnography be used to study design processes and thus the semiotics of the designed and constructed images and narratives? The autoethnographic part of my research has been a study of design processes and their results, the sign production. An inherent difficulty in studying design processes is that they are to a large part an internalized process, and thus difficult to access and document. The externalized part of the design process – sketches, meeting discussions and so on – is possible to record, and document, but it represents only a fraction of the process.

Why is it difficult to document and study design processes, especially in movie productions? It is common that design decisions are made as a purely cognitive internal process, and then sketched down. Sketching is highly important for the iterative loop that characterizes design work (Branzell, 1992; Jonsson, 2002; Mitchell, 1996; Rosell, 1990; Wählström, 1990). However, traditional sketching – drawing visual drafts with pen and paper – can be difficult to use in movie making. Many directors use production design sketches, concept illustrations and storyboards extensively (Keegan, 2009), but many aspects of movie making are difficult to sketch effectively. For example, the work of the cinematographer is highly dependent on experience, guesswork and decisions during principal photography (Fauer, 2006). It is usually difficult and inefficient to sketch these decisions on paper, because cinematography is a matter of light and shadow, details and texture. This is not as easy to sketch as, for example, the shapes and colors that architects and industrial designers concentrate on.

Thus, the internalized design process is difficult to observe or document with external means. Autoethnography seems to be ideal for observing the internalized part of the design process. Events in the design process can be externalized, primarily via logbook entries. But a problem is that much of the design process is internalized so deep that not even the designer herself is guaranteed to understand all the mechanisms and processes leading up to a specific design solution. Designers often experience how an idea emerges seemingly out of the blue after a long period of meandering thoughts (Branzell, 1992; Lundequist, 1998; Rosell, 1990). Observing and understanding your own internal idea generation is a skill that is important for designers since it is highly related to your capacity to apply self-criticism, so a professional designer utilizing an autoethnographic approach is able to see down through some of the layers of consciousness, but never the whole way down. Knowledge of the *complete* design process is out of reach, and any description of a design process will always be partial.

As already mentioned, the externalized design process is possible to document, using recordings, sketches and so on (Freitas, 2002). The documentation that is most easily done and retrieved is design sketches and e-mail conversations. I archived all these kind of artifacts, and they have been useful, both as data in themselves and as a device to remind of the different details of each design

decision. I have been experimenting with other sorts of recordings and documentations. In the previously mentioned Environmental Science Investigation project we had a number of desktop videoconferences using the Marratech software that enabled me to record audio, video and shared whiteboard communication. The extent of the design related discussions were highly limited though, resulting in a limited usefulness of these recordings. In the Via Tecta project my collaborator Jonathan Westin generously allowed complete audio recordings of all our production meetings, resulting in a quite rich documentation of parts of the externalized design work. I have also experimented with recordings of my own design and production work. When doing these recordings, I made a screencast recording of the design work I did on my computer screen as well as an audio recording of my verbal explanations and reflections on what I was doing. These have proved to be of very limited value. Often, a sketches is an after-the-fact jotting down of already emerged ideas, a kind of visual note making. Also, creative design decisions are often a matter of selecting signs, not constructing them. Consider signs such as [flickering] or [desaturation]. These are almost impossible to draw in a conventional pen-and-paper sketch. They are rather like words; I must select them before I can sketch them down, and when I have selected them, that design decision has already passed. Therefore these kinds of design decisions are better documented using ethnographic note taking, than trying to record the design work in progress.

So, I have tried several different methods for documenting design processes and have learnt some lessons. In the following the methods are ordered in accordance to their importance in relation to my research question (highest importance at top, then falling):

- Field notes (written and verbal)
- Archived e-mails
- Archived design sketches and the final product
- Audio recordings of meetings
- Documents such as scripts, meeting minutes, synopses and similar
- Audio recording of myself doing live commenting during production work
- Screen image recording during production work
- Recordings of video conference meetings (audio, video, text chat and digital whiteboard)

It is hardly surprising that the classical ethnographic field notes have been the most useful. Neither is the importance of e-mails surprising considering e-mail have been the primary form of communication in the geographically distributed teams I have been working with.

The observed media productions

Typical for the productions I have studied is that I have been primarily a computer graphic artist, but often take on other roles such as project leader, production

manager, scriptwriter, and director. My work has involved both creative design decisions and hands-on media production. This mix of roles is rather characteristic of smaller, semi-professional production teams. Often the productions have bridged the boundary between academia and the media industry, with participants from both sides. In some productions, there has been an external client with an interest in the end product.

Usually I used the production tools Adobe Photoshop (graphics and photo editing), Maya (3d modeling and animation), Adobe After Effects (compositing and 2d animation), and Adobe Premiere (video editing). They are all professional media production tools used by the industry, with the exception of Premiere that is on a semi-professional level. There has also been work done with Adobe Flash (interactive web graphics and programming), usually done by other participants. Several of the productions have had distributed teams, often situated on both sides of the Atlantic. In some cases, I have never met face-to-face with the other participants. I met Rick Dunbar – my closest collaborator in *Astronaut* – once in Washington and I have never met Alan Chan – the director of *Postcards from the Future*. Other productions involved frequent face-to-face meetings, for example the Via Tecta project with Jonathan Westin and the Environmental Science Investigation project. Distance communication was highly dominated by e-mail; the telephone was almost never used. In two projects – *Postcards from the Future* and Environmental Science Investigation – we used desktop videoconferences on numerous occasions.

These are the media productions I have included in my study of virtuality. They are ordered according to the time of production start.

- **Astronaut (ongoing since 2003).** This is a large private endeavor to produce a feature film using production techniques similar to *Sky Captain and the World of Tomorrow* and *Sin City* – shooting actors against a green screen and adding all environments as computer graphics in post-production. I wrote the script in 2003, and shot the live action footage with seven actors together with Rick Dunbar (two actors in Washington, USA, and the others in Göteborg, Sweden). For a few years I had non-profit help from a small production crew of semi-professional movie makers, but since the production was caught in limbo due to lack of time these participants dropped out one by one. The production has no funding and it is still uncertain if the movie will ever be completed. Nevertheless it has given much insight into semi-professional movie making and one scene depicts a virtual character – Ejahja – which makes it interesting for this study. This was my first self-ethnographic study and it also generated research results concerning distributed collaboration in the movie industry (Eriksson, 2003; Eriksson & Spante, 2004a; Eriksson & Spante, 2004b; Eriksson, Sundström & Thelander, 2004).
- **X-15 (2006-2012).** The science writer Michelle Evans wrote this historical book on the X-15 flight research rocket plane, and I provided computer graphics illustrations of the X-15 in different flight situations. Both Michelle and I agreed that the illustrations should be as photorealistic as possible, and I

experimented with using signs that could convey the virtual 3d model behind the visualizations.

- **Environmental Science Investigation (2007-2008).** This project was a collaboration between Chalmers University of Technology, the University of Gothenburg and Stanford University, financed by the Wallenberg Global Learning Network (WGLN). A total of twelve people worked on the project and five people were involved in design and/or production work. I worked 40% of a full-time position for two years, and was highly involved in design and production. We produced a web site intended to be used as teaching material in high-schools, and this involved a virtual laboratory (the *Gas Lab*) and a short computer graphics movie describing how gas atoms in a soda bottle form bubbles. Maya was used to build the graphics for the virtual lab, and the final interactions were done in Flash. The web site and especially the Gas Lab were extensively tested and evaluated in four different high schools in Sweden. The research results from these evaluations mostly concerned pedagogical issues (Eriksson & Sunnerstam, 2008; Eriksson, Sunnerstam & Karlsson, 2010; Spante et al, 2009; Spante et al, 2010).
- **Via Tecta (2008-2009).** Even though being a small production together with only one other participant – Jonathan Westin at Department of Conservation, University of Gothenburg – this project was highly focused on the issues of representation of virtuality, mostly because both Jonathan and I are computer graphic artists and we shared similar research interests. The production was a part of the interdisciplinary research project Via Tiburtina – Space, Movement and Artefacts in the Urban Landscape at Istituto Svedese in Rome. We created a computer graphics visualization / reconstruction of the ancient roman temple Via Tecta, investigating different strategies to emphasize the different levels of un-certainty in the reconstruction. All graphics were created in Strata Studio and Photoshop, and we used Flash to create animations and the final interactive visualization. The visualization was showcased for an audience of dignitaries at a press event for the inauguration of a new library at the Swedish Institute in Rome, March 24th, 2009. Since then, the display has been demonstrated at various institutes internationally and research results have been published in (Westin & Eriksson, 2010).

There are also a few media productions that I will refer to even if they are not related to virtuality. These are projects I have worked with that shed light on media production culture.

- **Postcards from the future (2005-2006).** On a non-profit basis I participated in this independent short film production crewed by various industry professionals in Los Angeles and elsewhere. The computer graphic artist Alan Chan directed it and Eric Adkins was the director of photography. I worked

for about four months on animatics, and built parts of a 3d-model for a Moon base.³⁷

- **Rymdlust (2005-2006).** This was a major project where we produced 25 minutes of computer graphics for an interactive science show movie depicting a voyage through our galaxy. Myself, Josef Wideström and Magnus Axelsson at Chalmers University of Technology collaborated with Saab Ericsson Space and Universeum (the science center where the final product was exhibited for about a year).
- **Solen, månen och den röda planeten (Utbildningsradion, 2007-2008).** I worked with producer Helen Rundgren at the public service company Utbildningsradion, supplying a few minutes of computer graphics shots visualizing different astronomy scenery. The shots were used in a science show series for young children (distributed on DVD to elementary schools in Sweden).

Interviews with media producers

As a complement to the movie analysis and the study of my own work process, I have also done a number of interviews with people involved in movie and TV productions. As suggested by Atkinson & Hammersley (1989), ethnographic observations and interviews can illuminate each other. Thomas (1993) suggests that interviews with high-profile professionals can be easier to set up when the interviewee happens to be close at hand, something that aligned with my own experience; often, I planned interviews in conjunction with industry conferences. These interviews did not focus specifically on representation of virtuality; rather, they covered general aspects of digital movie making. They also investigated issues concerning distributed collaboration in movie production and authenticity in science shows (research questions that I have worked with before this study on a poetics of virtuality).

The interviews always started with establishing mutual rapport, trying to understand what kind of person the other one is, and implicitly negotiating the nature and form of the interview (Atkinson and Hammersley, 1989). One important aspect of this rapport making is that the interviewee needs to understand my agenda and how familiar I am with the movie business. Therefore, I usually try to make it clear that I am *not* looking for a job or pitching a movie, and that I am quite familiar with movie making in general, and visual effects and computer graphics in particular. During the actual interview, usually lasting 30-45 minutes, I start with general and open questions, and narrow down to more specific and confrontational questions towards the end, shaping the interview in the form of a conversation with a structure. The consistent impression during the interviews was

³⁷ It was one of the world's first independent short films produced in 4K resolution, and it achieved several awards; "Best Special Effects For Short Film" at Shriekfest Los Angeles Film Festival (2007), "HDFEST Deffie Award for Best Special or Visual FX in an HD Short Film" and "HDFEST Deffie Award for Best Short HD Film" at HDFEST 2007, "Gold Award – feature/short" and "Platinum Best of Show – Use of Special Effects" at Aurora 1997.

that the interviewees willingly and generously shares their experience and thoughts with me. John Thornton Caldwell evocatively describes issues of getting reliable research data from interviews with high-profile movie makers (2009b).

These guys know the drill, they have done hundreds and hundreds of interviews, and they are experts, there is no way to re-purpose that interview. They give you the line, they always give consistent lines, and they are on point all the time. They make the Pentagon look like amateurs.

Production companies and movie makers share extensive information with the press and the public, but everything is scripted; everything is regarded as a marketing opportunity. This ability to repurpose interviews according to their own interests is also noted by Thomas (1993) in regard to high-level decision makers in big companies in general. Thomas suggests that it is important to be aware of which one of the interviewees' different roles and personas you are interested in, that you need to recalibrate the interview and demonstrate that you are not a journalist, and that you need to show that you are quite knowledgeable in the issues that you ask questions about. I addressed all these issues, especially during the initial rapport building, throughout the interview. Sometimes, some additional probing, in areas concerning my rather specific research questions seemed to have the interviewee in a more thoughtful and elaborating frame of mind, even hesitating. I see that kind of hesitation as a good sign, suggesting that I am not given a standard response.

These are the people I have interviewed:

- Phil Dolling, BBC (2007). Dolling was executive producer on the science show *Space* (Turner & Campbell), and he also represented the production and broadcast company BBC in general.
- Mike Milne, Framestore (2007). Milne worked as director of computer animation for *Walking with dinosaurs* by Tim Haines, the 1999 BBC TV series that became the gate breaker for a rush of science show documentaries with advanced visual effects and semi-fictional narratives, at BBC and elsewhere.
- Dan Maas, Maas Digital (2008). Freelancing computer graphic artist doing high-end visual effects and computer graphics for contractors such as Disney, NASA, and the BBC.
- Helen Rundgren, Utbildningsradion (2008). Rundgren is a producer of science show TV series for children. I had worked with Rundgren on a science show for children, and this interview was an opportunity to summarize our experiences of working together.
- Bob Saul, NASA (2008). Saul works as computer graphic artist at NASA, doing visualizations of spacecrafts, space missions and such. He also worked uncredited with visual effects for the feature film *Deep Impact* by Mimi Leder.

Reflections on production culture and my own work process

Any fictional representation of virtuality in a movie is the product of a complex process of design and production. Understanding some of the particularities of this process is important in order to understand these fictional representations. The following notes are based on my own work process in the productions I have been involved with, and interviews with professional movie makers made by both others and myself.

Fundamental insights into design work inform the following discussion. Design is an elusive concept and there are numerous definitions that more or less overlap, but a common denominator among many definitions is the intentional adaptation of resources to reach a predetermined goal (Buchanan, 1989; Mitchell, 1996; Rosell, 1990; Winograd, 1996). A design process starts with an idea or a demand, and ends with a finalized artifact. A designer needs to envision the future, and give it form (Lundequist, 1998). Design work explores a mental space of possibilities, and finally selects a final solution by making numerous decisions. Some design work ends with plans for construction, as in architecture and industrial design, while in, for example, game design and movie making, there are design issues to be solved all the way into production; in movie making, design merges with craftsmanship (Bjurbom, 2005; Caldwell, 2008; Fauer, 2006).

Working as a computer graphic artist

Above-the-line movie makers such as the director, production designer and cinematographer have the most impact on how virtuality is represented in a movie. However, post-production crewmembers finalize the visions of the three above-the-line professionals, and computer graphic (CG) artists play a vital role in producing many of the movies that I have analyzed (for a brief introduction to the different computer graphics work in a movie production, see appendix 01).

A computer graphic artist creates computer graphics. Very often, the work is a flexible and complex combination of photography, digital painting and 3d modeling. The skills that are needed have a firm foundation in fine art such as painting and photography. The emphasis on *artist* is important; even though technical skills and problem solving are important, computer graphic artists consider themselves primarily to be artists. The work they do is artistic, albeit not always *art*. Rather, a computer graphic artist usually works with products that can be categorized as illustrations, visualizations, or entertainment such as games or movies. As a computer graphic artist, you often have a quite personal relation to the work you do. Movie makers, in general, and computer graphic artists, specifically, have a creative drive that is not connected to the audience, but to themselves. They rationalize their design decisions according to the idea of an audience, but it is not the audience that provides the drive. The creative drive, and one possible reason why some media workers work long hours under high pressure, is that they want to do the best work they can. They constantly compete with themselves and others. This makes it personal, and emotional. The creative drive is both intrinsic and extrinsic. Instead of having the mindset that *I do what the*

audience like so that they like my stuff, it is more a matter of the mindset that *I have to show the audience how wonderful my inner vision for this is*.

Two additional, quite personal creative drives are worth mentioning. The first is best described as a *curiosity*, a longing to see how the imagery actually turns out. When working as a computer graphic artist you often have a strong vision of how the final result will be, and there is much challenge and excitement in discovering how it will actually turn out. It almost feels like the faint memory of a dream, but with the twist that this image becomes more and more clear when time passes, rather than gradually fading into oblivion. This can be theorized as a tension between an internalized and an externalized vision. The more I work on an image, the more it becomes an external object that I can step back from and watch, almost as if someone else has done it. The second drive is what I call *the smell of the kill*. This is a drive that is more primordial, a hunter-gatherer instinct, an urge to finalize, to reach a goal. I would compare this feeling to the challenge of collecting yet another stamp in your stamp collection, of making a good deal in a purchase, or running the final hundred meter dash in a long distance race.

Pragmatic creativity

My study of my own media productions suggests that very little time and effort is spent on creative decisions. Instead, the design decisions are often pragmatic. The following logbook excerpts from one of my productions give an illustration of the situation.³⁸

Managed to find an hour to model on the microscope; didn't get very far; much to model. Many meetings, no time to work.

Desperately seeking the two or three hours I need to complete the GUI.

Not only is time in short supply, but a common observation is that the time and focus spent on creative and design oriented issues is a fraction of the total project work. In the Environmental Science Investigation project, much of the time was spent on talking about other issues such as production procedures or project management. Most design decisions were done without any deeper discussions. In both the *Rymdlust* and the *Solen, månen och den röda planeten* productions, most of the time was spent on just finalizing the computer graphics, not considering the look of them. One exception was the Via Tecta project together with Jonathan Westin. During this project, we talked for hours and wrote numerous e-mails about different aspects of the design of the visualization. Both Jonathan and I are computer graphic artists and, as such, we clearly took both pride and interest in working hard on the creative issues.

As a computer graphic artist you go into a production with a high level of creative ambition, but then the work often becomes a constant struggle to keep on striving for the ideal imagery despite the difficulties. There are indications that these pressing working conditions are the norm in high profile, professional visual

³⁸ From the Environmental Science Investigation project (December 7th, 2007 and January 30th, 2008).

effects work as well. During 2012, there was a recurrent debate within the American visual effects industry about the poor working conditions, with short-term employments, low salaries, unfavorable insurance policies, and general time pressure to produce more in less time. In my interview with Bob Saul, a computer graphic artist at NASA, he describes his own experience of working on a high profile Hollywood based feature film production.³⁹

I have done a little bit of animation for Deep Impact, and that was the hardest most frustrating thing I have ever worked on, because initially they came in and said we want you to do this little scene, it's going to be used here, and I was intrigued and excited. From the start to the time when I finished, I worked 20 hours a day, and some days 2-3 days in a row, because it kept going back and forth in so many iterations. Change after change after change. On the last version I worked Thursday, Friday, Sunday, no sleep, no food.

Under circumstances like these, design decisions can become pragmatic and intuitive instead of rational and thought-through. Any analysis of sign-making in movie production needs to take this pragmatism in to account. We must restrain ourselves from inferring meaning where it might not exist.

Serendipity in movie production

Serendipity is when a solution to a problem appears by chance. Serendipity plays an important role in design processes. Movie makers frequently mention it in interviews and behind-the-scenes material (Clarke, 1972; Fauer, 2006; Giger, 1979; Murch, 2001), and I have often described it myself in my autoethnographic observations. Designers often confess to the suggestion that limitations bring about creative solutions (Neumann, 1999). Ridley Scott illustrates this in an interview when he claims that the influential production design of *Blade Runner* (a retrofitted futuristic city drenched in rain, darkness and smoke) came from budget limitations that forced the crew to reuse old sets and to hide the less than perfect set dressing from too close scrutiny. He ends with the comment that “by a necessity we actually started designing it that way” (Lauzirika, 2007, at 02:22).

The process of accepting limitations and surprises, and turning them into a means of coming up with creative ideas and design solutions pervades these kinds of accounts. The need to work with and around restrictions is closely related to the resources and budget of each production. In a production with extensive resources, it is usually possible to confront limitations directly. If the weather is wrong one day, then there are resources to just wait until the weather changes, or to adjust the weather, either with extensive special effects (such as rain and wind machines) or with post-production visual effects. Large-scale productions with huge resources abound with accounts of how the movie makers exert an arrogant control over every nuance of the final shot.

The importance for a poetics of virtuality is that the construction of any sign in a complex movie production is a messy process governed both by intentional planning from the storytellers as well as external limitations turned into creative

³⁹ Interview April 22nd, 2008.

solutions. Therefore, it is necessary to read these narratives not as perfect executions of the author's intent, but as a highly complex negotiation between the storyteller's intent, the production circumstances, and the reader's interpretations.

Shaman or auteur – freedoms and limitations in design processes

This poetics of virtuality concerns how virtuality is portrayed in fictional, narrative texts. Contrary to virtualities that have actually been built in real-life, fictional virtualities are essentially unconstrained by technical limitations. The storyteller is seemingly free to depict any kind of imaginable technology. These fictional virtualities are, however, constrained by other limitations related to production methods and production cultures. When working with fiction, the storyteller is influenced by the context of production culture.

As in other design work, movie makers reference each other extensively. Even though the movie industry tries to convey a sense of secrecy towards the audience and journalists, the exchange of ideas inside the industry is quite free. According to Caldwell, there is a continuous flow of ideas in Hollywood, a continuous pitch of ideas; "It is like free water" (Caldwell, 2009b). Design in movie making is a balancing act between staying within the boundaries of the familiar in order to not estrange the audience, while being innovative in order to achieve attention and acclaim. This is especially important in storytelling and movie making, where there is a constant demand for new stories and new worlds (Bjurbom, 2005; Buchanan, 1989; Neumann, 1999). However, these new ideas must be grounded in the known, as "the unfamiliar is always extrapolated from the known" (Gombrich, 2002, p.72).

Creative leadership in movie productions is often described as highly hierarchical, related to the idea of the director as an auteur. The creative and aesthetic decisions are lead by the movie director, with the help of primarily the cinematographer and the production designer (Fauer, 2006; LoBrutto, 1992; Tarkovsky, 1986). An important aspect of the director's and the production designer's work is to guide the other professionals into a team working towards a common design goal and a shared aesthetics. The production designer and cinematographer collaborate quite intimately on the look of the movie, since the cinematographer is essentially responsible for making the props, sets, wardrobes and locations of the movie visible; the cinematographer controls the light that brings the world of the movie into being (Fauer, 2006; LoBrutto, 1992). In addition to the above mentioned professionals, a movie production can involve hundreds of workers, often divided into above-the-line (people responsible for high-level creative decisions) and below-the-line (people who primarily execute the creative decisions, applying different crafts) (Caldwell, 2008; Caldwell, 2009).

Roland Barthes (1977) metaphorically compares the author to a shaman, meaning that authors reuse utterances of previous authors. This aligns well with movie professionals' own comments about their work. Production designer Ted Haworth says, "if I have any style, it's not mine, it's borrowed" (LoBrutto, 1992, p.31), and cinematographer Hiro Narita says "when you have an idea, it is usually an idea you have seen it, you have heard or you have experienced it" (Fauer, 2006, at 30:00). The myth of the auteur, the individual, dictatorial genius, strongly

contradicts Barthes' idea of the author as shaman.⁴⁰ The collaborative approach of different directors actually covers a broad range, from directors who are very decisive about what they want and often do much on their own, to directors who listen extensively to their creative team, or not even know what they want (Keegan, 2009; Landon, 1992; LoBrutto, 1992; Neumann, 1999; Tarkovsky, 1986). Essentially all movie making is a collaborative art (Caldwell, 2008; Handyside, 2004; Lacey, 2000; Neumann, 1999; Sundstedt, 1999), where cohesive unity is important. Andrei Tarkovsky (1986) acknowledges that cinema is a composite art, but he then singles out the director and writes that in the center of the creative work done by artists and craftspeople "stands only one person: the director, and he alone, as the last filter in the creative process of film-making" (p.18). But Tarkovsky also emphasizes the importance of the artists and craftsmen to work as a single unit; "because until we are linked up, as it were, by our very veins and nerves, until our blood starts to circulate around the same system, it is simply not possible to make a real film" (p.136). In America, the auteur myth appears in the early 1970s when a number of directors managed to establish themselves as "distinctive artistic personas" (Thompson, 1999, p.2), more or less importing the idea from Europe where it was already popularized (Handyside, 2004). The French auteur concept originated in a 1954 essay *Une certaine tendance du cinéma français* (A certain tendency in French cinema) by François Truffaut, and was theorized in 1968 by Andrew Sarris in his book *The American Cinema: Directors and Directions 1929–1968*. The auteur concept implies that a movie should be a personal statement and that a good film cannot be made by committee (Bordwell, 1985). The assumption that American cinema is a commercial, mindless industry while European cinema is a playground for geniuses was a very successful marketing strategy for the European industry, and it still works (Bordwell, 1985; Caldwell, 2008; Handyside, 2004; Thompson, 1999). Setting such marketing stunts aside, movie making is a balance act, a balance between ideas on creative leadership, between the auteur director and the committee making decisions. The following quote from Giger's (1979) diary notes about his work on *Alien* succinctly illustrates the dictatorial relentlessness that appears to lie behind the auteur myth.

Scott thinks it's absolutely great. O'Bannon, who has just flown over from the USA, doesn't think it's technical enough. A battle of pros and cons begins. I keep quiet; I know that Scott will win the argument.

This should be compared with Scott's own comment in an interview concerning the work on *Blade Runner* (Lauzirika, 2007, at 10:09).

I don't like discussions, I know exactly what I want, I'm gonna walk in and say it; that's a director's job, directors are not meant to stand there and consult with half a dozen people in the room, the term director means direct me, do the job.

⁴⁰ Flueckiger (2008) suggests that there is a parallel "personality cult" (p.45) in academic discourse concerning the visual effects industry and computer graphics, emphasizing visual effect artists such as Dennis Muren.

Whether the director acts as a dictatorial auteur or not varies between productions and depends on individual preferences. TV series production, in particular, is highly based on design-by-committee (Caldwell, 2008).

“Hollywood” – breaking down the monolith

Many of the movies I have analyzed are well-known parts of popular culture, and it would be easy to characterize them as “Hollywood” movies. What do we mean when we speak about Hollywood? It is important to realize that the concept of Hollywood is more or less illusionary. Hollywood conveys the image of itself as one entity, but Hollywood is not a stand-alone ziggurat or monolith; rather, the production culture in Los Angeles is highly interconnected with other production hubs such as Canada, London, Paris, Sydney and New Zealand (Caldwell, 2008; Caldwell, 2009). Industry people move between these locations; they meet each other. They are connected with lower profile media industries such as the ones in Stockholm, Copenhagen, and further on. At least one of my field studies gave direct access to the production culture in Los Angeles – the short film project *Postcards from the future*. This is important because it bridges the two parts of my study: the study of my own work and the study of narratives produced by professional storytellers. Even though these are very different in many aspects, they still share fundamental aspects when it comes to design processes, and sign production.

Have I accessed the production culture of Hollywood, sitting in my studio in Göteborg, Sweden? After all, Ortner (2009), another academic studying production culture, has clearly stated the importance of being on location. However, Hollywood is not an isolated community; it is diluted with other production cultures, dispersed geographically as well as across different levels of professionalism. Visual effects artists with work experience from high-end productions occasionally collaborate with semi-professionals such as myself. The differences in scale and commercialism are huge, all the way from privately funded, zero-budget short films, through the independent feature films that are exhibited at art-house cinemas, up to industrialized, high concept movie franchises. Within this spectrum there is room for both highly experimental, individual work of art as well as highly formalized box-office successes, and a wide range of hybrids between these extremes (Buckland, 2006; Caldwell, 2008; Thompson, 1999). My poetics of virtuality stretches across this range. So even if my level of access has been peripheral, I believe I can make a relevant and interesting research contribution.

THE POETICS OF VIRTUALITY

Surprising complexity – a thousand signs

The following poetics is the result of my study of fictional representations of virtuality. Parts of, as well as additions to, this poetics have been published elsewhere, see appendix 03.

We will start this exploration of fictional virtualities with a general observation. A quite surprising result from this study was the quantity and complexity of the observed signs. There are almost a thousand signs that I have identified in the more than 50 narratives I have analyzed. Out of these signs about 350 have been classified as super-signs. The movie with the highest number of observed signs of virtuality is *Tron* with about 250 sign types used almost a thousand times, some used once, others over and over again during the movie; each usage is a *token*.⁴¹ The Matrix franchise – three feature films and ten short films – count in at a total of over 300 sign types used 1 400 times.⁴² The movies with the *least* number of signs, such as *Escape from New York*, exhibited about ten sign types.

Another way to quantitatively describe the usage of signs in each movie is the ratio between number of signs (number of *types*) and how often they have been used (number of *tokens*). That is, which movie has repeated a limited number of signs over and over again? This would be the TV series *Life on Mars* with its ratio of almost 1:5, followed by *Tron* and *eXistenZ* (ratios close to 1:4). These narratives are quite different in their fictional representations of virtuality.⁴³ The signs used in *Life on Mars* are highly related to dialogue, character behavior and events, and they often form a complex and efficient weave of intratextual references and signs where a simple representamen has several interpretants. The depiction of virtuality in *Tron* is highly visual, but it is also highly dialogue and event driven. In comparison, *eXistenZ* takes a minimalistic approach, using a comparatively limited number of signs (about 30) repetitively.

Even though I start with these quantitative measurements, this poetics of virtuality is not a quantitative study. The point is not *how many* signs there are, but that they *are many*.⁴⁴ It shows that the representation of *one* condition, virtuality, employs a *numerous* and complex set of signs. It might be that any representamen can be made to signify virtuality; however, such a claim is difficult to support empirically. Even if a thousand observed signs is a large number, it is still a fraction of all potential signs that can be used in a movie. If we investigate the paradigmatic

⁴¹ For movie franchises such as *The Matrix* and *Star Wars* I count each individual movie, but when it comes to TV series such as *Life on Mars* I count the series as one singular media artifact.

⁴² There are also computer games and comic books situated in *The Matrix* saga, but these have not been included.

⁴³ *Life on Mars* does not represent technical virtuality per se. The plot remains mysterious concerning the nature of the protagonists whereabouts, but the most common suggestions (quite clearly spelled out in, for example, diegetic dialogue and director's commentary) are that he is in coma.

⁴⁴ Also, the quantification of how many times a sign has been used is highly approximate. Statistical results are not possible to draw, but major quantitative differences that are too large to be explained away as an interpretational error can be relevant to discuss.

structure of a sign, exploring the range of possible variations of a sign, then we can get a hint at how well these variations are covered. The representamen [color] is easy to investigate with a paradigmatic analysis. A color-based representamen is limited to a constrained set of available hues, for example red, orange, yellow, green, blue, black, grey and white.⁴⁵ When looking at how the movie makers have utilized this repertoire, it is clear that the colors blue and green have been used most frequently (in about 70 different sign types in 26 of the movies, and 50 sign types in 13 movies, respectively), but movie makers have also used yellow, red, orange, pink, purple, violet, grey, black and white. That is, the movie makers have more or less drawn from the whole paradigmatic repertoire. Thus, any color can signify virtuality.

Using a syntagmatic analysis to investigate how signs of virtuality are combined with each other and other signs, we see an obvious reason for why so many signs can be used to represent virtuality. Virtuality is something other than the actual; therefore, the signs must differentiate the virtual from the actual. Therefore, a natural color grading is not very suitable, since it is not in contrast with the actual. But any other tint – green, blue, red, orange – works fine since it contrasts with the natural.

There is actually an interesting exception, or rather an example where the relationships between natural and unnatural color grading has been cleverly switched around. This occurs in *Avalon*, where the plot moves between a computer game environment and what is supposed to be the actual. Both environments are heavily color graded with deep desaturation, strong yellowish tint and blooming highlights. Since the computer game environment has a more extreme visual style and color grading, and the mise-en-scène of that environment also exhibits other signs of virtuality, it seems obvious that the game world is the insert virtual world of the narrative. If so, then the other world, into which heroine Ash wakes up when leaving the game world, is her actual world, even though the latter also has a quite distinct color grading and seems strangely vacant. But, late in the movie,⁴⁶ Ash comes to a new level of the computer game, and surprisingly enters a world that seems to be our own actuality, with *natural color grading*, busy city streets and familiar soft-drink ads. So, this illustrates how, surrounded by the proper context, even a mise-scène and visual style that usually signifies *actuality* can be switched around into signifying *virtuality*.

But if anything can signify virtuality, why does not the text of the movie break down completely? How can we make sense of a text if any representamen can connect with any interpretant, if any sign can mean anything? The explanation is that even if any representamen has the potential to mean anything, the signs mean

⁴⁵ The number of actual hues is of course virtually unlimited, but the number of hue categories is limited. The green in one movie is not exactly the same as in another movie, for example one being bright and the other being murky, but the precise hue of the representamen is not relevant. Compare with how the color [red] often signifies danger. It is not the precise hue of red that makes it a sign, as long as it is quite distinct, but instead it is the context that make red signify danger.

⁴⁶ At 01:22:20.

something specific in each text, and it is the context of the text that determines the interpretant. As in the example of *Avalon* – the natural color grading represented virtuality since it was in contrast to the previous un-natural color grading, and also because events in the plot (additional signs) suggest that the storyline takes place inside a computer game.

A vagueness we have to accept is when to consider the usage of a sign as being new or not, and how to discern between a unique type and repeated tokens. Consider, for example, the green color employed in *The Matrix* and several other movies. When we see the operator’s screen-based views into the virtual world, we see scrolling computer code in a green color. This is one sign, a type. We see this on several occasions in the movie, and each occasion is a new token (instance) of the sign, but it is the same sign type. Then, all scenes taking place inside the virtual world have a characteristic green-tinted color grading. This is another sign type, once again occurring in numerous tokens. At the end of the movie,⁴⁷ the protagonist Neo takes conscious control over the virtual world and in his point-of-view shot the virtual world is revealed as curtains of green glowing computer code. Are these curtains of computer code a third sign type, or can it be regarded as yet another token of the first screen-based computer code? We could regard *green* as a representamen, and then regard both [green tint] and [green code] as complete signs, the latter also being a sub-sign in the Matrix super-sign [curtains of green glowing code]. Thus, every substantially different way in which [green] is used should be regarded as a separate sign type. When [green] is used in a highly similar manner as seen before, then that occurrence is a new token and not a new sign type.

The most frequent signs

Which signs has been used most frequently in the studied movies? The list below includes the ten most frequent, from the more than 50 different narratives. Most of these signs are not only used frequently in specific movies, but they are also used in about half of the analyzed narratives; more or less every second fictional representation of virtuality uses each of these signs.

representamen	sign types
[monochrome color scale]	65
[semi-transparency]	75
[floating]	110
[blue color]	75
[wireframe]	55
[glow]	115
[dialogue reference; computer software]	100
[stylization]	100

⁴⁷ At 02:00:30.

[dialogue reference; simulation]	75
[appearing from nowhere]	70

All these signs are conceptually straightforward and simple, and none of them form a super-sign. Also, most of these have visual representamina. This illustrates the dominance of visual signs when representing virtuality, but it does not mean that signs related to narrative structure, plot or dialogue have not been observed. On the contrary, non-visual signs play an important role, as we will see in many of the examples that will be discussed further on.

Simple representamina such as [glow] and [semi-transparency] can be used in many different ways, and thus lend themselves to frequent usage in many different sign types. Observations from my own productions show that some signs are favored simply because they are easy to construct; for example, both [glow] and [semi-transparency] can be added to an object in a matter of seconds in post-production using software such as Maya and After Effects. Compare this to signs such as [super-human agility] or [solids becoming liquid] which might take days or weeks to accomplish in a movie. It is also quite obvious that highly specific super-signs such as the [curtains of green glowing code] in *The Matrix* or the [light cycles] of *Tron* are much more confined to one movie. Such signs can be highly influential, spawning similar signs in other movies, but the specific sign type can hardly be used in another narrative.

A tapestry of intratextual signs – the case of *Life on Mars*

Some of the analyzed narratives have highly complex structures of super-signs: these narratives exhibit super-signs that have three or four levels of nested super-signs, super-signs sharing signs in complex manners, and super-signs that are consistently and effectively used. These super-sign structures are so detailed and complex that they are difficult to take in when represented as a static figure.⁴⁸

When it comes to complexity both the Matrix franchise and the TV series *Life on Mars* stand out, and I will exemplify this with a few cases from the latter. The storytelling in *Life on Mars* signifies virtuality in an often self-reflective way, and the production crew has managed to create an intriguing fantasy world with a minimum of spectacle and visual effects. The signs of virtuality in *Life on Mars* are almost completely reliant on *non-visual* signs related to characters, dialogue and events. The story of *Life on Mars* has a profound feeling of nostalgia and sadness. The modern day police officer Sam Tyler is hit by a car, and he wakes up in 1973, attired in periodic clothing and with a fresh employment at the local police force. Piece by piece he tries to puzzle together how he got there, where he is, if he is trapped in a coma dream or not, and how to get home. The storytellers never make it completely clear. What is clear is that the Manchester of -73 is an exaggerated caricature version of Manchester. Estranged from his more or less lunatic

⁴⁸ With the mind map tool Mind42 I have created online representations of some of the most complex super-sign structures. These structures can be investigated interactively, see appendix 02 for URL addresses.

colleagues, Sam desperately tries to wake up from the enigmatic illusion. But his growing love interest for fellow officer Annie Cartwright and his growing taste for an illusion that is more alive and real than the actual, finally have him make the choice to stay in the illusion.

Media technology plays a central role in the narrative, and can be regarded as one of the top super-signs. The emphasis on [media technology] reminds us that just as the TV screen is an image, Sam's world is just an illusion. This super-sign breaks down into several lower level super-signs, for example the [talking through the TV screen], [Test Card Girl character], and the [Open University Professor character]. The Open University Professor is an example of a super-sign that works on different levels. The character connotes old-style television programs, and is therefore one of many signs signifying that Sam is caught in a [different era]. Other signs that create the impression of a different era are the periodic clothing, architecture, a pronounced lack of modern day technology, and irrational police procedures. All these super-signs coalesce into one of the top super-signs: the old-fashioned and apparently primitive time of 1973, deliberately contrasted with modern day style, technology and rational police procedures. Media technology has other connotations as well in *Life on Mars*. The Open University Professor always talks to Sam via the TV screen, and Sam always wakes up afterwards as if it was all a dream. Here, communication technology denotes mediation and it connotes a lack of actuality, signifying that everything might be just illusions in Sam's mind. Additionally, the Open University Professor occasionally talks about Sam as if he is Sam's doctor, and he can never hear what Sam says back to him. This emphasizes that Sam might be in a coma, as well as his profound loneliness in this strange world of 1973. So, the [Open University Professor character] is a sub-sign in five different super-signs – [different era], [talking via TV screen], [dreaming], [coma], and [not belonging]. This illustrates how many of the signs and super-signs in a narrative are interconnected in complex, syntagmatic patterns. Other branches of the complex pattern of related signs include the two super-signs [different era] and [not belonging]. Sam Tyler's loneliness in the foreign world and his conflicts with his police colleagues are persistent themes in the TV series. His loneliness is often accentuated in front of the TV screen; he eats his TV dinners in front of the screen, he sleeps in his clothes in an armchair in front of the screen, and he occasionally makes desperate attempts to have the mysterious characters of the TV screen (such as the Open University Professor) actually acknowledge him. It is an equally recurrent theme that Sam is caught in a world that is in stark contrast to his actual world. He is amazed and aggravated over caricatured police brutality, police sloppiness, sexual harassment, and so on. There are many examples of short dialogue that effectively holds several meanings. Often, one of the meanings is related to the in-diegetic situation, while it simultaneously can be interpreted as a self-reflective, non-diegetic comment. Late in the series, his boss Gene Hunt overhears when Sam records audio commentary about the outrageous police work at the station.⁴⁹ Hunt's line – "What are you; the narrator?" – both means that he

⁴⁹ Season 2, episode 8, at 10:48.

has overheard Sam, and at the same time references the fictive status of both Sam's illusionary world, and the BBC produced TV show itself. Another example is this dialogue exchange.⁵⁰

Gene Hunt: "How do you think I spend my time here Tyler?"

Sam Tyler: "Building a Death Star?"

Gene Hunt: "By listening to the sound of the cogs in the machine going round and round all day, while your cog is out of synch with the rest of us since you rode in on your big Hyde horse"

The phrase "spend my time here" points out that the world they are in is not the real world, but a world within the world; the "*here*" is the place, the contained illusion, where Sam is caught. The phrase also reflects on whether the characters in this world are autonomous or not. Does Hunt actually do anything when Sam does not interact with him? Or does he, as with the proverbial tree falling in the forest, cease to exist when Sam is not present? Sam's reference to the Death Star is both a reference to another fiction (the Star Wars saga) as well as to his out-of-time situation,⁵¹ while Hunt's final line both suggests that the world they inhabit is an artifact, an illusion upheld by stage machinery, and once again emphasizes Sam's estrangement. In this manner, different kinds of signs support each other; a handful of simple representamen can be loaded with several interpretants, and a short dialogue exchange open up several connotations.

This is typical for how the dialogue in *Life on Mars* is highly self-reflective, especially the many dialogues between Sam and Annie where they swap arguments about whether the world and its inhabitants – including Annie herself – are illusions in Sam's mind or not. One such example comes from the first episode.⁵²

Annie Cartwright: "Where're you going?"

Sam Tyler: "I can't deal with this place. Look; somewhere out there, Maya needs me. My mind could only invent so much detail; you know, so I'm gonna walk until I can't think up anymore faces or streets.

Annie Cartwright: "What will you find; a mist; a big cliff, white door?"

The idea of breaking down the illusion and of reaching the end of the world is used elsewhere, most notably in *The Thirteenth Floor* where characters literally drive until the road ends. As we will discuss later, #containment is a topology of virtuality, and the end of the world suggested in the dialogue above is a distinct way to signify this containment.

Life on Mars uses some super-signs that are somewhat spectacular, such as the characters that speak to Sam in his dreams, and the sudden black-outs enclosing him in darkness. But most of the signs and super-signs used in *Life on Mars* are

⁵⁰ Season 2, episode 3, at 08:15.

⁵¹ *Star Wars* had not premiered in 1973.

⁵² At 41:20.

incorporated as natural parts of the diegetic world, such as the dialogue examples above. The production design is another example, where the super-sign [Manchester 1973] becomes heavily loaded with the interpretant that it might all be an illusion. One of the clearest signs of the era is Sam's leather jacket which he is mysteriously outfitted with when waking up after his car accident, and which he almost never takes off. It is as if it is his second skin, an embodiment of his status in the illusionary world.

Building a world that represents itself

The designed world of a narrative becomes a super-sign in itself, as when Los Angeles connotes the American dream, New York connotes film noir undergrounds, Paris connotes romance, and London connotes the world of espionage. In similar fashion, the virtual world represents its own virtuality through production design, visual style, *mise-en-scène* and cinematography. There are general similarities between designing buildings and such for real-life usage, and for movies. But the difference in purpose creates an important difference in result. In architecture, the utilization of the building itself is the end product. In movie making, a building is just a means to an end, the end being the story (Neumann, 1999). The cityscape of *Blade Runner* has no other purpose then to say *this is the future and it's hell*. In the diegetic world of the narrative, a whole palace might be there to make a king appear a king. In storytelling, a whole world, including its inhabitants (characters) and history (plot) is designed (LoBrutto, 1992). A common ambition is to make this world more complex and deep than what is shown on screen, both when it comes to characters and their back stories, and to environments with a level of detail and complexity that overwhelms the viewer in order to be perceived as realistic (Bjurbom, 2005; Card, 1988; Keegan, 2009; LoBrutto, 1992).

In the studied narratives, the signs of virtuality seldom come one by one. Usually, in movie after movie, a syntagmatic analysis reveals that the signs support each other, and that there is tight integration – what Buckland (2006) refers to as organic unity – between style, narrative, production design and production value.⁵³ The total sum of signs combines, and it is possible to consider a top-level super-sign in each narrative text, a top super-sign representing the fictive virtual world itself. This super-sign represents the idea of the virtual world in its entirety, a world that represents itself. The [1973 world] of *Life on Mars* has been discussed previously, and another example, likewise based on a historical period, comes from *The Thirteenth Floor*, where the *mise-en-scène* and cinematography work tightly together in characterizing one of the virtual worlds (the 1990s world) as vacant, moody, depressive, stylish, and modern; one of many examples are the green and blue computer diode lights which in other shots are repeated by the green and blue lighting scheme. The 1990s is cold and modern, while the other virtual world, (the 1920s world) is warm and vintage, but also has a sense of closure and loneliness. At

⁵³ Aristotle speaks much about unity in his *Poetics*, and refers to it as organic, comparing a narrative to a living creature.

the end of the movie, the supposedly real world (the 2024's world) successfully balances between being even more futuristic but at the same time warmer and friendlier, once again seamlessly combining cinematography and production design. This contrast between worlds – their mise-en-scène and their visual style – is frequently used as a means to distinguish between different virtual worlds and/or the actual world, as highlighted by Judith Kerman (1992) in her critical analysis of *Tron*. A third example of consistent world design comes from *Avalon*. As described by Crogan (2010), the different worlds have their fundament in contemporary and historic Poland (most of the movie was shot in Poland). The supposedly actual world is portrayed as a “drab, featureless and vaguely authoritarian ... Warsaw Pact urban dystopia” (p.102) with “‘soup kitchen’ bistros, dilapidated public transport and high density cramped apartments” (p.103). The supposedly virtual war game world Avalon is represented as “a mix of World War II Eastern European battlefields and Cold War urban spaces of resistance to Communist rule” (ibid., p.103), and the final virtual game level is contrasted with the two others by being “depicted naturalistically as a living color, buzzing, contemporary post-89 city” (p.103).

The time epochs portrayed in the virtual worlds discussed above can be compared to the romantic convenience of placing real-life computer game worlds in medieval and other historical environments. Medieval environments in games such as *World of Warcraft* depend on the popularity of the fantasy genre in games. World War II and other historical settings reflect a thematic interest for re-enacting more or less historically correct world events and societal changes. Considering fictional virtualities, barely any are set in a medieval time (the Matrix franchise short movie *Program* being an exception), but many are set in twentieth century worlds: the 1920s of *The Thirteenth Floor*, the 1940s/1970s of *Avalon*, the 1972 of *Life on Mars*, and the 1990s of *The Matrix*. The choice of these historical, nostalgic environments seems surprising when it comes to portraying futuristic technology such as virtual worlds. However, if we consider narrative requirements these design choices make more sense. When the virtual is conceptualized as being opposed to, or at least thoroughly separated from, the actual, then the virtual world needs to contrast with the framing actual world of the narrative. One way to create this contrast is to set the virtual world in another time epoch. Some of the studied narratives describe the virtual as highly futuristic – for example *Tron Legacy* and *Neuromancer* – but in these narratives, the protagonists are aware that they have entered a virtual world. However, in narratives where the protagonists, and partly the audience as well, need to be fooled into believing that the overt virtual world is the actual world, then historical time epochs are used, as is the case in the movies *The Thirteenth Floor* and *The Matrix* mentioned above.

The subtle world building that the above examples illustrate is not always as visually spectacular or memorable as the dense characterizing super-signs such as the Matrix [curtains of green glowing code] or *Tron's* light cycles, but nevertheless plays an important role in signifying virtuality.

Sound signifying virtuality

Even if visual and dialogue based signs of virtuality dominate in numbers and complexity, sound nevertheless plays a small but vital part in representing virtuality.⁵⁴ A syntagmatic analysis shows that the sound-based signs usually connect to the other super-signs and to the general topologies that are discussed at the end of this poetics.

The most prominent kind of sound-based signs, and one that connects to the topology of the #engineered space, see page 224, is the kind that emphasizes artificiality. A common way to connote artificiality is by using non-acoustic sounds (or manipulated acoustic sounds), for instance from a synthesizer or by using effects such as a reverb or a flanger. These sounds often seem to denote "electricity", as opposed to naturally occurring sounds. These unnatural, electrical sounds are the sound-based equivalent to the glowing lights (both city lights and electricity connote urbanity and artificiality), and have been used in, for example, *Avalon*, *The Lawnmower Man*, *The Thirteenth Floor*, *Tron*, *Tron Legacy*, *Minority Report*, *Virtuosity*, and frequently in the whole Matrix franchise. These sounds come in different versions, but they all have a timbre of a decidedly electronic nature.

The sounds that signify virtuality usually show a syntagmatic combination with visual signs. Quite often, the sound accompanies a volumetric display. In the science show *Atom*, for example, the narrator Jim Al-Khalili interacts with a graph displayed as a fake hologram or floating screen in front of him.⁵⁵ Several visual signs – [floating], a thin lined [grid], [white glow], and [pixels] [flickering in and out of existence] – suggest that the graph is a virtual object, along with a flickering and artificial sound that is softly heard while we see the display. Sound signifying virtuality is often related to appearance and disappearance, as when volumetric displays of meeting participants fade away with a flickering of scan lines and a slight electronic buzz in *Resident Evil Extinction*.⁵⁶ Sound also marks the dramatic event of entering or leaving the virtual world. This is used prominently in *Avalon* and the Matrix franchise, often as a windy [swoosh]. A more dramatic example is the screaming that accompany a jacking-in sequence in *The Matrix*, when Neo re-enters the virtual world the first time after his escape from it.⁵⁷

Most of the sounds signifying virtuality emphasize the artificiality of the virtual. A specific version of the electronic sound is what I call [the glitch], the abrupt sound of something disconnecting or connecting, or malfunctioning. The glitch connotes the technology that sustains the virtual. The glitch sound often acts as a sub-sign, combining with visual sub-signs into a super-sign. The most obvious example is the electronic glitches or flashes in *Tron*, in the form of moving flashes of light gliding along glowing lines or on top of a wireframe. These are often

⁵⁴ Dialogue should be regarded as a third communication channel alongside visual and sound, even though it is carried by audio.

⁵⁵ At 13:10 in episode 4.

⁵⁶ First seen at 17:34, and similar scenes of a videoconference meeting with volumetric display avatars are repeated at 46:46 and 01:23:10.

⁵⁷ At 37:45.

accompanied by a glitch sound. Other kinds of artificial sounds are the different sorts of alert sounds, often some sort of [beep] or [ping] emphasizing interaction via touch, as when a character manipulates data in a volumetric display. This is used in, for example, *Tron*, *Avatar* and *Johnny Mnemonic*. The visual equivalent is when part of the interface or display lights up when interacted with, and the light-up effect and the alert sound usually work together.

It is very seldom that sound-based signs are used in the literature, but one exception is the Virtuals that Stephen Baxter includes in several of his short stories and novels. In his descriptions of these Virtuals (volumetric displays of artificial intelligences), he mentions soft chimes and tiny pings, often associated with Baxter's idea of protocol violation rules for these Virtuals, as in the following excerpt from *Siege of Earth*.

They played elaborate games of hide and seek, which could involve hiding inside the fabric of a wall, which evidently didn't hurt that much; the air was full of warning pings, and the laughter of the boys.

Besides Baxter's violation protocol pings, there are very few literary sound-based signs used to signify virtuality, but the following descriptions from William Gibson are an example. Gibson envisions an artificial voice composed of arbitrary sounds from a large sound archive (from *All Tomorrow's Parties*).

It was one of those voices that they fake up from found audio: speech cobbled from wind down skyscraper canyons, the creaking of Great Lakes ice, tree frogs clanging in the Southern night.

This example works by highlighting the artificial nature of the character's voice. What unite all these sounds signifying virtuality are their associations to artificiality and electricity, and to computer technology.

Yet another aspect of sounds that emphasizes artificiality, and thus can signify virtuality, is the synthetic voice. This often signifies that the character is a virtual character and it can for example be heard in *Johnny Mnemonic*, *Resident Evil*, *Tron*, *Tron Legacy*, and episode 9 of the TV series *Ghost in the Shell: Stand Alone Complex*. Usually these voices are manipulated with effects such as echo, reverb and flanger (very short delay combined with phase variation). They can also have the archetypal detached computer voice. The trope of the emotionless and detached voice of an artificial intelligence is highly influenced by the computer HAL 9000 in Kubrick's *2001: A Space Odyssey*. HAL's voice, performed by Douglas Rain, superficially involves a detached performance, but several other aspects of the voice are outlined in James Naremore's *On Kubrick* (2007). HAL has been referred to as sounding gay, but he is rather androgynous, maybe revealing traces back to the originally scripted idea that HAL should be female (Clarke, 1972). Michel Chion (1994) calls HAL's voice an acousmètre, a disembodied voice that seems to have panoptical knowledge of everything. HAL's voice is recorded with a microphone very close to the actor's mouth and with no reverberation. This contrasts his voice with the human astronauts that have voices that belong in the physical space portrayed on screen. The effect is the suggestion of an ubiquitous artificial

intelligence, permeating both the material ship interior as well as the immaterial, electronic spaces of the spacecraft. HAL's voice subtly signifies that he is a creature of both the physical and the virtual. A decade later, in *Alien* (Scott, 1979), the aptly named artificial intelligence and ship computer Mother cemented the science fiction trope of the female artificial intelligence.

In my own productions, I have only once worked with sounds; in the Via Tecta project, Jonathan Westin and I discussed the possibility of using audio. When the virtual heads-up display slides down across the visualization it does so with a mechanical, clunky sound, and we did discuss other sounds that could be used to signify the virtuality of the wireframes that appear in the display. We had the ambition to try something new and fresh, and we experimented with the screeching, tearing sound of wrinkling a half filled balloon. The idea was interesting but regretfully we never had time to actually test the sound and the visuals together.

Thus, the audio signs that are used to signify virtuality are few, and they are also rather simplistic, and attached to the visual signs. A [beep] here, a [buzz] there, and the obvious choice of manipulating the voice of the virtual character. In general, sound plays a vital role, but in a quite limited manner. One exception is *The Matrix* and its sequels where the soundscape is especially dense and complex, using a variety of sounds to signify virtuality. In an interview with sound designer Dane Davis, he explains how the directors, the Wachowski brothers, required the soundscape of the movie to be "motivated by electricity" (Carlsson, 1999, p.1). The movie makers also establish a specific sound, unique for the Matrix franchise. It occurs almost immediately, during the title sequence: a complex blend of chiming, sliding, metallic, creaking sounds. It is repeated frequently throughout the movie, seemingly related to different events in the virtual world; it is heard when a telephone, or when the sub-way train approaches during the climactic fight between Neo and Agent Smith. The sound does not have any diegetic explanation and it is not directly associated to artificiality, electricity, or any particular topology of virtuality. The only occurrence of the sound being diegetic appears in the short story *Final Flight of the Osiris* when the sound accompanies a samurai sword slicing through the air of a virtual sparring program world. The moving blade distorts the air around it, causing a kind of ripple effect, suggesting that both the sound and the ripple are caused by the synthetic disturbances occurring in the virtual air around the virtual sword blade. Both the ripple and the sound are arbitrary signs, signifying virtuality because it is strange and different. Things like that are not seen or heard in the actual world. Therefore, they are beyond the actual. *They are virtual.*

Production culture and representation of virtuality

One mistake in media analysis is to regard media production as a perfect process, as if everything is a direct expression of the storyteller's intentions and professionalism. This is not the case, and the productions I have participated in and my interviews with other media producers bring forward some of the production culture circumstances that can be especially related to fictional representations of virtuality.

The computer graphics and live action divide

When movie makers produce shots that are supposed to show a virtual environment, they have two production approaches to choose between.⁵⁸ One approach is to use computer graphics in order to build the environment as a 3d model (an actual virtuality) and then render it. In this case, the artist use technology and artistic skill to *add* details to the originally empty 3d model, thereby increasing realism. In this approach, the work with increasing realism does not go all the way to full photorealism. Instead, the work stops somewhere between the abstract and the realistic, in order to convey virtuality. What conveys virtuality then is the lack of realism that comes from the production method itself. The other production approach is to not use computer graphics, and instead shoot live action. During the 90s, virtual worlds in movies started to be realized by shooting actual actors and physical sets. They were then made to appear virtual by a range of different signs: unnatural color grading, image artifacts, and signs related to the narrative and the dialogue. Instead of adding realism, realism was taken away from footage that originally appeared real. *The Matrix*, *Avalon*, *The Thirteenth Floor* and *eXistenZ* are all examples of this.

During the 80s and 90s, the makers of movies such as *Tron*, *The Lawnmower Man* and *Johnny Mnemonic* primarily used computer graphics, the first approach outlined above, to portray the fictive virtuality. These computer graphics were similar to the technology that was used to create the actual virtual reality environments of those days. Limitations in technology then became the source of signs of virtuality. When *Tron* was produced, the computer graphics of the day was highly limited. Rendering algorithms only allowed simple shadows, it was difficult to apply complex surface textures, and 3d models had simple shapes. The limitations to 3d modeling were such that simple, geometric shapes and flat textures prevailed. Signs such as [abstract] and [geometrical] were motivated by such production procedures and such technical limitations. As Bill Kroyer, storyboard artist at *Tron*, explains in an interview (Pellerin, 2002, at 03:28):

It was this constant give and take of visual requirements with their technical possibilities that created Tron.

Today we have the technical capability and artistic skills to create fully photorealistic virtual environments, and thus it is more common to use the second production approach outlined above. The paradigmatic repertoire of signs is broader thus, and signs of virtuality can be more arbitrary. This might have freed movie makers creatively to more or less abandon computer graphics to create fictional virtualities, in favor of live action. When real-life computer graphics could create photorealism it became uninteresting to accentuate the computer graphic style when signifying virtuality, and live action was used instead. Also, it might be that shooting live action is to a large extent a creative decision grounded in production circumstances. After all, it is easier – and more cost effective – to shoot

⁵⁸ Making the movie as an 2d animated movie – a cartoon – is actually a third production approach that has been used, for example in *Ghost in the Shell* and *Magnetic Rose*.

an actor and then color grade her than it is to build and then animate the same characters using computer graphics. The effect is that the virtual worlds we see portrayed in contemporary movies appear much more realistic, and not as abstract as their predecessors. Flueckiger (2008) suggests that during the 1980s and early 1990s, fully photorealistic virtual characters were so “inconceivable” that they were considered “unattainable” (p.13). It might be that it was not until the late 1990s that photorealistic virtual characters could have been plausibly incorporated into fictional narratives, and thus the production method of shooting and then color grading live actors was opened up.

Since the two *Tron* movies bridge the time between the early productions using computer graphics, and the later productions using live action, it is interesting to discuss how the sequel *Tron Legacy* was produced. The production crew of *Tron Legacy* shot actors on sets. It featured much more visually complex and realistic environments, trying to find a balance between on the one hand an abstract virtuality and on the other hand a rich, dense and spectacular virtuality that almost seems physical. Since the mise-en-scène and visual style of the virtual world of *Tron Legacy* is highly realistic and almost fully physical (with virtual smoke from virtual tires, virtual skid marks on the virtual ground, virtual clouds in the sky, and so on), the movie makers had to rely on subtle color grading, production design, supernatural actions and dialogue to signify virtuality. The production design of the movie indulges in a visual feast of virtuality; the obligatory metaphor of the glowing lines is taken up from the original *Tron*. Everything is aglow, representing electricity and hence virtuality. However, at the same time, the production design defies and shies away from the virtual. The visual style is highly photorealistic – as opposed to the stylized and often cartoonish *Tron* – and the director Joseph Kosinski mentions in interviews that he deliberately wanted to have a very physical version of virtuality (Nathan, 2011; Pollack, 2011). In flashback shots, we see the avatars of the humans Kevin Flynn and Alan Bradley, wearing stylish black leather jackets, with only one reference to the production design of the original *Tron*-suits – a white glowing stripe running along the front of the jacket.⁵⁹ It is as if the director Kosinski and production designer Darren Gilford cannot make up their minds; is it cool to be virtual, or is it nerdy? *Tron Legacy* is based on the legacy of the original *Tron* movie, and Kosinski seems to believe that the abstract and cartoony style of the first movie is a bit too much for modern audiences, accustomed to the apparently real virtual prisons of *The Matrix*, *The Thirteenth Floor* and *Inception*.

Literature obviously does not have the production limitations that movie productions have, but William Gibson nevertheless let his cyberspace be highly influenced by the real-world limitations of computer graphics. Examples of abstract virtual objects include “the little yellow pyramid” and “bright geometries representing the corporate data” in *Burning Chrome*, and the “stepped scarlet pyramid of the Eastern Seaboard Fission Authority burning beyond the green cubes of the Mitsubishi Bank of America” in *Neuromancer*. Sabine Heuser (2003) has also discussed the latter passage, and Istvan Csicsery-Ronay (1992) has made similar

⁵⁹ At 52:35.

observations, commenting that Gibson's cyberspace seems to be built by "rapidly moving geometrical figures of light in a metaphorical transformation of solids" (p.236). William Gibson conveys a landscape built of artificial, immaterial abstraction.

When the virtual becomes a spectacle

The representations of virtuality that I have studied are often deeply integrated with the narrative. They are not wallpaper added just to help the audience distinguish virtual from the actual, on the contrary they are a central backbone of the story. This often makes it impossible to separate the designs of the fictive virtuality from the requirement of telling a dramatic and compelling story. Many signs of virtuality are also used to dramatize events, forming the spectacle of the narrative. Thus signs of virtuality not only have the function of representing virtuality, but sometimes the double function of bringing spectacle to the narrative. Sometimes this might be their only function. Spectacle has been theorized, most notably by Guy Debord in his *La Société du spectacle* (1967). His main argument is that mass media have replaced lived experiences and human interaction with mere representation, and *being* has been replaced by *appearing*. Spectacle has a political dimension, but can be discussed disconnected from the ideology of Debord. Some movie makers object to cinematic spectacle on both aesthetic and implicitly political grounds, maybe most noteworthy Lars von Trier when he justified the Dogme 95 manifest with the lament that "anyone at any time can wash the last grains of truth away in the deadly embrace of sensation. The illusions are everything the movie can hide behind" (von Trier, 1995, p.1).⁶⁰ Political implications aside, there are aesthetical and narrative hazards with spectacle. Just as with the aesthetics of *sexy*, the aesthetics of *spectacle* often rely on extravagant exposure. Exposure of skin can be sexy, and to create spectacle other things need to be exposed, for example, advanced technology, huge spacecraft, and large-scale destruction in slow-motion detail. As pointed out by Baudrillard (1990), there is a pornographic dimension to the totalizing hyper-reality that he speaks about. But, too much exposed skin becomes un-sexy, and too large a spacecraft, or too huge an explosions become un-cool. Both *sexy* and *spectacle* must push the boundary, but not penetrate it.

When Neo and Smith perform their epic battle over the virtual metropolis in *The Matrix Revolutions*, when *Tron Legacy's* Sam Flynn materializes his light bike in a cascade of light, or when Sam Tyler in *Life on Mars* sleeps in his leather jacket... is it virtual, or is it just spectacle? It is reasonable to assume that sometimes a specific expression is merely a spectacle, and sometimes carries the meaning of virtuality *and* being a spectacle. Consider the scene in *The Matrix Reloaded*, where the virtual character Merovingian forces a virtual woman to orgasm using computer code hidden in a (virtual) dessert cake. The primary meaning of the scene is to depict Merovingian as unsympathetic and to create a spectacular situation. Indirectly, the

⁶⁰ A few years later von Trier directs the spectacular art-house-porn-horror *Antichrist* and then the dystopian science fiction *Melancholia*, both embracing visual effects without the slightest hint of embarrassment. This suggests that von Trier does not reject the possibilities that the spectacular manipulation of the image have opened up, rather he reflects on it.

scene also portrays aspects of the virtuality, since it is an example of a character using code in order to take control over someone else. As I will discuss frequently in this poetics of virtuality, many signs of virtuality have a tight unification between what they denote, what they connote, and thus, these signs often have an aesthetic of spectacle. It might even be obvious that representations of the virtual are perceived as spectacle. Technology can be regarded as a spectacle, as illustrated by action heroes such as James Bond and Iron Man, who rely on spectacular high-tech devices. Virtuality is characterized by technology, and often extraordinary such. Therefore, an effective way to signify virtuality is to contrast it with the ordinary, with the nature, and instead make it stand out. This can be the flickering of a hologram, opposing it to the calm and steady nature of a physical object. It can be the supernatural speed and strength of Neo, opposing his capabilities to our weak actual bodies. So there are numerous signs of the supernatural that connote virtuality, and since they stand out from the ordinary, such signs also create visual interest and spectacle.

Signs of virtuality and their relation to the plot

Signs can be characterized by how they relate to the narrative and its plot. If we consider the *purpose* that signs of virtuality have in a plot, they can be roughly categorized as per the bullet points below. This emphasizes that signs of virtuality have a purpose in relation to the plot. Some signs of virtuality are plot related and have to carry a large burden of meaning. Other signs of virtuality do not have to convey so much of the plot, and then the storyteller are more free to construct these signs. The former, plot related signs, might be constructed primarily to convey the story and only secondarily in order to say something about virtuality per se. The latter, not plot related signs, can have the reversed priorities, opening up for several relevant reflections on virtuality.

- **Signs carrying narrative clarity** are important as prime carriers of the plot. These are signs that show the audience as clearly as needed where the narrative takes place at any given time, in a virtual or an actual world. A good example is the usage of different time epochs in *The Thirteenth Floor*. The two virtual worlds are portrayed as the 1920s and 1990s. These time epochs efficiently differentiate between the different worlds, but their production design and cinematography do not have much explicit to say about virtuality.
- **Dense characterizing signs** are primarily used to establish and maintain the movie's specific style, often becoming a trademark for the movie. The streaming curtains of computer code quickly became a stylistic code which characterizes *The Matrix*, and the light-bikes rushing through the virtual space of *Tron* launched themselves into twentieth century iconography. These signs are often striking and visually spectacular; they are examples of the stylistic codes described by Eco (1982; 1985). Stylistic codes are often, according to Eco, the mark of an auteur, or the result of a typical aesthetic ideal. They are predominantly complex super-signs, and even if their primary purpose is to be memorable and spectacular, they can nevertheless have much relevance for

our way of interpreting the virtual. It should be noted that even though these stylistic codes for signifying virtuality become highly associated with the narrative – as in the case of the [curtains of green glowing code] of *The Matrix* – they are just the tip of the proverbial iceberg, and should not get all the attention in our analysis.

- **Supporting signs** do not draw much attention; often they are not even brought to the audiences' attention at all. They can be repeated dialogue references such as “download” (*The Thirteenth Floor*), “simulation” (*The Matrix*, *The Thirteenth Floor*) or “system” (*Avalon*). They can be visual details such as scan-lines (*Avalon*, *The Matrix*, *Tron Legacy*), desaturation of the image (*Avalon*, *The Thirteenth Floor*, *The Matrix*, *Tron Legacy*), or pixelation (*Avalon*, *The Matrix*, *Tron Legacy*). Even though these signs are often subtle and non-intrusive, they nevertheless permeate the diegetic world with a tapestry of reminders of the virtuality of the depicted environment.

A narrative can be split up into *appearances* (mimesis) and *events* (diegesis) (Bordwell, 1985; Genette, 1980).⁶¹ Appearances are how the world seems, how it looks and sounds. Events are what happen in the world, the characters that inhabit the world, and what they are doing and saying. There are many signs of virtuality that fall along a continuum between these two opposites; they are related to both events and appearances. Immateriality for example can be signified by [semi-transparency] – which is an appearance – but it can also be signified by objects that [fragmentize] – which is an event. The division into mimesis and diegesis will be used as a starting point in the following two chapters. However, we should remember that, as the example of immateriality illustrates, many signs and super-signs have a syntagmatic construction where mimesis and diegesis support each other.

⁶¹ Flueckiger (2008) makes a similar division into appearance and behavior in her analysis of digital bodies.

Mimesis – show, don't tell

As explained at the end of the previous chapter we will now look at how virtuality is represented via *appearances* (mimesis) and *events* (diegesis) in a fictional narrative. We will start with mimesis. Mimesis “conceive(s) of narration as the presentation of a spectacle: a *showing*” (Bordwell, 1985, p.4). This showing, this representation, originates in Aristotle’s ideas about narratives, especially in relation to theater, and Plato’s more general ideas about perfect imitation, extending the concept to include not only drama but also iconic representations such as statues or pictures (Genette, 1980). Mimesis is not replication or copying; rather it is “the active process of imitating or representing something” (Ricœur, 1984, p.33).

Mise-en-scène, cinematography, and production design

In movie making, the concepts of mise-en-scène, cinematography, visual style and color grading blend together.

The mise-en-scène, literally meaning *to put in the scene* (Sikov, 2010), usually refers to everything that appears in the picture (Bordwell & Thompson, 2003) and how “the overall patterns of actor movement and stage space” are organized (Bordwell, 1985, p.14). The prefix *mise* emphasizes the involvement of a “creator’s intervention” and the “overriding intelligence” (ibid., p.15) of a storyteller.

Cinematography is how the camera shows the world (Bordwell & Thompson, 2003). In classical Hollywood cinema, cinematography is subordinate to the story, but there are also movies where the cinematography is allowed to dominate and “to be consumed as an experience in itself” (Bolter, 2000, p.70). The importance of these components varies, and in spectacular narratives – such as science fiction – the mise-en-scène, and the production design, often become centerpieces of the movie, even becoming a kind of character (Arnman, 2005; Buckland, 2006; Lacey, 2000; LoBrutto, 1992; Neumann, 1999). The monster in *Alien* or the metropolis in *Blade Runner* become almost erotic in a way that is comparable to pornographic movies. The drive of the story is to confront the monster or inhabit the city, but at the same time this only works if we, the audience, are handed out carefully measured glimpses of monster teeth and futuristic skyscrapers. If we see too much, it becomes silly and boring (Arnman, 2005).

Visual style could simply be described as *how the images look*, and cinematography and color grading are the methods for achieving this look; they are – together with production design – a part of the visual style. Generally, cinematography deals with actions taken before acquisitions of the images, before shooting, such as selecting camera, camera settings, film stock, lighting, filters and so on, while color grading refers to actions taken in post-production, for example, the digital manipulation of hue, saturation, brightness and so on. Bordwell (2007) suggests that the visual style of a movie can be a manifestation of the movie maker’s personality, an expression of an emotional state, or a property of the movie’s design. In art history, the concept of *style* is used to group together works that relate to each other, often because they have been designed and produced at a specific time, place or by a specific artist or group of artists (Ferne, 1995; Gombrich, 1998; Shapiro, 1998).

Style is a distinctive, and therefore recognizable, expression, manner or production method. Therefore, visual style is a matter of paradigmatic choice between different options within a defined design space, and these available options can often be influenced by technological change (Gombrich, 1998), such as a new kind of paint or a new kind of rendering algorithm (to contrast a centuries old technological change with innovations occurring nowadays in computer graphics). Sometimes, a particular style can be connected with specific visual features, but often the characterization of a particular visual style can be hard to define. For example, anime – Japanese animation – often features characters with large eyes, but also involves more subtle features, such as limitation of movements. If a particular artist makes choices that move the artwork outside of a particular style, it stretches the boundaries of what that style can be, or the artwork can no longer be categorized under that style. Style can thus be both descriptive and normative (Gombrich, 1998), and style can also be conceived of as a value term (Shapiro, 1998), making a distinction between a right and a wrong style. I use visual style as a descriptive term, and I see it as a more generic term than cinematography, color grading, production design and mise-en-scène. For example, *Tron* and its sequel *Tron Legacy* have distinctly different styles, *Tron Legacy* being more detailed, more photorealistic, more physical, and more modern, and all these differences show in the cinematography, color grading, production design and mise-en-scène.

It is easily taken for granted that photography and cinema show the world just as it is, but the situation is not that simple. Imagine taking a photograph of the view through your window. The image would look quite similar to what your eyes see directly, but not exactly. Different image artifacts show marks from the production process. Maybe the strong sunlight creates a lens flare, or the photographic emulsion we used has an obvious film grain. These differences can be regarded as signs. The lens flare and the film grain tell us that the image is not what our eyes see; it is what a camera has acquired. The visual style of a movie, its cinematography, will always be something else than what our eyes would have seen, and this visual style is invested with meaning. Is the visual style a way to see the world, or is it how the world really is? Imagine stepping into the diegetic world of *The Matrix*, or any of the other studied narratives with a pronounced color grading. Would your hands be green tinted when you look at them? Tint is a part of the color grading, and it plays a vital part in characterizing the diegetic world. In a movie such as *Traffic* by Steven Soderbergh – where the scenes taking place in Mexico have a yellow tint and the scenes taking place in the US have a blue tint – the intention is not really to suggest that Mexico actually is more yellow than the US. However, in *The Matrix*, is it the world that is green, or is it conveyed as that? Usually the audience does not engage in this kind of hairsplitting, as long as the movie has organic unity between its different parts. We have learnt to accept the quite blurred line between the world and the storytelling. What is relevant is that green – along with other hues – represents virtuality.

As an example of how cinematography, production design and mise-en-scène combine, consider how the following excerpt (Figure 10) from *Tron Legacy* was created.



Figure 10. Excerpt from Tron Legacy, exemplifying how different design decisions are created by different professionals during a long process of production design.

The image exemplifies how one single shot can have a production history and a design process that involves many artists over a long period of time. Most likely the work with the scene started with a sketch for the conceptual design – investigating lighting, color, mode and such. Most of the scene was shot live action with the actors in suits with practical light effects. In post-production, the computer generated hologram head was added, and the whole image was color graded. Before and during the shoot the cinematographer is responsible for deciding on camera, camera settings and the lighting on set. At the same time, the wardrobe designer has been working under the production designer, deciding on the design of the suits and their glowing patterns. This means that the cinematographer and the production designer are leading creative professionals that have responsibility for what is shot and then handed over to post-production. They both report to the director, the top creative leader of the movie production. When the shot enters post-production, computer artists will build, animate and render visual effects such as the hologram head, a compositor will add it to the shot, and a color grader will make final adjustments to color, light and such in the final shot. They all have influence on how the final image will appear, and thus have input on how this particular example of virtuality will be conveyed. The director remains the creative leader throughout the post-production as well.

The complexity described above is typical, especially for movies such as *Tron Legacy* and *The Matrix*. Many signs related to cinematography, visual style and production design have simple representamen with complex interpretants, such as [glowing lights], [primary colors], and [semi-transparency]. Others have more subtle and complex representamen, for example how the movement of the camera occasionally seems to signify virtuality. In the 3d animated short *Final Flight of the*

Osiris, the camera work is notably different in the virtual world sequences and the actual world sequences. In the latter, the camera moves in a conventional nonintrusive manner, typical of live action photography (even if the camera is 3d animated). The camera is locked down, makes subtle dolly moves, or mimics Steadicam shots following running characters. In the virtual world the camera work is different. One of the virtual worlds we see is the training program where the male and female protagonists are engaged in an erotically charged sword training sequence. During this sequence, the camera moves freely and draws attention to how it follows the characters movements. When the clothes fall from the male and female bodies, the camera studiously circles around and perfectly captures the grace and beauty of their virtual avatars. When the woman later races through a city the camera speeds along by her side; the complex movements of the woman and the camera take on the form of a choreographed, acrobatic dance.⁶² Complex camera movements are, of course, not unique for movies depicting virtuality; contemporary action movies often have complex camera movements, and even as early as in *Citizen Kane* from 1941, complex free-moving camera work has been used.⁶³ Such camera movements do not signify virtuality in *Citizen Kane*. Neither does the free-moving camera in *Final Flight of the Osiris* explicitly tell the audience that the world is virtual; instead, it is a supportive sign, characterizing the virtual world. The choreographed camera motions connote both how the point of view moves in computer games (Kampmann, 2003) and the floating, liquid freedom of a world where physical restrictions such as gravity are optional.

Semiotic inertia - the green flickering screen

The very first computer graphics I made was in the last term of secondary upper school, in 1987. My classmate Dennis Saluäär and I coded software that, amongst other functions, displayed an accurate star field chart. We ran the software on *Compis* computers using the Comal programming language. The screens were low-resolution and mono-chrome (Figure 11). They displayed monochrome green graphics on a dark background. And, they *flickered*.

⁶² See for example the shots at 01:51 and 06:00.

⁶³ At 14:17.

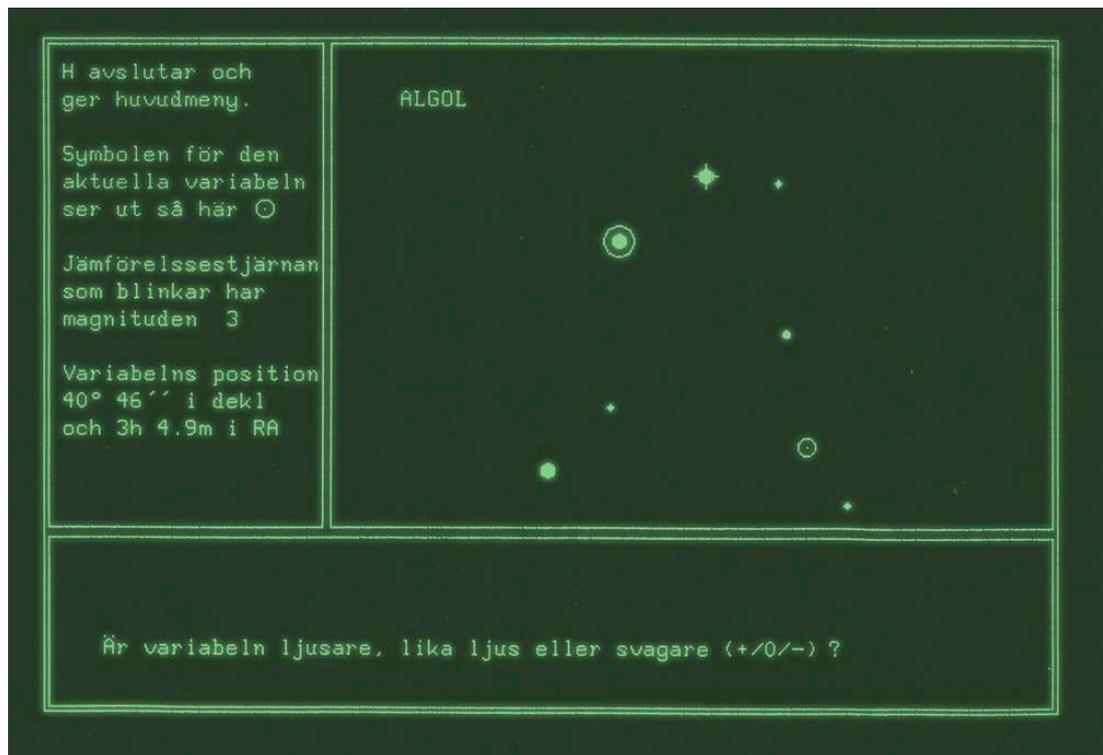


Figure 11. The D&T Astromedia star field chart, created by the author and Dennis Saluäär in 1987.⁶⁴

About twenty years later, in 2006, I did computer graphics star fields for the science show *Rymdlust* using the state-of-the-art 3d software Maya (Figure 12).

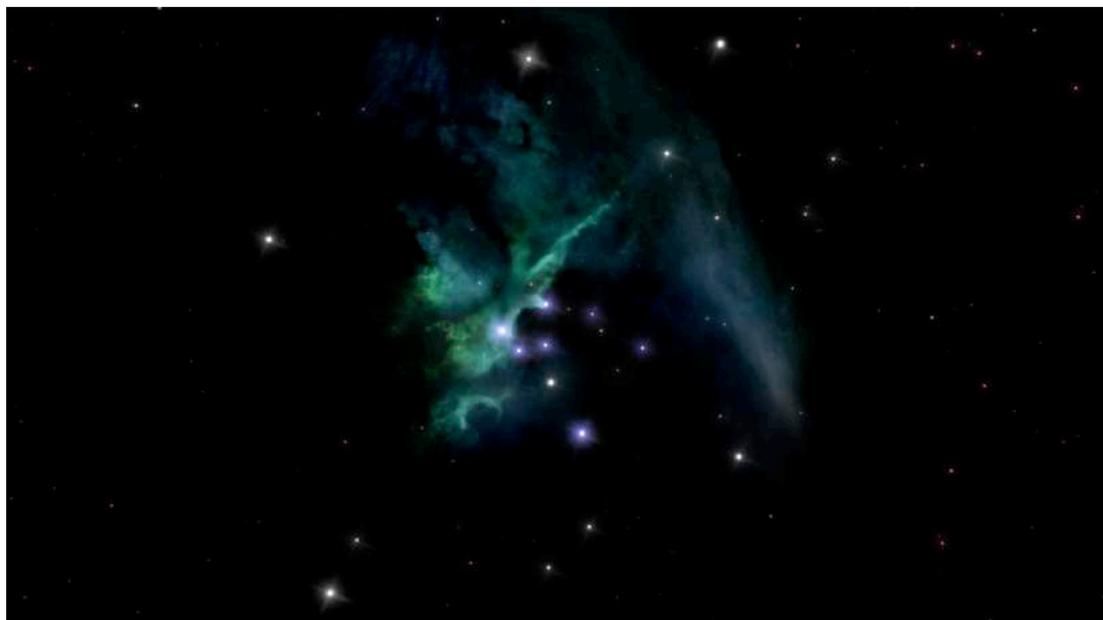


Figure 12. Star field from the science show *Rymdlust*, created by the author in 2006.

⁶⁴ This is a simulated screen shot, based on actual screen printout modified to correspond to my memory of how the screen appeared.

Just as when comparing the movies *Tron* (1982) and *Tron Legacy* (2010), it is striking how far computer graphics have evolved in a few decades. In the light of this evolution, it is interesting that one common strategy to signify virtuality is to use signs related to vintage computer graphics and display technology. The 1987 screen shot above includes many of the most important signs related to old computer graphics and displays: [flickering], [low resolution]/[pixelation], [mono-chrome], [green color], and [glowing lines]. It is as if there is a semiotic inertia causing old image artifacts to turn into signs of virtuality that survive, and thrive, long past their due date. This tendency to use the appearances of old signs, a tendency which I choose to call *semiotic inertia*, is a common phenomenon in sign-production.⁶⁵ It is similar to the often-stated example of how the first cars retained the attributes of horse carriages long after the horse was cut out of the equation (see Figure 13 for another example). Umberto Eco (1976) emphasizes that new signs are always based on the previous, suggesting “no new cultures can ever come into being except against the background of an old one” (p. 256).



Figure 13. Another example of *semiotic inertia*; even though modern trains do not look like this, road signs depict an old train.

Jay David Bolter and Richard Grusin (2000) use the term remediation to describe how a new media reforms and refashions an older media, and how this leads to the “representation of one medium in another” (p.45). They argue that modern media has both immediacy and hypermediacy in a contradicting and ambivalent way. Immediacy is the urge to erase all traces of mediation, as in an engaging action movie with photorealistic visual effects and continuity editing, or a virtual reality environment. Hypermediacy is the urge to play with the media, and indulge in mediation, as in a found footage horror movie or a Dogma drama, both of which represent a documentary style that acknowledges the camera as an object, and thus acknowledges the mediation. The ambivalence between immediacy and hypermediacy can be seen in the fictional representations of virtuality, for example in *The Matrix* where the virtual world seems to be a total simulation, fully realistic

⁶⁵ The phrase *semiotic inertia* has been used by Corrington (1992; 2000) but in a different context, more related to how mythical images express themselves.

and immersive for Neo and the other inhabitants. This gives the virtual world a high level of immediacy. In contrast, the movie makers deconstruct the perfection of the illusion by tinting the virtual world in the green hue of an old cathode ray tube computer screen, emphasizing the mediation of the world, making it hypermediated. Likewise, in *Tron Legacy*, the virtual world is given a tactile, physical impression by the movie makers, but then they deconstruct it by inserting elements of primitive computer graphics, such as grid lines and pixels. However, I will not make any extensive use of the term remediation. These virtual worlds are not primarily old media refashioned in new media; they are, rather, virtual worlds that in different ways signify, or remind us of, their virtuality and artificiality. They are perfection that borrows imperfection from earlier technologies.

Semiotic inertia connotes a certain nostalgia that appears when new technology is integrated into the fabric of society (Olivier, 2011). Etymologically, nostalgia traces back to the Greek words for returning home and pain or sorrow. Nostalgia gives the impression of something being lost, and when we mythologize new technology with the impression of old technology we soothe us into believing that we have returned to what has been lost. Nostalgia gives new technology a certain status, infuses it with a historical context, and prepares us for the shock of the new. Ultimately, this technological nostalgia is reminiscent of the mythological Garden of Eden, a paradise lost through our choice of wisdom and thus technology. The Fall of Man can be read as a metaphor for the idea that we lose an earlier, more innocent state when we develop society and technology. Going forward means leaving something behind. Even though the following discussion will focus on signs referencing old display technology, there is another kind of nostalgia in how movie makers often choose to portray fictional virtual worlds in the style of historical epochs, discussed on pages x and x.

When signs of virtuality reference old technology, it is often a matter of picking up on image artifacts that have been more or less eradicated today and then emphasize them to a point where the technology seems close to breaking down. Movies such as *Tron*, *The Matrix* and *Avalon* exhibit the paradigmatic repertoire of [flickering], [scan-lines], [pixelation], [green color], [glitches], [distortions], [static noise], the simulated [TV screen shut-down], and so on. These are all signs that are reminiscent of old and faulty display technology. These references to old technology can be direct, one example being the inclusion of computer or TV screens in the *mise-en-scène*. This is used frequently, and it is similar to how computer technology, in general, is connoted via physical devices such as tape stations, computer screens or keyboards (Bolter, 1984). The digital and the virtual are elusive and often not very visual, so physical manifestations of technology are often used instead. Both *The Matrix* and *Avalon* exhibit an almost fetishist fascination with old technology. In *The Matrix*, computers in the virtual world are clunky and old. In *Avalon*, the apparently actual world also shares the retro-futuristic visual style of *The Matrix*. In *Avalon*, the protagonist Ash's computer in her apartment often seems to be on the verge of just simply breaking down.

References to old technology can also be more indirect, taking the sub-signs of particularly the TV screen out of their original context, in order to have them as

components in new super-signs. The hologram in *Star Wars*⁶⁶ is a good example; the scan-lines and flickering of the TV screen have been applied to a futuristic, fictive volumetric display recording. A quote from the 2004 DVD commentary track highlights that this is an interesting case of how production technology influences the construction of the super-sign. Dennis Muren states that they ran live action footage of the actor “...through sort of a TV screen like that to give it a real TV electronic look”.⁶⁷ Thus, the reminiscent TV screen attributes were created by actually using a TV screen, even though no TV screens are found in the mise-en-scène. In Figure 14 below, the structure of the *Star Wars* hologram super-sign shows how image artifacts of the TV screen are combined with other sub-signs, remediating the TV screen.

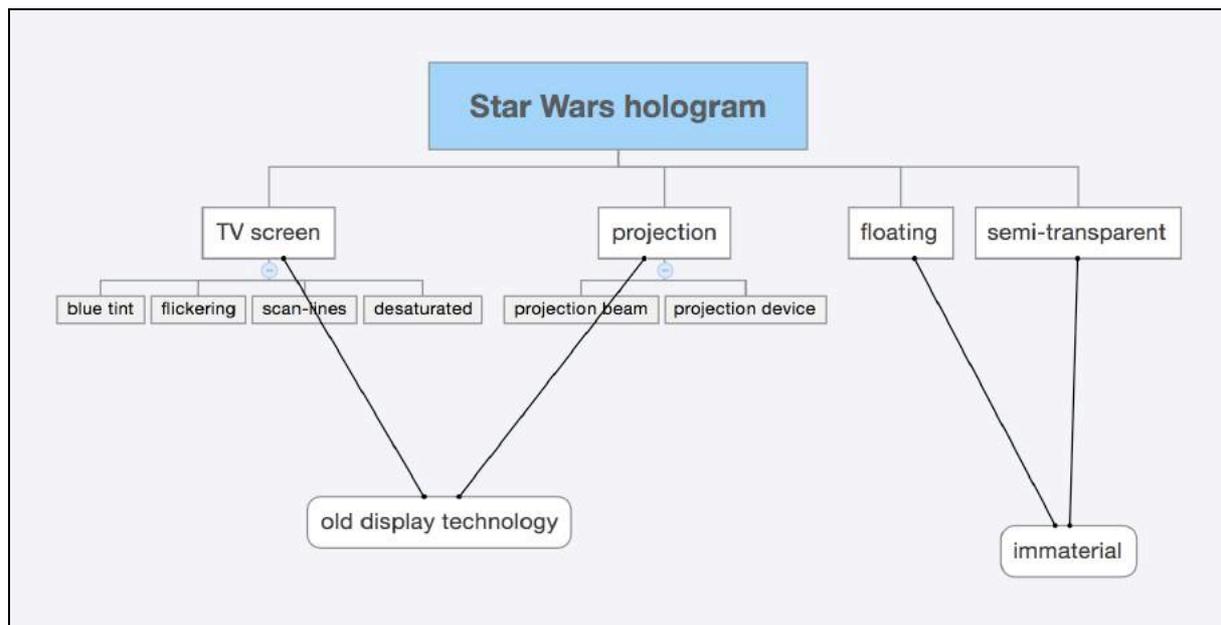


Figure 14. The structure of the *Star Wars* hologram super-sign.

Flaunting artificiality via mediation

The virtual is an artifact, something constructed. Its construction is based on code, written by man. This artificiality of the virtual is often emphasized using signs that connote mediation, as if the artificiality of mediation is copied, and remediated, to the virtual. Virtuality can be seen as both representation and existence; a model slice of the actual world is simulated, and the simulation is then mediated through an interface. By emphasizing the mediated nature of the virtuality, artificiality is likewise emphasized.

A range of signs can be sorted under the strategy of flaunting artificiality via mediation, often related to the foregrounding of old media technology artifacts

⁶⁶ First used at 20:17 in episode IV, then expounded and repeated many times during the whole franchise of movies and the TV series.

⁶⁷ At 20:15. Dennis Muren was assigned the role as second cameraman of the miniature and optical effects unit. In practice he was responsible for many of the visual effects techniques applied in the movie.

such as scan-lines, flicker, green colors, low resolution and wireframes. These old display artifacts are quite often deeply related to *mediation* rather than *virtuality*. Why do the movie makers make such frequent visual references to mediation technology? It is as if the storytellers conceptually mix up mediation and virtuality, or deliberately let mediation technology permeate the virtual. The mix-up seems to have been there in early fictional accounts of virtual reality technology; Ray Bradbury imagined the telvisor, described by Reid (2000), as “a combination virtual-reality room and television” (p.55). The virtual reality room in Bradbury’s short story, *The Veldt*, speaks of glass walls creating the illusion. William Gibson has explained how he conceptualized cyberspace as an extrapolation of existing television technology (Gross, 1989).

So that rather than having to look at a television set and put on the earphones, you simply plug yourself into something that makes you feel that you’re in the environment that the media producer has generated.

The aesthetics of the TV screen are used, *remediated* using the terminology of Bolter and Grusin (2000), to signify virtuality in different ways. The TV is not only a template for reimagining virtual reality, it is also a machine surrounded by symbolism. In *Life on Mars*, Sam Tyler lives alone in his apartment, and his TV set plays an important part in the strange illusion he is stranded in. Mysterious people seem to communicate with him via the TV screen, and the threatening Test Card Girl occasionally leaves the mediated TV world and harasses him. TV screen references abound in the Matrix franchise as well, and the most prominent might be Neo’s audience with the Architect (the machine intelligence that created the virtual world).⁶⁸ The Architect meets Neo in a space completely walled by arrays of TV screens. The camera viewpoint passes through one of the screens several times, only to arrive in the same space again. When breaking the membrane of the screen, the scan lines seem to envelop us. An electronic buzz whispers softly. The Architect illustrates his dialogue by showing scenes of Neo on the screens, as if the TV sets represent the Architect’s artificial mind and his panoptic surveillance of everything that happens inside the matrix. The TV screens are a metaphor, not for mediation, but for the artificial in general, and for different hierarchies of actuality and virtuality. The sequence has been discussed by Catherine Constable (2006) and she interprets the enclosing sphere of TV screens, and the circular passage through screen after screen, as an “inescapable mirror space” (p.240). No matter how many screens Neo passes through, he is still trapped. The difference in Constable’s and my own interpretations – Constable emphasizing entrapment and myself emphasizing artificiality – illustrates how a quite simple super-sign can have multiple connotations.

Flaunting artificiality via electricity

In *Tron*, the virtual world seems infested with electricity. Wherever we look, there are glowing electronic pulses gliding along grid lines. The grid pulses from *Tron* are

⁶⁸ At 01:45:14.

similar to the Matrix [curtains of green glowing code] with its lines of falling, glowing, pulsing signs, and other electronic, racing light pulses can be seen in a range of movies – *Johnny Mnemonic*, *The Thirteenth Floor*, and the Danish cyberpunk movie *Skyggen*. The commentary track provided on the 2002 DVD release of *Tron* gives some glimpses into the creative and technical process behind these running pulses.⁶⁹

...and then it has that pulse to it, which is after I saw the first composite of this scene, I felt that we were lacking a kind of energy, and we needed to bring some life to it, some magical, and so I put this pulse to the light to give it more life.

The above quote is director Steven Lisberger's explanation, seconded by the claims from producer Donald Kushner:⁷⁰

We did little things to keep it alive as it is a lot of dialogue that was going along here... ..so I come up with this zingers that go wailing by in the background, electric comets that blast by just to add the potential for sound, that they are moving more, just to create something interesting in the background, which we tried a lot. ...to keep it from monotonous and boring we just came up with little things in the background.

In an interview, Lisberger suggests another background for the light pulses (Burnett, 2002, at 55:54):

What we did was that from that point on any footage that had this problem, that's where you have these little zingers going through the background like little pulses of light... ..because it was an electronic world and sometimes things glitch.

These explanations could be after the fact rationalizations, but they at least suggest that the [running pulses] super-sign, albeit simple, might come from a complex mix of creative intentions and technical circumstances. And, even if it is a quite simple sign, the interpretants nevertheless form a complex chain of associations, where electricity connotes both artificiality in general and computer technology specifically, which connects further to virtuality. The complexity of this seemingly simple super-sign, and the likewise complex interpretants, is illustrated in the Figure 15 structure (next page). Note that the line between what can be considered a sub-sign is diffuse. [Glow] is a sub-sign of virtuality since it connotes immateriality, artificiality and electricity, but [round] and [small] do not have a connection to virtuality; thus, they are considered structural properties of the sign, rather than sub-signs.

⁶⁹ At 01:04:35.

⁷⁰ At 01:09:35.

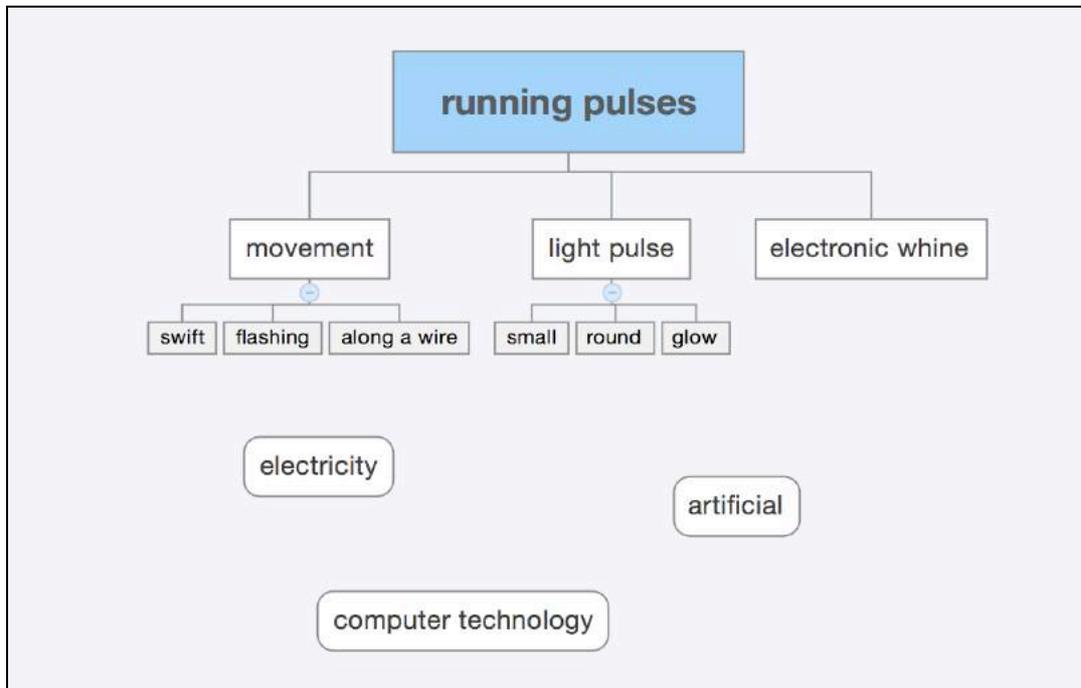


Figure 15. The structure of the running pulses super-sign.

The green and the other colors

...colorization is a bit weird.⁷¹

In *The Thirteenth Floor*, there is the unique example, quoted above, of a direct dialogue reference to the color tint of a virtual world. It is a rare occasion where the characters in the narrative actually acknowledge that the strange colors are a diegetic part of the fiction. In *The Matrix*, the virtual world is slightly green tinted. In *Avalon*, the game world has a strong yellow-brown tint. These are examples of how cinematography conveys virtuality.

Green is one of the primary colors, and as with all the other distinctive colors it comes with its set of connotation and symbolism. Green connotes not just computers, the digital and the virtual. Green also represents nature, and being environmentally friendly; it can even represent weird and alien – as in little green men from Mars. The connection between the color green and computers is possibly motivated by the reference to early phosphor cathode ray tube (CRT) computer screens (a claim suggested by Shedroff and Noessel (2012) as well). A more contemporary connotation is the void of the green screen. A green screen is a background used to key out the background in visual effect shots; a person photographed in front of a monochrome green screen can later be placed in front of any image background. The green screen connotes the virtual set that so often is used to create the backgrounds that replaces the green screen, as well as the total fluidity of the digital image.

Below is a quantitative summary of the observed color based signs.⁷²

⁷¹ In *The Thirteenth Floor*, at 07:31.

Monochrome hue signifying virtuality

blue	85 signs in	30 narratives
red	65 signs in	21 narratives
green	61 signs in	17 narratives
yellow	23 signs in	13 narratives
grey	17 signs in	7 narratives

Color tint signifying virtuality

green	39 signs in	10 narratives
blue	24 signs in	14 narratives
red/yellow	18 signs in	12 narratives

What counts as green, or blue, or any other hue? Green is of course green, but when does it signify virtuality, and when is it just a design choice that does not signify virtuality? For the specific hue to have meaning, it usually needs to be quite dominant, in terms of saturation strength and screen coverage. It is also reasonable to assume the hue has a meaning based on the syntagmatic combination with other signifiers, such as the [blue] [wireframes] used for the 3d visualization of the plane crash into a Manhattan skyscraper in *Escape from new York*.⁷³ There are two fundamentally different ways in which a color is applied – either as a monochrome, solid color on an object in the mise-en-scène, or as a general tint to the image. In the first case, a color in the mise-en-scène, there are often other signifiers coming in to play as well, often signifying virtuality through a stylized, abstract design. One example is the introduction sequence in *Ghost in the Shell*. A collage of images shows the construction of the cyborg/android heroine Major Motoko Kusanagi – apparently the imagery shifts between her physical body and her virtual body. The excerpt on the next page (Figure 16) shows a still image from the introduction sequence, illustrating an abstract visual style, combining the solid [monochrome green] with [floating] in an [empty environment], [stylized shapes], [simple raycast shadows], [pixel cloud] and [superimposed graphics].

⁷² These colors correspond closely with the three most common colors – blue, red and green – used to depict fictional graphical interfaces, according to Shedroff and Noessel (2012).

⁷³ At 11:39.

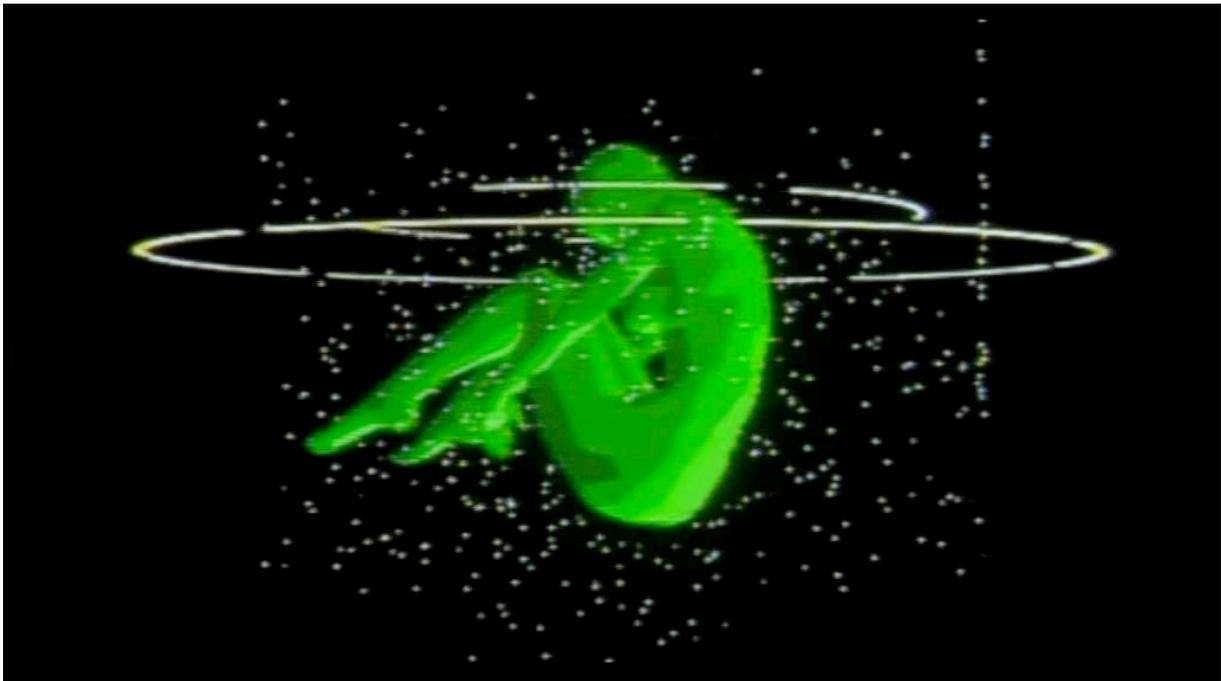


Figure 16. Excerpt from the anime feature film *Ghost in the Shell*. The digital/virtual part of Major Kusanagi's cyborg body is represented in a stylized manner, showcasing a typical usage of solid monochrome green.

An example of [green tint] comes from *The Matrix* where all the sequences taking place in the virtual world are characterized by this sign. This is one of the ways in which the virtual and the actual worlds of *The Matrix* are contrasted with each other. It is used consistently through-out the whole franchise. The strength of the tint varies from subtle to pronounced. The example below (Figure 17) is taken from an *Animatrix* short film; *Final Flight of the Osiris*.



Figure 17. Excerpt from the Animatrix anime short film *Final Flight of the Osiris*. The virtuality of the world is signified by a strong green tint, characteristic for the whole *Matrix* franchise.

Compared to the frequent use in the movies, color is used quite seldom in literary descriptions of virtuality. Stephen Baxter has not referred to color at all, and summarizing the usage of color in William Gibson's descriptions of virtual environments, we see that color does not seem to be that important.

Color signifying virtuality in six of William Gibson's novels and one anthology of short stories

[green]	used 11 times in	6 sources
[blue]	used 11 times in	3 sources
[grey]	used 6 times in	5 sources
[red]	used 3 times in	2 sources
[yellow]	used 3 times in	1 source

Green and blue dominate, just as for the visual depictions in the movies. Gibson uses phrases such as “green walls”, “emerald arches”, “walls of emerald green”, and “infinite blue space”, “chill blue neon”, “a blue flicker” in *Neuromancer*, his first novel. Most of the mentions of blue and green occur in this work. In his later works, reference to color is scant, being used only once or twice in each novel.

That the green hue is grounded in vintage computer displays is an assumption. It gets some support from statements by movie makers. In an online chat session (Wachowski & Wachowski, 1999), the directors of *The Matrix* offered the explanation that “it was a whole motif inspired by the phosphorous green of old PCs”. In an interview (Hanson, 2005) production designer Owen Paterson claims that (p.106):

We decided the real world... would be cold, mechanic. So we would have a blue-gray color sense to the real world. Within the Matrix, it was natural to have a green hue, because we just thought of the basic computer monitor color, that of the green type on the black screen of early DOS operating computers. ... It was easy to get lost, so coming up with those visual keys was really needed.

In addition to green, the usage of blue to signify virtuality also takes possible inspiration from old display technology. The well-known hologram from the Star Wars franchise, first introduced in 1977 in episode IV, has a distinct [blue tint]. This color tint, originally caused by the TV screen used to create the visual effect of the Star Wars hologram, has developed into a common super-sign representing the idea of fictional hologram technologies, picked up by recent movies such as *District 9*, and *Avatar*.

Thus, the frequent use of green and blue can be explained by references to old display technology; the blue TV screen and the green PC monitor. But why can other hues be used to signify virtuality as well? Other hues work by connecting to the interpretant of abstraction, as exemplified by the excerpt on the next page (Figure 18) from *Resident Evil: Afterlife*. Here, the [red] and [blue] do not connote either TV screens or old CRT screens. Instead, it is the syntagmatic combination of minimalistic abstractness and primary colors that connotes artificiality and virtuality.

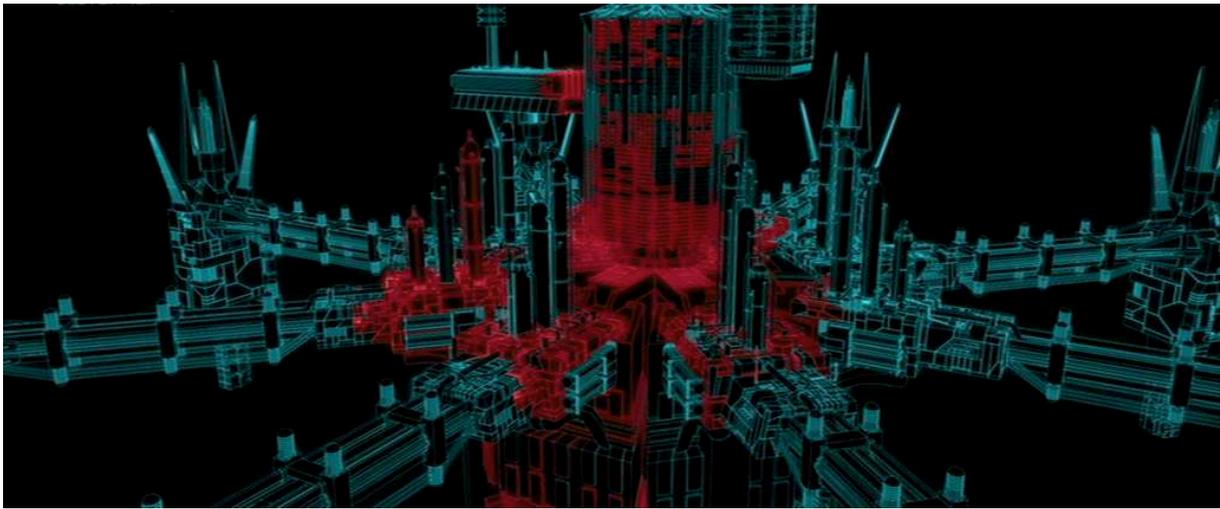


Figure 18. Excerpt from the feature film *Resident Evil: Afterlife*. Two monochrome primary colors, together with empty background, wireframe, and superimposed graphics and data, signify the virtuality of this 3d model depicting an underground facility.

Thus, any color can signify virtuality, as long as it is used in an unnatural, abstract way.

The Cartesian construction kit

Maya is a well-known 3d modeling software that I have been working with for many years. When a new Maya file is created you always see the same: a grey non-space with a single, floating grid. Thin black lines forms a plane. The grid is the basic underlining canvas of the small artificial space just created. On the hard drive, the space is folded into itself, collapsed into a database of x, y and z coordinates, coordinates that through their relationship with each other open up an information space. The connections from this real-life virtuality to canonical cyberpunk narratives such as *Neuromancer* and *Tron* goes deep; in both fictional and real-life virtualities we see the void of cyberspace, the intersecting lines of the Grid. However, William Gibson and Steven Lisberger both got their initial inspiration not from 3d modeling but from watching kids playing arcade games, and Gibson has claimed that he was highly ignorant about computers. He offers the following comment about his first computer (acquired *after* he wrote *Neuromancer*): “I’d been expecting an exotic crystalline thing, a cyberspace deck or something, and what I got was a little piece of a Victorian engine that made noises like a scratchy old record player” (McCaffery, 1991, p.270). That Gibson could nevertheless catch on to the fundamentals of 3d model production by watching arcade games suggests a closeness between the production and the product. Gibson understood the fundamentals of the construction process manifested, as they were, in the arcade games he saw. Form follows tools.

The most fundamental property of the 3d model is the point, a position in Cartesian xyz space. Between two points a line forms. The line connecting dots in the virtual goes back to Sketchpad, one of the first and most influential drawing programs, written by Ivan Sutherland in 1963. The user of Sketchpad positioned

points and then the software connected them. Considering lines more generally, we recognize that drawing a line is a fundamental aspect of our pictorial culture. The line is used in millions of comic books. The line characterizes established line art forms, such as pencil drawings and etchings. The line is fundamental in architectural and construction drawings. The line emerges spontaneously when a young child uses pen and paper. The line was there in the early cave paintings, at least 30 000 years ago.

Parallel and *intersecting* lines create the grid, the basic framework of the computer screen, the TV screen and the 3d model. In *The Grid Book*, Hannah Higgins (2009) describes a grid as “spaced parallel bars broken by another system of spaced parallel bars at such regular intervals as to form a visual lattice and set of standard modules” (p.275). Parallel, intersecting lines create the polygon, the grid, and the wireframe in the 3d model; it creates the pixelation of the digital image and the similar pixelation of the old analogue TV image. These lines are typically straight and the intersections at 90 degrees.

Several of the signs that relate to semiotic inertia – lines, grids, wireframes, polygons, pixelation, scanlines – are deeply connected according to a syntagmatic code, so that they can be combined in different ways. There is no grid without its components, no brick wall without bricks, no street grid without the urban block, and no image grid without the pixel (Higgins, 2009). The first bricks were invented about 11 000 years ago in city-states in Mesopotamia. This collection of signs with ancient roots – lines, grids, wireframes, polygons, pixelation, scanlines – is what I call the *Cartesian conglomerate*. The Cartesian conglomerate symbolizes *construction* and it does so by *stylization* and *abstraction*. This construction is not the physical, material construction of the actual world – based on applying violence to raw material – but the immaterial construction of the virtual world – based on abstract relationships within a Cartesian coordinate system. The drawing, which is the prelude to construction, is abstract because it is a simplified model of the world. Virtual worlds and objects have the abstraction of points, lines and surfaces as their fundamental building blocks. The line, the grid and the polygon with their straight lines and intersections are the opposite of organic shapes. Rosalind Krauss (1985) writes in her essay *Grids* that the grid is “geometrized” and “antinatural ... antireal. It is what art looks like when it turns its back on nature” (p.9). Hannah Higgins (2009) corrects the view that grids are purely artificial with the example of bubbles in a pond forming a quite regular grid. The beehive is, of course, another example. But, despite these examples of natural grids, the general connotation of the grid is artificiality.

The glowing line

In 1968, Charles Csuri created the computer animated video art piece, *Hummingbird*. A collection of scratchy black thin lines formed the image of a hummingbird, an image that fragmented and transformed. The *line* is used over and over again in his art. Even in artwork published by Csuri just a few years ago we see ribbons of color floating in a tangle, we see repetitive curves, and parallel lines. It was obvious for Csuri, and other early computer artists such as Pierre Hebert,

Herbert Franke and William Fetter, to employ the line; the computer displays could not display much more than lines. However, the line was important before computer art. It was a vital part of abstract art in general, and a very specific example is the oscilloscope artists of the 1950s such as Ben Laposky and Peter Keetman (Carlsson, 2003), doing work that was a precursor to computer art. A characteristic of both the oscilloscope screen and early CRT computer screens was that the lines glowed. The glowing line on a dark background became a dominant motif, and a sign of virtuality, in *Tron* and then in a long line of succeeding movies. Everything in the virtual world of *Tron* – from interiors, vehicles, the landscape, and the inhabitants themselves – seems to be outlined and decorated with lines glowing in different primary colors. The sequel almost thirty years later followed up with a substantially different production design – but the glowing lines remained. They became the motif holding the two movies together visually. The very first shot of the *Tron Legacy* title sequence seems to self-consciously reflect on this; across a faintly glowing grid, a single line of light falls down, followed by another, and another, and so on, until the shape of high-rise buildings is outlined. Production Designer Darren Gilford, interviewed in the behind-the-scenes documentary on the 2012 DVD release, alleged that (Horton, 2012, at 00:07)

when you look at the first film, you think of the lines of light, that kind of defines the characters and the architecture and the vehicles. ... The lines of light that flow seamlessly through-out the architecture and the vehicles and costumes are probably the most important theme of the film.

If the ascetic aesthetics of this first shot in this title sequence shows restraints similar to the first *Tron* movie, the shackles are swiftly overcome. In many scenes in *Tron Legacy*, the movie makers indulge in cascades of glowing lines (as in Figure 19).

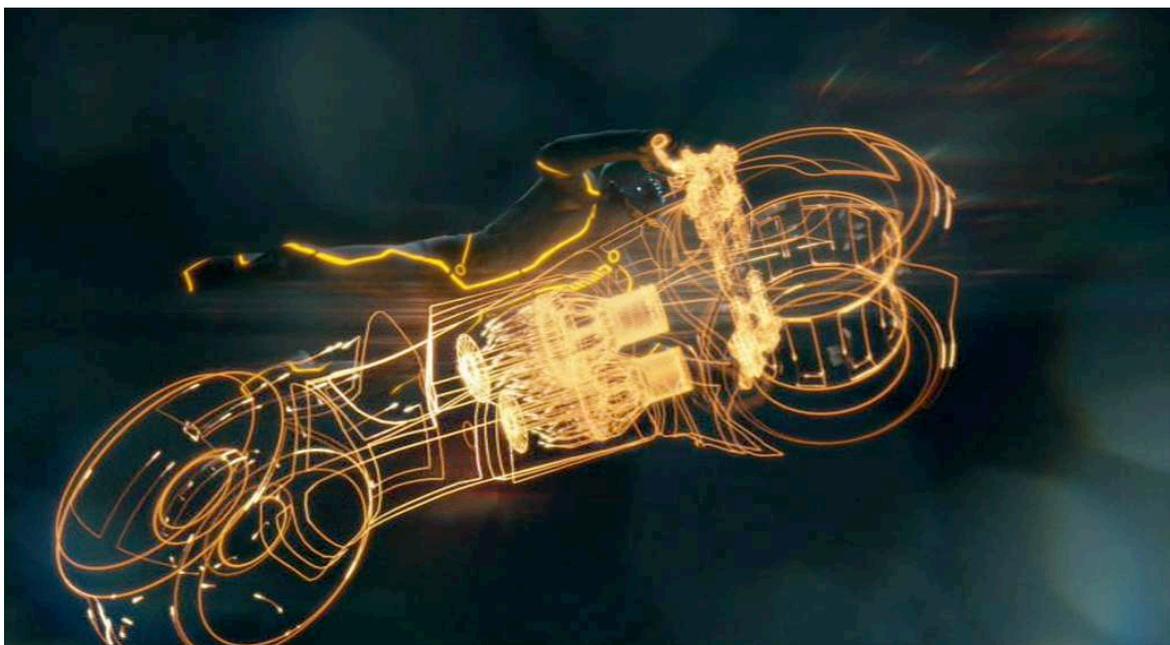


Figure 19. Excerpt from Tron Legacy showing the emergence of a light bike, in a cascade of glowing lines and curves.

The glowing lines characterizing the 1982 release of *Tron* did have its forerunners in influential feature films. *2001: A Space Odyssey* (1968), *Alien* (Scott, 1979), *Escape from New York* (1981), and *Blade Runner* (1982) all featured in-diegetic computer displays depicting different forms of 3d models on the screen.⁷⁴ And the glowing lines of *Tron* have its successors even though no other film has indulged so deeply in the glowing line aesthetics. *Johnny Mnemonic* featured glowing lines, as did *The Matrix* in its own way: the lines of glowing code.

The line signifying virtuality comes in two variants: the glowing line referencing old computer displays and the thin black line, possibly inspired by traditional pencil line drawings. In contrast to the glowing and often ribbon shaped lines in *Tron*, there is the thin line that is often black, like a line on a pencil drawing. The most prominent example is the Zion Control Room in *The Matrix Reloaded*,⁷⁵ a virtual environment used as a control room for the landing dock of the underground city of Zion (see Figure 20). Flight controllers enter the environment and use it as an interface. It is a blank void room similar to the one in *The Matrix*, and the controllers are surrounded by sketchy interactive graphics; floating and immaterial controls have replaced the clunky mechanical levers of a physical control panel.

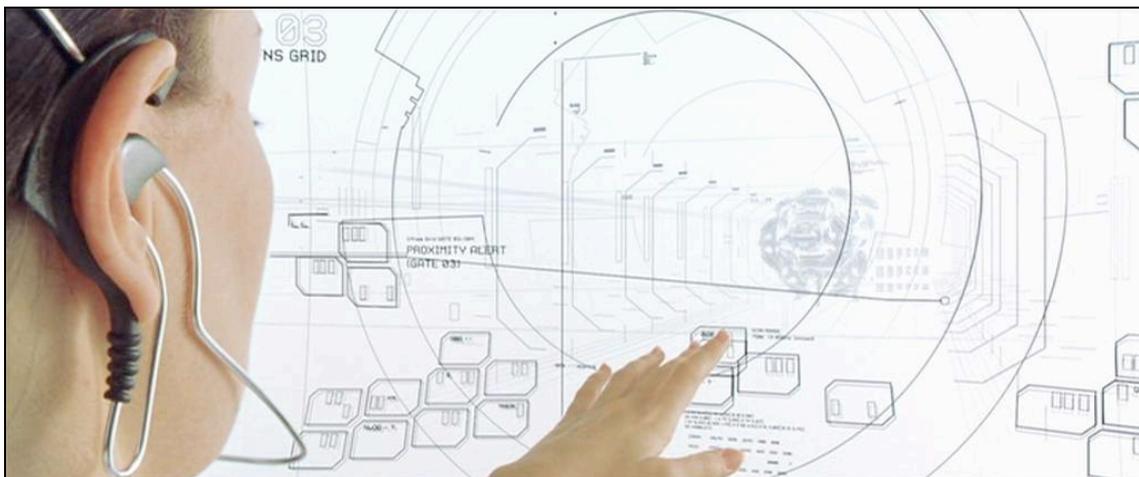


Figure 20. Excerpt from *The Matrix Reloaded* showing thin black lines sketching the immaterial control panels of the Zion Control Room.

Yet again we see how a simple representamen has a complex web of interpretants; the glowing line and the thin black line connote artificiality since glow is artificial, reminiscent of neon lighting. The glowing line and the black line also connote artificiality because the line connotes non-organic shapes, construction drawings, as well as the construction principles for real-life virtual 3d models.

⁷⁴ In *Blade Runner* at 10:24 and in *Alien* at 12:29 two very similar air traffic/approach pattern displays are shown on control panels. Simple 3d models are shown in *Escape from New York* at 02:45 in the title sequence and in scenes at 11:39 and 24:35 visualizing airplanes approaching Manhattan. In *2001* a 3d model of the faulty communication antenna is shown repeatedly, starting at 01:07:09. Approach patterns shown as lines on computer displays are used in *2001* as well, at 22:15 and 48:05.

⁷⁵ At 12:00.

The grid

The grid, a digital frontier.⁷⁶

In the title sequence of *Tron Legacy*, actor Jeff Bridges rumbles in a deep voice about the grid and the frontier myth of the virtual. This is the only time there is a dialogue reference to a grid, and in the original *Tron* the grid is mentioned only twice in dialogue.⁷⁷ Despite the scarcity of these direct mentions, the idea of the game grid pervades the narrative of both movies. The visual motif of the grid – often in monochrome neon glow – is repeated over and over in the mise-en-scène, and the game grid arena plays a vital role in both plots. Considering how the grid is referenced, it seems to take on two meanings. There is the game grind, the floor of the gladiator arena. This is where you play until you die (or get “derezed”, dissolved, as the characters call it). Then there is the general grid underlying the whole world, the bedrock of the virtual world. This grid seems to be the basis for construction and the basis for digital life. In real-life, the grid plays a vital part in the history of construction, as described by Higgins (2009). Not only buildings, but also urban landscapes are built according to grid structures. The word grid is also associated with the power grid, national networks of electrical power cables. The grid symbolizes modern life; it is “a visualization of modernity’s faith in rational thought” (ibid., p.6). This might have inspired movie makers to regard the fictional virtual grid as a source of power and life. In *Ghost in the Shell*, the creation title sequence, when cyborg Major Motoko Kusanagi is constructed, shows her virtual *ghost body* resting on a green grid, as if it gives her life, and underpins her existence (see Figure 21).

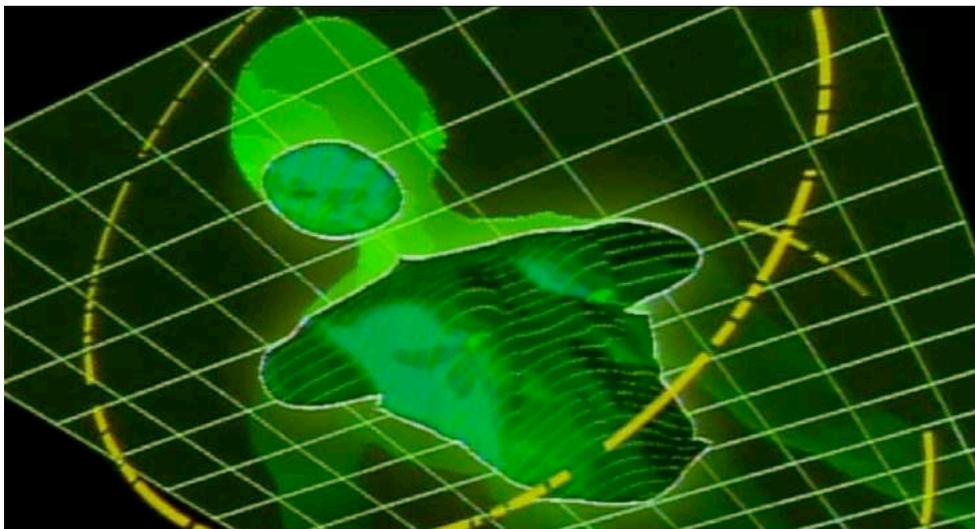


Figure 21. Excerpt from *Ghost in the Shell*, showing the grid supporting the cyborg’s virtual *ghost body*.

⁷⁶ The title sequence of *Tron Legacy*, at 00:25.

⁷⁷ Early in the introduction (at 03:04) a virtual character is sent down to “the game grid”, which soon is revealed to be a kind of virtual futuristic gladiator arena. Later on (at 40:53) one of the protagonists is sent to a similar play-to-the-death arena, the “light cycle grid”.

The grid also has an indirect association to control and surveillance; living off-the-grid is American slang for a self-sufficient and autonomous life style, and it is fitting that in *Tron Legacy*, Sam and Quorra escape from the game grid and run off into the virtual wilderness to Kevin's off-the-grid abode and sanctuary.

Tron and *Tron Legacy*'s game grid where light bicycles race against each other seems highly reminiscent of the holographic airplane battle in William Gibson's short story, *Dogfight*: "He buzzed the grid, millimeters from the glass". Compare this literary description to the excerpts from *Tron Legacy* below. The grid in *Tron Legacy* glows; it is a reference to electrical power, to the artificial light, and to the phosphor glow of vintage computer screens (see Figures 22 and 23).

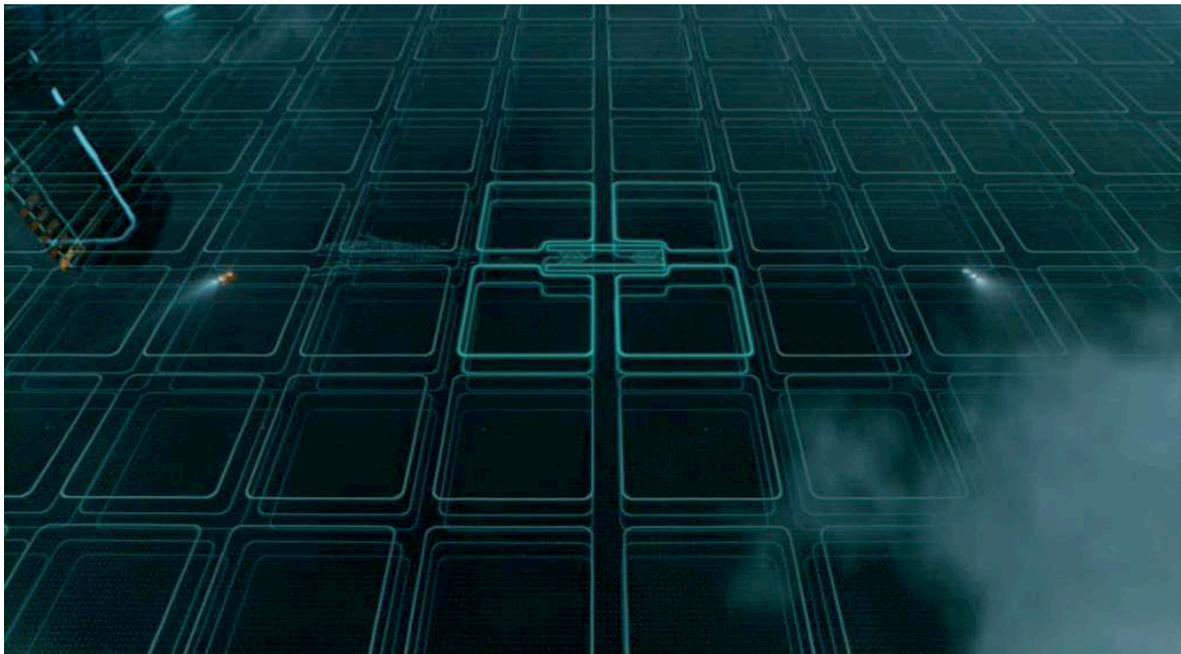


Figure 22. Excerpt from *Tron Legacy*; aerial view of the game grid arena floor.

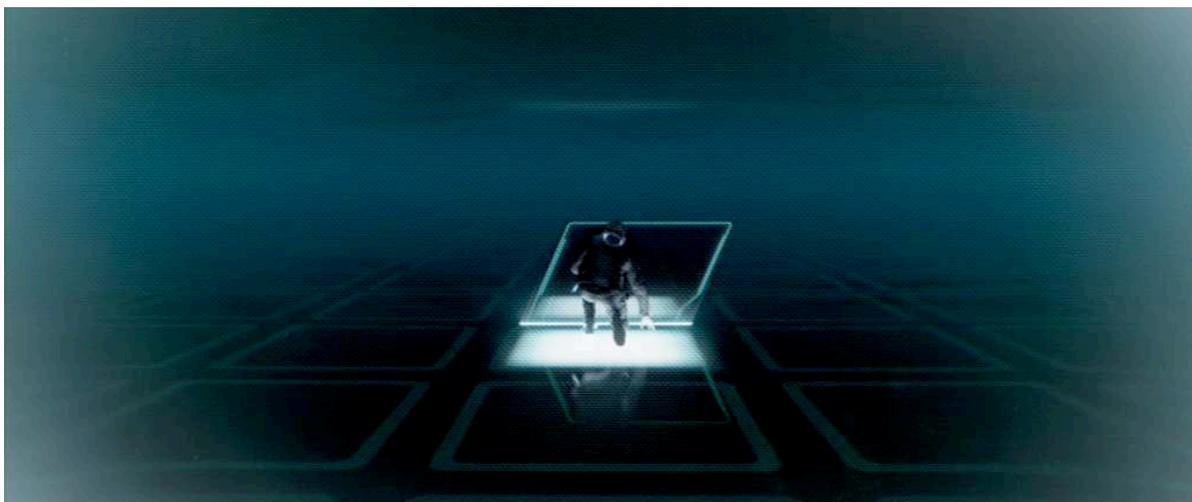


Figure 23. Excerpt from *Tron Legacy*; Kevin Flynn uses the power of the ground grid to mirror himself into the artificial intelligence Clu.

The pattern of the grid pervades our technology and our culture, from city planning to children's math books. It symbolizes artificiality, rationality, and technology. It is also one of the strongest signs of virtuality. Nusselder (2009) claims that cyberspace is the continuation of the Cartesian grid and the mathematical space it creates, and Higgins (2009) points out that the map, with its gridded model of the actual, is an ancient method of organizing a space, a map space that imitates the actual. The map, being a model of the material landscape, is a forerunner to the virtuality we now have. Having a map means having control, and the grid connotes achieving control, making something possible to manipulate. Predating real-life digital image manipulation, this control is symbolized when the bounty hunter of *Blade Runner*, Deckard, digitizes a photograph into the Esper Machine. The scanned image appears on screen, with a blue grid on top of it.⁷⁸ The grid signals that the image now has become virtual, and since it is virtual it can be controlled. Deckard navigates through the image via voice commands, and the machine is able to fragmentize the content of the image, making it fluid, so we can peak behind corners and through mirrors. The interpretant of the Esper Machine grid is power and control.

In *The Matrix*, the term "matrix" in itself is a direct reference to a grid, the grid of a rectangular array of numbers or symbols. William Gibson used the term matrix extensively in his Sprawl trilogy (*Neuromancer*, *Count Zero* and *Mona Lisa Overdrive*) as a term synonymous with the word he coined himself: cyberspace. Gibson actually uses the two words in approximately equal numbers. According to Heuser's (2003) reading of William Gibson, the "matrix is almost synonymous with cyberspace, but the term also carries a more general meaning" (p.105). Gibson also repeatedly refers directly to the grid of cyberspace, often described as "grids of neon" (*Mona Lisa Overdrive*) or the metaphorical "bright lattices of logic" (*Neuromancer*). According to Heuser's interpretation, these phrases evoke references to glowing pixels on a screen as well as the invisible logic of the computer. The grid stretching into infinity also emphasizes the geometrical infinity of the virtual world (Bingham, 1999; Heuser, 2009; Higgins, 2009; Kneale, 1999). The neon glow of the grid combines the "articulating Cartesian grid" and "light, the informing essence of sight" (Hillis, 1999, p.40). The glowing grid simultaneously creates the world and makes us see it.

The wireframe and the polygon

On December 18th, 2011, I sent an e-mail to science writer Michelle Evans with a link to the image on the next page (Figure 24), the latest iteration of a computer graphics visualization of the research rocket plane X-15. Evans was writing a technology history book about the vehicle and we worked on some of the illustrations for the book. I wrote in the e-mail that the image showed

⁷⁸ At 41:00.

a suggestion for adding a wireframe, to clearly reveal that the image is fake. This is an idea that I have toyed with for a while. We don't need to use it but I wanted to suggest it.

The following day Evans responded.

As for the wire frame, I don't think we need to worry about things like that. The more realistic the better and anything that takes away from that would probably not be welcomed by the publisher.



Figure 24. Computer graphics illustration from the collaboration with Michelle Evans. The visualization of the rocket plane X-15 has a wireframe image added to it. My intention was to signify the lack of authenticity and the virtual 3d model from which the image originated.

The response from Michelle did not come as a surprise. The hesitation to side-step realism and the risk of breaking suspension of disbelief were concerns I had encountered before. The X-15 project was the fifth visualization project where I tried to use wireframes with this meaning. Jonathan Westin and I did use wireframes in our final version of the Via Tecta visualization, but not without difficulties. Adding wireframes made the image more complex and hard to interpret, and it was also not obvious how the audience would understand the wireframe. We wanted to signify uncertainty by alluding to virtuality, rather than signifying virtuality directly. Uncertainty means lack of information and a lack of precision. But there was a risk that adding wireframes could give the opposite impression. Wireframes superimposed on the objects of the reconstruction made the image more visually complex, thus increasing the amount of information, at least on an aesthetic level. We also feared that wireframes would suggest construction drawings and via that association signify precision, and not the intended signification of uncertainty.

Wireframes abound in movies portraying virtuality; *Tron*, *Tron Legacy*, *The Thirteenth Floor*, *The Matrix Reloaded*, as well as the holograms of for example *District 9* and *Iron Man* are a few examples (all in all I have observed about 70 sign types in almost 30 sources). Wireframes and the previously discussed grid are similar, but the grid is more general, more fundamental. The wireframe is a specific kind of grid, the grid that outlines the shape of a particular object. The line between wireframe and polygons is also blurry. Technically, wireframe lines outline a polygon's flat surface, so they are actually two components of the same structure. But, both of these two components can be visually emphasized. The excerpts from *The Matrix Reloaded* and *Sunshine* below exemplify this (Figures 25 and 26).



Figure 25. Excerpt from The Matrix Reloaded, showing how the green code lines becomes lines of wireframes outlining shapes in the virtual world. The polygons between the lines are not emphasized at all.

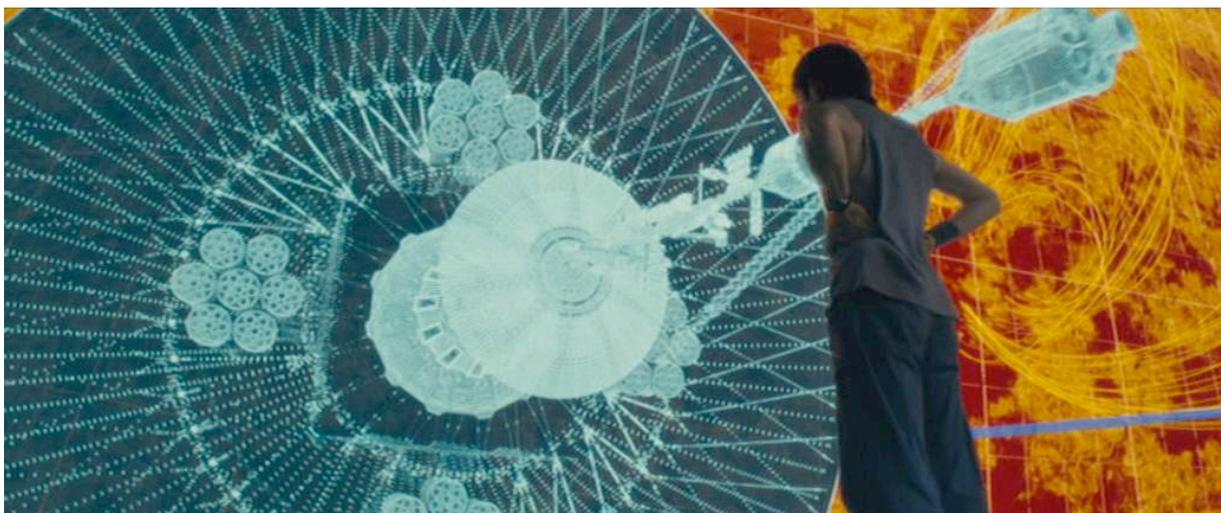


Figure 26. Excerpt from Sunshine; showing how a wireframe outlines the 3d model of a spacecraft. The polygons between the wireframe lines have a dark blue color, contrasting them with the bright blue of the wireframe.

Barbara Flueckiger (2008) describes how wireframe figures were a trendy metaphor for technology in general during the 1980s, and illustrates this with the animation by Rebecca Allen for the music video *Musique Non Stop* (1986) by Kraftwerk. Nowadays, wireframe is typically used in advertisements for computer graphics tools and services, as shown in the two examples (Figures 27 and 28). The logic of the two images are similar; the textured and rendered areas appear almost photoreal, and to *reveal the successful illusion* there are areas where signs of virtuality are used to let us see what is behind the scene, so to speak. The intent is similar to trompe-l'œil art, the triumphal look-how-I-fool-you. The pants of the woman (Figure 27) are revealed as [grey-shaded without texture] in the mirror, and a [thin-lined] [wireframe] can be seen both on her leg and the small of her back. The gunman hands (Figure 28) are outlined with [green] [wireframes], signifying the underlying 3d model. It is typical that a few common signs work together in this syntagmatic way.



Figure 27. Advertisement (detail) for the company Eyetronics, taken from the trade magazine Cinefex.

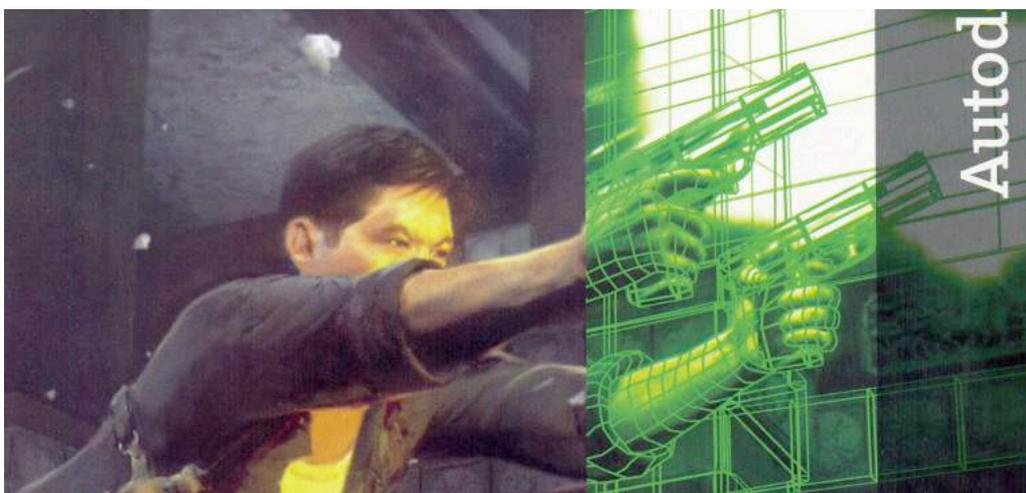


Figure 28. Advertisement (detail) for the company Autodesk, from the trade magazine American Cinematographer.

The voxel and the pixel

“What’s a sea of simulation?” The question is rhetorically phrased by Nikos Kalaitzidis in an interview (Duncan, 2010, p.56) about his work as vfx sequence supervisor on *Tron Legacy*.⁷⁹ The Sea of Simulation was a mysterious part of the virtual landscape in the original *Tron* movie, an undulating surface of wireframes and polygons, and Kalaitzidis describes the process of look development for the sequel’s version of the sea. He answers his own question, claiming it to be “a sea made out of millions of cubes” (ibid., p.56), and visual effect supervisor Eric Barba offers that they considered it to be “made up of these cubes that represent the simulation” (ibid., p.56). The sea is depicted as a dark surface with a grid pattern and below the surface the grid extends in all directions as arrays of glowing cubes. These cubes look like voxels. A voxel (volumetric pixel or volumetric picture element) is a volumetric, cubic construction element used in 3d modeling. It is the three-dimensional equivalent to the pixel. When working with voxels, a volume is sliced up into cubes, as if stacking lots of Lego bricks together. It is often used to render semi-transparent volumes such as clouds and gases. It is quite render intensive and is therefore not widely used. The scarcity of voxel usage in real-life computer graphics is mirrored by the scarcity of fictional references to voxels. *Tron Legacy* is the only movie that makes extensive and explicit use of voxel aesthetics.

A well-known real-life example of voxel aesthetics comes from the sandbox game *Minecraft*. The *Tron Legacy* voxels have a material, photoreal quality to them; they are slightly rounded, and their self-glow and interaction with other light sources are visually complex and alive. The *Minecraft* building blocks (they are not technically voxels) are intentionally the opposite: hard-edged, and with repetitive and stylized textures, no specularities and simple shadow rendering (Figure 29).

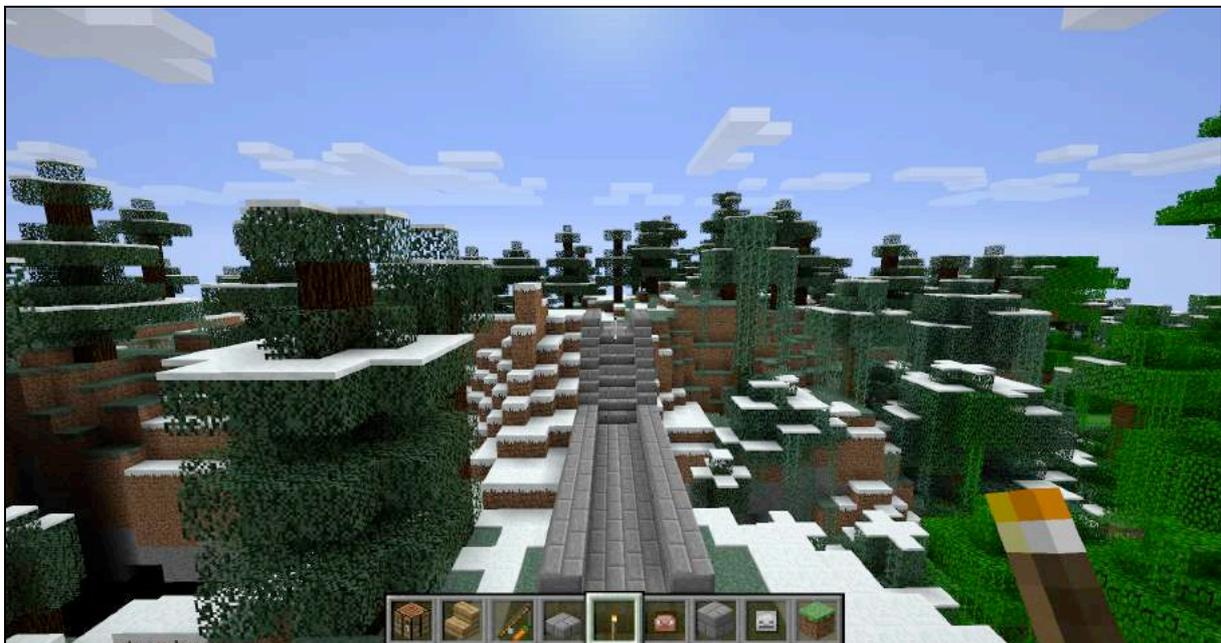


Figure 29. Screen shot from the sandbox game *Minecraft*, showcasing its voxel aesthetics.

⁷⁹ Vfx stands for visual effects.

Other computer games such as *Fez*, *Iloilo* and *Planets*³ also have a distinct use of voxel-like cubic blocks.

William Gibson never mentions voxels, he only makes occasional references to two-dimensional pixel graphics, such as a brief mention of a “wonkily bitmapped fish” in *Idoru*. In contrast to Gibson, voxels are frequently used by Stephen Baxter, describing the virtual projections that saturate many of his stories, as in the following examples from *Reality Dust* and *Dante’s Dreams*.

Sarfi reached out and swept her arm down at the desk – no, Hama saw, startled; her arm passed through the desk, briefly breaking up into a cloud of pixels, boxes of glowing colour.

Pixels, cubes of light, swirled in the air. They gathered briefly in a nest of concentric spheres, and then coalesced into a woman: thin, tall, white, thirty-ish, oddly serene for someone with a sparrow’s build.

Baxter often refers to *cubes* and *pixels* interchangeably, just giving a general idea of computer graphics elements fluttering through the air.

Contrary to voxels, pixels are much more common in the movies. Pixels can be employed in different ways. They can be free floating, as if being parts of a fragmented virtual object, being part polygon, part pixel.⁸⁰ They can be the arrays of pixels on a low-resolution texture on a part of an object.⁸¹ They can be a pixelation pattern wrought across parts of the image, as in the flickering pixelation of the attack helicopter in the *Avalon* war game.⁸² Pixelation has a strong conceptual connection both to computer graphics and television technology, which in the case of *Avalon* is directly acknowledged by Isao Sato in a behind-the-scenes interview where he claims they “simulated a damaged video” (Miramax Films, 2003, at 36:28). Pixels are not unique for the digital age of the computer. Creating images from small picture elements is an ancient technology, starting with mosaics in stone, glass, ceramics and textiles (Wagner, 2003). Textiles with patterns have a deep connection to the origin of the computer, since one of the predecessors to the first computers was the Jacquard loom. In twentieth century art history the different aspects of picture elements were utilized by, for example, pointillism (approximately 1880s) and cubism (roughly 1910s). During the 1960s and 1970s, one branch of computer art and computer graphics occupied itself with ASCII graphics. The pixel is one of the most dominant ornaments of our age.

Scan lines and flickering outside of the TV screen

The connotations connected to the TV screen have been discussed previously, and one specific feature – scan lines – can be discussed from the viewpoint of the Cartesian construction kit as well. A syntagmatic analysis of how different signs are used together suggests that two characteristics of the TV screen – scan lines and flickering – can be taken out of context and used more or less stand alone. The

⁸⁰ For example the traces left by an exploding virtual tank in *Tron*, at 44:34.

⁸¹ For example the face of a tortured virtual character in *Tron*, at 07:07.

⁸² At 05:35.

other Cartesian signs – lines, grids, wireframes, polygons and voxels – are related to the construction process of virtuality. When we see these signs, we seem to be peeking behind the wall paper, seeing the virtuality of the 3d model as it is before it has its photoreal render added. Flickering and scan lines are not related to the construction of 3d models; instead these signs are motivated by physical display technology and its early limitations. When we create 3d computer graphics, the lines, grids, wireframes, and polygons are always there, just behind the surface of the texture. In contrast, it is a long time since we saw TV screens actually flicker, and scan lines are more or less a conceptual idea and not something we actually see on the TV screen.⁸³ Despite this the sign of scan lines is very predominant. It has been used to suggest virtuality in 40 sign types in about 15 of the analyzed movies. A syntagmatic analysis shows that it is very common for the three CRT screen signs [scan lines], [scrolling bars] and [flickering] to be used together, and this use is often quite subtle. Note, in the excerpt below, how the example from *Tron Legacy* is so subtle that the scan lines need enlargement to be clearly seen. This is highly typical for *Tron Legacy*; signs of virtuality are contrasted with contradictory signs of realism and physicality, such as the rain puddled street surface around the central action (see Figure 30).

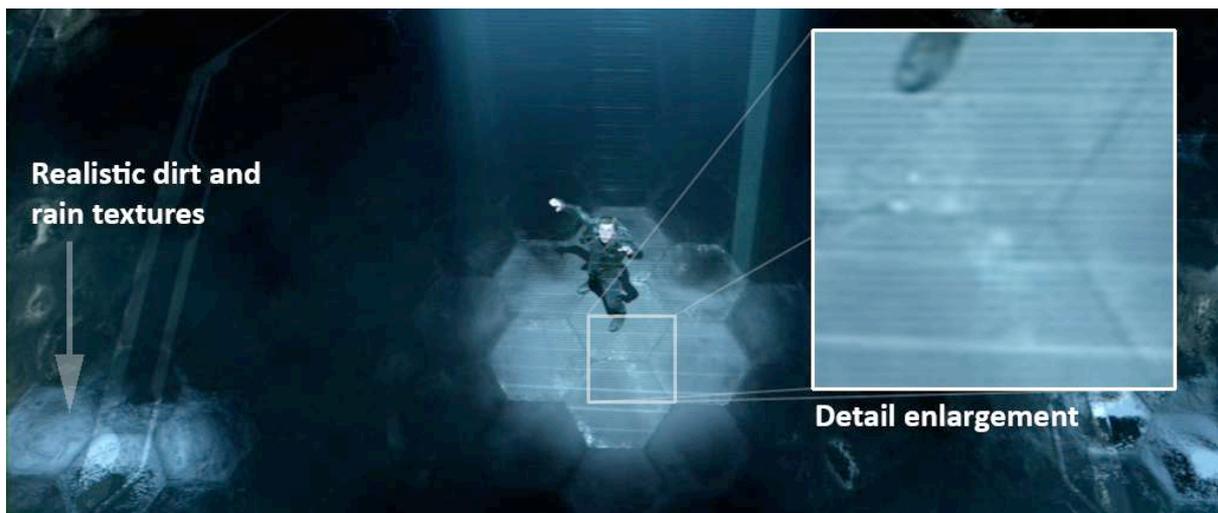


Figure 30. Excerpt from *Tron Legacy*, showing a typical combination of scan lines, scrolling bars and flickering. The hexagonal pattern is also interesting since it is a kind of grid and was used in a prominent way in *Avalon* as well.

Flickering has quite complex interpretants emerging out of a simple representamen. From the stroboscopic and visually violent effect in Paul Sharits' video art and the feature film *Enter the Void* by Gaspar Noé, to the subtle flickering of the glowing suits in *Tron* and *Tron Legacy*, flickering always conveys a sense of intensity and energy, and adds visual interest. Karl Denham – vfx sequence supervisor at *Tron*

⁸³ CRT screens had mask patterns in different configurations – hexagonal grids, square grids, and so on – but the horizontal scan lines could usually not be seen because that was the back-and-forth horizontal movements of the in itself invisible electrode beam behind the glowing screen.

Legacy – explains that the original flickering comes from exposure mistakes in the complex optical compositing done in the first movie and that it had the advantage of suggesting electrical energy (Duncan, 2010, p.41).

That look had been unintentional, but they used it in their favor, and even added a sound effect to go with the flickering. It's subtle, but it's there. So we did the same thing. The flickering also made it look as if there was a pulsing energy moving through the suits.

Flickering also has associations with some sort of breakdowns. A quick burst of flickering is often used to show how a screen starts up or shuts down as well as for the appearance or disappearance of virtual objects. So, once again, we see a connection between signification of mediation (the screen) and virtuality (the virtual object). This is illustrated in a scene in *Sunshine* where the protagonist stands inside a virtual reality room and explores different simulation scenarios for their future voyage (see Figure 31). The projection walls flicker chaotically in large square patches. This is yet another example of how signs work together, coalescing into a super-sign. The patches can be read as a sort of pixelation, or a grid revealing the projection technology behind the walls. The flickering evokes both the sense of a simulation that has broken down, and the mediation of the flickering TV screen. This illustrates why Cartesian construction signs are successful in signifying virtuality; they have simple representamina that are easy to create and easy to combine, their denotations points to real-life construction principles behind computer graphics and media technology, and the connotations of the interpretants are complex and rich, evoking deep connections to the virtual via immateriality and artificiality.

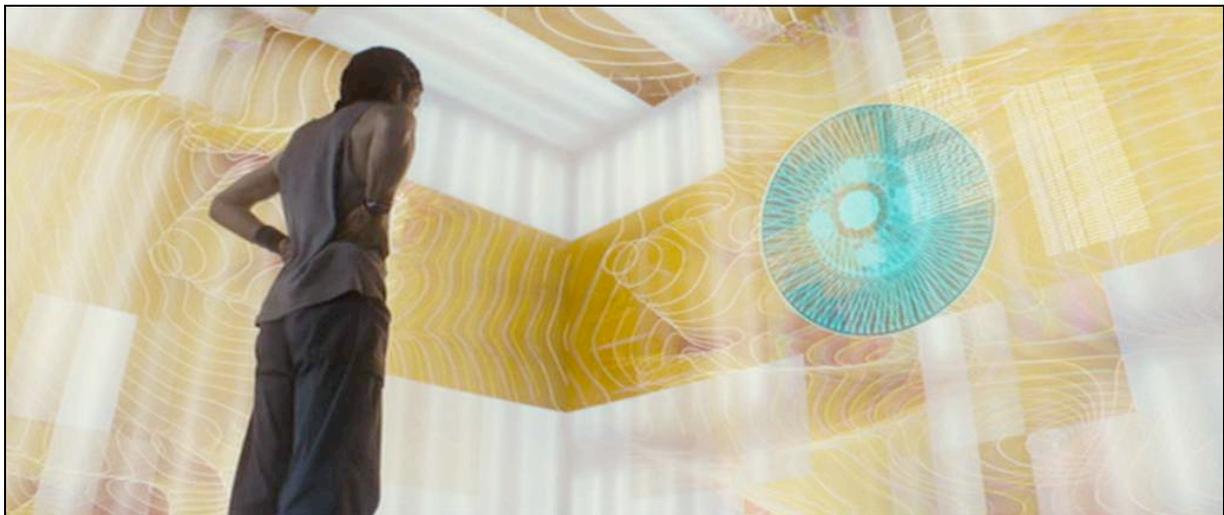


Figure 31. Excerpt from Sunshine, showing the breakdown of a simulation.

Diegesis – tell, don't show

While mimesis is imitating and showing, diegesis is a recounting *telling*, the way the narrative is told (Bordwell, 1985; Genette, 1980). Virtuality in fiction is an integral and central aspect of the story, and therefore it is also often highly integrated with elements of the story, such as events, dialogue, and characters. The plot is at the heart of movie making, and connects it deeply with other forms of storytelling such as theatre and literature. Even cinematographers, the artists responsible for making the world of the narrative visible by light, acknowledge that “it starts with the story, it's always, always about the story”, as stated by Charles Minsky (Fauer, 2006, at 23:55). Nevertheless, much happens with the words of the script during a movie production. A movie production involves many different artists and craftspeople that influence the final movie; thus, the scriptwriter of a movie is not the almighty autonomous creator that we see in a novel writer (Bjurbom, 2005).

A narrative is a sequence of statements that tell of the events of the plot (Genette, 1980). The plot can only be analyzed indirectly, through the narrative. Narration is the act of telling, and can be viewed as managing the audience's knowledge about events and characters in the diegetic world; narration controls the flow and disclosure of what happens (Buckland, 2006; Genette, 1980). What the audience gets to know is highly dependent on the narrative viewpoint, the narrative mode; who is it that tells the narrative and what relation does this storyteller have towards the diegetic characters (Genette, 1980; Ricœur, 1984)? Is the storyteller one of the characters? Is she among them, or is there an external omniscient storyteller (Barthes, 1977)? In cinema, the camera viewpoint is the incarnation of an invisible observer, sometimes the emotionally engaged filmmaker and sometimes a more detached narrator (Bordwell, 1985). The storyteller puts the plot together by connecting events into a chain of logical cause and effect (Thompson, 1999). Or as Tarkovsky (1986) describes it, the story is sculpted in time, the director removing what is not needed so that we see the story more clearly. This viewpoint makes no distinction between storytelling about actual events (when a coherent story need to be found in a river of flowing events) and fictive events (when a coherent story needs not be built from fragments of real-life events and fantasy). Both become a matter of finding the relevant chain of causalities.

At the heart of the plot are the characters, what they strive for, and the justification for this striving. The goals and needs of the character are then hindered by something, and the conflict, the holy grail of storytelling, arises (Bjurbom, 2005; Card, 1988; Carlshamre, 2005; Thompson, 1999).

Verbal and textual references

Narrative signs of virtuality can be direct or in-direct. The storytellers behind for example *Tron*, *The Matrix* and *Life on Mars* have their characters discuss, debate, refer to and in other ways directly mention the virtuality of the worlds they inhabit. Out of the close to a thousand signs that I have observed, about forty-five were textual. By textual I mean that they were spoken in dialogue by characters or written in text. Written text was not used as frequently as spoken dialogue, and it

was almost always diegetic; that is, the text was *in the fictive world* of the movie. For example, in *The Matrix* there is a book cover with the title *Simulacra and Simulations*.⁸⁴ In the game sequences in *Avalon*, there is repeated use of game related texts – such as “Mission Complete”⁸⁵ – in floating letters superimposed on the realistic environment.⁸⁶ I have observed only three cases of non-diegetic textual signs: a title card in *Avalon* introduces the game world with phrases such as “illusions of their own”, “illegal virtual-reality war game”, and “can leave a player brain-dead”;⁸⁷ in *Tron*, a title card explicitly point out what kind of world we see (“Meanwhile in the real world...” at 03:40); and in *Johnny Mnemonic*, a title card explains what we see (“INTERNET 2021” at 01:16). The infrequent use of title cards is easily explained by the strong convention in movie making to let the story tell itself. An important part of the heralded suspension of disbelief is that the audience is not told the story; instead, the audience experiences the story. This is summarized in the almost mantra-like claim that movie makers should *show, don’t tell*.

The most frequent kind of verbal sign has been some kind of [explicit verbal reference to computer software]. To exemplify, we can list verbal signs from *Avalon* (“program”, “load”, “data”, “bug”, “system”, “virus”, “digital” and others), *The Matrix Reloaded* (“upgrades”, “code”, “encryption”, “system”, “program”, “copy”, “source”), *Tron* (“program”, “file”, “memory”, “bugs”, “system”, “code”) and *The Thirteenth Floor* (“download”, “link”, “program”, “connection”). [Explicit verbal reference to simulation] has also been used, for example, in all parts of the Matrix trilogy:

It is the world that has been pulled over your eyes to blind you.⁸⁸

See those birds; at same point a program was written to govern them.⁸⁹

[Explicit verbal argument concerning reality or the lack thereof] has been exemplified in my discussion about the *Life on Mars* show, but it also forms an integral part of the story in *eXistenZ*, exemplified by:

I’m feeling a little bit dis-connected from my real life.⁹⁰

Don’t panic it’s just a game!⁹¹

⁸⁴ At 08:11. This is a reference to the book by Jean Baudrillard, and there is a more subtle reference to Baudrillard when Morpheus refers to “the desert of the real” at 39:40, one of Baudrillard’s metaphorical concepts. These references have been theorized in (Constable, 2006; Irwin, 2002; Lavery, 2001; Rovira, 2005). An interesting interview with Baudrillard concerning *The Matrix* has been published (Bryx & Genosko, 2004).

⁸⁵ First used at 07:30.

⁸⁶ The environment is live action footage color graded to look like a photorealistic computer game.

⁸⁷ At 01:10.

⁸⁸ *The Matrix* at 27:00, Morpheus explaining the ontological status of the world.

⁸⁹ *The Matrix Reloaded* at 44:50, the artificial intelligence The Oracle describes how all aspects of the illusionary Matrix is under intentional control.

⁹⁰ At 01:23.

[Explicit verbal reference to computer games] has also been used, which is not surprising considering that several of the studied narratives have plots concerning computer games.⁹²

Apparently, movie makers utilize dialogue to a high degree, when representing virtuality. Dialogue plays a vital part in a poetics of virtuality, and the signs usually refer to familiar aspects of computer hardware, computer software, and computer simulations. The rule-of-thumb to *show, don't tell* is an oversimplification since these examples suggest that movie makers to a large extent *show, and tell*.

Interrupted narrative and surrealism

Gentry unzipped his beaded jacket, exposing his bone-white, hairless chest. “Do something about the sun”, he said. Twilight. Like that. Not even a click. Slick heard himself groan. (*Mona Lisa Overdrive*)

In what I call interrupted narrative, the plot of the story is interrupted by a shift to another world, virtual or actual. This is used in two different ways: the parallel linear narrative and the disrupted, fragmented narrative. A parallel narrative usually has a plot where characters jack-in to or jack-out of – enter or leave – the virtual world, and it is characterized by the contrasting production design of the different worlds. The jack-in sequences often foreground the technology that is being used, and occasionally reference death (as in *Life on Mars*, *Avalon* and *The Cell*) or at least becoming impassive by lying down (the Matrix franchise) or going to sleep (*The Thirteenth Floor*).

The disrupted narrative shows swift *transfers between* the worlds (as when Sam Flynn suddenly finds himself in the *Tron Legacy* world or when Sam Tyler wakes up in the 1972 of *Life on Mars*), but it can also be used in a more complex manner, suggesting the fragmented nature of being *in* the virtual world. This is most pronounced in the short film *Magnetic Rose* where environments, characters and events change repeatedly between cuts, resulting in a dreamy, hallucinatory impression of surrealism.

Literary descriptions lend themselves to swift transcendence from the actual to the virtual and back. Ray Bradbury was early in describing this with his line “he stepped into Africa” in his 1950 short story *The Veldt*, and, much later, sequences of disruptive narrative abound in the writing of William Gibson. Gibson uses the “surreal logic found in dreams” (Heuser, 2003, p.128), the literary equivalent to jump cut editing, to characterize the encounter with cyberspace (Heuser, 2003; Kneale, 1999). He employs it in terse off-the-cuff fashion, as in *Fragments of a Hologram Rose* “the transition from delta to delta-ASP was a dark implosion into other flesh”) and in *Neuromancer* (“Case hit the simstim switch [...] and flipped into the agony of broken bone”). Gibson also uses disrupted narrative in longer, narratively crucial passages such as when the artificial intelligence Wintermute

⁹¹ At 15:47.

⁹² According to an interview (Pellerin, 2002), *Tron* script-writer and director Steven Lisberger were inspired by contemporary computer games such as *Pong*.

meets Case in *Neuromancer*. Case is instantaneously transported from the abstract virtuality of cyberspace to the fully realistic simulations of first a shop and then a beach. The completely different styles of the different worlds are highly reminiscent of the contrasting production designs in the movies such as *The Thirteenth Floor* and *Avalon*, even though Gibson uses prose to describe them. The protagonist Case does not know how he got there or how he can escape, and when he is eventually released he realizes that even though the stay in the virtual imprisonment went on for hours or even days, he was gone for just a few seconds in the actual world. This is similar to scenes in *Contact* (the protagonist Ellie is gone for hours meeting alien intelligences on a simulation of a beach, while no time has passed on Earth) and in episode 9 of the TV series *Ghost in the Shell: Stand Alone Complex* (during an online chat session a participant is taken away by the Major to a blank void room virtual worldlet and then the Major herself is taken away to a library room without an exit). These examples show how the interruption of space, the jump from one space to another, also leads to a compression of time, both in the form of compressing the time it takes to transfer between worlds, making it instantaneous, and in the form of allowing the time to run at different speeds in different locations. Usually time is portrayed as running faster in the illusion, maybe connoting the speed of computing, or tapping into the wishful urge of having more time, more life.

In many cases, the parallel flow of narratives is simple and straightforward. The archetypical example is, once again, the Matrix franchise. When a character jacks-in to the matrix, her physical body becomes inert, and the character is almost fully transcended into the virtual world. Characters remaining in the actual world can talk to the character inside the virtuality, and can even see what happens via the Operator's screens. From a cyberpunk point-of-view this symbolizes the liberation into cyberspace thanks to the separation of body and mind (Heuser, 2003). But, from a narrative point the situation is actually quite mundane, being similar to, for example, two people being in different buildings, talking over the cellphone, one character watching the other via surveillance cameras. Alan Paul (2010) has described how the movie *Inception* provides a more complex structure of entangled narrative threads. Superficially the situation is similar; characters enter artificially induced dream states and their bodies become inert (sleeping) while other characters remain awake, watching over them (albeit not in direct communication with the dreamers). But inside the dreams of *Inception* the dream alter ego can enter a second level of dreams, and another, and so on. In the long third act of the movie there is a complex hierarchy of dream worlds within dream worlds, almost a Russian doll of worlds. The worlds are dependent on each other; a slight jolt in a top world gives a chain reaction of literally world-shaking events further down. Time is going slower, so a second in the actual world (the top of the hierarchy) translates to months two or three levels down. This shows how the fundamentally simple concept of nestled worlds, a space within a space, a room inside another room, can be expounded upon by creating surreal chains of cause and effect, emphasizing the un-natural, and thus virtual, nature of the nestled worlds.

The jump versus the transit

The original idea of cyberspace as a three-dimensional space to navigate human knowledge, proposed in fiction by William Gibson and taken up as a real-life vision by Michael Benedikt, David Gelernter and others, has not been fulfilled. We do not fly among virtual skyscrapers of data to find information or to book a train ticket. Gibson's vision, a narrative device never meant to be a roadmap for building real-life interaction design, might have been taken too literally by cyberspace visionaries. In 1991, Benedikt seemed to be standing with one leg in the naïve cyberspace idea and the other leg in the future World Wide Web when he writes (p.172).

It also seems plausible that frequent trips between the same locations could be truncated. Commuting can be tiresome, and the geography of cyberspace, once learned, may not be that enthralling to the jaded user...

One aspect of cyberspace navigation that *did* become significant is the idea of quickly switching between different foci of presence. Gibson vividly describes and builds a suspenseful plot around how *Neuromancer* protagonist Case can instantaneously flip between presences. Case flips between cyberspace, his own view of the actual world, and a mediation of his collaborator Molly's sensorium. The effortless switch between presences can easily be recognized in what we do today; we flip between Facebook text communication, Skype video conferencing and e-mail writing (Turkle, 1995). Michael Heim (1993) wrote, two years after Benedikt, that (p.96)

the jump, not the step, is the characteristic movement in hypertext. As the environment for sensory hypertext, cyberspace feels like transportation through a frictionless, timeless medium. There is no jump because everything exists, implicitly if not actually, all at once.

If we consider the real-life Internet, the two different navigation methods discussed first by Benedikt and then by Heim – the jump and the transit – have actually been realized. The instantaneous click-and-jump of the World Wide Web is used for achieving goals such as finding information and running errands. The transit through environments only occurs as a spectacle, for fun, in online games such as *World of Warcraft*, or in virtual worlds such as *Second Life* where the user actually can either teleport instantaneously or navigate by flying.

Specific references to Oz and Wonderland

Kansas is going bye-bye.⁹³

Cyberspace can be seen as a continuation of our ancient yearning to replace the actual with a range of different imaginations. It draws from myth and fairytales, just as surrealism art does (Smejkal, 1974). One way to suggest that the narrative moves between, and jumps between, different worlds is to reference well-known fiction.

⁹³ Cypher's sardonic remark just before Neo is extracted from the virtual world prison at 29:26 in *The Matrix*.

References to *The Wizard of Oz* and *Alice in Wonderland* (Carroll, 1865) dominate in fictional representations of virtuality, as observed by others as well (Irwin, 2002). When looking at the narratives analyzed in this poetics of virtuality, there are a total of 14 references to *The Wizard of Oz* in five of the analyzed movies, and 14 references to *Alice in Wonderland* in six movies. Usually the references are explicit dialogue references to “see the Wizard”, “the yellow brickroad” and falling down “rabbit-holes”. There are also subtler references such as the character names in *Resident Evil* (the protagonist Alice and the artificial intelligences Red Queen and White Queen). Neither William Gibson nor Stephen Baxter make any such reference in any of their novels or short stories.

Why these? Of all the fiction in our culture, why *The Wizard of Oz* and *Alice in Wonderland*? Obviously, both stories have plots with two parallel worlds, as pointed out in an interview (Burnett, 2002) with Donald Kushner, producer for *Tron*, and the stories also involve transcending from a prosaic place to a fantastic place (Olsen, 1992), following Campbell’s monomyth structure, a narrative pattern described by Joseph Campbell (Campbell, 1949; Palumbo, 2014). Both are very well known and appreciated children stories in the US, and after all it is American popular culture that has spawned the majority of contemporary fiction about virtual worlds. The screen adaptation of *The Wizard of Oz* actually displays what might be the first movie-based depictions of holograms (released in 1939, almost 40 years before the Star Wars hologram hit the silver screen and cemented the idea of how a hologram should look). One explanation is the special treatment of space and time that *Alice in Wonderland* offers, according to McLuhan (1964). He writes that Carroll creates a “fantasia of discontinuous space-and-time” and a “playful foretaste of Einsteinian time-and-space” (p.162). This disrupted space-time corresponds well to how space-time often is portrayed in virtual worlds.

Alice in Wonderland is even referenced by Ivan Sutherland, the inventor of the first head-mounted display virtual reality system, when he wrote his seminal essay *The Ultimate Display* (Sutherland, 1965). The essay is a kind of manifesto encouraging researchers to utilize the ultimate possibilities of input and output devices, and he ends the essay with the phrase (p.3):

With appropriate programming such a display could literally be the Wonderland into which Alice walked.

Jacking-in – the techno-transcendence into the virtual

In the interrupted narratives of virtual worlds, fictive characters repeatedly pass from one world into the other. This is the case in the Matrix franchise, *Avalon*, *eXistenZ*, *Inception*, *Johnny Mnemonic*, *The Lawnmower Man*, *Life on Mars*, *The Thirteenth Floor*, *The Cell*, *Tron*, *Tron Legacy*, *Vanilla Sky*, and in most of William Gibson’s novels. In other fictional narratives of virtuality, the plot lingers in the actual world, and the virtual projects into the actual. This is the case in *Avatar*, *District 9*, *Resident Evil*, the Star Wars franchise, some of Gibson’s novels (*Virtual Light* and *Idoru*), and in some of Stephen Baxter’s writing. When do you enter another world, and when are you just glimpsing virtual objects? How much of the actual world must be

replaced, how much of the senses, how much of your sensations, how much of your presence need to be changed, before you consider yourself being somewhere else? Can you be in two places at the same time? Everyday experiences, such as reading a book or watching a movie, illustrate that it is actually quite natural and easy to shift between different foci. When attending a videoconference you are not really immersed in a virtual world, but you nevertheless have a presence in another space, and there is a sensation of partially being in the video conferencing space. In fictional representations of virtuality, the situation is usually much more clear-cut than these real-life examples. Either the characters are in the actual world or in the virtual, and the transfer between the worlds then becomes a fundamental plot point, a matter of changing location; the event of entering is a sign carrying narrative clarity.

Entering the virtual is a modern-day rite of passage (Tomas, 1991), and the theme of transcendence is one of the characteristics of western narratives, according to the monomyth template (Palumbo, 2014). Palumbo describe how the transcendence to the virtual world in *Tron* and *The Matrix* follows the patterns of the monomyth where the hero takes on a quest and must pass a line between the ordinary world (the actual) and the extraordinary world (the virtual), and similar patterns prevail in several of the other narratives studied in this poetics.

The transfer between the actual and the virtual is foregrounded in a number of quite different, distinct ways. It can be through the display of futuristic virtual reality technology, or through subtle signs such as a flicker in someone's eye.⁹⁴ It can be vaguely hinted at as Gibson often does in his more poetic passages, fleetingly referred to as *jacking in*. The word *jack* has a range of meanings, one of them being an electrical connector of some sorts, as in an audio jack or telephone jack. Jack also means a gash, a wound, or an opening into the body. Openings into the body, penetration of the flesh, are accentuated in *eXistenZ* as well as in the *Matrix* franchise. Circuitry invading and integrating with the body and mind is a recurrent theme in cyberpunk fiction (Gordon, 2002; Hollinger, 1991; Sterling, 1991), and the idea of feeding the brain with sensory stimuli via a neural jack appeared in fiction at least as early as 1930, in the pulp story *City of the Living Dead* by Laurence Manning and Fletcher Pratt (Lovén, 2001). In *The Matrix*, the mind is connected to – jacked into – the virtuality simulation by a highly prominent neural probe; a metal stick is inserted into a head plug in the back of the head.⁹⁵

William Gibson writes with a thorough focus on jacking in. He shifts from hard-boiled, off-the-cuff, and breezy mentions of the process of jacking in...

⁹⁴ One example is the Flynn's Ride, the visually spectacular and lengthy travel into the virtual world in *Tron*, criticized by Kerman (1992) as merely being "the interface between a melodrama and a cartoon" (p.196).

⁹⁵ There are real-life Brain-Computer Interfaces in progress, both invasive and non-invasive. The most well known application is the cochlear implant which replaces parts of the inner ear, and there is also extensive research into restoring vision for the blind. One major difficulty is that current interfaces only connect with a large number of neurons, not individual neurons, making the connections rough and limited (Friehs et al, 2004).

He settled the black terry sweatband across his forehead, careful not to disturb the flat Sendai dermatrodes. (*Neuromancer*)

Something covers Laney's eyes. Red wink of a diode. Cables. (*All Tomorrow's Parties*)

Plug for each one. Jack and *jack*... (*Idoru*)

...to detailed, technical and exhaustive accounts.

He fitted the Batang behind his ear after coating the inductor surface with paste, jacked its fiberoptic ribbon into the programmer, and plugged the programmer into the wall current. Then he slid the wafer into the programmer. It was a cheap set, Indonesian, and the base of his skull buzzed uncomfortably as the program ran. But when it was done, a sky-blue Spad darted restlessly through the air a few inches from his face. It almost glowed, it was so real. (*Dogfight*)

She leaned forward and picked up the trode-set, shook it to free its leads from the tangle.

No there, there.

She spread the elastic headband and settled the trodes across her temples - one of the world's characteristic human gestures, but one she seldom performed. She tapped the Ono-Sendai's battery-test stud. Green for go. She touched the power-stud and the bedroom vanished behind a colorless wall of sensory static. Her head filled with a torrent of white sound. (*Mona Lisa Overdrive*)

Often jacking-in is done in a hurry – the protagonist's swift preparation for yet another heroic feat inside the virtual world. As pointed out by Heuser (2003), the almost effortless transit from actual to virtual stands in sharp contrast to the archetypal spacecraft voyage depicted in science fiction, the first being swift, and the latter being long in duration, often of epic dimensions. Sometimes jacking-in has the feeling of a more tender, even intimate action between the two persons involved; it seems as if you then need help establishing the connection. There is often one person penetrating the other, as in this polite exchange where a woman has her mind jack inserted by a man.⁹⁶

“Would you mind?”

“Not at all.”

The insertion of the brain jack is often accompanied by an expression of first pain or surprise, then an almost erotic pleasure. The emphasis on strong emotion, as well as the occasional subtle erotic undertones, is a quite obvious way for movie makers to dramatize the transcendence from the actual to the virtual. The transfer can also be violent. Transcending is dramatic in *Life on Mars*. Protagonist Sam Tyler is hit by a car and wakes up in the illusionary 1973. In *Avalon*, the chair in which you have to be seated is strikingly similar to a death chair, as if it is a gate through death and the virtual world of *Avalon* is a modern-day equivalent to Valhalla or Elysium. The drama of entering is equaled by the effort it takes to leave. In *The Thirteenth Floor*, the characters need to go to sleep in the virtual world in order to

⁹⁶ At 05:35 in the *Animatrix* short film *Matriculated*.

wake up in the actual world again, otherwise the abrupt ejection from the virtual will result in severe nausea and discomfort. In contrast to this gentle exodus, the dreamers of artificial dreams in *Inception* can only be awakened by a strong invasive experience such as being plunged in water, and in *The Matrix* leaving the virtual becomes a complicating plot point, an obstacle; you have to find a landline telephone to exit.

Entering the virtual world is always a matter of going somewhere, often with a bang or at least a whimper. It is a continuation of a long line of dramatic transcendence in popular fiction, the twister in *The Wizard of Oz*, and the fall down the rabbit hole in *Alice in Wonderland* being just two examples. Entering the virtual also symbolically relates to the ancient dream of transcending to a heavenly existence. However, the Heavenly city as metaphor for the virtual that Benedikt (1991) discusses has no clear equivalence in fictional virtualities. The glowing virtual city in *Tron Legacy* is spectacular, and seems to be formed by light, but it is also shrouded in a perpetual night; there is no sun in the virtual world. The Machine City in *The Matrix Revolutions* is also radiant and might be interpreted as a Heavenly City; however, the fiery color scheme, the dire situation (Trinity has just died from a vehicle crash and Neo is about to meet the menacing machine artificial intelligence and eventually sacrifice his life) and the scurrying machine critters tend to make it a nightmarish, hellish Heavenly City. There are frequent religious references in fictional representations of virtuality but the virtual worlds themselves are usually quite ordinary, quite decadent and conceptualized as downwards, underneath the actual. The process of jacking-in, the act of transcendence, is often more spectacular than the destination.

The brain jack and its slightly erotic implications are cunningly investigated in *eXistenZ*. The female protagonist, Allegra, asks Ted “where’s your bioport?” and is surprised when she realizes he has never been “fitted” with a brain jack in the small of his back.⁹⁷ The character Ted has a fear of having a bioport inserted, of having his body penetrated. Thus, Ted experience much angst when Gas, a car mechanic, is hired to fit him out with a bioport in a greasy workshop. When Allegra later helps him to port into the virtual world, she lubricates the organic looking jack hole in the small of his back, and penetrates him with the umbilical cord-like cable of the game pod. The sexual implications are taken up again in a scene of reversed sex gender roles.⁹⁸ Allegra investigates Ted’s swollen bioport and comments that “...it is not infected, it is just excited, it wants action”, while moistening her finger in her mouth and then slipping the finger into him. He repels and slaps her away, crying out “I really don’t think I want action, me I mean, the bearer of the excited bioport”. The question of identity, free-will and sexuality is a theme investigated repeatedly in *eXistenZ*. Olsen (1992) as well as Springer (1996) note that there are subtly sexual implications of jacking-in, especially considering how William Gibson brings together two metaphors: cowboys and wombs. Hacker *cowboys* jack in to penetrate the *matrix*, a word that derives from the Latin for womb. Later in the

⁹⁷ At 16:35.

⁹⁸ At 34:37.

movie *eXistenZ*, the invasive, penetrating and organic bioport is contrasted with non-invasive, metallic neural probes.⁹⁹ This so called SQUID-interface (superconducting quantum interference device) is a fictional version of existing real-life technology that can measure magnetic fields with high sensitivity. In real-life, this promise interesting opportunities for actually developing non-invasive brain-computer interfaces. However, the real-world technology that is used to feed sensory impressions directly into the brain is so far very rudimentary, only capable of triggering a mental image with a resolution corresponding to a few hundred pixels (using invasive probes).

In real-life, VR goggles (head-mounted displays) have been the established means of immersing the user in virtual reality since they were invented in 1968.¹⁰⁰ Codognet (2003) has pointed out that the VR goggles quickly became an important symbol for virtual reality in general, maybe in part due to the fact that it shows how the user is immersed within herself, thus illustrating how she is enclosed in an apparently private universe. Movies that showcase fictional virtual technologies that are similar to real-world equivalences, for example *Avalon*, *Skyggen* and *Johnny Mnemonic*, use different extrapolations of the head-mounted display. The resulting images of people with their eyes covered by hardware are striking; covering the mirrors of the soul make the user seem detached, and robotic, as if we who watch from the outside can glimpse the immersion in another world which the wearer of the helmet experiences. One of the most prominent features of cyberpunk – mirrored sunglasses – creates a similar effect.

⁹⁹ At 01:13:00.

¹⁰⁰ There are also systems such as the CAVE where immersive graphics are projected on surrounding walls.

The anatomy of super-signs

The super-signs that are discussed in this poetics are often intricately constructed. A strong super-sign forms a coherent, logical and memorable organic unity, and in the following chapter I will de-construct a few illustrative examples. I will also describe the design process and rationale behind a couple of the super-signs I have built in my own productions. The intent is to show examples of how narrative and appearances, diegesis and mimesis, often work together to signify virtuality.

Ejahja – building a female Virtual

In my independent feature film production *Astronaut*, one of the characters is Ejahja. She is the on-board artificial intelligence who manages the spacecraft depicted in the movie. Ejahja is an example of what Stephen Baxter in his fiction refer to as a Virtual, a volumetric display embodiment of an artificial sentience. She has an inter-textual ancestry going back to artificial intelligences in movies such as *2001: A Space Odyssey* (Kubrick, 1968) and *Alien* (Scott, 1979). She was portrayed by an actress and the live action imagery was manipulated to look as if she is a virtual character (see Figure 32).¹⁰¹



Figure 32. The virtual character Ejahja in the movie Astronaut. Tempcomp by the author.

¹⁰¹ The movie is still in production. I made a temporary composite (tempcomp) for the scene in 2003 and have still not finalized the sequence of shots.

The character Ejahja is a super-sign, signifying the idea of a [volumetric display of an artificial intelligences]. As we will see, similar super-signs have been constructed in many other movies, as well as in several of Baxter's stories. I will dissect Ejahja's construction, and point to a few similarities of what other storytellers have done.¹⁰² Ejahja's construction is quite simple and the sub-signs making her can be described in full:

- [young female artificial intelligence] – as will be discussed later this is highly typical in the science fiction genre
- [virtual character, direct reference] – the name Ejahja is an intentional reference to the term AI, for artificial intelligence.
- [on-screen presence] – she is seen on a large computer wallscreen
- [black empty background] – she is situated in an empty void
- [grey color] / [monochrome] – her featureless, grey clothing
- [surrealistic color grading] – I manipulated the grey scales and colors to achieve an effect similar to solarization¹⁰³
- [blooming blacks] – a color grading effect where dark areas of the image increase in size
- [transformation] – the color grading changes slightly
- [frozen motion] – she briefly pauses, as if waiting for instructions
- [neutral expression]/[zombie-like] – her emotions and behavior are downplayed in a subtle way by the actress
- [referring to data] – "Yes, it is ready for display"
- [virtual character, direct reference] – "It is not certain that I have a life."
- [virtual character, direct reference] – "Are you aware of yourself?", "I don't know."
- [virtual character, direct reference] – "You won't go HAL on me will you?"¹⁰⁴

These sub-signs are organized as shown on the next page, Figure 33.

¹⁰² This is based on my reading of the half-completed shot, eight years after I last worked with them. The erosion of my own memory of the work gives me more the status of a reader than of an author. This is interesting from an auto-ethnographic viewpoint, as well as in relation to the hermeneutic discussion about the death of the author. As an author of these shots, I have "died" and returned as a reader. But, the parallel reading of the archived e-mail conversations symbolically resurrects the author in me.

¹⁰³ Solarization is an effect where grey scales and colors are displaced to make a surrealistic effect.

¹⁰⁴ HAL is the artificial intelligence in *2001: A Space Odyssey*.

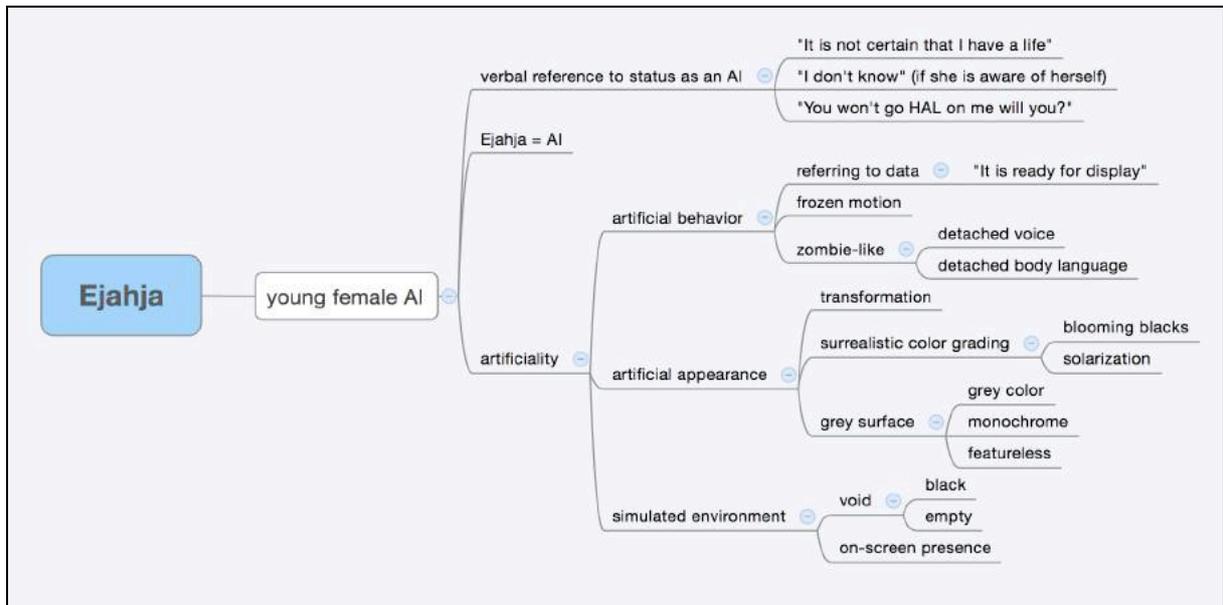


Figure 33. The structure of the Ejahja super-sign.

One prominent sub-sign is that Ejahja is a young female. Similar characters have been used in several movies (for example the Test Card girl in *Life on Mars*, Seraph in *The Matrix Revolutions*, the Ghost in *Avalon*, and Skynet in *Terminator Salvation*). I will look more closely at the Red Queen in *Resident Evil* and the White Queen in one of the sequels, *Resident Evil Extinction*. Both of these characters are Virtuals, volumetric display projections of artificial intelligences, taking the form of a young girl with artificial appearance and behavior.

What strategies have I, and other movie makers, used to represent these characters as virtual? Ejahja is seen *on* the screen, in her own enclosed black void of hers. The Red Queen is a volumetric display and the display technology is emphasized by light beams projecting her, and by typical image artifact signs such as [flickering] and [scan-lines]. The (likewise female) Skynet character in *Terminator Salvation* is also seen on computer screens. Seeing a character displayed on a screen is a strong, hard to miss, sign, but the meaning is not obvious. After all, the imagery could be interpreted as mediated, as in a videoconference. One way to create supporting signs of virtuality, is to manipulate the visual style, especially the color grading of the character. That is a method I used and the signs I created for Ejahja are listed above. Color grading effects are also used for the Red Queen: [red-tint], reflections reminiscent of [liquids], [desaturation], [semi-transparence], and [brightly lit]. Note that the White Queen (in the sequel) uses only one of these signs, [brightly lit], maybe because the movie makers anticipate that the first movie firmly established this artificial intelligence character. From a production viewpoint, shots of these Virtuals can be created in two ways: either you shoot live action footage and manipulate it (making it look virtual), or you create computer graphics that appear virtual because the 3d model used in the production process is a real-life virtual object. From a production viewpoint it is advantageous with the first option of manipulating live action footage into representing virtuality. The reason for this is quite straightforward – it is much easier (quicker and cheaper) to shoot a real

actor instead of modeling and animating a computer graphics character – and this was very much the rationale when I created Ejahja.

Yet another similarity between Ejahja and the two Queens of the Resident Evil franchise was how verbal signs were put to use. For Ejahja, the dialogue with the human protagonist Scott about her ontological status as self-conscious entity highlights her as an artificial intelligence, and was one of the meanings I wanted to convey in the scene. Essentially, the two characters, the man and the machine, say good-bye to each other before they are both destroyed. The two queens of the Resident Evil saga also talk with human characters in a manner relating to their status as artificial intelligences. The White Queen reveals her status with the line “My sensors have detected...”¹⁰⁵, which is quite similar to Ejahja’s line “Yes, it is ready for display”. They both refer to hardware peripherals that in-directly designate them as not human.¹⁰⁶ A similar verbal reference has been used in another of my productions. The science show *Rymdlust* had a narrator, with lines written by me, that was supposed to be the ship’s on-board computer. She presents herself with “I am Technica, this spacecraft’s main computer”.¹⁰⁷ Note that Technica is female, just as Ejahja and the *Resident Evil* Queens. Interestingly, the ship-bound, disembodied artificial intelligence voice that is such a common trope in science fiction movies is usually female. The father of all these fictive spaceship artificial intelligences might have been the male HAL 9000 in *2001: A Space Odyssey*, but HAL was distinctly androgynous and the aptly named Mother in *Alien* (Scott, 1979) has become the ancestor to a long row of female on-board AI’s. Huysen (1981) points out that fictional robots in general are female. Then there is the virtually embodied artificial intelligence (that is, the Virtual, projected as volumetric display), which often appears as a young girl. Without being consciously aware of these predecessors, I created two characters – Ejahja and Technica – that corresponded to this pattern. The logic of the young female Virtual is open for different interpretations; one might be that the syntagmatic juxtaposition between young innocent girls and futuristic technology creates a surrealism that emphasizes the artificiality of the character.¹⁰⁸ Other possible motivations for the female gender of these Virtuals are the old heritage of female secretaries and the human computers of early Twentieth century; originally, computer was the term for a human – often a group of women – doing mathematical calculations. As pointed out by Cheri Kramarae (1998), “women are employed to do what the men don’t want to do and the machines can’t do yet” (p.15). Huysen (1981) suggests that the

¹⁰⁵ At 01:14:20.

¹⁰⁶ The phrase “It is ready for display” could be uttered in a natural way by a human, but my co-director Rick Dunbar had actress Grace Folsom look up and freeze in an anticipating manner, subtly indicating that the display feature was an embodied part of her being. This is a clear example of how a combination of subtle signs, in themselves unrelated to virtuality, can support each other and create a super-sign that connotes virtuality.

¹⁰⁷ Originally in Swedish; “Jag är Technica, den här rymdfarkostens huvuddator”.

¹⁰⁸ This is similar to how the juxtaposition of an innocent girl and a demon creates an intriguing representation of evil, as exemplified in *The Exorcist* by William Friedkin and countless other horror movies.

robot, the artificial life, is so often female because it symbolizes man's final conquering of nature, it is "the male phantasm of a creation without mother;" allowing man to be "at long last alone and at one with himself" (p.227). Concerning Ejahja, I rather considered her as a companion to the lonely, male astronaut protagonist of the story, the other side of a symbiotic, platonic relationship.

My exact reasoning for having Ejahja being female remains vague. E-mail conversation from the production suggests that the choice of gender for Ejahja was somewhat arbitrary. I wrote this with co-director Rick Dunbar on January 21st, 2003.

Thommy: "I suggest female"

Rick: "I agree! No idea why I changed this..."

It could be that I was influenced by intertextual references, possibly *Resident Evil* (it was released the same year I wrote the script for *Astronaut*). I did write into the movie script that Ejahja was female, but there was no mention of her young age. Ejahja's young age – the actress being in her early teens at the shoot – was somewhat arbitrary and an example of serendipity. Ejahja appearing as a young teen had partly come from production circumstances. This e-mail exchange is from July 1st, 2003.

Thommy: "BTW, again, I just realized that we will need a female voice for Ejahja, the artificial intelligence onboard the ship. It would be nice to have an american accent on that voicer, not swedish, and I started to think about young girl I mentioned that auditioned together with Ted. Would she be interested in doing the voice over? Or maybe even have screen time, we could use footage of her on a computer screen, and filter it, so it looks as if Ejahja is a virtual ship member, not only a voice."

Rick: "The question for you is, what age would you like the voice to sound? An actress would much prefer to have her face on screen, but a VO is better than no role at all. There is one particular actress I would like to have a shot at it because she is a friend of a friend. However, I don't want that to influence your decision. Just tell me what age you are looking for and we'll take it from there."

Thommy: "I think Grace is the one for the Ejahja character. She was good during audition, and she got a personal look which I think correspond great for Ejahja. A good second choice would be Rachael, I really think she did an equally good performance, even though she doesn't look like Ejahja to me (but if Grace can't do Ejahja I can consider Rachael instead)."

What this exchange shows is that we were in a small-scale production situation where we had to make use of the actors we had easy access to, and that both the age of Ejahja and the idea to color grade ("filter") the imagery co-evolved with the casting procedures. The example of the Ejahja super-sign is an example of how creative decisions can be influenced by different vague influences: a mix of intertextual influences, plot-derived necessities, and practical production circumstances.

The grey surface and the Virtual Gas Lab

A surface attribute that is often used as a representamen when signifying a virtual object is a featureless, solid grey surface. The [grey surface] is a supporting sign, subtly suggesting virtuality, instead of intrudingly claiming virtuality. After all, a grey surface can also be just a grey surface. The sign [grey surface] might be thought of as a very simple sign – the representamen being just a grey surface. But, both the representamen and the interpretant of this sign bloom into complexity, and the sign can also be seen as a super-sign assembled by sub-signs, such as the [lack of color], [lack of texture], and [the lack of specular]. The lack of specular means that the surface is completely matte. All three sub-signs share the notion of [lacking] something, and this engages three different interpretants. The stylized simplicity of these matte grey surfaces connotes computer rendering, emphasizing that the imagery has been rendered and not photographed. This means that it is artificial; it has been engineered. And finally, the featureless grey evokes immateriality, emphasizing that the objects or environments are not fully there; they are not fully physical.

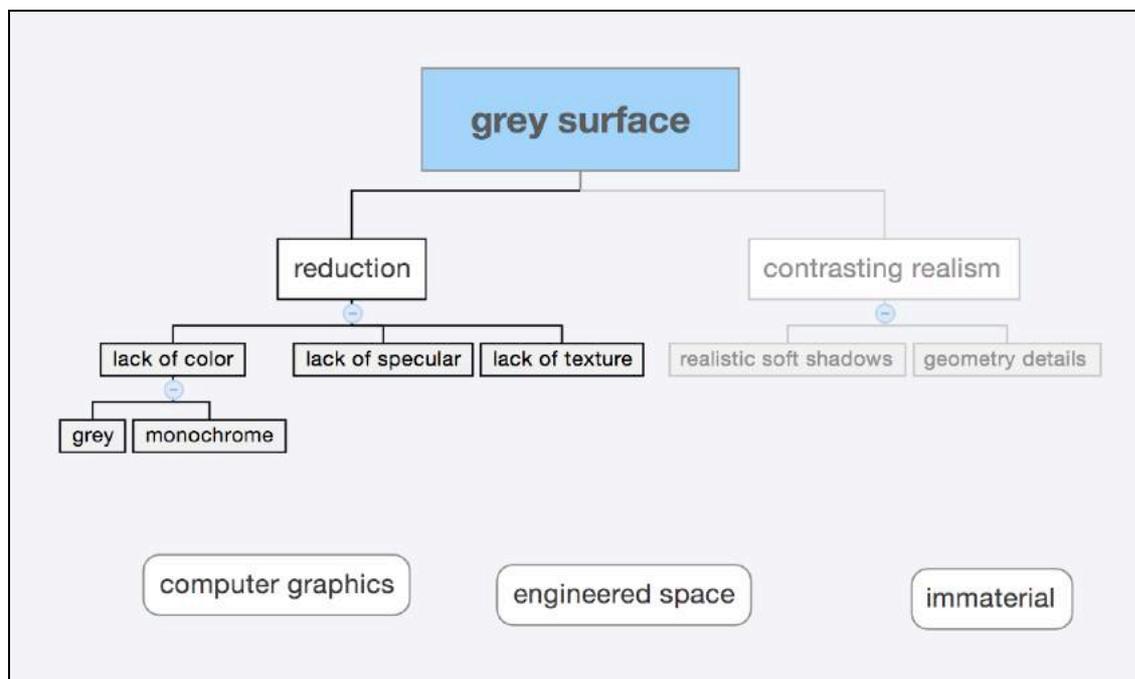


Figure 34. The structure of the grey-surface super-sign, showing how reduction and abstraction combine with contrasting sub-signs of realism.

Sometimes the [grey surface] is a construct incorporating realistic, high-quality shadow rendering and a high-level of geometrical detail. One example comes from the Eyetroneics advertisement on page 165. The jeans bottom in the mirror shows fine details with wrinkles in the fabric and sews, and the shadows are smooth and realistic. The surface texture, however, is grey and featureless. This syntagmatic combination of image quality attributes combine into a striking and visually strong super-sign (see Figure 34), and the conflicting juxtaposition of both high visual

fidelity and low visual fidelity makes the image tell two things at the same time; that it is real, and that it is not real. It is as if the virtual tries to rival the actual; *I am virtual, but that does not matter*. This combination of low and high visual fidelity might be yet another example of how a representation of virtuality have its roots in production practices. The procedure of rendering a detailed 3d model with high-quality shadows but without a texture, with only the default grey surface shader, is a common way to both showcase the accuracy of high quality rendering algorithms, and to showcase the perfect and detailed geometry of a 3d model (as was the intention with the Eyetronics advertisement). Also, in 3d software used by computer graphic artists, such as Maya, the default surface material for newly created geometries (objects) is a matt medium grey, non-textured shader.

I used the [grey surface with realistic shadows] super-sign in a couple of my own productions. I used it in *Astronaut*, deciding that the actress should wear as grey and featureless textiles as possible, and in the Environmental Science Investigation's Virtual Gas Lab, where the grey look of the lab bench became one of its most prominent characteristics. In this design decision, I was influenced both by fictional representations of virtuality and aesthetic preferences. As a designer I favor the minimalism of the grey surface, and as a computer graphic artist I recognize how the grey surface connotes 3d modeling. The juxtaposition of both abstract and realistic is intriguing. And, I knew that the grey surface of the Gas Lab and the empty void behind it were quite similar to what I had seen in movies such as *The Matrix*. So, here lies a double rationale for the [grey surface with realistic shadows] super-sign: that it is pleasingly aesthetic in its minimalism and simultaneously the very same minimalism represents virtuality.

The following suite of images (Figures 35-38) illustrates the progress of design work I did on the Environmental Science Investigation production. Two cities, the actual Athens and the virtual city of *Mirror's Edge*, inspired the design and visual style of the Gas Lab. I was especially inspired by the grey-white facades, primarily colored details and the soft real-life light, and I let details metaphorically fused actuality and virtuality. I used the materiality and realism that is suggested by soft shadows, and by high level of detail in a 3d model's geometry. Then, as a contrast, I emphasized, and signified, virtuality by using a featureless grey surface. Color accents highlighted interactive parts of the graphical interface, and aesthetically broke the blandness of the grey surface.



Figure 35. Real-life city that inspired the Gas Lab; the city of Athens. Photo by the author.



Figure 36. Virtual city that inspired the Gas Lab; promotional image for the computer game Mirror's Edge.

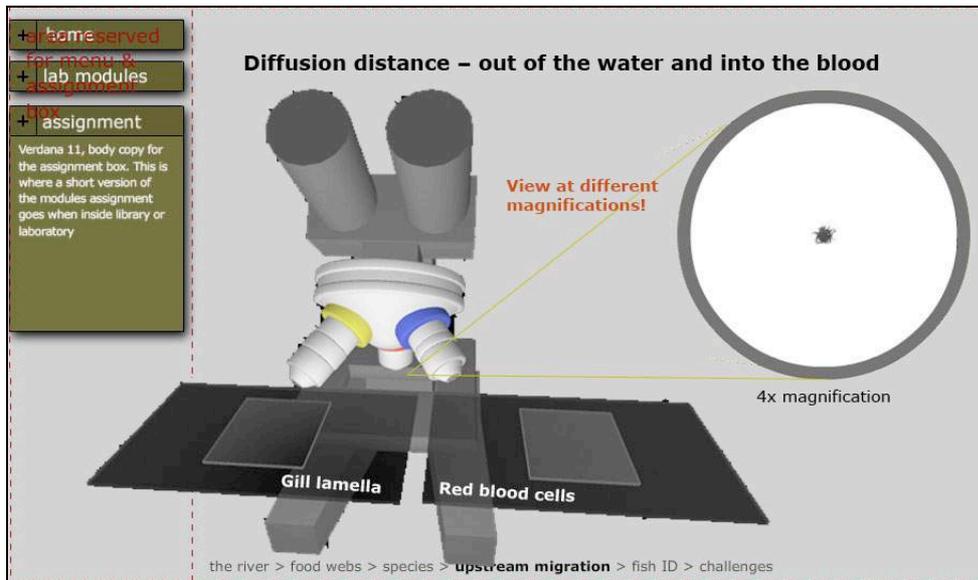


Figure 37. Design sketch for virtuality; a low-level prototype of the Virtual Microscope (a never realized virtual lab in conjunction to the Virtual Gas Lab) using a grey surface with soft shadows, and accents of primary colors. Sketch by the author.



Figure 38. Final virtuality; the Virtual Gas Lab from the Environmental Science Investigation project.

The immateriality of a flickering candlelight

They manifested, like a flame.¹⁰⁹

In the visualization project, Via Tecta, Jonathan Westin and I made an interactive presentation showing a reconstruction of an ancient, Roman temple, the sanctuary of Hercules Victor. We developed what we called an *open visualization*, as in open for interpretation. The purpose of the project was to investigate different methods of conveying the inherent uncertainty in reconstructions such as these. Historical remains – from dinosaur fossils to temple stones – are always partial. Sometimes, there are only a handful of bones, or a few stonewalls in the grass. The interpretations of such remains are vague and full of uncertainties and alternative explanations. This comes in conflict with visual reconstructions; in order to make the visualization both interesting and possible to understand, much information needs to be added to the image, information that is based on interpretations. The problem is to show enough to let people understand what they see, but not so much that we suggest things we do not know. This is a difficult balance to find. Even if the visualization is introduced with an explicit explanation that the reconstructions are incomplete and uncertain, this knowledge is soon subsumed by the experiential power of the visualization (Favro, 2006). In the project that Westin and I worked on, we tried to find ways in which the representation can speak directly to the audience about its lack of certainty and its provisionality. Such methods have been investigated by a number of scholars (Haselberger, 2006; Klynne, 1998). Even though our visualization concerned an archeological reconstruction, the issue of representing uncertainty is relevant in other domains where 3d visualization is used as well (Johnson, 2004), for example in geographic information systems (Ehlschlaeger, Shortridge & Goodchild, 1997) and medical imaging (Lundström et al, 2007).

Our main approach was to reference virtuality of different sorts. The rationale was that virtuality also has a sort of uncertainty and immateriality to it. We used several signs and super-signs to signify levels of virtuality/uncertainty. We attempted to use flickering and changes over time as indicator of uncertainty, paths that have been explored by others as well (Ehlschlaeger, Shortridge & Goodchild, 1997; Lundström et al, 2007). The rationale behind using flickering to indicate uncertainty was the connection to immateriality and virtuality; we took inspiration from flickering TV screens and flickering virtual objects we had seen in fictional representations of virtuality. We worked with the assumption that more flickering meant a higher degree of uncertainty. We experimented with the speed of flickering, the strength of it, and whether it was random or regular. However, it was difficult to strike a balance between drawing attention and giving the feeling of not-being-there. We had to balance foregrounding on the one hand (in order for the viewer to become aware of our signs) and repression on the other hand (less certain aspects of the reconstruction would be metaphorically pushed away, as if they were

¹⁰⁹ Character Kevin Flynn describing the spontaneous emergence of artificial intelligence in the virtual world of *Tron Legacy*, at 53:15.

not really there). Since we wanted objects to appear uncertain, one seemingly logical way was to make them less “there”, less material. But, the flickering turned out to be too imposing, drawing too much attention to the effect. As a final attempt to make comprehensible use of flickering and striking a balance between attention and fading away, we tried to emulate the look-and-feel of a flickering candle. Our intention was to communicate virtuality/uncertainty through the connotations of a starving flame. The concept of a dying flame was also our attempt to viscerally suggest how the scale of colors we used should be interpreted. We had problems with showing how the color scale was mapped (for example, is red or blue the most uncertain color?), and by using the dying candle metaphor we hoped to establish that red was the most uncertain, because the flame was red when it almost died away. We hoped that the irregular flickering would emphasize the feeling of a flame dying away, establishing that the more it flickered the less certain the object was. Eventually we abandoned both colors and flickering, mostly because it still drew too much attention. Instead, we used blur and transparency together, a combination of signifiers that Penny Rheingans and Shrikant Joshi (1999) also arrived at in their work on visualization of positional uncertainty in molecules. Transparency was also used by Djurcilov et al (2001) to indicate uncertainty in medical imaging. The reason we chose blur was that conceptually it lessened the amount of information, which gave the appropriate connotations of a lack of certainty, and of information. Transparency was chosen because it connected with ghosts and fog, and of not really being there materially. Balancing the effect of the signs remained an issue even with blur and transparency, but it worked quite well; it was a true reduction of the information content of the image, and it gave the impression of fading away, while at the same time being quite obvious and visible.

What is interesting with the failed super-sign of the flickering candlelight is its illustration of how a design idea that seems promising in the initial design phase meets practical issues in application, leading to a quite different solution, and a different set of signs.

The world that is sick

“How was your life like before?”

“Before?”

“Before it was changed by Alegra Geller.”

“I operated a gas station”

“You still operate a gas station.”

“Only on the most pathetic level of reality.”¹¹⁰

This dialogue from *eXistenZ* emphasizes how similar life in the actual world and the virtual world can be, while having a distinct difference in value. It also illustrates the common idea that the virtual has *less value* and how it is sometimes portrayed as sick and depraved in the analyzed narratives. This is related to the topology #engineered space, the world that is initially empty, waiting to be filled, but there is

¹¹⁰ From *eXistenZ* at 20:10, dialogue between characters Ted Pikul and the aptly named gas station operator Gas.

also a specific kind of sickly emptiness, as if the world has *been* populated, but then was abandoned. This stylistic and supporting super-sign is frequently used in the Matrix franchise. Not only are the back streets empty, and not only is the nighttime lighting spooky, there is also a distinct impression of being a run-down world. It is dirty. There is wind blown garbage on the pavement. The building facades are worn and broken (see Figure 39). The green tint of *The Matrix* references not only old CRT computer displays, but also a sickness and unhealthiness as well.



Figure 39. Excerpt from *The Matrix Reloaded*; a typical view of the vacant back street aesthetics and sickly green tint used in the Matrix franchise.

Similar depictions of run-down city environments can be seen in, for example, *Inception*, *Chatroom*, *Storm*, and *Avalon*. Should this be understood as a degrading frown towards the artificiality of the virtual? Or is the intent to signify a world run out of control, an artificiality that humans have lost control over, just as we have lost control over so much real-life technology? In *Storm*, there is a plot-based motivation to the deprived environment; the illusionary visit to his childhood that the character DD is forced to encounter is a reflection of the disturbing memories that haunt him. The childhood town he wanders through is completely empty, and wind strewn autumn leaves cover the foggy streets. The director Måns Mårland claims, on the DVD commentary track, that the leaves were a coincidence that they took advantage of. Concerning the shabby look of a building, he offers that “the idea was that the closer he gets to places where he has done bad things, the places gets more infected and rotten”.¹¹¹ Similar logic prevails in *Inception* where crumbling skyscrapers represent the troubled subconscious of one of the movies fictive characters. Thus, these signs of a depraved illusion not only support the plot, but they are also signs which carry some sense of narrative clarity.

These dystopic cityscapes seem to fit well with how Heuser (2003) characterizes the aesthetic of the cyberpunk genre in general, mentioning “the omnipresence of

¹¹¹ At 48:38. Translated from the Swedish statement: ”Iden här var att ju mer han närmar sig ställen där han gjort dumma saker så blir dom ställena mer infekterade och ruttna.”

black leather clothes and mirrorshades, the obligatory neon lighting and dreary rain, and the ubiquitous chrome and concrete” (p.41). However, it is more than just a matter of stylistic codes and a visual style; as mentioned above, the mood of the environments could also be attributed to what the plot needs. Is it then reasonable to speak of sickness and depravation as a sign of virtuality? Is it reasonable to assume that we think of the virtual as sick and broken? What can be said with certainty is that in a plot that interweaves two narratives, moving back and forth between the virtual and the actual, there is a necessity to distinguish between these different worlds. This distinguishing contrast between worlds is portrayed in a way that is logical too, and forms an organic unity with the visual style, themes, and plot of the movie. In *Tron*, the virtual world glows with energy, as if fueled by the heroic fight for freedom. In *The Matrix*, the virtual world is run down because it is a prison. In *Storm*, the illusionary world is rotten at its core because the human subconscious hides dark secrets. This illustrates unity between story and style, and between diegesis and mimesis.

Virtual death – how to die without the flesh

How do virtual characters die? Is it death when you do not have a material body? As illustrated by the following examples, dying is both a dramatic plot event and an opportunity for storytellers to signify virtuality.

The death of a progeny in *Tron*¹¹²

During torture – represented by screams of agony, blue electrical bolts, and bursts of pixelation – the virtual character Clu is killed in the virtual world. At his death, his body is gradually replaced by a green-glowing wireframe. The lines and dots of the wireframe are then gradually erased. Similar step-by-step disappearances – and corresponding appearances – are used frequently throughout the *Tron* movie, and it is referred to in dialogue as being “de-rezzed”. The creation of something out of nothing is referred to as “rez up”. Disappearing and appearing connects to the topology of #immateriality. In subsequent *Tron* deaths, the aspects of dying in the virtual world are expounded upon even further. A fallen gladiator disappears with a bright flash and then a series of red glowing discs float upwards, as if his digital soul is leaving his body.¹¹³ When the virtual character Ram dies, his body fragmentizes into a myriad of glowing dots and disperses into the glowing circuitry lines of the floor.¹¹⁴ It is as if his body is returned to the digital dust from which he was made. Thus, the first death referred to how virtual objects, digital code, can be written and erased, appearing and disappearing seemingly without effort. The two later deaths are instead clearly inspired by traditional religious ideas about the soul going to Heaven and the body returning to dust.

¹¹² At 07:40. Clu is the digital, semi-autonomous alter ego of the human hero Kevin Flynn.

¹¹³ At 35:25.

¹¹⁴ At 53:50.

The death of a gladiator in *Tron Legacy*¹¹⁵

In *Tron Legacy*, the characters from *Tron* have been upgraded into higher levels of realism and they look completely physical.¹¹⁶ In most cases, it is only the futuristic design of their suits and the prominent lines of glowing light that signify them as virtual characters.¹¹⁷ When characters in *Tron Legacy* are killed they instantly fragmentize, cascading into a shower of disintegrating cubes. When the inside of the virtual body is opened up, it lights up as if an inner glow was released when the outer shell was compromised. The effect is very simple in its components (its sub-signs), but the resulting look is highly complex and beautiful. The sight of an apparently living human fragmentizing has unsettlingly, un-natural connotations; the super-sign signifies virtuality by a syntagmatic juxtaposition of what appears to be a human body with a strange and surreal fragmentizing.

The death of a soldier in *Avalon*¹¹⁸

When game character soldiers (NPC's, Non-Player Characters) are shot to death in *Avalon*, they instantly freeze, and then their image is slashed into pieces by straight cuts. These pieces swiftly turn, revealing them as flat 2d pieces of imagery, and then fragmentize into a cloud of debris. The emphasis on two-dimensionality is repeated in the more complex death patterns of the more advanced virtual characters. When the Ghost is shot by Ash, the camera viewpoint circles the frozen image of the Ghost, revealing that her previously 3d body has been split up into ribbons of 2d planes.¹¹⁹ These image ribbons start to rotate, leaving cylindrical dark trails, which then turn into thin blue glowing circles, which expand and fade out. A few brilliant pinpoint lights are seen along the blue lines. When human avatars are killed in the virtual world, the death-sequence starts with a subtle blur of the face, and a strange sound.¹²⁰ The body splits up in 2d planes that swipe around in 3d space, leaving a cylindrical, trailing 3d shape. These shapes expand and are infested with brightly glowing bars of green light. Finally, the cylinders fade and shrink, as if eaten up by the glowing bars of light. These deaths in *Avalon* are built from the same paradigmatic repertoire as the deaths in *Tron* and *Tron Legacy*; the movie makers use different forms of fragmentizing and contrast the apparently human body with sub-signs such as voxels and 2d-planes, related to the construction of virtual 3d-models.

In fiction, death is seldom realistic. Western operas and Asian drama have a tradition of very slow, outdrawn and poetic deaths. Much has to be sung or said before the last breath. In feature films, dying seems to have evolved from a short scream followed by a graceful collapse in vintage Western films, via the famous last

¹¹⁵ First revealed at 29:15.

¹¹⁶ Production-wise, the *Tron Legacy* characters were live actors shot with practical lights in their costumes. The glow of the lights was enhanced and changed slightly in color grading.

¹¹⁷ Here, I am only referring to their appearances. There is much in their behavior and dialogue that signifies their virtuality.

¹¹⁸ First seen at 04:25, then used frequently in the same sequence.

¹¹⁹ At 01:15:00.

¹²⁰ Stunner at 01:13:10 and Murphy at 01:36:15.

words before a silent relaxation in dramas and soap operas, to violent cascades of blood and gore in contemporary action and horror movies. Cyber-punk movies have evolved these tropes into the quick, but complex, deaths described in the examples above. These deaths are mostly portrayed visually, but the visual often shows narrative sequences of events, such as step-by-step fragmentation.

A paradigmatic study of these sub-signs of virtual death throes clearly shows that they have things in common, and that there is a specific repertoire to draw from. [Fragmentization] is a recurring sub-sign. It is not only dying characters that fragmentize. It is also a very common sign applied to vehicles, buildings and other parts of the environment. This kind of fragmentation has been observed in *Kid's Story*, *Program*, *Beyond*, *Johnny Mnemonic*, *The Matrix Revolutions*, *The Matrix Reloaded*, *Tron*, *Tron Legacy*, *Ghost in the Shell*, *The Lawnmower Man*, *Skyggen*, and *Virtuosity*. Looking at written descriptions of virtuality, fragmentation is a motif in the writings of Stephen Baxter as well, here in *Reality Dust*:

Sarfi reached out and swept her arm down at the desk - no, Hama saw, startled; her arm passed through the desk, briefly breaking up into a cloud of pixels, boxes of glowing colour.

Already in Charles Csuri's computer animated short film *Hummingbird* from 1968, fragmentation was an important part of the aesthetics (Glowski, 2006).

Fragmentation is sometimes combined with apparently material objects turning liquid, both in movies such as *Tron Legacy* and – as pointed out by Sabine Heuser (2003) – in William Gibson's fiction. This is used occasionally in the Matrix franchise and in *Johnny Mnemonic*, but *Tron Legacy* makes it a fetish by excessive, stylistic devotion to the cool, beautiful imagery of how the crashing Light Cycles fragmentize in liquid cascades on the Game Grid gladiator arena.

Why would fragmentation be related to virtuality? I believe it connects with the interpretant of two high level super-signs, that of [immateriality] and [the clockwork mechanism]. It is as if the characters and objects have an inherent tendency to fragmentize, because they are so close to *not being there*. Therefore fragmentation represents immateriality. An adjacent super-sign is the reveal of [the-code-behind], as in the super-sign of Neo's unique vision; the hero Neo in the Matrix franchise can see the green glowing computer code that is the background fabric of the illusionary virtual world. It's like peeking behind the curtain, or behind wallpaper. This is reminiscent of the famous Flammarion engraving¹²¹ depicting a man breaking through the edge of the world and seeing the mechanism behind (Figure 40).

¹²¹ It was published by Camille Flammarion in the 1888 book *L'atmosphère: météorologie populaire*, the artist is unknown.

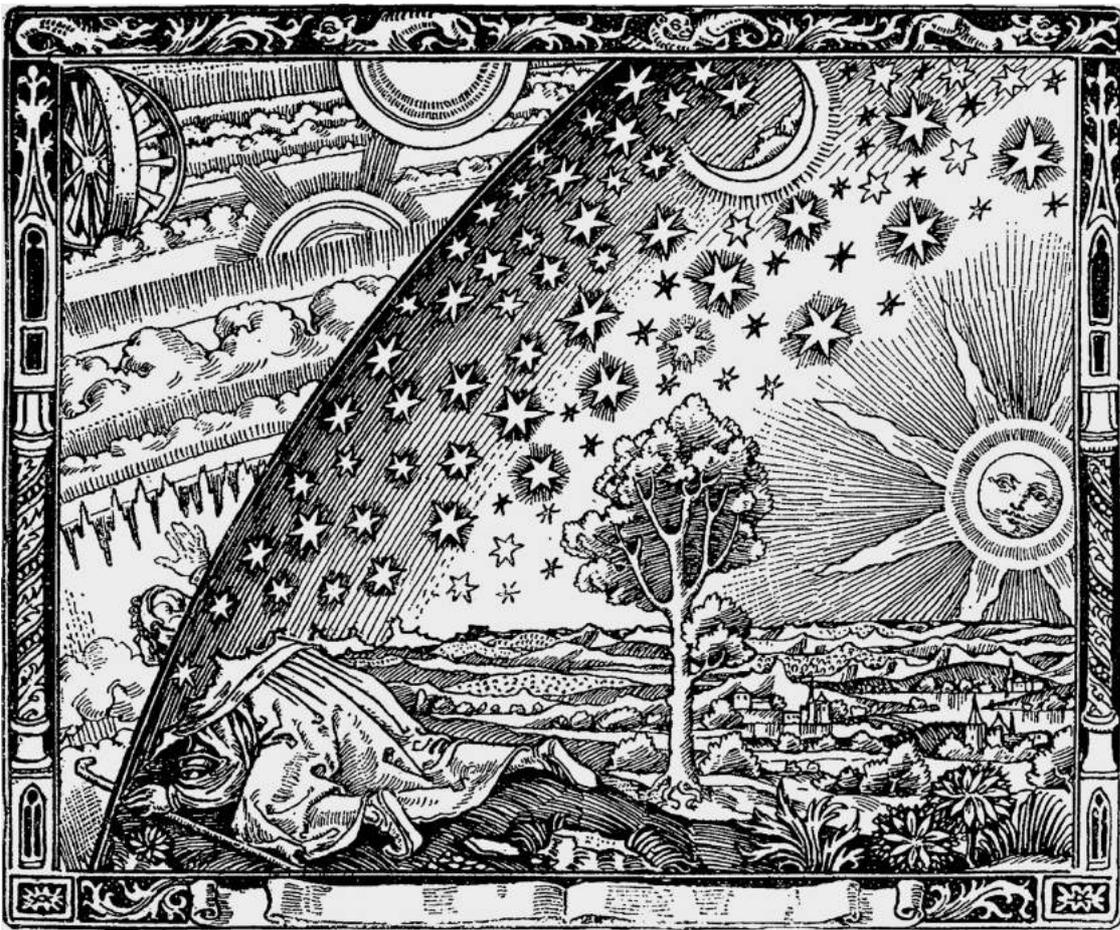


Figure 40. *The Flammarion engraving, a precursor to Neo's vision in 'The Matrix – seeing the mechanics behind the scene.*

The association to clockwork mechanism – or behind-the-stage mechanism – is highly related to the way the fragmentations reveal the inner structures of the virtual object. The digital deaths that we have discussed are designed to reveal the inner mechanisms of the virtual characters. Either they reveal an inner wireframe skeleton, or a cascade of voxels, or the characters are turned into 2d imagery – acknowledging that flat 2d-textures are one of the most important components of producing computer graphics. Voxels are a modeling and rendering technique used in some computer graphics. The cubes that the fictive *Tron* characters fragmentize into seem to be motivated by this real-life production technique. Writer Stephen Baxter has also used [voxels], putting them into words in the short story *Darkness*.

Hilegas looked down, startled, at the hole in his chest. Pixels fluttered about him, blocks of colour in the air.

The quote from Baxter exemplifies how the revelation of inner mechanisms is used not only in deaths, but also in wounds of virtual bodies. A memorable example is *Tron* villain Sark's huge gash in his skull, disgorging a cascade of white-yellow light out of his skull.¹²² A close-up shows sparks coming out of the wound, and in the

¹²² At 01:21:00.

gap in his head there are glowing electrical circuits, and machinery in different colors, as if his head is filled with electronics. This is a rather blunt denotation of artificiality.

There is another kind of death symbolism in the virtual world, the super-sign [dying and going to heaven]. There are more or less subtle references to the transcendence to another world: characters jump off roof tops and wake up somewhere else (*Life on Mars*, *Abre los ojos/Vanilla Sky*, and *Kid's Story*), characters refer to death as the only way out (“In order to get back home, we needed to kill ourselves” in *Inception*¹²³), and characters jack-in to the virtual reality simulation by donning a death mask (*The Cell*) or lying down in something that resembles an electric chair (*Avalon*). The numerous references in the Matrix franchise to Neo as a contemporary cyberpunk Messiah – saving mankind with his calm, detached and contradictory combination of wisdom and confused searching for who he is, sporting almost god-like powers – have been described and debated thoroughly (Constable, 2006; Irwin, 2002; Kaveney, 2005). The most prominent example occurs at the moment of his death; sacrificing himself for the sins man has committed on intelligent machine, Neo is engulfed by light and throws out his arms, forming the symbolic image of the crucified Jesus. Here, there are strong parallels with the climax of *Tron Legacy*, where the protagonist Kevin Flynn also sacrifices himself, redeeming his sins (decades of neglecting his virtual offspring Clu) and saving mankind (from Clu’s invasion into the actual world), while being engulfed in light and holding a pose with outstretched arms. Flynn even sports a beard and wears a white toga, making him messianic. There is another parallel between the death of Neo and the death of Flynn; both die by merging with their evil creation, a creation that can be seen as the copy-gone-bad of themselves. Neo merges with Agent Smith, and Kevin Flynn merges with Clu. In both cases, the protagonist (Neo and Flynn) is a human visiting the virtual, and the antagonist (Agent Smith and Clu) is an artificial intelligence in the form of a virtual character. Their mutual destruction is reminiscent of how matter and anti-matter meet, causing a brilliant explosion. Is the subtext that the evil in man and the good in man adds up to nothing? Or is it a posthuman comment on the man-machine relationship, that merging might save/destroy humanity?

¹²³ At 01:13:20

Breaking the screen – how the virtual bleeds into the actual

Cyberspace has leaked into the real world. ...what was inside the box in all eras up to ours ...is outside (Vinge, 2006).

In the previous chapters, we have primarily discussed the archetypical virtuality in fiction, exemplified by *The Matrix*; the immersive, imprisoning virtuality that a protagonist breaks out of. But, virtual objects can also emerge into the physical, material, actual world. In fiction, these virtual objects are usually referred to as holograms. In real-life, some steps of development have been taken to realize these fictional technologies. Conceptually, the primary computer screen has already been broken into many secondary screens. The usage of these secondary screens contribute to a reconceptualization of the virtual from being locked into a box with a window, to being a layer on top of the actual. A discussion about holograms and virtual objects will navigate between fictional and real-life technologies. In real-life, the area is in fast development and this development is heralded as being revolutionary in how we interact with computers (Lamantia, 2009; Rakkolainen, 2008). In an interview, William Gibson acknowledges this shift, saying that “cyberspace is everywhere now” and it has “colonized the world. It starts to sound kind of ridiculous to speak of cyberspace as being somewhere else” (Wallace-Wells, 2011, p.199).

Anne Friedberg (2006) has theorized the window/screen of the computer, describing how the parallel usage of these two concepts, the window and the screen, highlights how the window is a transparent portal or frame we can look into, while the screen is an opaque page or surface we cannot penetrate. Friedberg suggests that the window metaphor was derived by the Renaissance architect Leon Battista Alberti, who in his 1435 treatise *De Pictura* instructed painters to think of the frame of the canvas as an open window. The window metaphor has during the twentieth century connected diverse medias such as photography, cinema, television and the computer, and it has now diversified into multiple screens, creating a new kind of fragmented space, a post-Cartesian, post-cinema, post-television, and post-perspectival space. Furthermore, the virtual seems to be ready to leave the screen entirely.

Holograms and volumetric displays

The term *hologram* is problematic. It has an accurate and technical meaning referring to a holographic display. It also has a popular meaning that is very broad and which does not correlate with the technical meaning. It is a bit surprising that the term is still so much in use, and has not become outdated like other over-hyped and inflated technical terms such as *multimedia* and *cyberspace*.

The technical meaning is that a hologram is an image that via holographic technology has an apparent depth. The physical media of the image is actually flat. Even if a good quality hologram gives a convincing appearance of being viewed from a range of angles, it cannot be viewed from a full range of 360 degrees. This

kind of hologram exists in real-life (holographic technology is also used in other applications such as data storage and security identification).

However, the popular meaning of hologram also includes images projected in the air. The technical term for images that are projected in the air is *volumetric display*.¹²⁴ A volumetric display is an image that actually has extensions in all three spatial dimensions. In contrast to the hologram described above, a volumetric display can be seen from all directions. It might not be fully correct to refer to a volumetric display as an image at all, but rather as a sort of immaterial, projected model or statue. From that viewpoint, it is a virtual object. In fiction, the archetypical hologram (technically a volumetric display) is the image of Princess Leia, floating semi-transparently in the air in the first *Star Wars* movie (1977), noted as well by Shedroff and Noessel (2012). This kind of volumetric display is very difficult to realize with real-life technology. There is research and development on volumetric displays, but real-world examples are far from the holograms of science fiction. Just to mention a couple of emerging technologies, there is the Perspecta system developed by Actuality Systems (Genuth, 2006) and there is the laser plasma system developed by The National Institute of Advanced Industrial Science and Technology in Japan, Keio University and Aerial Burton Inc. (AIST, 2006; Whitwam, 2014). The Perspecta is not actually a true volumetric display; rather, it works by projecting a 2d image on a swiftly rotating projection screen inside a glass sphere and the projection is confined to the inside of the sphere. The Japanese system is a true volumetric display using laser beams to create glowing dots of plasma, ionized air, arranged in a three-dimensional volume. Even though the dots only form crude shapes, it is easy to envision how technological improvement could yield smaller dots and thus higher resolution, modulation of spot brightness and thus a grayscale, and finally color. Of course, it remains to see if such development will ever be feasible.

One way to achieve the illusion of an image projected in the air is Pepper's ghost effect. Pepper's ghost is not a hologram, nor is it a three-dimensional image projected in the air. It is an illusionary technique where the sight path to an object or a screen is reflected into another environment by a semi-transparent mirror; the effect is that the object seems to hover in front of the audience, semi-transparent and floating in the air. The Pepper's ghost image is actually projected in the mirror, and it cannot be seen from the side. The technique is very similar to a heads-up display. The effect is often used to display ghost-like appearances in theaters, concerts, theme parks and so on, and in popular media it is often called a hologram. This is technically incorrect, but the appearance of a Pepper's ghost effect is similar to the archetypical *Star Wars* hologram. One of the most dominant visual aspects of Pepper's ghost effect is the semi-transparency of the image. It seems to be a strong stylistic code that holograms should be semi-transparent. The only observed deviations in the studied movies are *Forbidden Planet* and *Resident Evil Extinction*, which feature opaque volumetric displays. In the commentary on the 2004 DVD edition of *Star Wars*, Dennis Muren comments that the animated chess

¹²⁴ The term mid-air display is also used.

game pieces were “transparent because they too were supposed to be holograms”.¹²⁵ More or less all other volumetric displays depicted in movies are semi-transparent – from the early examples in *The Wizard of Oz* and *Star Wars* to contemporary versions in the Matrix franchise, *Avatar*, *Iron Man*, *Resident Evil*, and *District 9*. This might be heritage from the Pepper’s ghost illusion, since it is one of the most well-known examples of real-life display of images-in-the-air that we can create so far (Shedroff & Noessel, 2012).

Looking at literary depictions of volumetric displays, we see an example of how William Gibson shifts between explicit, technology-heavy descriptions and short, suggestive, almost poetic, depictions. The following quotes illustrate how Gibson describes a volumetric display in *Mona Lisa Overdrive*.

“Here, I’ll show you.” When he returned to the white breakfast table, he carried a shallow square black tray with a number of tiny controls arranged along one side. He placed it on the table and touched one of the minute switches. A cubical holo-display blinked on above the projector: the neon gridlines of cyberspace, ranged with the bright shapes, both simple and complex...

In the later *All Tomorrow’s Parties*, a novel that Gibson himself claims to have the merging of the virtual and the actual as its central theme (Johnston, 1999), Gibson indulges in a much more poetic and suggestive depiction.

Something flickered. Neon butterfly. Torn wings.
And then this girl was there, kneeling, right up close, and he felt his heart roll over,
catch itself.
The how of her not being there, then being there.

A specific kind of volumetric display is the Virtual, a projection of an artificial intelligence, a partial embodiment of the virtual sentience. Different aspects of Virtuals and artificial sentience are discussed repeatedly in this poetics of virtuality, see pages x, x. Virtuals are portrayed in several different narratives – for example in *Man of Steel* and the *Resident Evil* franchise – but the most extensive and interesting construction of this super-sign that I have observed is the Virtuals that populate many of Stephen Baxter’s narratives. The structure of the Stephen Baxter Virtuals super-sign is shown in Figure 41 on the next page, and the complexity of both the sub-sign representamen and the interpretants is quite high.

¹²⁵ At 57:20.

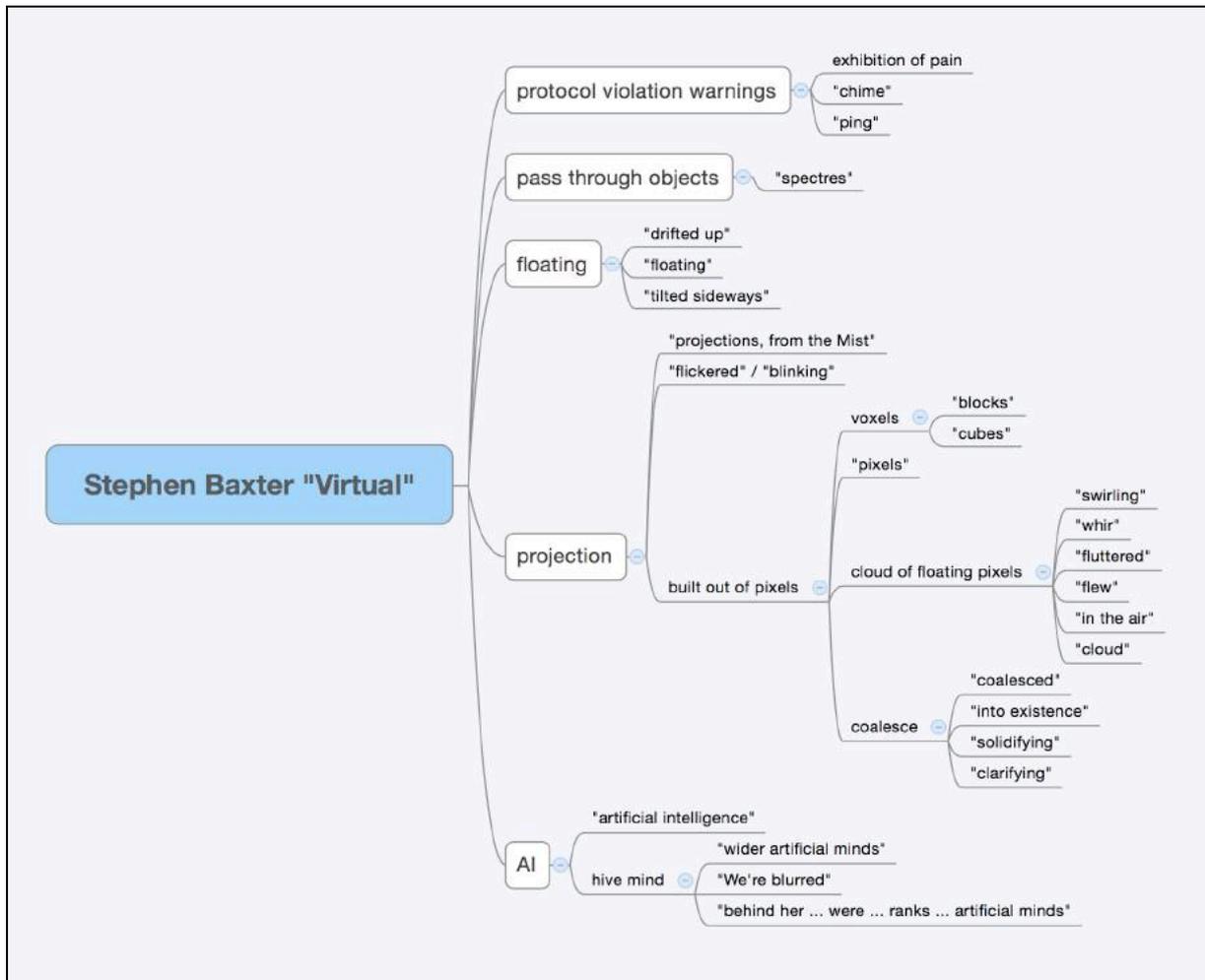


Figure 41. The complex structure of the Stephen Baxter Virtual.

The first fictional volumetric displays

Fictional volumetric displays seem to acknowledge the technical difficulties related to real-life volumetric displays, in a kind of backward semiotic inertia; depictions of fictional volumetric displays employ a variety of image artifacts highly related to the artifacts discussed in the chapter on semiotic inertia and old style computer displays. These artifacts are invented artifacts, as if the movie makers suggest that *if* or *when* we will achieve actual volumetric displays, they *will have* these artifacts. These signs seem motivated by technical restrictions, but are quite arbitrary choices. A paradigmatic analysis shows that the representamina that are selected when constructing a [volumetric display] super-sign are quite standardized, and that the syntagmatic construction follow quite distinct codes. In movie after movie, holograms are monochrome, blue tinted, glowing, semi-transparent, flickering, and they show scan lines or pixelation, a strong uniformity that has been noted as well by Shedroff and Noessel (2012). Obviously, these signs are not arbitrary; even though they represent an envisioned technology, they have their origins, their motivation, in the image artifacts of existing technology, especially the TV screen. This is an example of the remediation, the refashioning of an old media into a new media, that Bolter and Grusin (2000) describe. Volumetric displays are often used as advanced TV screens, either to look at a scene distant in time and/or space, or

to communicate with someone as in a videoconference. So it is not a matter of a substantially new media borrowing nostalgic traces from an old media (as in *The Matrix* where the green tint is borrowed from old CRT screens), it is rather an old media refurbished into something new.¹²⁶ And, as has already been stated, the look and style of the iconic *Star Wars* hologram borrows directly from the TV screen; a TV screen was actually used to create the visual effect. Roots in television are still there in almost every fictional hologram, but the super-sign has been expanded with additional sub-signs.

The *Star Wars* hologram has been influential in creating the popular culture ideas about volumetric display. But the *Star Wars* hologram did have its predecessors. The 1939 *The Wizard of Oz* feature film with the projection of the wizard could be thought of as the first cinematic depiction of a volumetric display (see Figure 42). The floating head of the wizard is semi-transparent and green colored, and surrounded by a display of smoke and fire. The smoke and fire adds to the drama, and connects to real-life stage magicians. Underneath the head there is a collection of strange machinery, and quite late in the movie the dog Toto unveils the trick; behind a curtain the ordinary man that is the actual wizard can be seen manipulating machinery and voicing the wizard's booming voice via a microphone.



Figure 42. Excerpt from *The Wizard of Oz*, showing what might be the first fictive volumetric display from 1939.

¹²⁶ This reasoning assumes that the step from CRT screens to fully immersive and realistic virtual environments is bigger than the corresponding step from the TV screen to a volumetric display. This is a general assumption in a very complicated area that is beyond the scope of what is investigated in this poetics of virtuality. But, if we limit ourselves to how the different technologies are used in the plot of the studied narratives, volumetric displays are essentially portrayed as advanced TV screens.

Between *The Wizard of Oz* and the 1977 hologram of Princess Leia there was also the mind projection device of the feature film *Forbidden Planet*, from 1956. The antagonist Edward Morbius attaches a device on his head – slightly reminiscent of the mind-reading SQUID tiaras that much later will populate Gibson’s fiction and real-life research laboratories – and soon an image of his daughter Altaira forms inside a machine.¹²⁷ The image is referred to as a “statue” and a “three-dimensional image”, which is interesting because it is actually more technically correct than the term hologram generally used today. The image of Altaira is picture perfect. While Princess Leia 22 years later will be flickering and twisting with the image artifacts remediated from television, Altaira looks like an exquisite miniature model. She is not even semi-transparent.

It is revealing how the very earliest attempts at depicting hologram grapples with how to conceptualize what it is, and how later holograms are depicted as dependent on more or less faulty projection technology. *The Wizard of Oz* seems inspired by the real-world Pepper’s ghost illusion that was well known at the time, so here it is the Pepper’s ghost that is remediated. The movie makers of *Forbidden Planet* make the correct assertion that a volumetric display is to be considered the equivalent of a projected statue, rather than a flat image. The visual effects crew of *Star Wars* instead selected the television screen as the real-world technology to remediate in order to envision the futuristic technology of their movie.

Augmented reality – projecting virtual objects

Augmented reality means overlapping and supplementing our ordinary experience of the world with additional contextual information, often done as a visual projection overlapping what the user sees of her surroundings (Holmquist, 2000; Milgram et al, 1994). Andy Clark (2003) contrasts augmented reality with virtual reality, explaining that “the aim here is not to create a richly detailed version of the daily world inside the machine, but to use the machine to add new layers of meaning and functionality to the daily world itself” (p.53). However, the concepts virtual reality and augmented reality overlap extensively, and Milgram et al (1994) describe a continuum between fully actual environments and fully virtual environments, where the in-between can be referred to as *mixed reality*. Head-mounted displays, heads-up displays, immersive or non-immersive displays and other technologies can be combined in many different configurations, resulting in a number of differently mixed realities. A technology that is similar to augmented reality is the heads-up display. Heads-up displays present information in a user’s direct line of sight, typically for fighter pilots or drivers of vehicles (Lamantia, 2009). Usually, the graphics are not intended to look three-dimensional or photorealistic, and heads-up displays do not match positions and orientations of the background in the way that augmented reality does. Nevertheless, augmented reality and heads-up display overlap each other in fiction as well as in real-world examples, since they both add graphics and virtual objects in a way that makes them appear to overlay the actual environment. It can be disputed whether graphics

¹²⁷ At 55:34.

displayed with heads-up displays or augmented reality can be regarded as virtual objects. Simpler graphics in the shape of, for example, projected text or numbers stretch the concept of virtuality too far; they are not *almost as if* something else. However, graphics that gives the impression of being actual objects, could be regarded as at least to some extent virtual, since they are almost as if they had a material existence. For example, the projection of what appears to be a hovering model of something (a house, a car, a human, and such) would then be a virtual object.

Real-life augmented reality can be projected in two different ways: via the combination of a camera and a video display, or via a see-through screen. Real-life consumer applications are so far essentially limited to the first technology, augmented reality seen through smartphone cameras or some other combination of video camera and display (Boda et al, 2009). The general concept is that a camera records a view in real-time, inserts the additional graphics – for example a simple 3d render of a building – and then displays the mix of actual and virtual imagery for the user to see (Holmquist, 2000; Milgram et al, 1994; Robinett, 1992). Position and motion trackers make it possible to position the projected object at a specific spatial position. Even with this simple technology, it is already possible to project a virtual object in a room, and have the user walk around it. However, tracking position is still quite inaccurate, the real-time rendering of the virtual object is still far from photorealistic, and – most importantly – the object disappears as soon as the smartphone or similar device is lowered. The other technical solution uses a see-through screen, making it possible to build augmented reality goggles; these are similar to the head mounted display used for virtual reality, but with the exception that augmented reality shows virtuality superimposed on the actual environment. The user's view of the actual environment is seen directly, not mediated through a camera system (Milgram et al, 1994). There are already companies offering such goggles.¹²⁸

Augmented reality and heads-up displays in fiction

Augmented reality has been anticipated in science fiction for a few decades. William Gibson has dealt with the concept extensively in *Virtual Light*, and his other stories also include notions about additional visual input, such as time displays fed directly into the optic nerve. A combination of augmented reality and heads-up displays is used quite often in the action and science fiction genres, and two examples stand out: *Iron Man* and *District 9*. In *Iron Man*, the protagonist Tony Stark constructs and wears an advanced exoskeleton suit, enhancing his physical strength, and giving him powerful weapons. In *District 9*, the anti-hero Wikus Van De Merwe finds an advanced and powerful exoskeleton suit constructed by extraterrestrials. Both exoskeletons feature a heads-up display that the audience sees either in the point-of-view of the character, or seemingly floating in front of the protagonist's face. The production design of the two displays is quite similar: [floating],

¹²⁸ One such company is Vuzix, and Google with its very large resources have already entered and temporarily left the game with their Google Glass. Microsoft demonstrated their HoloLens in early 2015, and Magic Leap is a promising start-up company.

[monochrome], [transforming], [semi-transparent], [glowing] graphics with [geometrical shapes] and patterns, [data displays] and [thin lines]. It is interesting that even if these fictional heads-up displays can be regarded only as rudimentary virtual objects, they nevertheless share many typical signs of virtuality with full-fledged virtual environments.



Figure 43. Excerpt from *District 9*; the heads-up display of the exoskeleton suit, wrapping the characters head in an immersive sphere of information.

Two details distinguish the heads-up display in *District 9* (see Figure 43). The display is not a flat surface in front of the character, but gives the impression of a layered, deep, and immersive sphere of information. It wraps around the head, and occasionally it displays positional information, such as the triangular/circular markings in the excerpt above. These are gunshots hitting the suit from different directions. This makes it into a blend of augmented reality, heads-up display and volumetric display.

There is also a hint of how this projection is created; when Wikus mounts the inside of the suit, his painful grimace and a drilling sound suggest that neural probes are drilled straight into his brain. This suggests that the images are not projected in the air, but directly into the brain. The technical solution that is hinted at in *District 9* could be a technically feasible way of creating real-life volumetric displays. In some fictional descriptions, such as in Stephen Baxter's novels and short stories, the volumetric displays seem impossible to achieve with real-life technology. They appear anywhere as if they do not need projection devices at all and they look completely real. This means that they are even opaque, just like the projection of *Forbidden Planet*. How could a volumetric display be projected without a projector? And how could an image painted in thin air occlude objects, even strong light sources, behind it? Baxter does not give a clue; he only describes how the Virtuals can walk through solid objects and how they break "up into a cloud of

pixels, boxes of glowing colour”, as in the short story *Reality Dust*. Other science fiction writers with similar visions give more clues. In *The Dreaming Void* (2007), Peter Hamilton writes that a character’s “exovision displays had paused at the point where he’d fallen asleep, colorful profiles of exotic density modulators floated like mechanical ghosts around him”, and Alastair Reynolds in *Redemption Ark* (2002) provides the explanation that a battle display highly similar to the ones depicted in *Star Wars* and *Avatar* is “not a hologram, a joint hallucination”. From the Swedish popular science writer Peter Nilsson comes similar suggestions. He concludes his fact book *Stjärnvägar: en bok om kosmos* (2013) with a fictional, depiction of the far future, describing how “shining signs suddenly flashed into thin air... the machines did not write in the air, but inside my own brain”.¹²⁹ This is a way to solve the technically challenging task of projecting volumetric displays in the air – to not actually project the display in the air, but make it appear as if it is. That would mean that for every person seeing the display, it is actually an individual display – from the appropriate vantage point. This could be achieved with augmented reality, assuming that the volumetric display is displayed in the augmented reality glasses that each viewer of the volumetric display have to be equipped with (projecting the imagery directly into the brain is so far quite beyond our technical capabilities).

The anticipation for augmented reality is the blend of real and virtual, a “deliberate blurring of the boundaries between physical and informational space” (Clark, 2003, p.53). Clark further anticipates that the “next-generation human minds will not invest very heavily in the virtual/physical divide” (p.54) and Klastrup suggests that the blend with the actual will be so thorough that the concept of virtuality might “lose its descriptive value” (Klastrup, 2003a, p.343). Kathy Cleland (2009) describes how the online and offline become “increasingly blurred and enmeshed” (p.1), and Lars Erik Holmquist (2000) claims that computation will “seep into the very fabric of our existence” (p.21). The comments made by informants in the attitude survey *Digital Life in 2025* (Anderson, Rainie & Duggan, 2014) echo the anticipations of Clark and Cleland; they speak about multiple layers of the actual, and how the Internet will be like electricity, “woven right into everything” (p.38) and “blend into the background of all we do” (p.26). The idea of a total blend between actual and virtual, and the stance that it does not matter if it is actual or virtual, has been investigated in fiction. Stanley Kubrick touched upon the concept twice. The Victorian hotel room beyond the Stargate in *2001: A Space Odyssey* is one example, and the other instance is the distant future in *A.I. Artificial Intelligence* (Spielberg, 2001) where autonomous god-like artificial beings engulf the android David in some kind of simulacrum, re-creating a final happy day for him. It is never clear in any of these sequences what is real and not, “because it posits a situation beyond human understanding” (Naremore, 2007, p.262), and the blend is so total that the question is rendered meaningless.

¹²⁹ My translation. The original wording is: “lysande tecken plötsligt flammade upp i tomma luften... ...maskinerna inte skrev i luften utan inne i min egen hjärna”.

The transparent screen

A specific kind of volumetric display seen in the studied narratives is the transparent screen; this is a semi-transparent screen that seems to float more or less unsupported in the air.¹³⁰ Depending on how advanced the portrayed technology is supposed to be, the screen either seems to be material – as in a sheet of glass – or immaterial – as in some kind of volumetric display. The curved screens in *Minority Report* is the canonical example, but there are examples to be found in *District 9*, *Renaissance*, *Gamer*, *Terminator Salvation*, *Total Recall*, *Avatar*, *Iron Man*, and *Sunshine*.¹³¹ The material transparent screen can be regarded as similar to a heads-up display, projecting virtual objects for the user to see. Immaterial transparent screens can be seen as a volumetric display, showing virtual objects projected in mid-air. Usually these transparent screens allow interaction via touch, making them a virtual object that also serves as a graphical interface.

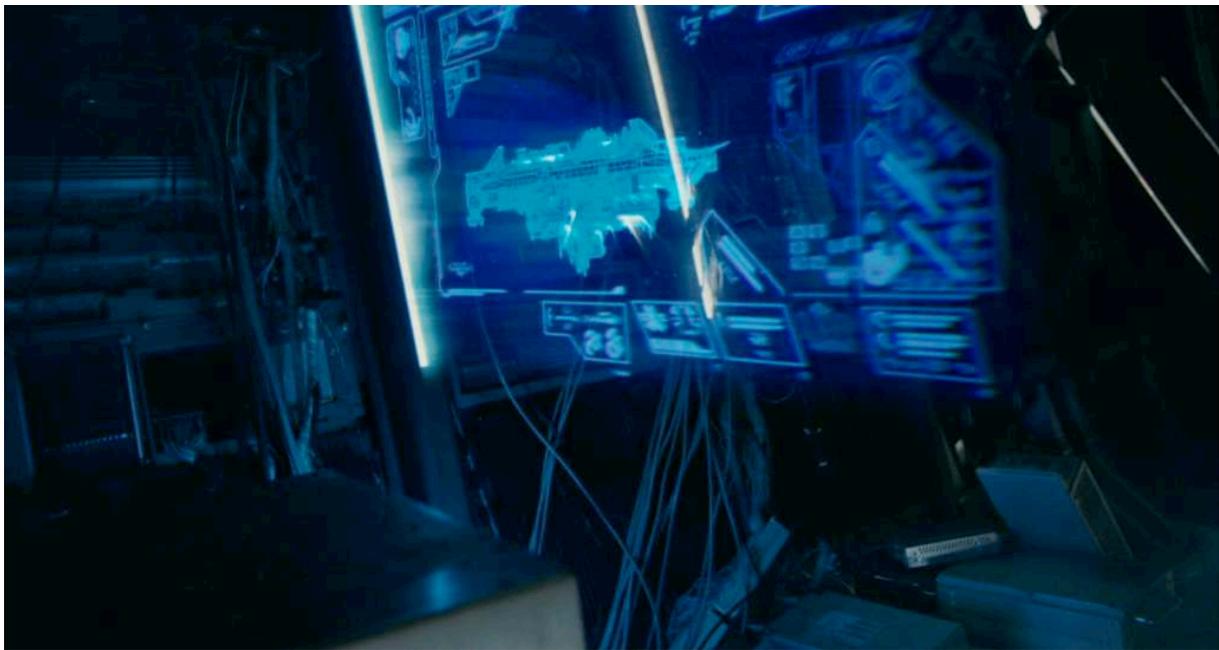


Figure 44. Excerpt from *District 9*; a volumetric display in the form of a flat transparent screen.

District 9 uses an interesting mix of hologram and transparent screen, seen in the excerpt above, Figure 44. This is found onboard an alien spacecraft and it is far beyond our present-day technology, showcasing an obviously immaterial transparent screen. In this scene a sheet of glowing light slides out of a physical slit in the wall.¹³² The display [floats] in the air and [gradually appear]; it is highly

¹³⁰ The floating screen is primarily discussed as a fictional technology here, but there are real-life displays that partly correspond to the fictional vision. There are semi-transparent physical screens, often referred to as see-through screens, and the FogScreen uses back-projection on a thin wall of fog, creating a floating image (Rakkolainen, 2008).

¹³¹ The following discussion on transparent screen and volumetric displays has been published elsewhere, see appendix 03.

¹³² Starting at 01:19:51.

[pixilated] at first, then stabilizing. Segments of the heads-up display slide through air, without connecting to each other, emphasizing their immateriality.

[Monochrome], [blue] and [abstract] [geometrical] shapes, often-repeated signs of virtuality, are used in the *mise-en-scène*.

The image below (Figure 45) from *Sunshine* shows another example with a transparent screen that seems more material. A group of characters observes and interacts with an expository computer graphics visualization showing a model of an external scenario (happening outside their spacecraft). From a visual storytelling perspective, the set-up has clear advantages. It lets the characters interact with elements of the story – such as incoming data or, as in the *Sunshine* example, simulations that forecast coming events – while the audience can see their acting, most importantly their faces (Shedroff & Noessel, 2012). For a movie maker, it is a win-win solution: the *mise-en-scène* provides narrative exposition, human emotions and technology that looks good and conveys the futuristic setting – all in one package. The interaction design and display technology is for the benefit of the audience; from the audience point-of-view, the information content is maximized. We see the actors *and* what they look at. However, considering the interface as a real-life display, the transparency would in most circumstances be highly impractical, primarily because of the visual confusion of seeing a graphical user interface in front of a background environment.

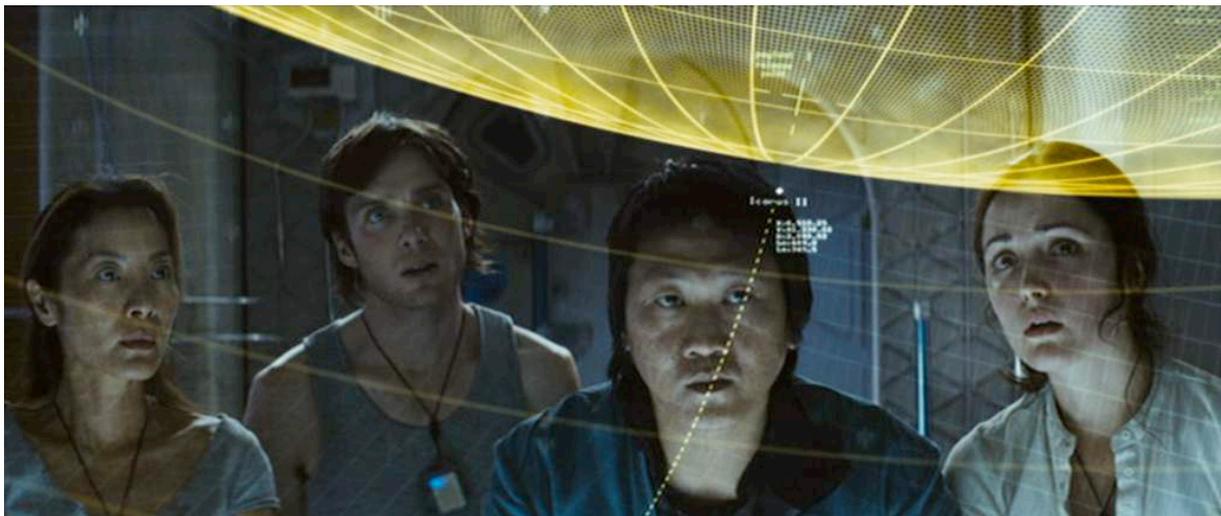
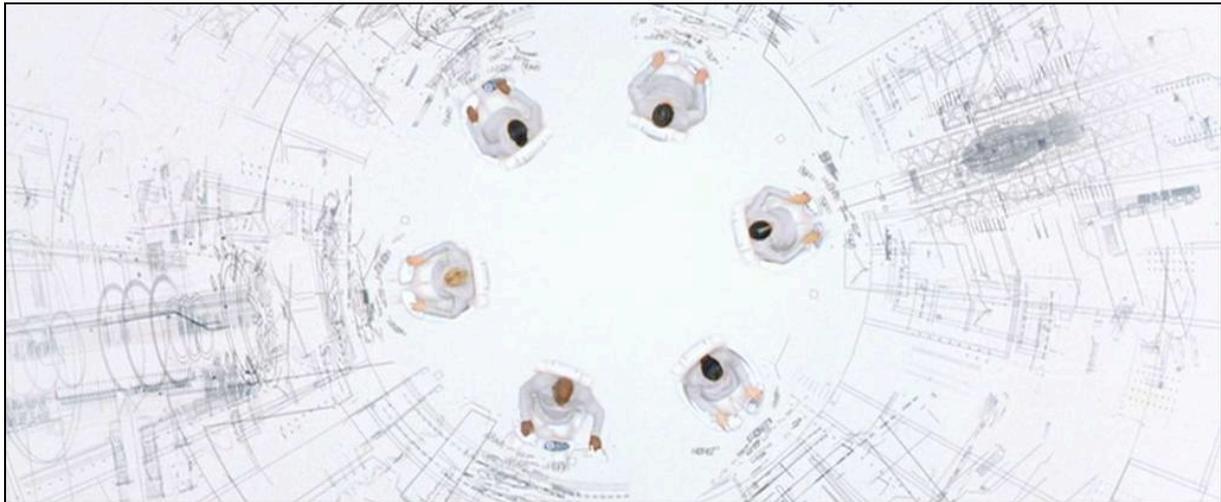


Figure 45. Excerpt from *Sunshine* showing a typical scenario with characters observing, interacting and reacting to a semi-transparent display.

The Zion dock control room in *The Matrix Reloaded* features another set of transparent screens used as a graphical interface, combined with a blank void room environment. Here, the movie makers have taken the [blank void room] super-sign – an empty and contained virtual worldlet concept – and made it into a control room (see Figures 46 and 47). A small group of users jack-in to the virtual room, and there they are surrounded by a circular display of information and virtual control interfaces, layered in depth in a manner similar to the heads-up display seen in the *District 9* exoskeleton. The graphics are [minimalistic], [abstract],

[geometrical], [monochrome] and characterized by [thin black lines]. This production design combines visual novelty with the often-repeated signs of virtuality. At the same time the usability of the Zion dock control room interface seems reasonably effective from the fictive characters viewpoint. The contrast in the interface is good and there is no confusing background behind the transparent screens. The transparency is cleverly used to display information in layers. A quite similar blank void room with virtual transparent display screens can also be seen in *Renaissance*¹³³ (premiered 2006, three years after *The Matrix Reloaded*). Transparent screens can also be seen surrounding an avatar in the 1998 Danish cyberpunk movie *Skyggen*.¹³⁴



Figures 46 and 47. Excerpts from The Matrix Reloaded; the Zion dock control room, a virtual blank void room showcasing what might be good usability in a transparent screen setting.

Science fiction scenarios can influence real-world graphical interface development, especially if the envisioned interfaces seem to be a good idea (Butz, Endres &

¹³³ At 01:15:37.

¹³⁴ At 03:00.

Schmitz, 2008; Shedroff & Noessel, 2012; Özcan & Ünlüer, 2012). Transparent screens often look cool, fun and innovative. It is seductive. The question whether it would be a good idea in a real-life scenario remains open. Are transparent screens similar to the vision of three-dimensional browsing in cyberspace, a spectacular idea that provide only limited real-life usability? The obvious risk is that if the screen displays dense information then the combination of the display and the often complex background environment seen through the screen could lead to visual confusion, as well as bad contrast between, for example, text and background.

The many fictional scenarios with transparent screens can be regarded as an interaction design playground, a design laboratory investigating different user scenarios, designs and technologies. Human-computer interaction scenarios shown in many science fiction movies can then be thought of as a sort of fictional, high-level prototyping (Butz, Endres & Schmitz, 2008; Shedroff & Noessel, 2012). Occasionally, the designs are created in close collaboration with interaction design experts and researchers, as in the case of *Minority Report*.

Backtracking the transparent screen

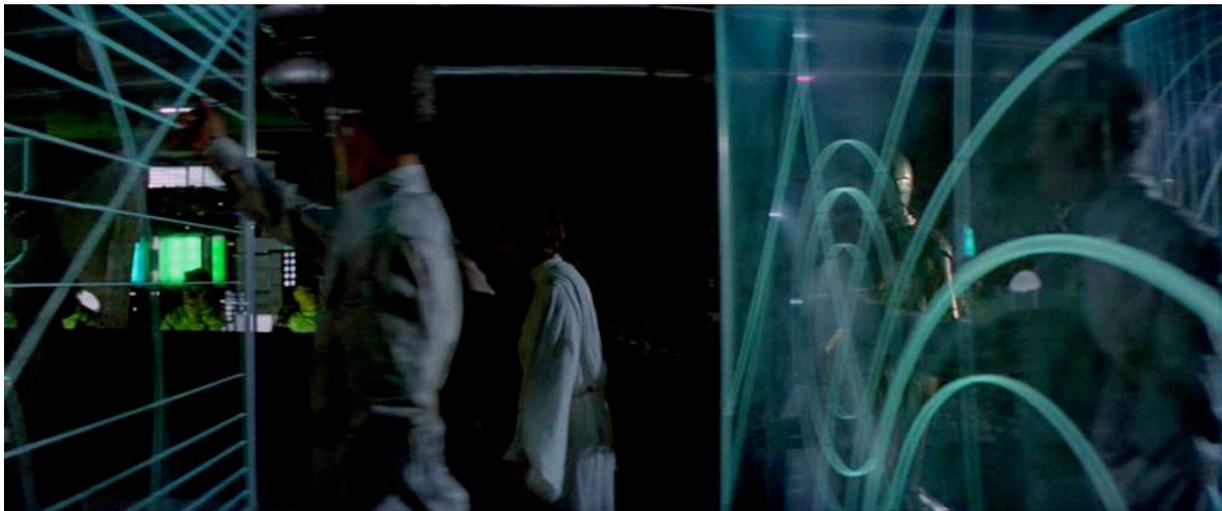
Transparent screens are in some ways the cyberspace of our time, an idea for interaction design popularized in fiction, but with dubious real-life usability. Future development of interaction design and technologies will show how the transparent screen will come to use (or not), but we can still discuss the historical origin of the idea. When tracing the history of the fictional transparent screen, *Minority Report* stands out. This feature film premiered in 2002 and has inspired numerous successors; similar displays have been seen in many movies after *Minority Report* premiered. One precursor predating *Minority Report* is *Star Wars*, from 1977, that shows an early example of a transparent screen. In one brief shot (see Figures 48 and 49) in a military command room, there is a large transparent screen with simple graphics; [green] [glowing lines] and [grids] yet again suggesting virtuality.¹³⁵ The effect is produced by very simple means on the set; it seems to be a large sheet of glass or Plexiglas with the graphics of the screen being realized as physical cutouts attached to it. It is difficult to know what the intention is, or if there even is a clear intention. Should the display be interpreted as a static physical structure? Or should it be interpreted as an interactive, floating, transparent screen? The context – a high-tech civilization that in other situations can clearly display volumetric displays for recording and communication purposes (as shown by the Princess Leia hologram) – suggests that it is the latter, supported by a few details of the mise-en-scène. The visual style of the displayed graphics show the typical signs of virtuality; [green] [glowing] [lines] and [grids], similar to the style of the Death Star wireframe virtual model that is seen in a following scene. We can also see a brief glimpse¹³⁶ of characters apparently interacting with the screen using pens with glowing tips, a user scenario that mimics existing real-life interaction technology where light pens

¹³⁵ At 01:40:55.

¹³⁶ At 01:49:57.

are used as input devices on computer screens. It seems as if *Star Wars* has been influential in popularizing not only holograms, but transparent screens as well.

The movie makers of *Star Wars* might have been inspired by another source. In September 18th 1976, eight months before the *Star Wars* premiere, the episode *Journey to Where* (Clegg, 1976) of the TV series *Space: 1999* aired on UK television. In a brief shot (see Figures 50 and 51)¹³⁷ from a futuristic control room (supposedly on the far-away future Earth), we see brief views of characters sitting in front of a transparent screen; simple graphics are displayed on what appears to be transparent panes of glass, with no frame, rising out of the table. In front of the characters, there is strange looking semi-transparent objects, held in a way that suggests that they are interfaces for interacting with the screen.



Figures 48 and 49. Transparent screens from *Star Wars*, released May 1977.

¹³⁷ At 15:33.



Figures 50 and 51. Transparent screens from the *Space: 1999* episode *Journey to Where*, aired September 1976.

However, Shedroff and Noessel (2012) and Friedberg (2006) have pointed out that even earlier, in the 1936 feature film *Things to Come* (Menzies), a transparent display can be seen.

It is not clear if the transparent screens popularized by *Minority Report* can actually be traced back to *Journey to Where* or *Things to Come*, via *Star Wars*. It is not clear whether the transparent screen was a carefully thought through design choice, or a more intuitive, spur-of-the-moment decision in the perpetual hunt for the new, the different, and the spectacular. But, it is clear that *Minority Report* was not first.

The first occurrence of an idea and the popularization of the same idea usually do not happen at the same time. The same pattern seems to repeat over and over again: precursors, break trough, and followers.

Environmental Science Investigation – interfaces within interfaces

What all the fictional examples of volumetric displays, augmented reality, heads-up displays, and transparent screens show is that there are many different configurations and overlapping combinations between virtual worlds, virtual objects and the actual. The number of possible configurations is daunting and well outside the scope of this poetics to taxonomize, and it will take much time for researchers to explore and evaluate them all. Also, the different screens of computers, cinema and television converge, while a variety of screens are available in different sizes, formats and using different display technology, from the smartphone to the animated billboard (Friedberg, 2006). Which of the envisioned technologies that will find real-life use will be a long negotiation between the possible, the wished-for and the needed.

A virtual object can be an interface to a digital tool, as in the example of a virtual keyboard projected as a volumetric display or via augmented reality. The keyboard is an interface to a word processor, for example. However, the virtual can also be regarded an interface to itself; the *world is the interface*. When I experienced real-life immersive virtuality in the CAVE virtual reality system we managed at the Chalmers University of Technology, my interaction with the system was an interaction with the computer. When I walked forward, or bent down on my knees, the tracking system informed the computer of my movements, and adjusted my viewpoint of the virtual world accordingly.

It has been proposed that interactive virtual objects can change the current icon-oriented interaction paradigm, making interaction with computers more direct. Bardzell, Bolter and Löwgren (2010) have commented that touch displays have the ability to erode the conventionalized division between content and interface, so that you do not manipulate content via the mouse or via icons. Instead of pressing the keys for D, O and G on a keyboard you can draw a dog shape with your fingers. Even though this concerns touch displays, a similar argument can be made for interaction with virtual objects, assuming that they can be manipulated directly via, for example, gesture and touch (as in many real-life virtual reality environments); Lanier claims that virtual environments open up for what he calls a *post-symbolic communication* (Lanier & Biocca, 1992) where the virtual world can be changed by directly interacting with it. The virtual could enable a more direct communication without the middle-hand of signs (Benedikt, 1991; Lennon, 2000). According to Brenda Laurel (1993), the advent of virtual reality “contradicts the notion that one needs a special-purpose language to interact with computers” and thus “the pane is blown out of the interface window” (p.204). These claims can be disputed; after all, putting aside the mouse does not necessarily change the division between an icon and the underlying data or function it represents. It might be true for specific cases, such as when the pinch-to-zoom function of a map leaves the

plus and minus signs behind and instead makes use of gestures. Moreover, neither gesture based interaction nor interaction with virtual objects automatically excludes all usage of indirect interaction via icons or menus; a slider that adjusts audio volume is still an icon with an underlying function, regardless of whether we control it with mouse or fingers, or whether it is displayed on a conventional screen or floating in the air as a volumetric display. In this example, audio volume is not directly manipulated, it is manipulated via a graphical icon that represents changes in audio volume.

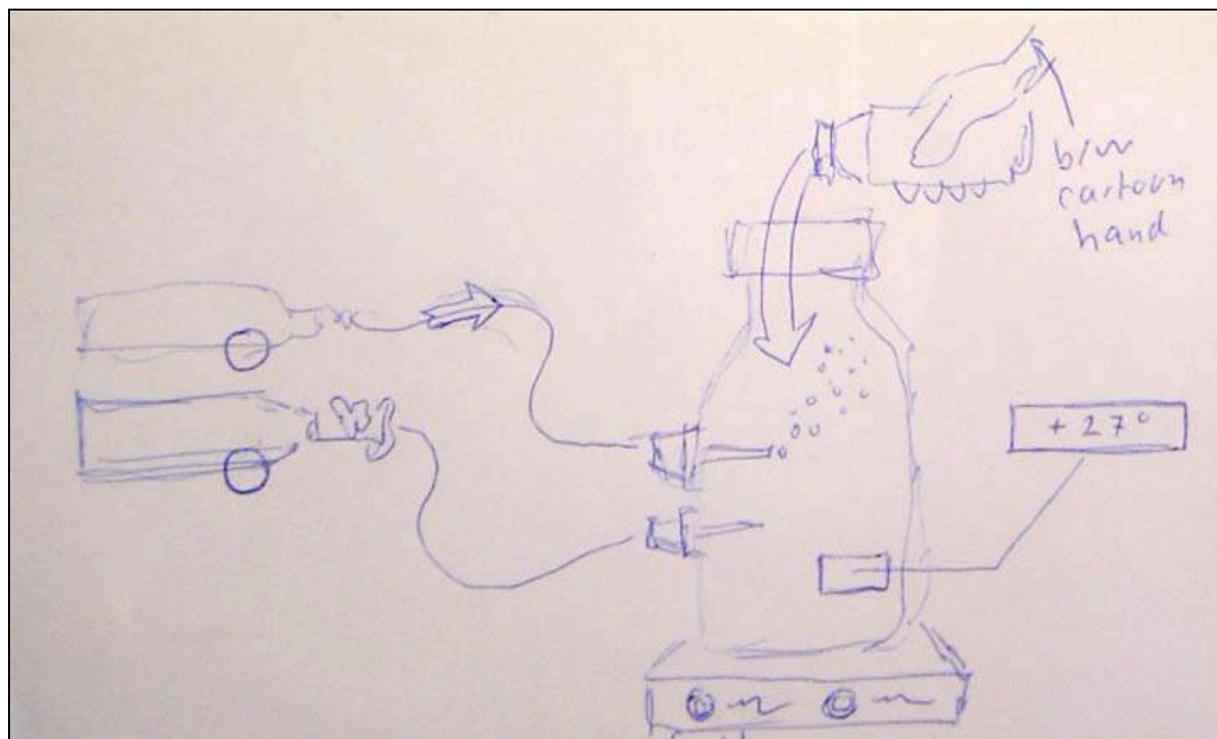


Figure 52. Sketch of virtual lab interface for the Environmental Science Investigation project, with features that are either part of the virtual environment of the lab, or part of an additional interface layer. The gas bottle valves to the left are interfaces within the virtual environment, while the rectangular thermometer display to the right is an interface on top of the virtual. Sketch by the author.

The virtual laboratory I built for the Environmental Science Investigation project illustrates how the virtual can be an interface in itself and to itself (Figure 52). The Virtual Gas Lab was a virtual lab experiment mimicking an actual chemistry experiment. The intention was to have high school students learn about gas solubility in water, via guided experiments. The virtual lab showed a semi-realistic lab bench with equipment such as an experiment canister, containers with chemicals and gas bottles. The students interacted with the lab in a semi-realistic, partly non-symbolic way by clicking on objects in the lab environment. These interface controls were conceptually a part of the virtual lab itself, so the interface was an example of the virtual environment being an interface to itself. As a layer on top, or in front, of the virtual lab, we created additional superimposed graphics showing data about what happened in the experiment canister (amount of gas in

the water, temperature and pressure). The superimposed graphics should be regarded as an additional layer of interaction, and not a part of the virtual environment, because of the way they appear to float in front of the lab bench. At the same time, these floating graphics were represented as three-dimensional, semi-realistic objects, and they had lines – symbolic electrical cables – connecting them to the virtual lab bench.

In the Virtual Gas Lab, the difference between the virtual world and the virtual interface was rather subtle. Some of the controls seemed to float slightly in front of the lab bench, and one small detail of the design is how the shadows from the controls fall onto the background. This question was brought up on February 14th, 2008, by the two Flash programmers involved. They asked whether the shadows would fall across the lab bench – distorting along the three-dimensional shapes of the lab bench – or fall on the *image of the lab bench* – falling flat and un-distorted. We quickly decided on not using shadows at all, primarily because the production needed to be done as quickly as possible and this would complicate the process. But, the question was nevertheless an excellent way of highlighting the small but existing difference between an in-world interface and an on-top interface. Other details signaling the difference were the shape and design of the meters. The meter showing the amount of gas in water was the most abstract since that kind of measurement is not really done in an actual, hands-on lab. The abstract visual style of the gas meter suggests that it is a part of the interface layer on top of the more realistically depicted lab bench virtuality. The meter was designed as a flat rectangle with a [solid monochrome color] fill, a [black outline] and no other details. The pressure meter on the other hand was conceived more realistically as a physical shape, a circular object with self-shadow and specular highlights. This made it appear more physical and material, suggesting that it was to a greater extent an in-world interface, a part of the lab bench environment. There was also a discussion about how the lab should give feedback to the user when the user did something that was not allowed. One option was that the engaged part of the lab bench would change, so that it would flicker slightly. If so, that interaction feedback would be a part of the lab bench virtual environment. But since we chose to keep the lab bench quite realistic (and actual objects do not flicker), we decided to put this user feedback not *in* the world but in the interaction layer *on top* of the world, as rectangles with pop-up texts and a minimalistic, abstract visual style.

Virtuality can be both conceptualized as existence and as representation, and the design choices discussed above exemplify how quite minute changes in design, how the selection of different signs and sub-signs, can explore and straddle the spectrum between existence and representation.

In fictional representations of virtuality, different forms of direct interaction, post-symbolic interactions, are common, and usually followed by transformation. The causality of touch/transformation is linked in a syntagmatic chain. Characteristic examples are the transparent screens in *District 9* and the volumetric displays in *Tron Legacy*. These interfaces respond by different transformations: blinking lights, sweeping lines, and transforming shapes. When virtual objects react to touch and transform in this way, they engage two topologies of virtuality that

will be discussed later; the user has #control over the object, and the object is #immaterial and can therefore change shape in any way.

Topologies of virtuality

I will now generalize a set of topologies that emerges from the rich tapestry of signs of virtuality I have analyzed. This will not be an attempt to categorize signs into distinct and separate categories, nor will I propose a nomenclature. Instead, I will describe different *conceptual* principles for world construction that are apparent in the analysis of how we depict virtuality in fiction. The term *world-views* lies close at hand, but I will not use the term world-views because virtual worlds can not only be viewed in different ways, but they also *are different*; they have different foundations, different conceptual assumptions. It is also important to be able to incorporate not only virtual worlds but also virtual worldlets and objects. Therefore I will use the term *topology*. Topologies are the different configurations that an entity has and that remain even after extensive deformation. It can refer to the fundamental shape of an object, and also the structural arrangement of parts, as in a network topology. Topology is primarily a mathematical concept, originating in Leibniz' ideas about mathematical structures and relational systems. Leibniz ideas create, according to Michael Heim (1993), the foundation for the contemporary concept that virtual space can have different spatial dimensions, dimensions other than the three dimensions of Cartesian physical space. Virtual space can have dimensions built on relationships between data, as a supplement to the dimensions that mimic the three spatial dimensions of the actual world.

The way I use topology refers to both its application in cosmology and 3d modeling. In cosmology, topology is a description of the general shape and properties of space itself. For example, is our universe closed or open? In 3d modeling, topology is a description of the fundamental shape of an object. For example, is it a sphere or a cylinder? This topology is so fundamental that it cannot be taken away, not even by extensive transformations and deformations. In 3d modeling, a sphere can be twisted into what appears to be a cylinder, but it will nevertheless continue to have some properties of being a sphere. A common example of topology is the Möbius strip compared to a conventional circular band. Even though they look quite similar these two geometries have fundamentally different topologies; the Möbius strip is one-sided while the conventional circular band is two-sided.



Figure 53. An example of topology – the one-sided Möbius strip.

So, topology is the fundamental principle for how we think about a virtual world. This does not mean that the topologies are mutually exclusive; a virtual world can be based on different topologies. Compare how the Möbius strip can be said to have one-sidedness as one fundamental topology, and circularity as another.

My use of topology extends the concept beyond geometry. Some of my topologies of virtuality include descriptions of geometry, such as the inside-outside and down-up of the topology of #containment. Others, such as the topology of #control, is based on non-geometric but relational arrangements, as in how the creator of the virtual world can have total control. This is topological in the sense that it is an aspect that remains even after extensive deformation. Since the virtual world is based on code and data, access to this code and data will always grant extensive control, regardless of the content or the size of the virtual world.

My topologies of virtuality could be compared with the different aspects of virtuality brought up earlier, such as the characteristics of technical virtuality described on page 37 to 55, as well as the essences described by Michael Heim and the topological rubrics brought up by Michael Benedikt (both on page 56). However, these describe the virtual from a rather philosophical and abstract approach, while the following topologies of virtuality are interpretations based on my empirical observations.

Topology #surrealism

“A long long way away”

“In Mexico?”

“Even further than that”¹³⁸

Virtuality is often signified by creating dichotomies between the actual and the virtual; the virtual is portrayed as an alternative world. Related is the idea of the virtual as a surreal world; pieces of the actual are in there, but juxtaposed, and mixed up. This relates to surrealist art of the twentieth century, as well as to earlier examples of combining unrelated elements in non-rational combinations, such as the art of Hieronymus Bosch. Surrealism was a movement of thought which expressed its ideas in different art forms. Even though it was short-lived, it has influenced later art forms and styles since its start in 1924. Typical for surrealism is the dream-like, non-rational juxtaposition of different realistic elements, often resulting in bizarre contradictions and contrasts. The basis for the art was often free, associative fantasies, trying to mediate or evoke inner mental images. There were actually quite few surrealists that used night dreams as direct inspiration for their art, Giorgio de Chirico being an exception in that he used his own night dreams in his work. The intent – at least according to André Breton’s *First Manifesto* – was to merge reality and dream into a new reality, a surreality (Smejkal, 1974). This connects surrealism to virtuality on a conceptual level since virtuality can be seen as a kind of fantasy. There are also similarities between surrealism and

¹³⁸ *Life on Mars*, episode 4 at 29:05.

cyberpunk; both were short-lived but influential, and both were more about a conceptual attitude towards the world rather than a genre or style. Both have their roots in written literature; the first surrealists were poets (ibid.).

There are several interesting examples from both literature and movies of how the surreal juxtaposition of contradictory elements is used to signify virtuality.¹³⁹ For example, William Gibson describes strange virtual landscapes where a god-like artificial intelligence “leaned in across Barcelona like a cold dark rain” (*Count Zero*), and how the sky in cyberspace is covered with the “spiral arms of military systems” (*Neuromancer*). A syntagmatic analysis show why these utterances are surrealistic; representing an artificial intelligence as a rain cloud and military computer systems as celestial objects is so uncommon and counter intuitive that it can be regarded as a juxtaposition of contrasting elements. This surrealism then represents virtuality, since it is something other than what we would expect in the actual world. In his later novels, Gibson’s style of writing becomes less poetic and instead increasingly more explicit and direct; moreover, in some of his later narratives his descriptions of virtuality remain surreal (from *All Tomorrow’s Parties*).

The other presented in far more abstract form: an only vaguely human figure, the space where its head should have been was coronaed in a cyclical and on-going explosion of blood and matter, as though a sniper’s victim, in the instant of impact, had been recorded and looped. The halo of blood and brains flickered, never quite attaining a steady state. Beneath it, an open mouth, white teeth exposed in a permanent, silent scream.

This is a quite graphic and disgusting scene and such depictions occur in virtualities depicted in movies as well. In *The Cell*, a man has his entrails pulled slowly out through his navel, and in another scene a horse is cut up in multiple sliced segments by a number of glass panes. This reveals the inner surfaces of the horse body, while the segmented horse continues to breathe and move as if nothing had happened.¹⁴⁰ While Gibson’s descriptions of rain and spiral arms are metaphorical, these graphic depictions are more direct, and therefore signify virtuality not only by the contrasting surrealism, but also because such scenery is impossible in actuality.

A well-known surreal episode in science fiction canon comes from the end of Kubrick’s *2001: A Space Odyssey* – the Stargate Sequence. Astronaut David Bowman is drawn into a passage through space where he first encounters alien planetary landscapes and finally ends up in an enclosed hotel room where he is transformed into the Starchild, a posthuman demi-god. The hotel room is a surreal mix of Victorian style with modernistic additions such as a white glowing, gridded floor. The whole sequence is intriguing and open for interpretation, so it is difficult to judge whether any of the environments are supposed to be virtual (the movie premiered in 1968, so the conception of virtuality was not culturally established by that time). The hotel room is most likely intended to be a facsimile of some sort.

¹³⁹ Beside my own examples, Sabine Heuser has also brought attention to how, in Pat Cadigan’s *Mindplayers* from 1987, “transitions between scenes follow the surreal logic found in dreams” (Heuser, 2003, p.128).

¹⁴⁰ At 11:00.

The novel describes it as a physical object hidden in the core of a red star, but the movie is much more mysterious.¹⁴¹ Besides the *mise-en-scène* with the strange hotel room floor, the scene shows a montage of events creating a surreal disruptive narrative. Since astronaut Bowman has traveled across space to end up in an environment where he eventually is transformed by alien intelligences into a posthuman, it is not likely that the hotel room is a hotel room. Hence, it is an artifice. Whether this artifice is physical or virtual, we do not know. But since the hotel room seems to be there in order to cushion Bowman in an apparently familiar environment, and veil the complex machinery that transforms him, it could very well be some kind of mental construct – a virtuality – created by the aliens. If so, this is an early example of surreal virtuality in a feature film. A conceptually similar sequence is given at the end of the movie *Love* (Eubank, 2011). A last surviving astronaut wanders around inside an enigmatic alien spacecraft appearing as a worn down Russian art deco concrete building. The montage of images and events forms a disruptive narrative, and one possible interpretation for the whole sequence is that the astronaut is dead and his consciousness has been downloaded into some kind of simulated, virtual environment. The sequence is highly ambiguous, offering many competing interpretations. There is, however, one explicit reference to a simulation with a voice stating: “Sorry for this *projection*. . . The place that you see here is a scrap of a sorts, a collection of memories. . .”.¹⁴² The sequence ends with a scene in what appears to be a hotel room, followed by the astronaut’s immersion in a clearly virtual environment, reminiscent of a planetarium, projecting a space simulation around him, and then engulfing him with light.

Surrealism is an effective sign of virtuality since the juxtaposition of objects, environments and events can be made quite explicit. The surreal combinations can be strange and surprising, but in many cases also directly contradictory. Objects in the environment can actively contradict each other. Events can also contradict each other, and such disruptive narrative is discussed in the chapter Interrupted narrative and surrealism, see page 172. There is also surrealism in the form of geometrical, spatial discontinuity, such as when a big space seems to fit inside a smaller enclosure. This is not only contradiction, but also impossibility. In the *Animatrix* short film *Beyond*, the main character opens a door inside a small house and reveals a huge black abyss that could not possibly fit inside the house.¹⁴³ The central plot device of the story is the breakdown of causality and natural laws; the cause for the breakdown is supposed to be a series of simulation errors. The characters of the story refer to the site of the breakdown as a haunted house. This is an explicit connection to ghosts and the supernatural. The animated short *Magnetic Rose* tells a story about a derelict and in some way haunted space ship, shifting between ghostly appearances, memory replays and virtuality in a confusing, disruptive narrative. Space-suited explorers that investigate the cramped interiors of the spaceship

¹⁴¹ The two versions, the novel and the movie, were co-written by Arthur C. Clarke and Stanley Kubrick, more or less at the same time (Clarke, 1972).

¹⁴² At 01:14:00.

¹⁴³ At 09:46.

encounter huge beautiful concert halls inhabited by the enigmatic ghost/avatar of a long dead opera singer.

When relations between different spaces are constructed in an impossible manner, the result can become a level of surrealism that shows that the world is not only strange, but immaterial and insubstantial as well. Such spaces are not fully part of the same world; rather, it seems as if the unity of space is broken, and some space fragments become supplants to the general space. In *The Matrix Reloaded*, the characters can leave the large Matrix simulation through specific doors. They then find themselves in an endless straight corridor. This corridor cannot possibly fit in the geometry of the space that the characters just left behind. The clearest example is the door Neo emerges from just before the fight sequence, the Burly Brawl; the corridor Neo comes from would cut straight through a brick wall besides the door, but does not.¹⁴⁴ This apparently simple sign engages three different interpretants. The corridor is [outside] of the inside of the virtual world. The corridor also reveals that the main virtual world of the plot functions as a [world as a stage], since the corridor goes [behind-the-scenes] of this staged world. There is a very similar surreal mix of spaces in the dream worlds of *Inception*, where an elevator goes back and forth between different disconnected spaces, and even opens up onto a sand beach outdoors.¹⁴⁵ These spaces, the corridor and the elevator, are fragments of spatiality that are only fleetingly connected to the other space of these virtual environments. These impossible spaces are example of the complex interrelations between super-signs.

Topology #containment

On a fundamental level, the virtual is a contained world, a contained space. As with television, the world is literally inside a box, at least if we consider conventional computers. This world-in-a-box aspect dominates our relation to the virtual. The real-life virtual reality CAVE that we hosted at the Chalmers Medialab from 1998 to 2004 shared this world-in-a-box aspect. We used to call it “the cube”, and it was literally a cubic room inside another physical room. The virtual world was always *in there*.

This topology of containment is strongly reflected in the fictive stories I have studied, often being a central part of the conflict of the plot, a super-sign carrying narrative clarity. Here, the virtual world is a *contained* environment into which you can be *trapped*, and when you are in there, you want to *get out*. The idea was used in the first feature film depicting the virtual world, *Tron*; the protagonist Kevin Flynn is brought *into* the electronic world when he tries to hack into its mainframe. One of his objectives becomes to escape via the so called I/O tower (short for Input/Output). The up and down hierarchy of this contained world was strongly emphasized. The transfer to the electronic world goes in a downward direction.¹⁴⁶ We see the electronic world from the outside, like a stylized asteroid worldlet with

¹⁴⁴ At 41:40.

¹⁴⁵ At 52:40.

¹⁴⁶ This sequence is often referred to as Flynn’s Ride, occurring at 29:20.

pixelated clouds floating above the curved hide of the world. In later movies, the concept of being captured inside the virtual world is repeated, often with the addition that characters are not aware they are imprisoned; *The Matrix* franchise, *Life on Mars*, *The Thirteenth Floor*, *Abre los ojos*, *Vanilla Sky* and *Tron Legacy* are all clear examples. In some cases, the confinement is signified by the world actually having an edge. This idea of an edge mirrors Michel Benedikt's (1991) reminder that "we will nonetheless have to decide how cyberspace terminates. Will cyberspace have edges to blackness, walls of final data? Or will it be endless?" (p.152). In *Life on Mars*, the trapped Sam Tyler verbally refers to an attempt where he is "gonna walk until I can't think up anymore faces or streets",¹⁴⁷ and in *The Thirteenth Floor* the end of the world is visually depicted as a landscape ending in a green glowing wireframe.¹⁴⁸ The contained world can be very small. In *The Matrix Revolutions*, the protagonist Neo is initially trapped in a circular *worldlet* represented as a subway station.¹⁴⁹ When Neo tries to escape by running out along one of the train tracks, he immediately comes running into the same station from the opposite direction. In *The Matrix* and a few of the Animatrix short films (*Flight of Osiris* and *Program*), the concept of a confined virtual world used for training is established. For example, the Sparring Program world is characterized by paper thin Japanese walls connoting screens that suggest that there is nothing outside (this assumption is confirmed when the worldlet collapses in *Flight of Osiris*¹⁵⁰). In one of the *Life on Mars* episodes, Sam is trapped in a storage room where there is no door out.¹⁵¹ Confinement is occasionally referenced verbally, for example, with the line "...in this little world of ours ..." in *eXistenZ*.¹⁵² The concept of contained worldlets is taken to the extreme in a particular Matrix franchise super-sign; the [blank void room]. This is a virtual environment that is so contained that it does not even have proper walls; instead it has a blank empty nothingness around it. A memorable [blank void room] is the one used in *The Matrix* where Morpheus explains the digital illusion for Neo.¹⁵³ The excerpt on the next page (Figure 54) is taken from the movie *Renaissance*, showing the environment one of the characters finds herself locked into, a physical sphere that has an inside completely covered by a virtual reality projection display, so that she is completely surrounded by a white space. In the excerpt, the white void is temporarily filled with a swiftly growing, virtual forest.

¹⁴⁷ Season 1, episode 2, at 41:20.

¹⁴⁸ Svante Lovén (2010) notes that in the novel *Simulacron 3* by Daniel Galouye – which the movie is based on – the end of the virtual world is depicted as a void of utter blackness.

¹⁴⁹ At 14:10.

¹⁵⁰ At 02:43.

¹⁵¹ Season 2, episode 5, at 35:35.

¹⁵² At 08:20.

¹⁵³ At 37:45.



Figure 54. Excerpt from Renaissance, showing a blank void room environment similar to the one in The Matrix.

The holodeck of the TV series *Star Trek: The Next Generation*, described by Janet Murray (1997), is another example with its black void wrapped in a white grid. Computer art often work with virtual environments that seems to be highly confined, enclosed by an empty void. Some examples are works of Magnus Wallin (*Formation 1-3* from 2002, and *Colony* and *Mission* from 2009) and Edgar Martin (*National-Bank*, 2010). I used two [blank void room] super-signs myself. The lab bench of the Environmental Science Investigation's Virtual Gas Lab stands alone in a light grey non-space, and the fictive virtual character Ejahja in *Astronaut* stands in a black void. When designing the Virtual Gas Lab, I was directly inspired by the Matrix [blank void room]. However, the initial idea might have come from other sources. For example, the background of any empty scene in the 3d modeling software I use, Maya, has a grey shade similar to the one we used in the Virtual Gas Lab. These examples show that there are a few paradigmatic choices for which color is used for the void; white and black are the most common, and grey is occasionally used as well. However, no other hues are used, probably because the range from black to white is the most neutral, and featureless. It gives the strongest impression of a non-space, a space-less space, of not being there.

The idea of the contained virtual world is also picked up in super-signs dealing with the spatial relationship between actual space and virtual space; these are the notions of being *inside* or *outside*, and the *up/down* hierarchy. One way to represent the inside/outside topology is that of looking into a world, and this also relates to the topology of #control. Interestingly, the virtual world is always signified as [inside], forming a strict syntagmatic code for how the spatial hierarchy is constructed.

In the studied narratives there are explicit verbal signs representing inside/outside aspects as well, for example in *eXistenZ* (“I think we are still inside the game”¹⁵⁴), *The Matrix* (“She got out”¹⁵⁵), and *The Lawnmower Man* (“I see you on

¹⁵⁴ At 24:50.

the inside”¹⁵⁶). The other spatial relationship – up/down – has also been represented verbally. In *Inception* the protagonist describes going down into layers of dream worlds when saying he “...wanted to go deeper and deeper... we could get trapped so deep that when we wound up on the shore of our own sub-conscious we lost sight of what was real...”¹⁵⁷ and in *The Thirteenth Floor* it is literally spelled out when one of the characters asks “So what are you saying, that there is another world, on top of this?”¹⁵⁸ While saying this, characters inside the virtual often glance *upwards*, towards the sky or the ceiling.¹⁵⁹ This subtle and every-day gesture becomes a representamen conveying the interpretant of a virtuality with a up/down hierarchy. *The Thirteenth Floor* is an example of how quite different sub-signs (verbal-spatial reference such as “down here” and “on top of this”, character glancing upwards, and power relations between characters) are combined in a seamless manner, subtly and coherently conveying the meaning that there is a vertical hierarchy. The actual world is always perceived as being above the virtual, and this connotes god-like power and control. The idea of the virtual being beneath the actual also corresponds with the narrative patterns described in Campbell’s monomyth (1949), where the world of the extraordinary is often an underworld, a cave or something similar (Palumbo, 2014; Vogler, 1985).

The intriguing idea of several nested worlds, simulations inside the simulation, has been mentioned by Michael Heim (1993), suggesting that “perhaps worlds should be layered like onion skins, realities within realities” (p.82). The idea has been thoroughly explored in movies such as *eXistenZ*, *The Thirteenth Floor*, and *Inception* – as noted by Lovén as well (2001). In all three movies, the logical conclusion – that you might not know how many layers there are and if you have reached the actual world on top – is confronted up-front in the final shot of each movie. In *eXistenZ*, a bewildered guard asks “...are we still in the game?”¹⁶⁰ In *Inception*, the final shot comes to an end just before a spinning top topples over (the protagonist uses this as a totem, believing that its realistic physical behavior distinguishes the real from the dream). And in *The Thirteenth Floor*, the last image – of the supposedly real world – ends in an effect mimicking that of a TV screen being shut down. The TV screen shut down connotes a lack of actuality, and one preferred reading is that at the end of the movie we still have not seen the actual world.

When there is an inside and an outside, then many opportunities open up from a story-telling viewpoint for creating the conflict of [breaking out]. This is a strong recurrent theme, usually in the form of the protagonist being trapped, and trying to break out. In *Life on Mars*, Sam Tyler shouts “Get me out of here!” and looks *up*

¹⁵⁵ At 06:00.

¹⁵⁶ At 52:05.

¹⁵⁷ At 01:11:40. See also (Paul 2010) for a longer discussions about layers of reality in *Inception*.

¹⁵⁸ At 01:04:31.

¹⁵⁹ The glance towards the ceiling have been used in *Life on Mars*, *Sofies verden*, *Kid’s Story*, *Program*, *Tron*, *The Matrix* and *The Thirteenth Floor*.

¹⁶⁰ At 01:32:30.

towards the ceiling.¹⁶¹ In *Abre los ojos* the protagonist desperately screams “I wan’t to wake up!”¹⁶² Occasionally, it is the vice-versa – the antagonist trying to break out. This is, for example, the conflict of *Tron Legacy*. The villain Clu, a virtual character, runs amok, and tries to break out of the stand-alone super-computer where he and his whole world are simulated. Another memorable example is *The Lawnmower Man* where Job – a former human who has become posthuman and post-physical by transforming himself to digital form – tries to break out of a stand-alone computer, containing the virtual environment where he resides, and onto the Internet.¹⁶³

There is an interesting contrast between the idea of the contained virtual world, and the idea of the unlimited possibilities of the virtual world (for example super-human capabilities such as extreme strength, speed and agility, flying, telekinesis and clairvoyance). We seem to regard the actual as a universe being infinite in time and space but limited in possibilities, and, in contrast, our artificially created virtual universes are limited in space and time, but infinite in possibilities.¹⁶⁴ Not only is the virtual literally contained in its boxes and seen through windows, it is also limited in scope because it is an artifact built by humans, and like all artifacts, it has limitations due to limited construction resources. A virtual environment is limited simply because it takes resources to build large virtual environments. This was an important lesson in the research project, Environmental Science Investigation. The Virtual Gas Lab we built was highly limited and this was frequently mentioned and criticized in the interviews and focus group discussions we had with students who had tested the virtual lab. This illustrates a close connection between our philosophical, cultural ideas about the virtual and the hands-on, production-oriented aspects of its production. The real-life production of virtuality is limited, constrained by the availability of resources, and this is one of the motivations for representing fictive virtualities as like-wise limited in scope.

Topology #engineered space

And it was a weird thing, because if you looked up from what you were doing, there really wasn’t anything there; nothing in particular, anyway.¹⁶⁵

Constructing objects in an actual environment and in a virtual environment are fundamentally different. In the physical, actual world, the construction starts with an existing segment of the world – a geographical site, a few kilograms of metal and stone, a living organism. This is then transformed by force. Much of this production process is targeted at controlling or even suspending initial conditions; gravity is defied by building structures, wind is stopped by walls, sun light is

¹⁶¹ Season 1, episode 5, at 27:50.

¹⁶² At 01:39:15.

¹⁶³ The plot point of an artificial intelligence breaking out onto the Internet is more or less taken directly from William Gibson’s *Neuromancer*.

¹⁶⁴ It might be that cosmologically speaking, the universe is actually finite in both time and space, but for us humans, billions of years and light-years are in all practical considerations infinite.

¹⁶⁵ A virtual reality simulation in Gibson’s *Virtual Light*.

controlled by shades, and so on. It could be viewed as a kind of reverse engineering. From a physics viewpoint human manufacture is a matter of reversing entropy. In a virtual environment, the construction starts with an empty stage, a null space. In its core, a virtual object consists of data, of code, from which a simulation is done. All that data and all these algorithms have to be constructed from scratch. Benedikt (1991) refers to cyberspace as being “an invented world” (p.234). Even death has to be implemented, as illustrated by the different ways in which the death of an avatar is represented in computer game worlds (Klastrup, 2007). All such fundamentals of the actual world like gravity, light and the rigidity of solid matter need to be *added*, not controlled. This is readily apparent when working with 3d modeling software. When a new file is started, it is like an empty stage filled with a grey non-descript background and a simple horizontal grid plane. The environment is without illumination, without gravity, geometries pass through each other like ghosts, and so on. Constructing the 3d model could be seen as a forward engineering; everything has to be chosen, brought forward, turned on, and adjusted to the correct settings. A new surface material is initially a smooth grey; more natural and realistic appearances such as dirt, wear and other defects must be added, often by extensive and meticulous artistic work. This is illustrated in the short film *World Builder* by Bruce Branit (2007), part science fiction story, part visualization of a concept for gesture based 3d modeling. The film starts with a man standing in an empty virtual environment, surrounded by a grey void. Then we see him build a whole city block from scratch using gestures. The sequence is also an illustration of the god-like control we can have in a virtual environment; it is reminiscent of the myth of God creating the world in seven days. Something that adds interest to the sequence is that the envisioned gesture based 3d modeling could be feasible to realize as real-life technology by the use of, for example, head-mounted virtual reality displays and position tracking of gestures.

N. Katherine Hayles (1999) writes about Platonic backhand and forehand. Platonic backhand “works by inferring from the world’s noisy multiplicity a simplified abstraction” (p.12), while Platonic forehand “starts from simplified abstractions and ... evolves a multiplicity sufficiently complex that it can be seen as a world of its own” (p.12). One way to conceptualize the difference between the actual world and a virtual world is that the virtual always *lack* attributes compared to the actual; it follows the Platonic forehand from simplicity to complexity, but always stops somewhere along the road, before reaching the fullest possible complexity. The actual is informationally inexhaustible (Borgmann, 2001), its level of detail essentially infinite. This contrasts the actual with the virtual; since the virtual is constructed, it always has a limitation in level of detail (Lanier, 2010) Therefore, the virtual can be represented by [reduction]; the virtual is less than the actual. My analysis of fictional representations of virtuality suggests that this aspect is important, but that it is used in a rather implicit and indirect manner. It is a sign working through other signs, through steps of representation. The things that you do not add to the virtual world become signs of the virtuality of that world. Sabine Heuser (2003) has also pointed out this and how this attaches to ideas about value and wealth. She describes how Neal Stephenson, in his novel *Snow Crash*, writes

about cheap avatars that are black and white, and expensive avatars that are solid and opaque. Actions such as floating and flying also denote a lack of something, a lack of gravity. Simple geometric shapes lack organic complexity. Darkness is lack of sunlight and smooth surfaces lack details. William Gibson repeatedly uses references to absence or emptiness when signifying virtuality in his fiction; he mentions “the non-place”, “the blank parts” in *Count Zero*, “the colorless non-space”, “monochrome nonspace” in *Burning Chrome*, as well as “without color or shape” and “these gray fields of light” in *All Tomorrow's Parties*. The empty, often black, environment of the virtual is so established that it seems completely obvious. The emptiness is just there without being prominent.

The vacant world

As well as being portrayed as empty of detail, the virtual world can also be empty of people. The [vacant] virtual environment is a common theme in fictional virtualities.¹⁶⁶ The feeling of loneliness and emptiness resonates well with the *film noirish* cyberpunk style established by William Gibson's early short stories and novels, as well as the movie *Blade Runner*. The melancholic sadness of vacant environments suggests a dystopian danger with technology, while also signifying virtuality. In *Mona Lisa Overdrive*, the virtual environment sports a “long straight empty highway”, a description corresponding to the climactic plot point in *The Thirteenth Floor* when a character takes a car and drives as far out from the city as he can get, and finally encounters the literal end of the world. The road he travels becomes more and more empty and he later describes it as “something wasn't right. There was no movement, no life. Everything was still and quiet.”¹⁶⁷ In this example, it is the natural landscape that is devoid of life. More often, however, it is cities that are portrayed as hauntingly vacant, a *mise-en-scène* that creates a strong visual contrast to the crowds of people that we usually associate with cities. The drained avenues of New York in *Vanilla Sky*, the empty Madrid streets in *Abre los ojos*, the vacant Swedish small town of *Storm*, and the unpopulated urban areas of the Matrix franchise, all share the same *mise-en-scène*. Not only is the vacant world empty of people and life, it is often decadent and worn down as well. A vacant world signifies virtuality because it lacks what the actual world has. The decadency of a world signifies virtuality through other and quite vague connotations. The syntagmatic connection of these two – vacancy and decadence – is not motivated by any aspect of virtuality per se. Rather, they are related by the logic of cause and effect; a vacant world will become worn down since no one is there to take care of it.

Avalon's two worlds, the insert virtual game world and the framing (apparently) actual world, give both the impression of Eastern Europe World War II battle fields and cold war Communist dystopic urbanity (Chung, 2012; Crogan, 2010; Ingram & Reisenleitner, 2006). The worlds are “drab, featureless” (Crogan, 2010, p.102), but instead of connoting a lack of something, they are “vaguely

¹⁶⁶ The vacancy of fictional virtual world stand in contrast to the worldliness and inhabitability that characterize real-life online game worlds.

¹⁶⁷ At 25:13.

authoritarian” (ibid., p.102) and suggest “inescapable surveillance and oppression” (Ingram & Reisenleitner, 2006, p31). So, even though the denoted *object* (vacancy and decadence) of these different super-signs are similar, the *interpretants* are different, with connotations that go in different directions; the mise-en-scène and visual style of *Avalon* connotes not only #engineered space but also the topology #control.

Reduction through abstraction

Looking further at other examples of reduction, of being less than real, the studied narratives are abundant with examples of abstraction and stylization. This is highly characteristic for the visual style in older cyberpunk movies where production crews used actual computer graphics to create the imagery of the fictional virtualities, as in *Tron*, *Johnny Mnemonic* and *The Lawnmower Man*. An example is the small, pet-like sidekick Bit in *Tron*. Bit appears early and is portrayed as a floating, geometrical, simple shape with a monochrome surface.¹⁶⁸ It is as if the character is point-like, and unformed. The virtual environments of *Tron* have a likewise abstract and geometric visual style. In contrast to the reduced environments and objects of these early movies, later movies often showcase virtual environments that are less abstract and more realistic, as in *The Matrix*, *The Thirteenth Floor*, *Avalon* and *eXistenZ*. Why were the early fictional virtualities depicted as abstract and stylized, while the latter were portrayed as photorealistic? Maybe the audience was not ready to believe in fictive photorealistic virtual worlds until the late 1990s. If so, the idea of being fooled by a virtual reality environment was not believable until 1999 when *The Matrix* premiered.¹⁶⁹ This development of the mise-en-scène and visual style, from abstraction to realism, is just general, though. Abstraction and stylization is common in later movies as well, for example in the *Animatrix* short movies and in the *Ghost in the Shell* anime. *Tron Legacy* provides an interesting mix. While *Tron* was stylized to the extreme, the sequel *Tron Legacy* is almost fully realistic in its portrayal of the virtual world. The director Joseph Kosinski has in several interviews (Duncan, 2010; Nathan, 2011; Pollack, 2011) claimed that the intention was to have the virtual world appear highly evolved visually. At the same time, the environments of the world are highly based on geometrical, simple shapes, and thereby they subtly signify virtuality.

William Gibson’s stories are abundant with descriptions of abstract virtual environments, worlds that compared to the actual are reduced and *less* than the actual. When describing an online dialogue with an interactive agent he mentions that, “her teeth were very white and looked like a single unit” (*Virtual Light*). In *Count Zero* he refers to an avatar as being a “glowing cartoon-squiggle of a woman” and in *Idoru* he picks up the reference to cartoony appearances again when describing virtual trees in a virtual reality simulation as “perfectly cylindrical Crayola-brown trunks, each supporting an acid-green cotton ball of undifferentiated foliage”. In his first novels, Gibson uses poetic and metaphorical

¹⁶⁸ At 04:37.

¹⁶⁹ There are early examples of fictive, fully realistic virtual environments, most notable the virtual reality children room in the 1951 short story *The Veldt* by Ray Bradbury, also filmed in 1969.

descriptions of cyberspace, offering evocative depictions of the virtual environments. In his later writings he uses more explicit and technical descriptions. It is interesting how this coincides with how Gibson's fictions gradually catch up with real-life technology. He gradually depicts futures that are more and more similar to the time we live in, and as decades have passed by since the first publication of *Neuromancer*, technological development have gained on even the more futuristic scenarios Gibson initially depicted. For example, the augmented reality glasses of *Virtual Light* (1993) are quite similar to real-life products such as Google Glass (released 2013) and HoloLens (announced in 2015).

Emphasizing engineering – the rotating display

The super-sign [empty background] has been discussed previously. Adding to this, there is a specific super-sign that expounds on the empty void by adding an object on display, an apparently engineered object, displayed in the void. This is the [rotating display]. The typical syntagmatic construction of this super-sign is a virtual object displayed on a screen, rotating around its axis against a blank void. The affording rotation suggests that the object is on display for scrutiny, as if being a constructed object up for sale or manipulation, as in a ceramic vase on a turntable.

In the visually influential *2001: A Space Odyssey*, a faulty antenna is shown as a simplified schematic on a computer display.¹⁷⁰ It is depicted as a wireframe rotating on empty blue. The likewise influential *Blade Runner* is a cyberpunk story *without* virtuality, apart from one possible exception; the androids of the movie – *replicants* – are first seen on a display as motionless, rotating figures against an empty background.¹⁷¹ These two examples are minor but I bring them up because they predate later examples, and they are used in two movies that have a production design and visual style that are among the most influential in the whole science fiction movie genre. Are these rotating displays virtual objects? How should we interpret them? The antenna display is used in an engineering context – two astronauts discuss a faulty piece of physical equipment; hence, the display could be interpreted as an advanced drawing, simply an engineering schematic. The replicant turntable displays connote both police arrest photographs and product display – the replicants are hunted by the police, and they are products of a company named Tyrell. But my argument for why these turntable displays are examples of early virtual objects is the revealing rotation. The rotation makes them more than a drawing, more than a simple portrait photograph. The meaning of the shots has to be considered in relation to the narrative context. The antenna shot is seen on a computer display and it is reasonable to assume that it is the artificial intelligence onboard – HAL 9000 – that is involved in showcasing the antenna. So the imagery could be a virtual object in the same way that a 3d model in a CAD software is a virtual object.¹⁷² The *Blade Runner* shot could be interpreted as just a video clip

¹⁷⁰ At 01:07:09 and 01:14:02.

¹⁷¹ At 13:58.

¹⁷² In the book *Hal's Legacy*, David Stork (1997) interviews Marvin Minsky who recount that director Stanley Kubrick visited the MIT Artificial Intelligence Lab and had a demonstration of

showing the replicants for the protagonist Deckard, an indexical movie clip from an in-diegetic camera. But why are the replicants standing completely still with a fixed, absent facial expression while they rotate? Is it because they are supposed to be computer generated product visualizations, and thus similar to the 3d model of the antenna, just fully photorealistic? Similar rotating displays have been used over and over again in later movies, usually when a graphical representation of an object is shown on in-diegetic displays. In the 2007 Final Cut DVD:s commentary track, the art director of *Blade Runner*, David Snyder, claims that "...we shot this for the insert tapes, which of course now you'd do as a wireframe and computer generated, they were just basically standing on a turntable with a motor on it, spinning around...".¹⁷³ This does not resolve the question of how this display was intended, but it supports the idea that there is a connection to more contemporary computer generated versions, and it also indirectly connects the shot with the *2001: A Space Odyssey* turntable shot (where a wireframe representation was used).

Topology #artificial light

Her eyes slid over an elusive darkness, deeper than the darkness inside her own skull.
(*Dante Dreams*)

The technology that so much characterized twentieth century urbanities – the artificial, electrical light – also characterizes virtuality. The difference between day and night is a deeply rooted aspect of our seeing, and since seeing is so important for humans, the day is our most natural surrounding. The day and the day lit landscape are natural for us. It is only with the help of artificially created light that we have been able to conquer the night. The glowing light in the night then becomes a symbol for artificiality, and artificiality then connects to virtuality, and this is why the virtual world is so often represented as an [urban city] and by its [city lights]. The city and city lights are one of the most prominent tropes of cyberpunk. Bukatman (1997) refers to the Gibsonian cyberspace as “a new conception of the urban” (p.45) and claims that in cyberpunk the urban is associated both with the dystopian and the electronic. Urban cyberspace has its predecessor in how science fiction stories tend to describe “new urban spaces” (ibid., p.46). Using the image of urbanity at night is a way to make the inherently invisible (and mundane) electronic world of the computer visible, spatial and kinetic. This is clear in *Neuromancer* where Gibson evokes images of “lattices of light”, “lines of light” and “city lights, receding...”. Heuser (2003) makes an explicit connection between the neon lit city of the night and the virtual with its black space and illuminated grids. She points out how Gibson explicitly describes the data ranges in cyberspace as taking the form of an urbanity, with glowing skyscrapers and towers. The structure of this virtual urbanity mimics the actual city, but the material is no longer steel and concrete, but light. William Gibson himself

the labs current computer graphics. The movie makers did not utilize any graphics directly though, since the graphics at MIT only had 512x512 pixel resolution.

¹⁷³ At 13:50.

claims in an interview that building the Internet is the equivalent of building the first cities (Adams, 2007).

Heim (1993) also claims a connection between cyberspace and the giant urban sprawl of cities like Los Angeles, suggesting that the “appeal of seeing society’s data structures in cyberspace ... is like the appeal of seeing the Los Angeles metropolis in the dark at five thousand feet” (p.85). Carr (2010) much later compares our actual Internet to the “endless, mesmerizing buzz of the urban street” (p.220). Benedikt (1991) goes even further, drawing parallels back into Christian legend. He suggests that Eden can be regarded as a metaphor for nature – a place where “the sun rose and set” (p.15) – while the Heavenly City – with its “crystalline gleam of its own lights” (p.15) – is a metaphor for knowledge and artifice, and thus a potential metaphor for information space. If so, the radiant city as a metaphor for disembodiment and immateriality is much older than Gibson’s urban cyberspace.

The ancient dichotomy between Eden and the Heavenly City relates to how the virtual today is often signified by contrast to the actual, emphasizing it as being [opposed to the natural], as [being artificial]. The *day* is a basic property of our natural environment. The day is sunlight. Sunlight is thus the light that is associated with the actual. In contrast to this, darkness connotes the city at *night*, and cyberspace as well. In the night and in the virtual, artificial objects gain their presence by how they radiate light. Rows of car lights, the glowing grid lines of cyberspace. This motivates dense characterizing signs such as the suits worn by the virtual characters in *Tron*, and the perpetual night of the *Tron* world. The suits sport circuitry-like patterns of glowing lines. The world of *Tron* is cast in darkness; there is no sun in this simulated world. These observations correspond well to the comments made by *Tron Legacy* crewmembers on the behind-the-scenes documentary of the 2012 DVD release (Horton, 2012). VFX art director Ben Procter says, “the dominating light source is the self-lighting effect” (at 02:32) and production designer Darren Gilford claims that “I would say the most important element in the world of *Tron* is light. I think that transcends our film and the first film” (at 00:07). Similar claims are made concerning the first *Tron* movie as well, as in these quotes from the commentary track of the 2002 DVD release. Director Steven Lisberger says that

the origin of *Tron* dates back to early work we did in animation experimenting with animated characters who would be made out of light.¹⁷⁴

Richard Taylor, the Computer Effects Supervisor, directly refers to the concept of a sunless world (Burnett, 2002, at 01:02:20).

If you look at the stylization of *Tron*, there is several major conceptual decisions that we made. One was that there was no sun in the electronic world, everything had its own light. It was all made of energy.

Leaving *Tron* aside, references to lights and urbanity are abundant in other fictional representations of virtuality. Textual and visual references to [glow], [lights] and

¹⁷⁴ At 00:25.

[neon] abound, amounting to about 250 sign types. References to a [city] are less frequent, around 25 sign types, but is used in significant ways. *Ghost in the Shell* director Mamoru Oshii explains why he chose the big city as backdrop for his cyberpunk anime (Hishida, 1995, at 01:30).

Since the information network isn't visible, I tried to think of how I could visually represent it. It would be pointless to show the monitor of a personal computer. However, if you think about Hong Kong, you imagine a city teeming with information. For example there are countless signs and a cacophony of voices and sounds, which flow through the city.

The glow of the cityscape is mirrored by the typical glowing graphical interface in numerous science fiction movies, and Shedroff and Noessel (2012) suggest that glow is used to captivate us, and to connote both power and heavenly otherworldliness.

Topology #immateriality

The actual is what you can touch. If you can't touch it, it isn't real; it is a dream, an illusion, or maybe a virtuality. If you think you are dreaming you pinch yourself to feel. The materiality of pain proves that the actual is real.

This is nonsense. You can dream that you feel pain; it does not prove anything. You can't touch a laser beam or sunlight, yet both are actual enough to burn your skin. In a haptic display, you can even touch a virtual object. So the idea of the actual being material and virtual being immaterial is not correct. Nevertheless, it is a common concept in popular culture, to associate immateriality with virtuality (Heuser, 2003). The idea of the virtual as being immaterial is related to the discussion of information space and the fundamental concept of virtual being almost as if. Information space is not directly grounded in physical materiality, and the *almost as if-ness* of the virtual suggests that it must be almost material but not actually. However, the almost as if-ness does not exclude materiality from virtuality. Instead, it means that the virtual shares some aspects of the actual, but not others. It is taken for granted that the virtual is immaterial, but it does not have to be. A paradigmatic analysis suggests that there are several representamen that can form signs connoting immateriality, such as [semi-transparency], [floating], and [emptiness]. Also, different sorts of disconnectedness in space and time can convey immateriality. With disconnectedness I mean, for example, that two objects seem to share a common space but they can't connect materially and causally; you can't shake hands with a hologram. Some expressions of immateriality have strong connections to the previously discussed topology of #engineered space, the space that is initially empty. The unfulfilled world of the virtual might, for example lack textures, or gravity, or people, or rigidity; all four variants of lacking also suggest immateriality.

Semi-transparency is an almost mandatory paradigmatic choice when giving gestalt to virtual objects projected into the actual world. Semi-transparency is also used inside virtual environments. The Game Grid arena in *Tron Legacy* is a good example; the huge arena floor and seemingly rigid structures such as ramps

between floor levels appear to be made out of glass. William Gibson frequently refers to transparency or translucence, especially in *Neuromancer*, as the following excerpts exemplify.

Translucent planes of color shuffled like a trick deck.

The Chinese virus was unfolding around them. Polychrome shadow, countless translucent layers shifting and recombining. Protean, enormous, it towered above them, blotting out the void.

Case watched childhood symbols of evil and bad luck tumble out along translucent planes: swastikas, skulls and crossbones, dice flashing snake eyes.

A few other signs that imply immateriality are interesting even if only one or a few sign types have been observed. The movies *The Lawnmower Man* and *Johnny Mnemonic* were produced at roughly the same time (1992 respectively 1995) and they both used the leading edge computer graphics of that time. The limited rendering capabilities give the imagery an impression of immateriality. The mise-en-scène of the environments are more a collection of colors and shapes than a realistic world built of textures and shadows. This is an example of how the representation of the virtual world engages several topologies; #surrealism, #engineered space, and #immateriality. It is also a representation involving a visual style and production design governed by the technical limitations of computer graphics at the time.

Materiality is highly connected to touch. Touch cannot be directly represented in movies or literature, it has to be shown or told, for example showing objects that pass through each other. Stephen Baxter frequently describes in his novels how virtual objects pass through actual objects, often combined with descriptions of how the Virtual breaks up into pixels or voxels in a manner that is similar to how virtual characters fragment in *Tron Legacy*. In his fiction, Baxter also suggests that this kind of ghostly insubstantiality might be regarded as disturbing and should therefore be prohibited according to future etiquette protocols. This is hinted at in the following examples from *The Siege of Earth*.¹⁷⁵

One of the boys approached him, and Symat reached out a hand. But there was a soft chime, and his fingers passed through the boy's palm. The boy yelped and drew back, as if it had hurt.

The wrestling boys fell to the floor and crashed through table legs. Pixels flew and protocol-violation warnings pinged, but the table didn't so much as quiver.

And they fled, sliding through the solid wall like spectres, accompanied by a soft pinging.

Note that Baxter explicitly refers to the virtual projections with the metaphor *spectre*; references to ghosts are a common way to connote immateriality.

¹⁷⁵ As pointed out by Heuser (2003), Stephenson incorporates similar restriction – towards materializing from out of nowhere – in his fictional Metaverse.

Solid, material objects in our everyday life stay put. So, by contrast, an object that comes [in and out of existence] is conceived of as immaterial. Objects and characters that appear out of nowhere have been used frequently in the studied narratives, and, most notably, the objects *flicker* in and out of existence. A paradigmatic alternative is the object that changes, flicker, between different states. This is vividly described by Baxter in his short story *Touching Centauri* where the world around us is revealed to be an illusion, an illusion that gradually breaks down when humans try to reach the nearest star Alpha Centauri. Baxter describes how the whole night sky starts to change and disappear, and the breakdown creeps constantly closer to Earth until the characters of the story look up and see that “new Moons and Earths burst like silent fireworks”. Also, when he describes his common motif of Virtuals (a volumetric display of an artificial intelligences), Baxter indulges in emphasizing the immateriality of the virtual, both by references to flickering and to appearing out of nowhere, as if by magic. In the novel *Proxima*, Baxter describes how the [volumetric display of an artificial intelligences] “Earthshine flickered into existence, blinking, solidifying, clarifying in a whirl of pixels”.

Similar flickering between states are visually depicted in several movies, for example *Sunshine* and *Magnetic Rose*, and one of the most memorable examples comes from *Chatroom*.¹⁷⁶ Much of the plot takes place in conventional text-based chat rooms, and these are visually and metaphorically depicted as virtual rooms. In one such chat room, an old man appears and asks whether “this is for teenage girls”, and then flickers between the form of himself and that of a young girl. This effectively emphasizes that he is an avatar in a virtual environment, and that he is a child groomer lurking with teenage girls. His young-girl appearance is his deceiving disguise, and the flickering and form-shifting establish that he is a virtual avatar.

Ghosts and the haunted house

Typical representations of ghosts depict them as [semi-transparent], [floating], haunting [vacant places], and [passing through walls]. All these are signs that signify virtuality as well. The connotations to ghosts are sometimes explicit. In *Idoru*, Gibson refers to “ghost-figures whipping past”, “some ghost-bastard thing on my site”, and “countless watching ghosts”. In the movie *Avalon*, a virtual game character manifests itself as a ghost-like young girl. The character Stunner describes her explicitly as a ghost.¹⁷⁷

You must have heard the stories of a hidden character in the Field-class A levels of the game. ... Some people thinks she is an Eastern Egg planted by the programmers, some thinks she's a bug in the system. They call her the Ghost.

The Matrix Reloaded uses another, very explicit reference to horror stories. Persistent ghost twins that exhibit a collection of horror movie attributes hunt the protagonists; they walk through walls, have snaking Medusa-like hair, and a

¹⁷⁶ *Sunshine* at 21:04, in *Magnetic Rose* at 37:35 and in *Chatroom* 25:46.

¹⁷⁷ At 28:54.

mummified appearance.¹⁷⁸ The Oracle gives the rationale for these horror movie characters.¹⁷⁹

Every time you heard someone say they saw a ghost, or an angel... Vampires, werewolf's or aliens... that's the system assimilating a program that is doing something it is not supposed to be doing.

Brian McHale (1992) has mentioned the abundance of ghosts in cyberpunk narratives, making a connection to the posthuman dream of immortality where dead humans have their consciousness, personality and memories uploaded and/or simulated by the machine. McHale suggests that an artificial intelligence can be seen as a metaphorical ghost in the machine. Catherine Constable (2006) has also made similar arguments, and she mentions Baudrillard's idea of the hyperreal as a haunted space. It might be that ghosts are used to signify virtuality not only because they are immaterial just as the virtual is immaterial, but also because ghosts share another aspect with virtual characters – they are thought of as being inferior. The relationship of the dead to the living is similar to the relationship of the virtual to the actual: an existence that is worth less. A ghost envies the living; it is an existence that lacks essential human experiences, such as eating and physical intimacy. The lonely and melancholic existence of ghosts has occasionally been depicted in fiction, as in for example *The Sixth Sense* by M. Night Shyamalan and *The Others* by Alejandro Amenábar.

The haunted house is an integral part of a typical ghost story, and several fictive virtual environments in the analyzed narratives exhibit a distinctly haunted quality. The short film *Beyond* makes explicit dialogue reference to the faulty house simulation as a “haunted house”¹⁸⁰ and the short *Magnetic Rose* throws its characters into a haunted house/virtuality simulation so mixed up that it is hard – or meaningless – to tell one from the other. The memories and recollections of a long dead opera songstress engulf the stranded astronauts, and it is not clear whether the apparitions of her are projected recordings or supernatural visitations. Here, the virtual allows for the technological fulfillment of old fantasies of the dead coming back as ghosts.

Floating

Along with semi-transparency, floating is one of the things that the archetypical ghost do, as well as the fictive holograms of *Star Wars*, *The Wizard of Oz* and numerous subsequent movie examples. The connection to lack of materiality is strong; if there is no matter, gravity has no effect. This is something that we know intuitively about clouds, light beams and flames from a fire, even if it is not accurate from a physics viewpoint. If it floats, we can put our hands through it. Gibson occasionally describes virtual objects as floating for example in *Mona Lisa Overdrive* – “They writhe above the ground like heat above a summer highway...” –

¹⁷⁸ The Ghost Twins are first encountered at 01:13:07.

¹⁷⁹ At 45:20.

¹⁸⁰ At 02:48 and 07:13.

and Baxter repeatedly describes Virtuals as floating, as in this example from *The Siege of Earth*.

He saw that their protocol respect was weakening; some of them drifted up from the floor, and others tilted sideways, reaching impossible angles. They were like floating spectres, not children.

In the TV series *Life on Mars*, Sam Tyler has vivid nightmares blending in with his waking hours and the Test Card Girl often haunts him. She is a mysterious, threatening entity that seems to step out of the test card image displayed on the TV set that Sam often falls asleep in front of. She eerily floats across the floor towards Sam. This makes her seem strange and unnatural but it also signifies her status as a imaginary, illusionary entity. On the commentary track of the 2006 DVD release, director Bharat Nalluri claims that the sign was not planned in pre-production.

On the day, we decided to float her around the room, it wasn't an early decision... In fact I thought it was the camera operator who thought, well, that's a good idea.¹⁸¹

If this is correct it gives an interesting illustration of how intuitive and off-the-cuff decisions are sometimes made in the turbulent and complex process of producing a story for TV or feature film.

Floating and flying are highly common characteristics of real-life virtual reality and virtual environments as well. It was a common way of moving about in *Second Life* and *Active Worlds*. Another example taken from the research group Digital Representation, is Magali Ljungar-Chapelon (2008) and her virtual reality arts play *Le Beau, le Laid, le Bon et le Mauvais*. Ljungar-Chapelon used audience response study to investigate the experience of the virtual environment; in many of the interview responses, the sensation of flying and floating was underlined as an important characteristic of the experience.

Topology #control

It might be Clu's game here, but in my world I got him in one key stroke.¹⁸²

The word cyberspace, stemming from cybernetic, relates to systems of control. The sub-genre cyberpunk is saturated with themes investigating issues of control and power hierarchies. The line of dialogue above exemplifies the importance of #control as a topology of virtuality. The quote highlights the arena for fictional struggles over control – the virtual world. This arena was already firmly established in *Tron*, the first movie which told a story about a virtual world. In one of the first scenes we have a clear demonstration of how the user Kevin Flynn guides and controls his virtual alter ego, Clu.¹⁸³ In subsequent scenes, we are gradually introduced – primarily via dialogue – to the power struggle within the virtual world; the tyrannical Master Control Program and his right-hand man Zarg have seized

¹⁸¹ Episode 2, at 24:30.

¹⁸² Character Sam Flynn in *Tron Legacy* at 01:00:15.

¹⁸³ Starting at 03:44.

total control over the virtual world and all its inhabitants (artificial intelligences, or as they are called *programs*). The driving conflict of the movie is the struggle to overthrow this regime. The concept of control continued to play a dominant role in subsequent movies such as *The Lawnmower Man*, *Tron Legacy* and the Matrix franchise, as noted by Zagorac (2009). Sabine Heuser (2003) mentions Neal Stephenson's novel *Snow Crash* as another example, and describes how the concept of taking control by *writing code* is emphasized in *Snow Crash*, and how this code writing can be compared to casting magic spells. The metaphor of magic spells echoes the myth of the golem, the mud creature brought to life by a spell written into its forehead. Predating Frankenstein's monster, the golem became dangerous, and had its life force taken out of it again by "the removal of certain letters" (Menon, 2007, p.158). This connotes control through code, through language. Another way of expressing this is the term *hacking*, used in misguided or creative manners, depending on your viewpoint. Hacking has become shorthand for taking control, not through blunt physical violence – as in the archetypal action movie – but through mysterious sequences of key strokes on a keyboard. The archetypal action hero contorts his face into a mask of pain and anger, and fire weapons to unleash death. The hacker hero's face expresses concentration and thinking, and her attack changes the world. These hacks are far removed from real-life coding and hacking. In the feature film *Hackers* (Softley, 1995), teenagers "hack the planet" and in the short film *Kung Fury* (Sandberg, 2015), time travel is made possible by simply hacking time. This hacking is not meant as logical explanations of the movie plot; rather, it a metaphor for taking control through cognitive skills rather than physical violence.

Michael Benedikt (1991) relates our capabilities of controlling cyberspace – both in real-life virtual worlds and cyberpunk fiction – with the ancient "desire to will the world into action" (p.226). In the virtual, our capability for control is so profound that it reminds us of magic. There is also ideological discourse concerning control over the real-life Internet, illustrated by the essay *Cyberspace and the American Dream: A Magna Carta for the Knowledge Age* in which Esther Dyson, George Gilder, George Keyworth, and Alvin Toffler (1994) claim that life online should be beyond standardization, centralization and control.

In fictional narratives, the issue of control is intertwined with the drama and conflict of the narrative. There are many forms of #control that relate to virtuality, and in order to demonstrate the range, I will discuss a number of these, starting with my own work with the Via Tecta production. In human-computer interaction, the concept of the user taking control is so taken for granted that it is usually not reflected upon at all. However, in the Via Tecta production, we built an interactive visualization and reconstruction of an ancient Roman temple, where we wanted to emphasize the users' ability to take control over the visualization. Archeological visualizations are traditionally static, so by emphasizing user control we created the super-sign [taking control]. Our intention was that the sign [taking control] should connote that since the visualization was interactive, the reconstruction it showed could be quite uncertain and open for different interpretations. The concept of taking control was realized as a virtual heads-up display control interface. It slid

down on top of the visualization and made it possible for the user to change the content of the visualization. The user could for example switch between two different versions of a balustrade, or select to switch it off completely. In other words, we let the audience deconstruct the reconstruction and build her own version. What we needed to represent in this visualization was *uncertainty*, which is not the same as *virtuality*. However, we reasoned that there is a conceptual connection between virtuality and uncertainty – both concepts having the connotation of almost being, almost existing. In a similar way to how the virtual can be perceived as a mental construct, the quite uncertain reconstructions of the ancient Roman temple can also be thought of as mental constructs.

Breaking space-time

I want to put the game on pause.¹⁸⁴

There are differences in how control is portrayed, based on *what* controls *what*. One often-used super-sign is that of a character [taking super-natural control over the world]. This act of taking control is sometimes portrayed as [stopping the world by a voice command]. Analyzing the sign's syntagmatic construction, it is clearly an efficient sign; the sign obviously connotes the super-natural and artificiality since we all know that we can't stop time by demanding it to stop; and it also combines the verbal (the dialogue line) with the visual (we see the world freeze). The sign was, for example, used in a scene in *The Matrix* where character Morpheus says "Freeze it!", and the time of the virtual environment stops.¹⁸⁵ This is yet another example of how a quite straightforward event is subtly loaded with sub-signs. When Morpheus gives his line he looks up, putting to use the super-sign of [up/down hierarchy], and earlier shots of the scene involves a [zombie-like crowd]. The idea of virtual characters being a zombie-like crowd, in combination with verbal commands used to freeze the world, is used in a similar scene both in *Abre los ojos* and the remake *Vanilla Sky*. The main character David is having a heated conversation with a strange man in a crowded and noisy bar. Finally he impatiently snarls "What I would love everyone to do is to shut up..." and he is shocked when everything around them grows quiet and still. Not every virtual world yields itself to commands as easily. In *Life on Mars*, there are several scenes where the protagonist Sam unsuccessfully tries to gain control over the illusory world he is caught in, for example, in the first episode when he snaps and starts to scream "Come on! Stop it now; enough!"¹⁸⁶ He slams his hands against the walls and continues "Stop! End! Finish! Come on!" But he remains trapped and *out of control*.

These scenes of achieving or not achieving control of the world are strong and memorable. Yet, they are surprisingly non-visual in their storytelling, relying heavily on dialogue, acting and plot events. They rely on diegesis rather than mimesis. The breaking of space-time can of course be seen in the bullet time effect of *The Matrix*,

¹⁸⁴ *eXistenZ* at 01:05.

¹⁸⁵ At 54:59.

¹⁸⁶ At 20:30.

but similar super-signs have been used in *The Cell*, *Vanilla Sky*, *Abre los ojos*, *Sunshine*, and *Avalon*.¹⁸⁷ Often the space-time break is explicitly referred to in dialogue or in other ways. In *Abre los ojos* the virtual character Sofia freezes while being together with her lover César, and says: “If you want me to move, you have to put a coin into me”.¹⁸⁸ The line is supposed to be a loving joke, but the sub-text is that she is a construct of César’s computer-assisted imagination. Built into this seemingly simple line of dialogue are three different signs. She is frozen in time, so space-time in the virtual environment is broken. She is controlled by another character, as if she is a mindless zombie. And, the notion of starting her up with a coin suggests her artificiality, as if she is an arcade game.

Time in the virtual not only stops on commands, it can also run in different speeds compared to the actual *outside*. Gibson explicitly described this in *Neuromancer*: “You aren’t missing anything, back there. An hour here’ll only take you a couple of seconds.” Thirty years later – in *Tron Legacy* – the character Kevin Flynn explains that “hours here were just minutes at home”.¹⁸⁹ One story taking the notion to its extreme, and making it an important part of the plot, is *Inception*. The events of this movie take place in up to four nested layers of worlds – technology-induced dream worlds – and time runs slower for each step down in world hierarchy. Two of the characters live a whole lifetime *at the bottom* while just a few weeks run by in the top-world. This is reminiscent of Nusselder’s (2009) claim about cyberspace in general, that “time and space seem to be dimensions of the world that we can compress by means of the computer: they lose their significance” (p.50). A real-life example of controlling time in virtual worlds is the control over time in simulations. For example, in sandbox games such as *Minecraft* and *Spore*, the time runs quickly; sunsets come and go swiftly in *Minecraft*, and in *Spore* millions of years sweep by while the game player controls the evolution of life.

Power struggles

Only human.¹⁹⁰

A fundamental aspect of a plot is the characters, and signs of virtuality related to characters are abundant in the analyzed narratives, usually represented by characters struggling for control. Control is, from a character design viewpoint, directly linked to the *capabilities* of the character. The capabilities characterize the character, and they can signify whether the character is inside a virtual world, or interacting with a virtual object. The characters’ capabilities can also signify that the character *is* a virtual character, an artificial intelligence.

Control over computer systems and how this control relates to individual capabilities have an obvious correspondence to real-life virtual worlds: that of

¹⁸⁷ First introduced in *The Matrix* at 02:55, the Bullet Time is an effect where the characters move at super-human speed, but at the same time the camera moves freely while the action is almost frozen.

¹⁸⁸ At 01:03:43.

¹⁸⁹ At 52:15.

¹⁹⁰ Artificial intelligence Agent Jones to human Neo, at 01:42:20 in *The Matrix*.

administrative rights in real-life systems. Kjastrup (2003a; 2003b) describes how players in multi-player worlds usually start with minor capabilities and then work on their *levelling* to become *wizards*, or whatever powerful players are referred to in each specific game. This increase in power and control comes with more capabilities (better health, intelligence, weapons and so on). In *Active Worlds*, a real-life virtual world, a so called police department had the administrative rights to delete offensive objects created by other citizens (participants) and peacekeeper civilians were given the right to eject abusive citizens from the world (Schroeder, Huxor & Smith, 2001). In the virtual world, these users had superhuman capabilities beyond that of ordinary users. The attaining of power in fictional narratives such as *The Matrix* mimics this, for example in how the increased capabilities of Neo let him take over the virtual world. There have also been reports of real-life cyber-attacks paralleling how the fictive Agent Smith tries to take over the whole virtual world in *The Matrix Revolutions*. In *Active Worlds*, a user “was running riot in the world, placing numerous objects and looking as if he intended to overload the world server” (Hudson-Smith, 2002, p.5). The user had employed a code that automatically built 85,000 objects in the course of five hours. Even further back in the short history of online virtual worlds, Turkle (1995) made this description of a well-known example of abuse in the LambdaMOO world (p.251).

Even when ejected from the room, Bungle was able to continue his sexual assaults. He forced various players to have sex with each other and then forced legba to swallow his (or her?) own pubic hair and made a character called Starsinger attack herself sexually with a knife. Finally, Bungle was immobilized by a MOO wizard who “toaded” the perpetrator (erased the character from the system).

The event and its aftermath have also been chronicled and analyzed by Julian Dibbell (1996). It took place in a text based MUD, so the events were not visually represented, and it can be disputed whether anyone was forced to do anything; what happened was that the Bungle user employed a subprogram that published the verbal descriptions of the events, making it *appear*, in text, as if the users behind legba and Starsinger had written those descriptions themselves. However, the reaction to the offense was strong from other users. The deletion of the Bungle user account, that Turkle mentions, did not happen until after a long subsequent debate that persuaded a wizard, a system administrator with high-level access, to execute the verdict. Note how the term wizard echoes the magical spell control commands envisioned by Vernor Vinge in his 1981 story *True Names*, and how the themes of characters struggling for control – but finding themselves being controlled by a user with stronger capabilities – echo events in the Matrix trilogy, especially the scene where the Merovingian forces a virtual woman to orgasm (using code hidden in a virtual desert cake). Other super-human capabilities such as telekinesis, clairvoyance, strength, speed, agility or invulnerability often signify virtuality. The storytellers of *The Matrix* utilize the virtuality of their fictive world as an excuse for spectacular action scenes. But there are examples from other movies as well; the characters fly in *The Lawnmower Man* and characters have superhuman speed and agility in *Tron Legacy* and *Storm*.

Issues of control, power and empowerment run deep in the virtual, and provide a conceptual connection to how counterculture in the 1960s tried to deal with issues concerning technology, control, and empowerment. Individual empowerment was the original promise of the personal computer, and the promise offered by the frontier romanticism of the early real-life virtual worlds – to be anyone you want to be, to do anything you want to do. Nusselder (2009) describes it as an ancient longing to surpass the limits reality have set for us; that the virtual “offer(s) to relieve us of the burdens of reality. ... What we cannot have in reality, we can have via the fantasy screen” (p.11). Our anticipations of the virtual seem to have matured now. Still, the capability to control a world might be one of the factors that draws players to the widely successful computer game worlds of *The Sims*, *SimCity* and *Minecraft*. In these simulators and sandboxes, the player feels empowerment and has control on a level that the actual world can't offer.

Surveillance, power and control

In what has been claimed to be a commercial for the electronics giant LG, a smiling man spies on a woman sleeping in her bed, and snaps a photograph of her through the window with his smartphone.¹⁹¹ The man starts to manipulate the woman through the image he took. He touches the image of her, and she feels his caresses in her sleep. She smiles appreciatively in her sleep, accepting the violation only because she is in a semi-conscious state, still in the land of dreams. She is an object and she is only open for sexuality when she is *taken*. Apparently, dreams of technology take the dream of male sexist objectification to a new level, and in the following discussion, gender issues, surveillance and freedom will be intricately linked with the representation of virtuality. We will now investigate aspects of control and surveillance in the virtual. Surveillance is tightly linked with both photography and control, because, as Susan Sontag (1999) notes, photography redefines reality into “an item for exhibition, as a record for scrutiny, as a target for surveillance” and “photographic recording is always, potentially, a means of control” (p.82).

The surveillance of a virtual world from an outer actual world is a common trope in the studied narratives, usually with the virtual portrayed as a contained world that is watched from the outside. The virtual is inside, the actual outside. This opens up interpretants situated both in the topology of #control and of #containment. One of the first descriptions of a virtual world is a memorable example. In the short story *The Veldt* from 1950, Ray Bradbury describes a virtual savannah projected inside a domestic virtual reality room, and finishes it off with the comment that “the only flaw to the illusion was the open door through which he could see his wife, far down the dark hall, like a framed picture, eating her dinner abstractedly”. This short line efficiently creates the image of two separate and independent, but linked worlds.¹⁹² The actual framing world and the virtual insert world have a relationship that is metaphorically similar to theater – the stage

¹⁹¹ <http://infontology.typepad.com/infontology/2008/06/ntligen-en-rikt.html>

¹⁹² Svante Lovén (2001) also highlights the metaphorical contrast between the high-tech actual world and the savage and pre-technological world of the virtual savannah.

is likewise an insert world surrounded by off-stage spaces, and by apparently hidden spectators.¹⁹³ The dualism of a stage and spectators is emphasized repeatedly in the Matrix franchise. The protagonists of the story enter the virtual world to do heroic deeds like gladiators in a futuristic coliseum. *Outside* in the actual world, the *operator* surveys and guides the visitors to the virtual world. We see these operators seated in front of a bank of computer screens, screens that display enigmatic rows of green computer code. Obviously the operators can interpret this code and understand what happens inside the virtual world. They seem to have complete surveillance capabilities, and the concept of the operators looking into the virtual world to guide and manage the events calls to mind how stage people work around the stage during a play. It is almost as if the operator peeks behind a curtain. Hannah Higgins (2009) has pointed out that the word *screen* – nowadays the window through which we see from the actual to the virtual – has another meaning that instead suggests protection against exposure. The *protection* against gaze that the dressing screen provides has been replaced by the *exposure* mediated by the display screen. Baudrillard (2008) refers to our culture as a pornographic culture; it is not only the erotic body that is totally exposed in our visual culture, it is also every inch of our intestines, and in science shows everything is shown: from vibrating sub-atomic strings, and long-dead dinosaurs, to far-away galaxy cores. We are obsessed with being able to see everything. Heim (1993) notes a similar idea, that in a virtual world – a simulation – everything is known, and everything could be counted. Take as an example the passage in *Neuromancer* where Case have omniscient knowledge of Wintermute's virtual entrapment.

The Kuang program spurted from tarnished cloud, Case's consciousness divided like beads of mercury arcing above an endless beach the color of the dark silver clouds. His vision was spherical, as though a single retina lined the inner surface of a globe that contained all things, if all things could be counted. And here things could be counted, each one. He knew the number of grains of sand in the construct of the beach (a number coded in a mathematical system that existed nowhere outside the mind that was *Neuromancer*). He knew the number of yellow food packets in the canisters in the bunker (four hundred and seven). He knew the number of brass teeth in the left half of the open zipper of the salt-crustled leather jacket that Linda Lee wore as she trudged along the sunset beach, swinging a stick of driftwood in her hand (two hundred and two).

Svante Lovén (2010) points out that Gibson's description of omniscience in the virtual echoes that of Vernor Vinge in his *True Names*, published in 1981, three years before *Neuromancer*.

But things would never be the same: the human that had been Mr. Slippery was an insect wandering in the cathedral his mind had become. There simply was more there than before. No sparrow could fall without his knowledge, via air traffic control; no check could be cashed without his noticing over the bank communication net. More than three hundred million lives swept before what his senses had become.

¹⁹³ Acknowledgement goes to my colleague Josef Wideström for our discussions about the connection between virtuality and theatre, and forthcoming PhD thesis investigating these issues.

Sometimes the surveillance portrayed in the studied narratives can be covert and have slightly sexual undertones to it, as when we, early in *The Matrix*, hear some one asking, “You like him don’t you? You like watching him?”¹⁹⁴ The specific idea of a love interest being covertly observed is brought up in a similar fashion in *The Thirteenth Floor* when the actual woman Natasha tells the virtual character Douglas that “from the moment the simulation was created, I have watched you”.

This slightly sexual voyeurism is portrayed as welcome, even as a romantic prelude to coming flirtation and love. We like to watch, and we often like being watched. We are fascinated and scared by the total surveillance of panopticon as well as the pleasurable watching of scopophilia, and this is reflected in fiction. Fictional cases of scopophilia have quite romantic connotations as in the examples above or as in the movie *Déjà vu* (Scott, 2006) where the male protagonist falls in love with a woman he watches through a wormhole device that lets him look into the past, anywhere in space. However, surveillance is sometimes represented as malignant. The archetypical example is, of course, Orwell’s *1984*. Surveillance and scopophilia are connected to control, and a struggle for control (Mann, Nolan & Wellman, 2003). The watcher attempts to watch, while the watched either tries to hinder or allow it. When the watched allows the watcher to watch, the meaning becomes a sexual, romantic act – at least in the logic of a typical western movie narrative. One archetypical example is the scene in *Witness* (Weir, 1985) where the male protagonist happens to see his love interest Rachel half nude while she does her evening washing (the character Rachel belongs to the prudish Amish society). She allows him to watch. Erotic watching – and the male gaze that objectifies women (Mulvey, 1999) – are typically pushed into two opposites; either the romantic sexual act, or the malignant perverted act. When Rachel allows the male protagonist to watch her, her control over the situation makes her less of an object and more of a subject. Comparing the two fictional examples of watching – *Déjà vu* and *Witness* – they highlight that the difference between malevolent surveillance and benign watching is both a matter of control, and of information. In typical panopticon surveillance, the observed subject is objectified because the observer knows more than the observed (Foucault, 1999); in the case of *Déjà vu*, the woman does not know she is spied upon. In the case of *Witness*, the man and the woman share similar knowledge of the situation, and thus engage in communication with each other.

Considering the intense debate on surveillance in real-life, it is surprising that fictional representations of virtuality fail to problematize the act of watching. Is surveillance so deeply integrated into our society that we regard it as an obvious aspect of an artificial environment? There have been many warnings put forward concerning the risk of a surveillance-based society, from Juvenal’s ancient quest¹⁹⁵ about who will guard the guardians to George Orwell’s Big-Brother, through Huxley’s chilling claim that “everyone belongs to everyone” in *Brave New World*

¹⁹⁴ At the very start of the movie at 00:56. Most likely it is Cypher asking Trinity since the later will finally confess a romantic interest in the hero Neo.

¹⁹⁵ The roman poet Juvenal coined the phrase, but Plato also discussed the general concept in his Republic.

(Huxley, 1932), to Donna Haraway's (1991) warning against "the formation of a strongly bimodal social structure ... controlled by high-tech repressive apparatuses ranging from entertainment to surveillance" (p.169). In *Postscript on the Societies of Control*, the philosopher Gilles Deleuze (1992) claims that the idea of an institutionalized panopticon has expanded to include not only specific sites such as prisons or shops, but also the open public spaces between institutions, such as the street.¹⁹⁶ There is broad modern debate about security cameras, online surveillance and such, see for example the essays in (Philips, 2010). In the large attitude survey *Digital Life in 2025* (Anderson, Rainie & Duggan, 2014), frequent voices of concern brought up the issues related to increasing surveillance made possible by the Internet, and the loss of control over this surveillance. It might be that just as science fiction failed to anticipate the Internet, contemporary science fiction also fails to predict the full extent of future panopticons.

Topology #virtual artificial intelligence

Samuel Eriksson: "There is someone who plays us."

Thommy Eriksson: "How do you mean?"

Samuel: "In the night the big guys stop playing us. That's how it is inside the computer."¹⁹⁷

I was amazed at this spontaneous conclusion from my five-year-old child; surprised that he could think of himself as a character inside a computer game. The idea of a god-like entity having control over the virtual world and being the creator of other sentient, virtual artificial intelligence is important in many of the studied narratives. This idea connects with one of the most common themes of science fiction: the struggle with the machines. Some of the most commercially successful and critically acclaimed science fiction movies tell stories concentrating on this conflict: *2001: A Space Odyssey*, *Blade Runner*, *The Matrix*, and *The Terminator*. In literature, *Frankenstein; or, The Modern Prometheus* stands out as a story conflicting the artificial monster and its creator. The artificial entity is an efficient combination of the dangerous *other* and the dangerous *technology*, "a perfect exteriorization" (Pope, 2008, p.3). Looking at stories involving virtuality, the plot of for example *Tron* and *Tron Legacy*, as well as the Matrix franchise, indulge in the conflict between man and machine, between the maker and the made.

The god-like control of the maker

A specific kind of #virtual artificial intelligence, related to the topology #control, is the maker's control over subordinate virtual artificial intelligence. The line between control and god-like control is a blurry zone of negotiation, but religious motifs

¹⁹⁶ The panopticon was originally an idea by Jeremy Bentham on how to monitor prison inmates, famously analyzed in Michel Foucault's 1975 essay *Surveiller et punir*.

¹⁹⁷ July 14th, 2007. The exchange, which was a spontaneous everyday discussion, has been translated from Swedish by the author. The original wording was: "Det är nån som spelar oss", "Hur då menar du?", "På natten slutar dom där stora gubbarna att spela oss. Så är det inne i datorn."

obviously set them apart. Also, god-like control means an almost total control over the virtual world. The hero achieving god-like control, referred to as *apotheosis*, is one of the recurrent themes observed in western narratives according to Campbell's monomyth (1949), and Palumbo (2014) uses the monomyth pattern to describe such transcendence in both *Tron* and *The Matrix*, even though the powers of the characters in these narratives seems super-human rather than god-like.

Dramatic events portraying god-like control are signified in spoken dialogue, narrative events and the visual *mise-en-scène*. In *Inception* – where the story unfolds in artificial dreams – there is the astounding visual motif of a whole virtual city being bent in on itself like a folding piece of paper at the will of its creator, the architect student Ariadne.¹⁹⁸ There is also the shot where Cobb and Mal build a sandcastle city at a virtual beach.¹⁹⁹ Cobb's voice-over narrates that "...we built a world for ourselves..." and behind them in the virtual world, at a distance across the sea, large city-structure reacts to their control. When a sandcastle city block is toppled, the enormous structure in the background topples as well. The shot is very short, but the concept – a dream world where the world is constructed by the inhabitants/dreamers via their construction of a model world within the world – is fascinatingly rich and complex.

Another way to demonstrate that you are God in your own world is to say it...²⁰⁰

Trainman: "Down here I make the rules. Down here, I am God."

Agent Smith: "This is my world, my world."

SID 6.7: "You're in my world now."

...and then emphasize it by some kind of exertion of power and control. In *The Matrix Revolutions*, both Trainman and Agent Smith strike Neo down despite Neo's own super-natural powers, and in *Virtuosity*, the whole world bends around the villain SID 6.7 in a manner reminiscent of the visual effects mentioned previously in *Inception*.

The super-sign [god-like control] engages the concept of *being* a God, but it does so at various levels of pronounced religiosity. The dialogue examples above connote a general concept of God and of having total control, but they do not refer to religion per se. Other movies play much more directly on specific religious associations, making references to world religions. The Matrix franchise paints a virtual world inhabited by a menagerie of artificial intelligences that control different aspects of the world (for example the Merovingian, The Key Maker, The Oracle and The Architect). The idea is similar to the artificial intelligences populating William Gibson's cyberspace in the novel *Count Zero*, directly fashioned after voodoo spirits.²⁰¹ Both Scott Bukatman (1993) and James Kneale (1999) point

¹⁹⁸ At 28:40.

¹⁹⁹ At 01:11:40.

²⁰⁰ *The Matrix Revolutions* at 13:10 and 01:46:37, and *Virtuosity* at 01:26:50, respectively.

²⁰¹ In an interview (McCaffery, 1991), Gibson claims that using Voodoo spirits was a serendipitous decision influenced by an article about Haitian voodoo in National Geographic.

out that the use of voodoo spirits for constructing signs of virtuality creates a destabilizing and undermining dichotomy between the rationality and perfection of cyberspace on one hand, and superstitious and religious beliefs on the other. *The Matrix* has been accused of being a mishmash of all sorts of religious associations (Ford, 2003; Žižek, 2002), and it clearly features biblical allusions: the character arch of Neo as a prophesized savior being the most obvious set of references (Fontana, 2003), as well as references to Buddhism and its claim that the world is an illusion (Brannigan, 2002; Ford, 2003). In *Count Zero* just as in *The Matrix*, different religious systems are mixed together; one *loa* (spirit) manifests itself as a wooden cross. Furthermore, in the Matrix franchise, the following line of dialogue from The Oracles – referring to a flock of birds – clearly suggests the idea of a nature religion where all aspects of the virtual world are governed by their own specific god or spirit.²⁰²

See those birds; at same point a program was written to govern them.

In the narratives I have studied, it is not only simple birds that are written code. There is a strong emphasis on virtual artificial intelligence that are written, and thus created. In spoken dialogue, they are often referred to as *programs*, but it is more correct to think of them as virtual characters or artificial sentiences. Artificial sentience and a god-like maker were portrayed as early as the first *Tron* movie, as exemplified by the following lines of dialogue from two quite early scenes in the movie.²⁰³

“If I don’t believe in users, who wrote me?”

“I wrote you”

“Yes sir.”

In the sequel *Tron Legacy*, references to God in a religious sense are made into a more indirect part of the *mise-en-scène*. The creator of the virtual world – Kevin Flynn – is dressed in a white, kimono-styled robe and sports long hair and a beard. He has a Zen style bead bracelet, and he later refers to himself as having a “Zen” mindset. When we first see him, he is meditating.²⁰⁴ The Kevin character, with his connotations to hippies and Zen Buddhism, join together spirituality, counterculture and the early development of the personal computer. His figure mimics the archetypical image of Jesus as well. This becomes even more pronounced in scenes where he drops into a praying pose (before using his supernatural control over the virtual environment, as if he uses the pose to gather his powers), or when a virtual character kneels to worship him. This worshipping character kneels with an expression of bliss in her face, and her shaven head is reminiscent of a Buddhist monk. When Kevin Flynn leads his son Sam and the

²⁰² In *The Matrix Reloaded* at 44:50.

²⁰³ At 02:54 and 04:03, respectively.

²⁰⁴ We first see Flynn at 46:58.

artificial intelligence Quorra away from a dangerous situation he holds his arms stretched out in a protective and benedictory gesture.²⁰⁵

The religious notion of god-like control is also emphasized in real-life computer games, so called god games, to a varying degree. In *The Sims* and *Spore*, the player acts as an implicit god, controlling the development of simulated life (Ferdig, 2014; Lorentz, 2014). In some games, such as *Populous*, *Black & White*, *Mega Lo Mania* and *Godus*, the player is explicitly referred to as a god, at least in promotional texts (Wiemker & Wysocki, 2014). It is characteristic for these games that the player can exert supernatural powers over the world and its inhabitants, and sees the world from above, often from an isometric perspective. This is reminiscent of the up/down layering of virtual worlds discussed on page 223, as well as the Heavenly City of Christianity and the Mount Olympus of Greek mythology. Of course, computer games in general let the player control at least the game character in the game world, but typical for god games is the vast scale of control. Acting as a god in a game references religious motif via the gameplay. However, religion can also be a part of the game world itself, characterizing the settings and characters of the game just as in conventional, linear storytelling (Ferdig, 2014; Grieve & Campbell, 2014; Heidbrink & Knoll, 2014).

Enslaved artificial sentience and the zombie crowd

I'm not in the business. I am the business.

These words from Rachel in *Blade Runner* mark our shift in focus away from the programmer-God towards the subordinate artificial sentience. Characters such as Rachel is highly resonant with the typical cyberpunk protagonist, a subordinated, marginalized creature on the bottom of social hierarchies and on the fringe of society. In the words of Donna Haraway (1991), “the replicant Rachel ... stands as the image of a cyborg culture’s fear, love, and confusion” (p.178). When uttering these words, Rachel is the artificial replicant with false implanted memories that just has realized that she is not a natural human. She is manufactured. Her words reflect her shift from being an active agent (a human) to a passive object (a replicant). This is a common theme in science fiction, and the concept can be applied to physical artifices such as Rachael, and to digital, virtual entities such as the ones encountered in virtual worlds. In real-life computer game worlds, these are referred to as NPC’s (Non-Player Characters) and even if they are becoming increasingly sophisticated they are not really artificial intelligences, nor sentient. In fiction, virtual artificial intelligences are numerous, ranging from the simpleminded workers/slaves in *Tron* to the superior enemy/masters of *The Matrix*.

The idea of artificial life, an artificial entity created for the benefit of its creator, is very old and predates modern science fiction and virtuality (Grau, 2003). In Jewish mythology there is the *golem* – a creature formed out of clay and given life. The original description of the golem is pre-Christian, but the most well-known, modern golem myth describes how the rabbi Loew ben Bezalel created a golem in

²⁰⁵ At 01:13:54.

Prague in the sixteenth century. Some versions of the story describe how the golem becomes violent, which is highly reminiscent of the later story about Frankenstein's monster. In Greek mythology, Pygmalion was a sculptor who made a female statue of such beauty and lifelikeness that he fell in love with it. His desire was so strong that the goddess Athena gave the statue life. Her name became Galatea, which means *she who is milk-white*. So even if she became alive, her name suggests her artificiality by reminding us that she had the grey-white color of ivory. Her ivory skin predates the grey and featureless surfaces of virtual objects that we see today, as discussed on in the chapter 'The grey surface and the Virtual Gas Lab, see page 185. Well known Pandora was also an artifact crafted out of mud by the Greek gods Hephaestus and Athena, and then sent to bring revenge on humanity (Austin, 2001; Mulvey, 1995). It is interesting how ancient Pandora and Galatea have their modern equivalents in artificial females such as *Blade Runner's* Rachael and *Metropolis's* Maria (Lang, 1927), and many other androids and artificial sentient beings. Springer (1996) suggests there is a general trend in how male storytellers and engineers both in fiction and real-life strive for creating the artificially perfect female, and that narratives about robots and artificial intelligences reflect the fear of women's liberation. Huyssen (1981) makes a similar observation, and specifically addressing Maria in *Metropolis*, he writes that "as soon as the machine came to be perceived as a demonic, inexplicable threat and as harbinger of chaos and destruction writers began to imagine the Maschinenmensch as woman" (p.226).

In real-life computer game worlds and other virtual environments, the avatar is the user's graphical embodiment, apparently fully controlled by the user. Both in real-life and in fiction, the relation between the user and her avatar can be problematized though. In the fictive virtual world of *Tron*, the "programs" are not avatars; they have a quite high degree of semi-autonomous artificial intelligence, but their relationship with their user is reminiscent of a highly subordinated worshipper's relationship with God, as exemplified by one scene in *Tron* where program Tron confers with his user Alan via the I/O tower portal.²⁰⁶ The religious overtones of the scene are represented in several ways: the music, Tron's praying pose, the architecture of the portal, and the light beam from above, as well as Alan's disembodied, booming voice-of-God. The virtual Tron refers to the human Alan as "Alan One". While giving the user Alan further god-like status, the term also suggests that there is an Alan Two. This is Tron. So Tron is second to Alan. He is the semi-autonomous embodiment of Alan, inside the virtual world.

The idea of humans inhabiting the fleshless body of virtual characters is picked up in *The Thirteenth Floor*. In the layered hierarchy of simulated worlds of this narrative, characters from the world above jack-in to the world below, and appear to possess the subordinate characters in a manner that mimics the relation between users and programs in *Tron*. It is also reminiscent of the mythological idea of humans being possessed by demons or spirits. For example, the character Natasha – inhabiting the middle-level world, similar to Rachael in *Blade Runner*, believing she is an actual human – does not know the protagonist Douglas Hall with whom she

²⁰⁶ At 01:04:58.

shares world. But when her upper-level equivalent Jane jack-in to the virtual world she *becomes* or *possesses* Natasha. When being Jane, the Natasha/Jane character pursues Douglas since Jane is in love with him. When Jane jacks-out, Natasha has no memory of what has been taken place. Jane wears Natasha as a mask or costume. Natasha is a sentient avatar, waiting for technological possessing; it is a chilling concept indeed. These processes are represented in different ways. It is mentioned in dialogue, for example in this line.²⁰⁷

I know why you pass out some times. I know why you wake up some times and have no idea of where you are.

It is also shown in acting, both in that the different characters behave (and dress) differently and that they seem surprised or confused when the possession ends, for example.

In other narratives, there are twists that further complicate the idea of humans infesting/possessing/becoming an autonomous avatar. In *eXistenZ*, the control acts both ways; when humans jack-in to the virtual game world, they at first seem to be themselves, but, especially in one scene, it is revealed that the personality of the game character avatars actually execute control over the human player's decision making. In this scene, to their surprise, the two characters Allegra Geller and Ted Pikul start to make-out, and Allegra explains that²⁰⁸

the characters are obviously supposed to jump each other; it is most probably a pathetically mechanical event to heighten the emotion of the next game sequence.

This enforced sexual encounter might seem farfetched. However, in real-life gameplay there are aspects of the game character that a player does not control, such as motion patterns, dialogue exchanges and even supposed behavior. Game characters often have a specific character and history of their own; this becomes obvious when considering games such as *Grand Theft Auto* where you are more or less supposed to act out the violent and criminal nature of the game character. To advance the game plot, many games occasionally take control of the game character and perform tasks or dialogue on its own before the control is given back to the player. In online role-playing games, you are supposed to stay in character, performing your part (Klastrup, 2003a). The fictional game world of *eXistenZ* mirrors this.

The scene in *eXistenZ* is quietly unsettling and at the same time intriguing, framing questions regarding individuality, control and intimacy. The character Allegra seems to regard the sexual encounter she is having as something that is not real; it is just something her game character does. However, the game is portrayed as completely realistic and as incorporating all the senses. So, aren't they actually kissing then? This merging of faked and real sex mimics that of prostitution. Sexual encounters in prostitution are actual, but at the same time they are staged and scripted. An important fantasy that drives sex buyers is also the urge to give over

²⁰⁷ At 17:28.

²⁰⁸ At 17:16.

control, to lose control and to lose the burden of responsibility (Månsson, 2005). At the same time, the purchase of a sexual encounter can be seen as the purchase of power over another human's acts and body. It is interesting how these complex issues regarding intimacy and control are mirrored by the complexity and ambiguity of the encounter in *eXistenZ*. The dichotomy of having and losing control at the same time is brought into light.²⁰⁹ In other movies the aspect of control in relation to sexual services is subtly hinted at. *Tron*, *The Matrix* and *Virtuosity* all make fleeting portraits of these virtual sex slaves.²¹⁰ William Gibson makes a subtle reference to the concept in his novel *Virtual Light* when a man enters a virtual simulation.

She is waiting for him. He has long since come to prefer her in silence.

Yet another very subtle, almost quaint, reference to sexual control comes in the American re-make of *Life on Mars*. The character Annie has an argument with Sam Tyler concerning whether she is real or just a figment of his imagination. She puts his hand on her chest.²¹¹

You feel it; my heart beat? If I was a figment of your imagination, I would probably let your hand linger on my chest. However, I gotta go.

Her control over herself and her choices make her real, at least according to her own logic.

The concept of virtual artificial intelligences who can be controlled as slaves could raise important ethical issues, as have been done in *Blade Runner* (Scott, 1982). But besides the discussed scene in *eXistenZ*, the analyzed movies generally do not attempt any such ideological discussion. It is as if the movie makers' primary concern has been to play with the concept of virtuality, to explore its nature, and not its problems. More chilling and fraught with ethical issues is Baxter's description of artificial virtual children from his short story *The Siege of Earth*.

And Virtual kids actually had advantages. You could back them up, rerun favorite moments. You could even wipe them clean if you really made a hash of raising them, though sentience laws discouraged this.

As the quote reveals, the concept of a virtual artificial intelligences under total control does not have to invoke connotations of prostitution and sexuality. It can also be depicted as a human parent's total control over a virtual child.

One common logic seems to be that since virtual artificial intelligences are simulated, their existence is not worth anything even though they appear to exhibit

²⁰⁹ Svante Lovén (2001) have pointed out that the novel *City of the Living Dead* by Laurence Manning and Fletcher Pratt already in 1930 described a simulated environment where the events are pre-determined and a machine provide the nerve impulses that convince the user that she is making the decisions.

²¹⁰ At 59:14, 54:49, and 21:37 respectively. I believe *sex slave* is more appropriate than *prostitutes* since these virtual characters do not appear to have a choice at all. They do not sell their sexual services. They offer them because they are programmed to.

²¹¹ Episode 1 at 19:20.

sentience. This [lack of sentient value] is mentioned in *Avalon*, *eXistenZ*, *Life on Mars*, *eXistenZ*, *The Thirteenth Floor*, and *Vanilla Sky/ Abre los ojos*, always via dialogue as exemplified by the following quotes.²¹²

Annie Cartwright: “What do you care; I am not real. As soon as I walk out that door, poof, I’m gone. Here I go; ready, steady.”

Sam Tyler: “You’re just some dog crawl out of some dark pit in the back of my mind.”

Abre los ojos visualizes the lack of sentient value in a dramatic scene where the human character repeatedly fires gun shots into an unconscious police officer,²¹³ and the American remake, *Vanilla Sky*, has the following dialogue emphasizing the value-less virtual character McCabe.

Support Technician: “Don’t feel bad for him Dave, this whining man is your creation. It’s in his nature to fight for his existence. But he is not real.”

McCabe: “I’m real. I have two daughters, you know that.”

Support Technician: “What are their names?”

McCabe: “Ehh... I’m real.”

Using dialogue in this way to signify a virtual character’s status as an artificial sentience is a fruitful approach. I used it in my own production *Astronaut* when I wrote the dialogue for the artificial intelligence Ejahja. In Ejahja’s dialogue with the human character, Scott, I gave her a quite high status as a sentient being, the point being that her destruction would be a sad moment. Nevertheless one of the points was that she is forced into destruction since her existence is less valuable than the human astronaut of the story.

Lacking value as an artificial sentience also logically leads to anonymity, as exemplified by the dialogue from *Vanilla Sky* above. Since McCabe and his daughters are presumably not real, he can’t even remember their names. Generally, anonymous and vegetative virtual characters have been used frequently in the studied narratives, a super-sign that I call the [zombie crowd]. This is a crowd where the virtual characters behave as if no one controls them, at all. They do not even exercise control over themselves. They are apparently ready for *becoming controlled*. One prominent example comes from *The Matrix* where human characters Neo and Morpheus enter a training program depicted as a busy city street, and Neo repeatedly bumps into the people of the crowd because they do not react to his presence.²¹⁴ In *eXistenZ*, there are individual virtual characters behaving in a vegetative and zombie-like fashion. The following dialogue comments on a virtual character stuck in a repetitive cycle of meditative motions:²¹⁵

²¹² From *Life on Mars* episode one at 27:28 and 35:00 respectively.

²¹³ At 01:40:15.

²¹⁴ At 54:20.

²¹⁵ At 12:28.

He's gone into a game mode, he won't come out of it until you give him a proper line of game dialogue.

An example from my own work is once again Ejahja, discussed on page 180. One of the signs of her virtuality that was scripted but wasn't realized was a zombie like behavior. On July 24th, 2003 I wrote the following directions to Rick Dunbar:

Ejahja starts out with her usual neutral, half zoomie like drone when trying to get Scott to talk, but then suddenly allocate more processing power (other displays shutting down etc.) and suddenly she is much more alive, emotional, almost as a real person, just to try to get across to Scott. I think I will change the image quality also, going from a stylized image of Ejahja (I will filter the Grace footage) to an almost non-filtered version.

The quote reveals that I quite intentionally connected her virtuality to game characters and simulations. My rationale for the transformations was re-allocation of simulation resources. The detached voice and behavior is similar to signs used in other movies, for example, the female artificial intelligence in *Johnny Mnemonic* and the Red Queen in *Resident Evil*.

These mindless behaviors also correspond to real-life virtual characters in computer games and virtual worlds. Due to programming limitations, the Non-Player Characters of real-life computer games are not at all smart or sentient; game soldiers walk straight into the player's fire and avatars in *Second Life* blink and look around in an obviously mindless manner.

In the Matrix franchise, the malevolent artificial intelligences called Agents have the power to take over any character in the virtual world. The possession has a strong visual representation, once again making the Matrix franchise stand out from the other studied narratives in how it depicts abstract concepts in a highly visual manner. When Agent Smith infests another character the process starts with him slamming his hand into the body of the other character. An oozing of black creeps out from his hand, and envelops the other. The black ooze then withdraws and reveals a perfect copy of Agent Smith himself. The event is a virus attack; one artificial intelligence hacks the programming code of another artificial intelligence, overwriting part of the code with his code. Thus, the black ooze of the scene is actually a visual representation of computer code.²¹⁶

As with so many other signs of virtuality, the sign of [characters infesting others] was applied already in the original *Tron* movie, almost thirty years ago. During the climactic fight between protagonist Tron and antagonist Sark, the latter is given new life force and giant size from the tyrant MCP, explained in the MCP dialogue line:²¹⁷

“All my functions are now yours.”

²¹⁶ The effect is first seen in *The Matrix Reloaded* at 31:51.

²¹⁷ At 01:21:12.

A similar line of dialogue in *The Matrix Reloaded* comment on the merging of Agent Smith and Neo, the two opponents of the plot.²¹⁸

Agent Smith: “Perhaps some part of you imprinted onto me, something overwritten or copied.”

In the first movie of the trilogy, *The Matrix*, Neo overcomes Agent Smith by apparently diving into him and tearing him apart from within. In the sequel, *The Matrix Reloaded*, Agent Smith reappears, with new capabilities. He, a virtual artificial intelligence, has mutated into a spreading virus. The rationale is that the computer code of Agent Smith has merged with Neo’s code. But, how can Neo, a human jacking-in to the virtual world, have a code? Regardless of the explanation, the merging of human code and artificial code evokes the concept of Neo as a cyborg made up of both his physical body and his virtual, coded corpus. This cyborg man merges with the artificial Agent Smith. This mimics the merging of female and male DNA taking place at the conception of a child. DNA is after all a natural, biological code defining the physical human, similar to how computer code defines a digital artifact. And all code can be rewritten, as stated by Donna Haraway (1991) in her *Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century*. Access to your own code, cultural or genetic, gives both the risk of “a grid of control on the planet” and the promise of a utopian society where “people are not afraid of their joint kinship with animals and machines, not afraid of permanently partial identities and contradictory standpoints” (p.154). We are all controlled via code, either by others or by ourselves.

²¹⁸ At 49:18.

END OF LINE

The design of cyberspace is, after all, the design of another life-world, a parallel universe, offering the intoxicating prospect of actually fulfilling – with a technology very nearly achieved – a dream thousands of years old: the dream of transcending the physical world, fully alive, at will, to dwell in some Beyond-to be empowered or enlightened there, alone or with others, and to return.

Michael Benedikt's claim in *Cyberspace: First Steps* (1991, p.131) now comes back, haunting us with its absurd techno-evangelism. The virtual is not a separate universe, and going there does not mean leaving the physical behind. On the contrary, the virtual seem to merge with, intertwine with and bleed into the actual.

At the start of my study I asked how is virtuality represented in fiction, and what that says about our anticipations and fears related to what the virtual is and will be? The poetics I have presented is one answer to that question, and I will now summarize these results. While my poetics of virtuality has been primarily descriptive, I will now take a more normative stance, reflecting on the dream of virtuality and how it relates to real-life technological and cultural development.

Combining autoethnography and film studies

As described in the method sections, I have combined, and triangulated, a set of research methods that quite seldom are used together. I have used autoethnography to study my own media productions, together with extensive analyses of professionally produced narrative texts, primarily science fiction literature and feature films. Combining methods in this manner has had the advantage of giving different viewpoints and different empirical material, and has been highly fruitful. I set out to write a poetics, exploring the theory and practice of signifying virtuality in fiction; autoethnography and film studies gave extensive insights in both the process and the product. My analysis of fictional representations of virtuality gave insights into our dreams and fears concerning virtuality, and the analysis of production circumstances gave insights that supported my reflections on the observed signs of virtuality.

However, two issues with the chosen combination of research methods is that it is a quite time-consuming approach, and it generates not only observations and insights that relate to the question of a poetics of the virtual. Concerning the latter, there has been quite extensive results which were outside the scope of this study. This now lies ready for forthcoming analysis and dissemination elsewhere. It could even be that the chosen combination of research methods generates too many results; the risk is that there will never be time to write it up and disseminate all results properly. Autoethnographic studies of movie production culture are in themselves a research method that is highly time consuming. The result is that quite small amounts of time is actually dedicated to observations of actual design processes at work, compared to all other production work involved. It is also highly time-consuming to achieve access to actual productions. Therefore, I do not recommend it if the sole purpose is to study media productions. In my case though, it was a matter of combining these research studies with my own professional

development as a computer graphic artist, and a matter of achieving synergy effects related to my teaching at the university (such as establishing industry contacts and gaining skills and insights that fed into my teaching practice). Another synergy effect was the agenda of popularizing the scientific content most of my media productions had, thus the projects had a meaning in themselves. And, for a practitioner as myself, there is a high satisfaction in itself to *make stuff*. The bottom line is that autoethnographic observations of movie productions makes sense as a piggyback research, but not as a stand-alone research effort with only a single intention. Combining media production practice and research is worth the time if you already are a practitioner and are working with media productions.

Then there is the issue of differences between the study of my own productions and the analysis of the work of others. The autoethnographic part of the study gave an insider view on semi-professional, small-scale productions. The analysis of movies and literary works gave an outsider view on professional and often large-scale productions. Concerning the results from these different studies, there were quite a number of design issues and text production cases where the scale and professionalism of the production did not matter so much, and common results could be found. The utilization of, for example color, transparency or dialogue is not dependent on a complex production apparatus, and therefore such cases became relevant in both of the research approaches.

A problem though with some of the media productions was that they became peripheral to a study of virtuality. For example, the work I did in the *Via Tecta* production – visualizing levels of uncertainty – is not directly related to representation of virtuality; instead it gave indirect results that are only partially relevant for a poetics of virtuality. This relates again to the issue of autoethnographic research being time consuming, and potentially not worth the time. Since autoethnographic studies of media productions often involve collaborations with external partners and clients, the researcher engages in a dynamic and changing real-life field environment where years can be spent on accessing the setting and starting up a collaboration project. There is also the risk of seeing the project evolve to a stage where the initial research agenda cannot be explored. Autoethnographic studies of media productions should therefore be regarded as opportunistic and explorative research; the researcher should be prepared to analyze and disseminate other findings than the ones that were initially sought after.

Technology and science fiction – crossbreeding fiction and real-life

I have studied fiction, especially science fiction narratives, in order to understand more about our dreams and fears concerning real-life technology. When juxtaposing these two domains – real-life technology and science fiction – there is a risk of being allured by the ideas that science fiction on the one hand predicts the future, and, on the other hand, inspires technology developers. However, the first claim is a misunderstanding of most science fiction narratives, and the other claim, even though partly correct, is highly complex and it is outside the scope of my

study to suggest or try to prove direct influences between technology and science fiction. What I have had the intention of juxtaposing, however, is our fear and dreams about fictional technology and real-life technology.

Connecting fictional and real-life technology

Storytellers that connect the fictional virtualities in movies and literature to real-life virtuality tend to look in multiple directions for inspiration: backwards and sideways.

As illustrated by the study of both professional productions and my own productions, storytellers look backward at old technology, infesting the representations of virtuality with the faulty technology of semiotic inertia: monochrome colors, pixelation, flickering, buzzing electricity. These examples of semiotic inertia can be explained as an attempt to be clear towards the audience; the green tint of *The Matrix* and the pixelation in *Tron Legacy* is unmistakable. But these design choices can also be interpreted as maturity towards technology; cyberpunk stories such as *Blade Runner* and *Neuromancer* emphasize that old and new technology co-exist and engage in remediation with each other. This mature vision of technology stands in contrast to earlier visions of the future such as the ones in the Star Trek franchise and *Things to Come* (Menzies, 1936) where the future was depicted as homogeneously new, shiny and white.

Storytellers also look sideways at existing technology. The semiotic inertia of old display technology and the Cartesian tool kit is not only nostalgia, it is also a way to ground fictional virtuality in real-life technology that is familiar to storytellers and audience alike. The hologram in popular culture is a striking example of remediation; the hologram is strongly fashioned on the aesthetics of the TV screen and the even older Pepper's ghost projection.

Through the years, fictional virtuality has at least partly gone hand-in-hand with the development of real-life computer graphics and virtual reality technology. The appearance of computer gloves, head-mounted displays, and gestural interfaces, to name a few, in movies, has been in step with what has been at the forefront in research labs. Both William Gibson and Steven Lisberger were inspired by arcade games when creating *Neuromancer* and *Tron*, respectively. The appearance of the fictional virtualities has to some extent been driven by production technology, because the tools to create the visual effects of these movies have been similar to the tools that are used to build real-life virtual worlds. The examples show a trend towards more and more advanced graphics, both in fiction and real-life. The first *Tron* movie had a blocky monochrome virtual city. *Johnny Mnemonic*, more than ten years later, showed complex shapes and textures. Fifteen years after that, the makers of *Tron Legacy* used photoreal rendering and complex fluid dynamics simulations to create their semi-physical, semi-material virtual city.

Science fiction is not free

I chose to study virtuality in fiction – and not real-life virtuality – because the seemingly unconstrained capabilities of designing fictional virtuality could reflect how we think about virtuality. This was a successful approach; there are substantial

and relevant differences between fictional and real-life virtuality. But, it is also clear that the representation of fictional virtuality is not free and unconstrained. Instead, it is enmeshed in a web of production circumstances and storytelling requirements, and this has been especially clear when juxtaposing the study of my own semi-professional productions and my analysis of professional productions. A fictional text is not a freestanding reflection of our society and our attitudes and beliefs, with the luxury of expressing any commentary on the human condition. Instead, it is constrained and supported by a set of highly different influences. There are narrative and aesthetic demands. Often the storyteller strives for a plot that is dramatic, easy to understand and emotionally engaging. This fuels a tendency to emphasize conflict and spectacle. Consider themes such as breaking out of a virtual world, actions such as superhuman fights, and events such as the liquid, glowing death of virtual characters. Are these signs of virtuality which reflect our thoughts about the virtual? Or, are they purely a means of creating an engaging story? The answer cannot be generalized or simplified, and any interpretation of fictional virtuality needs to be highly aware of these influences from media production circumstances. Mundane and practical issues such as the efficiency of choosing and applying different signs of virtuality should not be overlooked either; the high frequency of easy to create signs – such as color tint and pixelation – suggests that the need for streamlined production affects representations of fictional virtualities. We should be careful in assigning too much meaning into easy to produce representamina such as color, semi-transparency, and dialogue.

Storytellers have a troubling dichotomy in their work. Storytellers search for the new: new stories, new ways to tell stories, new fictional worlds. At the same time they are quite conservative, illustrated by the tendency to signify virtuality in the same way in text after text. This is most obvious when it comes to signs referencing old display technology (the flickering of the TV screen), and in how volumetric displays are represented (essentially a TV screen floating in thin air). This carefulness is driven by the urge to stay with the audience, to make the audience understand. There is a constant balance between surprising the audience and not losing the audience. With this viewpoint, it is obvious why the *Star Wars* hologram gained such impact. It's a perfect blend of the familiar and the spectacular; *a TV screen that floats in the air*. Another reason for this conservatism, this semiotic inertia, is not related to the audience but to the storyteller, and her tendency to use familiar expressions. This is an illustration of the shamanism that Roland Barthes (1977) writes about, that the writer repeats utterances that already exists our culture, and this constrains fiction into being quite conservative.

Foreclosing the future

In my introduction to this poetics of virtuality, I wrote that I saw a need to study “careless thoughts” concerning the virtual, because of the risk to “become entrapped” in “haphazard, accidental” (Lanier, 2010, p.22) designs. The future, or rather our technological and social development of our future, runs the risk of being “foreclosed” (Watts, 2006, p.35) too soon. What careless thoughts do we have about the virtual, as expressed in fiction?

The Princess Leia hologram and Stephen Baxter's Virtuals

Even though many of the fictional representations of virtuality fail to acknowledge the real-life spreading of the virtual into the actual, there is, however, one theme in fiction that expounds on this: the volumetric displays, popularized by the Princess Leia hologram from *Star Wars*. Stephen Baxter and others have expounded this trope, and Baxter use the terminology *Virtuals* for one specific kind of volumetric display; intelligent virtual agents displayed in mid-air. This vision is partly plausible, and partly problematic. What matches real-life technology and products is the spreading of the virtual into our everyday surroundings, breaking out from the already obsolete box-with-a-window computers at our desks. The possibility to project virtual objects as well as intelligent virtual agents in mid-air, seems inviting and useful. The issue is how the projection would be technically possible. What is hinted at in fictional stories is some kind of projection device. There is real-life development of volumetric displays, projecting glowing patterns in mid-air. But, these are still very crude, and it is highly uncertain if it ever will be technically possible to project a true mid-air volumetric display with high visual fidelity. We might be required to create volumetric display by means of augmented reality, and then we arrive at the question of how to feed these illusions into our eyes or the brain. So, in order to enjoy Stephen Baxter's *Virtuals*, we would have to either penetrate our skull with technology, or have augmented reality glasses hanging in our face. Are consumers ready to pay for expensive augmented reality displays, and hang them on their face? We accepted the displays on our desk, in our lap, and in our palm. *Will we accept them on our face?*

Movie makers promised us cute princesses floating in air, but did not say anything about technology pushing against our face and head.

Signs of the contrary

Images use a visual language, a code. This means there is a visual vocabulary, where specific signs represent specific things. A vocabulary means that the signs can be chosen, as Umberto Eco (1976) writes, “among a repertoire of established types” (p.152). Eco suggests that an important difference between written and visual language is that in written language, vocabulary is highly established and that using it is a matter of selecting existing signs, while in visual language the signs need to be created. This means extra work and it also means that the amount of visual signs “are not foreseeable” (ibid., p.214).

My study partly supports Eco, and partly contradicts his claims. I contradict the idea that using a visual language is inherently a matter of constructing visuals freely and laboriously. Instead, it is to a large extent a matter of choosing from a repertoire. The repertoire for representation of virtuality is described in the poetics of virtuality I have presented. Eco exemplifies image production with the drawing a dog, and in that example there is apparently endless variety in how the shape of the dog can be drawn: from which angle, in which pose, and how the hair of the dog can be drawn, and so on. But instead of considering an artist with pen and paper, consider an artist working with computer graphics. Such an artist surely decides on shapes as well as the pen-drawing artist, but the work of the computer artist is to a

large extent a matter of choosing from a repertoire: *choosing* an amount of color saturation, *choosing* a mathematical, procedural code to generate hair, *choosing* a certain level of specularity in the dog's eyes, and so on. This is a general aspect of image creation (even when doing a freehand drawing you can for example choose to represent a sun as a circle with radiating rays, an already existing sign for the sun). It is also a rather specific aspect of digital image creation, and it is an even more specific aspect of representation of virtuality. The latter is true because so many of the signs that represent virtuality are signs that are possible to choose from a repertoire – such as desaturation, color tint, flickering, and so on. My comparison between semi-professional and professional productions show that a large portion of the repertoire is technically and creatively simple to apply. Adjusting color tint or desaturation was as easy for me as for a professional movie maker. The difference between semi-professional and high-end productions was noticeable in complexity; large-scale productions such as the *Matrix* franchise and the *Life on Mars* TV series were highly intricate compared to for example my own productions *Astronaut* and *Environmental Science Investigation*.

Considering “the thousand” and “not foreseeable” (Eco, 1976, p.214) ways to utter something visually, Eco is supported by my study. The diversity and multitude of ways to signify virtuality give the impression that anything could signify virtuality, and that movie makers and storytellers are apparently free to construct any kind of sign for representations of virtuality. The explanation to this apparent creative freedom of choice lies in our conceptual understanding of the virtual as being *opposed to* the actual. Since we envision virtuality as being something-else-than-reality, almost any sign can be used to signify virtuality, given a context where the sign is turned against the actual. Green color tint can signify virtuality, because the actual world is not green tinted. The 1920s can signify virtuality, because the actual world is not the 1920s. Super-human agility can signify virtuality, because in the actual world we cannot dodge bullets. Virtuality thus becomes the *extraordinary*.

Tell, don't show

When interacting with a computer, a huge part of the communication from the computer to the user is visual, going via the *graphical* interface. One of the most common cliché advices for movie makers is the mantra to *show, don't tell*. When I approached this research on virtuality in fiction, one of my anticipations was that the visual would be very important: how the virtual world *looks*. When William Gibson wrote *Neuromancer* and established his concept of cyberspace, he envisioned a three-dimensional, *spatial* virtual world.

With the wisdom of hindsight, it seems as if both Gibson and myself got it wrong. Gibson's vision of a three-dimensional cyberspace was replaced by the flat, two-dimensional real-life World Wide Web. The fictional virtualities I have studied are indeed very visual – characterized as they are by color tint, glows, abstract shapes and so on – but they are dominated by dialogue and events as well. The virtual is to a high degree *told*. Action, narrative, and content seem to be as important as look, style, and surface. The importance of narrative connects closely to the importance of conflict and struggle, fundamental aspects of the plot. Real-

life virtualities – online computer game worlds – are also governed by narrative. Virtual worlds such as *Grand Theft Auto* and *World of Warcraft* are dominated by stunning characters and plots with willful schemes. When players inhabit and play these worlds, stories emerge. The splendid visual representation of these worlds seems to have one major purpose and that is to be astoundingly realistic. These worlds are often portrayed as nostalgic pre-digital, ten-minutes-back-in-time American cities, or as pastoral medieval fantasies. The production design in these worlds are not the exciting exploration of a new aesthetic promised by the early computer artists.

The conclusion is that the virtual is both existence and representation, and it is both visualized and told.

Hopeless dreams and misguided fears

Storytellers also look forward, of course, since most of these narratives about virtualities are science fiction, and thus they are stories about a more technically advanced future.²¹⁹ Here we must remember that science fiction is not necessarily concerned with predicting the future; science fiction is about revealing what we fear and hope will come. These fears and hopes are often far-fetched fantasies, but nevertheless they influence our thinking. We must also remember that storytellers often tell about imaginary technology not because we want the technology, or need it, or fear it, but because it makes a good story. The risk is not storytellers being wrong; the risk is that real-life technology is advocated with rhetoric arguments that tap into these dreams. With this in mind, what is it that storytellers anticipate and fantasize about? What dreams are we sold?

The revolt of the virtual artificial intelligences

One common science fiction narrative involves the conflict with our (sentient) creation. This seems to be a deep anxiety since it is a very common theme in science fiction; it occurs over and over again in well-known science fiction stories, for example, *Frankenstein*; or, *The Modern Prometheus*, *2001: A Space Odyssey*, *Blade Runner*, *The Terminator*, *The Matrix*, and *Tron*. A war with the robots is of course an efficient way to create dramatic and spectacular conflict, but is there a deeper philosophical anxiety inspiring the popularity of these stories? Do we actually fear the possibility of our creations will turning against us? Considering real-life technology, we can safely conclude that the villainous artificial intelligence and/or robot is far away into the future. It might be that the AI-running-amok is a metaphor for a more general anxiety about losing control over and not managing technology.

A more mundane fantasy about these artificial intelligences is that they will populate the virtual worlds we build for them. In *The Matrix*, *Tron*, *The Thirteenth Floor* and other stories, the virtual worlds are filled with crowds of *programs*, of more or less sentient, artificial intelligences. The anticipation of sentient, emotionally complex artificial intelligences is a huge assumption. It is highly uncertain if that

²¹⁹ Not that science fiction always is about advanced technology or the future, but it so often is.

level of technology will ever be possible. Interestingly, these artificial intelligences are portrayed as rather banal. They are often portrayed as pitiful lesser copies of ourselves. There are visions of god-like super minds, but they are few and mostly confined to literature. The notion of an artificial intelligence that behaves like an emotionally forsaken child or a romantic teenager (as Clu in *Tron Legacy* and Yori in *Tron*) might be proven as silly as the things we smile at today, such as the horse wagon with a car engine or the canon shooting spacecrafts to the Moon. Or, these lesser artificial intelligences might not be so farfetched. We actually might construct artificial intelligences that are caricatured versions of ourselves, for amusement purposes. The Non-Player Characters of games such as *Grand Theft Auto* and *The Sims* are essentially examples of this. After all, these and other games are populated by (very) simple artificial intelligences already, and they are quite silly and pitiful.

The artificial intelligences of science fiction are to a large extent a plot device. They are there because it is the perfect way to embody technology. Artificial intelligence gives technology a voice, a face. It turns mindless technology into movie villains. The real danger with technology might be car crashes and carbon emitting engines. But from a storyteller viewpoint, the calm voice of HAL 9000 saying “I am sorry Dave, I am afraid I can’t do that” or the emotionless Terminator saying, “I will be back” is so much more cinematic.²²⁰

The perfect simulation and the complete immersion

Another thing that seems to be taken for granted in fictions such as *The Matrix* and *eXistenZ*, and that seems to be under way in real-life games when looking at games such as *Grand Theft Auto*, is the completely realistic, perfect simulation of a believable, complex world. Real-time rendering of photorealistic virtual environments are not a possibility yet, but much progress is being made. Pre-rendered computer graphics are already there, thanks to huge render farms and skilled artists, as proven by movies such as *Dawn of the Planet of the Apes* by Matt Reeves, featuring what might be the most convincing 3d-animated, computer graphics characters so far. The gap in photorealism between pre-rendered and real-time graphics is closing quickly. However, perfect simulations and completely realistic virtual worlds are not only about visual fidelity. If total immersion and presence is the goal, there are huge obstacles on that path. The majority of gamers still use computer screens and simple game console controllers. The usage of head-mounted displays – a technology that started being developed in the late 1960s – is only now on the verge of entering the consumer market. Tactile displays have also been in development for decades, but so far they are highly limited niche products. The problem of achieving advanced tactile feedback seems unsolvable due to quite simple practical, geometrical and physical circumstances. The problem is how to feed sensory stimuli into the human body.

Storytellers – as well as researchers – fantasize about feeding sensory directly into the brain, circumnavigating the messy, complex system of muscles and nerves that our body is full of. This seems fine in fiction. In *The Matrix*, it seems so easy to

²²⁰ In *2001: A Space Odyssey* (Kubrick, 1968) and *The Terminator* (Cameron, 1984).

just slide that neural interface probe into your brain and dive into a perfect simulation. But in real-life, even though neural interfaces are being developed, this technology is still in its infancy. No one knows if it will be practically possible to stimulate enough points in the brain that would be needed to create a perfect sensory feed of another world, nor how to find all those points, nor whether the average consumer would ever be willing to undergo brain surgery just to play games or what ever we would do in a perfect immersive simulation.

Another issue with the fantasy about an immersive perfect simulation is that it contradicts the real-life development that we see right now with the virtual breaking the screen and saturating the actual world with its ubiquitous, augmented reality presence. So, on one hand we have the idea of the virtual being another, fully rendered world, a world we transcend into, leaving our bodies behind. The gateway into this virtuality goes via direct stimulation of the brain, at least in fictional narratives. This view pervades many of the film narratives I have investigated, and it was also called upon by the cyber evangelists of the late 1980's and early 1990s. On the other hand, we have the idea of the virtual spreading like a layer on top of the actual. This shows a deep dichotomy between fictional representations of virtuality and real-life virtuality technologies.

A post-physical existence

A recurrent theme concerning virtuality is the idea of transcending into the virtual, and the virtual being another world, another, post-physical existence. This transcendence has on one end of a spectrum been heralded as an evangelic heaven for digital souls, and on the other end of the same spectrum it has been dramatized as a prison for our minds. The lesson that cyberpunk narratives try to teach is that real-life usually falls somewhere between utopia and dystopia. The real-life development of augmented reality now reconceptualize the virtual from being another world to being a layer supplementing the actual. The idea of transcending to the virtual is revealed as a modern variant of older myths: for example, the frontier myth of North America, and the Heavenly City myth of Christianity.

The virtual as a lesser copy

Fictional virtualities are portrayed as having a value only in relation to the actual, encouraging the idea of the actual as a yardstick to benchmark against. The virtual environments are then either lesser copies – reductions – or exciting enhancements. This reduction relates to the roots virtuality has in the ancient history of illusion technologies. The reduction is often related to the appearances of the virtual, and to the status of the virtual as a constructed artifact. It is characterized by artificiality; the virtual does not look as real or natural as the actual.

Concerning the reduction of appearances, it is rather unfortunate that the virtual is still conceived as a lesser copy, as not being real at all. The sooner we accept that the virtual is *different*, and not *less*, the sooner we will accept it as being as important as the actual. The sooner the term IRL (In Real Life) falls out of grace, the better.

Grand Theft Auto is real life, gives real feelings, and involves real ethics.²²¹ The virtual can be interacted with and it can be inhabited, and the worldliness it gains from this makes it not actual, but real.

There are also enhancements in the virtual, often related to action and capabilities; in the virtual you can do superhuman deeds. Concerning the enhanced capabilities in the virtual, there is a similarity between science fiction and real-life. Real-life virtualities – from simple examples such as the Environmental Science Investigation virtual lab and ViaTecta visualization, to the huge virtual worlds of *Grand Theft Auto* and *World of Warcraft* – actually make you powerful. You can die and re-spawn, you can cast magic spells to kill dragons. The personal computer was originally conceptualized as an augmentation of the human mind, and this idealistic stance still echoes in fictional representations of virtuality. However, for better or for worse, real-life virtualities are extensively geared towards entertainment and amusement, and not primarily concerned with augmentation of mind, body and society.

Another example of how the virtual is measured against the actual is how virtual worlds are designed as nostalgic retrospectives. This is true for fictional virtualities; consider, for example, the five-minutes-into-the-past environments of *The Matrix* and *eXistenZ*, or the 1970s and 1920s of *Life on Mars* and *The Thirteenth Floor*. It is also true for real-life computer game worlds, where medieval fantasy worlds have been popular even since the first MUDs. Many virtual worlds – fictional and real-life alike – mimic the actual not due to necessity, but due to romantic convenience. Why should virtual architecture have roofs, when it does not rain in the virtual world? This question has been asked before, and there is still no obvious answer, besides a general nostalgia for the past and a demand for the virtual worlds to simulate actual worlds. Might this romantic convenience, this technological nostalgia, also be an echo from the origins of the personal computer, an origin with connection to counterculture and its off-the-grid, back-to-nature idealism.

There has been experimentation with true virtual architecture, a liquid architecture, constructed not as a nostalgic copy of physical architecture, but based on its own possibilities and principles. A successful example could be the computer sandbox game *Minecraft*. Granted, *Minecraft* has nostalgia (a frontier, mine digging, homesteading backstory of being left out in the wild and having to build yourself a house, a castle or even a city), but the appearance of the *Minecraft* virtual world embraces its virtuality (although with a nostalgic nod towards vintage pixel graphics).

Breaking out stories

If the virtual is a lesser copy, then of course you have to break out of it. If you need to break out but cannot, you have a conflict. If you have a conflict, you have a story. The virtual becomes a prison, a battleground. This idea, so deeply related to the need of good storytelling, pervades fictional narratives about the virtual; it

²²¹ But real-life is not the same as actual. Therefore, a murder in *Grand Theft Auto* involves real-life events and emotions to *some extent*, but not to the extent that it is reasonable to charge a *Grand Theft Auto* player with murder!

pervades *The Matrix*, *The Thirteenth Floor*, *Tron*, *Life on Mars*, *eXistenZ*, and others. We seem to fear being trapped by technology. Do we actually fear that, or is it just providing good storytelling? In real-life, the risk of ever being actually *trapped* in a virtual world seems very farfetched. Could fictional stories about the escape from the virtual be a metaphor for a feeling of being trapped by technology in general, of being trapped by the lure of the screen, in a way similar to how early twentieth century dystopias – for example Forster’s *The Machine Stops*, Huxley’s *Brave New World* and Bradbury’s *Fahrenheit 451* – alluded to being trapped by television. Ray Bradbury’s *The Veldt* actually is a bridge between narratives about being trapped by television and virtuality, respectively; it depicts the members of a family being seduced into a CAVE like virtual reality system, but it is also quite clearly a critique towards mass media and especially television. In the early 1980s, the cyberpunk sub-genre was characterized by a boredom with the nuclear apocalypse. The time has come to be equally bored with the fear of being trapped in the virtual.

Another metaphorical meaning of the breaking-out narrative could be the virtual breaking out into the actual, as dramatized in movies such as *The Lawnmower Man*, *The Thirteenth Floor*, *The Matrix*, *Tron Legacy* and *Virtuosity*. In these narratives, malevolent artificial intelligences attempt to embody themselves, transcending from the virtual to the actual world. In real-life, the virtual is now breaking out of its confinement – both technically (with numerous screens, augmented reality and ubiquitous computing) and in how it saturates more and more of our daily routines.

There is no escape

A potential problem with the fictional breaking-out narratives is that they promise that escape is possible, while in real-life, there is hardly any escape from technology. Many narratives about the danger of technology – such as *Fahrenheit 451* (Bradbury, 1953), *THX 1138* by George Lucas, and the theatrical release of *Blade Runner* – ends in similar fashion, with the protagonists leaving the city and technology behind, fleeing into the wild, the natural, the pastoral. The passage rite of entering or leaving the virtual worlds in fiction also promise that there is a clear line between what is actual and what is virtual. Yank out the neural brain jack, pull off the VR goggles, or rise from the bed or seat where you let your body rest while your mind entered the virtual world. Everything will be fine, and you will be free. Technology is *over there*, you are here.

In real-life, it is not that simple. The virtual is highly embedded in our society and our lives. We can turn away from smartphones and tablets, but they remain just an arm’s length away, soon to be raised again. Social media is constantly calling on our attention. We willingly allow Wikipedia, Google and other online services to become our externalized memory. Of course, we *can* leave the digital, even the city, behind, and some people do, but the technological society into which we are embedded is too comfortable to break free from. Stephen Baxter puts word on the ever-presence and inescapability of virtuality, when having one of his artificial intelligence Virtuals give the following warning in the short story *The Siege of Earth*.

We can come to you in the night. We can hide in walls, in your clothes, even in your body, human. You’ll never sleep again.

Things I would like to know more about

I have devoted eight years to the study that underlies this poetics of virtuality. Still, I am curious about a few things.

I would like to know how movie makers and writers reason about how they represent virtuality. Such an interview study would be yet another text to analyze, and such an analysis must consider the extent to which storytellers don't remember, make over-rational after constructions, and market themselves. It would give further details and validity to the study I have done.

I would like to know how the audience reacts to these stories about virtuality, a question investigated through an audience response study. Such a study would investigate what it is that many people react to and notice in these stories, and it would also explore what the audience takes with them from these movies. Such a study could tell us something about whether these stories actually influence our general cultural understanding of virtuality, or if it is primarily a reflection of existing cultural understanding.

I would like to know how volumetric displays, augmented reality and heads-up displays continue to evolve. How far will the development of this technology reach, and how will these different technologies overlap? Is my assumption correct, that volumetric displays will primarily be realized through the use of augmented reality?

And finally, I would like to know if the general consumer will accept the augmented reality displays that are in development. How physically close will we allow the display technology to come?

APPENDICES

Appendix 01: A primer to computer graphics imagery

Computer graphics and visual effects are important ingredients in the sign making process of film making, and especially so in the science fiction movies I have studied. Therefore, it is important to understand these tools and their underlying concepts.

To have a starting point, we can consider the general idea of manipulated indexicality in photography. When working with photographic images, we start with a profilmic scenery and end up with a photograph. Everything we do in the process of creating this photograph manipulates the final result.

It is common, at least in movie production, to talk about preproduction, shooting and postproduction. It is also common to think of different types of image manipulation as “belonging to” these different steps of movie production. For example, visual effects are usually thought of as being done in postproduction. However, visual effects work is often a part of the preproduction work process also, since you often plan and prepare visual effects in preproduction (Swartz, 2005). However, it is convenient to use the categorization of before, during and after the capturing of the image.

Introduction to image manipulation concepts

In movie productions, image manipulation is often referred to as [visual effects], abbreviated [vfx]. The term visual effects easily bring to mind large-scale, epic imagery such as in *The Lord of the Rings* or *The Matrix* movies. But visual effects can also be small and subtle, such as changing details in a cityscape or adding a fluttering butterfly. Visual effects can be summarized as being any kind of extensive change, addition or subtraction of content in the footage. The reason why I use the term [footage] instead of images or photographs is that visual effects usually refer specifically to moving imagery and not still photographs. The corresponding term for a still photograph would be [image editing], [re-touching] or just [image manipulation]. I also say that it is [content] that is manipulated, in order to stress that it is usually objects of different sorts – cars, dinosaurs, buildings – that are changed, added or subtracted. There is no sharply drawn line between visual effects and minor changes such as re-touching. Consider wire-removal for example, or replacing modern day street signs in footage for a period drama. Such changes could be called either visual effects or retouching. Re-touching could be defined with a re-phrasing of the visual effects definition: any kind of minor changes, addition or subtraction of content in the image. Note that I also changed to [image] since re-touching can be used in relation to still photographs as well. Actually, the term re-touching is not often used when it comes to moving imagery.

Minor changes to the image, such as wire-removal, sometimes fall under another category of work: [compositing]. Compositing is the work of combining two or more image sources into a final image. A typical example is adding an actor shot

against green screen into a new background, or adding computer graphics into a live action shot. However, successful compositing involves much more than just slapping images on top of each other. Often extensive work - adjustments to the multiple images – is needed to combine them into a believable single image.

The terms discussed above would not hold up as categories, since they are cutting the cake in different ways. Visual effects is a process that often starts in pre-production with planning and research work, continues during shooting with, for example, a green screen shot, and then is finalized in post-production using, for example, computer graphics and compositing. Compositing is a confined part of the work, but can also be seen as included in the general visual effects pipeline. To confuse the matter even more, the work that is done in compositing is often more than simply merging different images. Often re-touching is done during compositing, and compositing is not only a matter of simply adding a visual effect to a live action shot; the artist also has to do many changes to the imagery in order for the compositing to work. Compositing is where all the ingredients of a visual effect shot come together, and the visual effect is finalized.

Even though much of the preparatory work for a visual effects shot might be done in preproduction and during shooting, visual effects are deeply connected to post-production. In contrast, [special effects] are done during shooting. Examples of special effects are artificial rain effects, controlled explosions, or radio controlled animatronics (mechanical “puppets”). It is fake events or objects in front of the camera.

A form of image manipulation that is almost always done in movie is changing the colors of the image, usually quite subtly. A common term is [color grading], but [color timing] and [coloring] are also used frequently, as well as the short forms [grading] and [timing]. Color grading is the adjustment of the colors (hue, saturation, brightness and so on) of the image, in order to create the final look of the image (Svanberg, 2004; Swartz, 2005). Often the intention is to help create continuity in editing, and to make the images more aesthetically attractive, or more readable (the images might have been, for example, exposed too dark so the audience have difficulties seeing a face). Color grading is also an important part of visual storytelling.

Color grading is done in postproduction. But it is inseparable from the creative decisions made during preproduction and production. All the decisions that the cinematographer (director of photography) is responsible for – selecting to shoot on digital or on film, deciding on type of camera, type of film stock or digital camera settings, lenses, lens filters, lights, lighting set-up, and so on – have an impact on how colors are depicted in the captured images, and thus on the colors that will be adjusted in color grading.

Concepts in computer graphics

Computer-generated Imagery (CGI)

CGI [computer-generated images] is more specific than general CG (computer graphics), even though they are often used interchangeably. CGI often refers to

photorealistic, computer rendered images that are used in a movie. The concept of CGI is very closely related to 3d-animation, even though CGI refers to the general imagery, while 3d-animation is focused on the process of building and animating 3d-models which are then used to create the CGI. CGI can be more or less photoreal; in movies such as *Toy Story* from 1995, the images have a stylized, cartoony look, while CGI can be fully photorealistic when it is used to create visual effects. Sometimes the term all-CGI is used to indicate that a shot or even a whole movie was done solely with computer graphics, and this is often suggested as something good and impressive. It is often used in marketing interviews before the movie's release. It is important to note, though, that visual effects are normally done with a collection of techniques, very often combining special effects, physical models, 3d-models and CGI. And even though the image is directly created with the computer, it is very common that parts of the image actually originate from manual craftwork (such as painting textures in Photoshop) and from heavily retouched photographic material. Human artists almost always have a strong creative presence, steering, coaching and controlling the computer.

2d graphics (2D)

2d graphics is a (computer based) image, a visual representation, with two dimensions. There is a tendency to relate 2d and 3d graphics to CG and CGI. The term CG covers both 2d and 3d computer graphics, while CGI usually is related to 3d graphics only.

One problem with the term 2d graphics is that it is very broad; it can refer to the production of images, the images themselves, or their display. At the same time, some types of digital imagery such as digital photographs and digital video are usually not referred to as being 2d graphics, even though they per definition are 2d graphics.

3d graphics (3D)

The term 3d graphics is more elusive than 2d graphics. At first, it is a contradiction of terms. Images are always two-dimensional, whether they are prints, photocopies, oil on canvas or glowing dots on a computer screen. Even 3d graphics become two-dimensional eventually, at least when displayed, if not sooner.

The thing that is “three-dimensional” in 3d graphics are not really the images that are produced, but the production process of these images. When we talk about 3d graphics, we can, for example, mean images rendered from a 3d model. As an example, a virtual cube is defined in a mathematical space by the position of its corners, and if the computer software simulates a light and a viewpoint in this virtual space, then the computer software can calculate – render – how an image of this cube would look.

However, often the lines between 3d and 2d graphics blur. The 3d model can, for example, have a bump map, a two-dimensional image wrapped over its surface as a texture, controlling the rendering of highlights and shadows in order to simulate small-scale bumps, groves or any small-scale topography on the surface. Not all 3d-graphics are actually modeled in 3d space; a computer script executed by

the rendering software might provide algorithms for how hair or bird feathers covers a 3d model of an animal. These feathers do not “exist” as a 3d model; you can’t identify their xyz positions in the 3d space as you can with the cube. They only appear when rendered, and thus immediately become pixels in the rendered 2d graphics.

Note that in everyday language, stereoscopic imagery (a display method that use binocular vision to creates the illusion of depth in images) is often called “3d”. This is only partially related to the 3d graphics discussed here. What is called a “3d movie” in everyday language can be entirely shot as live footage, with no use of 3d graphics.

Virtual cinematography

Virtual cinematography is a very broad and elusive concept, very much so because it is quite new and used by different people in different meanings. The advantage with the term is that it is free from the often cumbersome and irrelevant division between 2d graphics and 3d graphics, or between pre- and postproduction. The concept of virtual cinematography recognizes that there is a *mélange* of digital techniques which can be put to use in order to create a movie. Virtual cinematography usually refers to advanced production methods, for example using 3d graphics to pre-visualize a shot, or complex blending of live action and computer graphics, or extensive use of virtual sets (digitally generated backgrounds). Virtual cinematography is a general term for shooting a movie with a virtual set and/or a virtual camera. In some movies, the intention is to create apparently photorealistic visual effects, hide the digital production methods, and persuade the audience that what they see is “real”. In other movies, this production process has been allowed to merge with the aesthetics of the movie, so that the audience experiences a world hovering on the boundary between what looks real and what looks artificial. The properties of the world are blurred with how it is presented (examples include *Sky Captain and the World of Tomorrow* as well as *Sin City*). Note that virtual cinematography and fictional representations of virtuality are fundamentally two different things. In some cases – most notably the Matrix franchise – the movie production methods of virtual cinematography are used to tell stories about virtualities. But, stories about virtualities can be told with very conventional production techniques, without digital visual effects or virtual cinematography.

Appendix 02: Examples of complete super-sign structures

The super-sign structures which signify virtuality are in some cases very complex and are difficult to grasp in a static figure. The mind map tool Mind42 was used to create interactive online representations. They are to be considered works-in-progress and illustrations of complexity, and not final models.

The Thirteenth Floor

<http://mind42.com/pub/mindmap?mid=c9dbea84-fbb1-4fae-8523-1dee570cd21f>

Avalon

<http://mind42.com/pub/mindmap?mid=455fa5d7-f78b-4cc3-a1ce-26e957efe3a5>

The Matrix

<http://mind42.com/pub/mindmap?mid=89f1e17a-b77b-4fc7-9c79-6615a0f3dc95>

Appendix 03: Additional publications

These are the additional publications from this study of fictional representations of virtuality, published elsewhere. Sorted by publication year.

Eriksson, T. (2015). The floating screen; a fictional device and its possible origin. Paper presented at the *27th Australian Conference on Human-Computer Interaction (OzCHI)*. Melbourne, Australia.

Eriksson, T. (2015). Fictional Volumetric Displays; plausibility and design choices. Paper presented at the *27th Australian Conference on Human-Computer Interaction (OzCHI)*. Melbourne, Australia.

Karlsson G., Eriksson T., Sunnerstam M., Axelsson M. (2013). Joint reasoning about gas solubility in water in virtual laboratory experiments. Paper presented at the *10th International Conference on Computer-Supported Collaborative Learning*, Madison, Wisconsin.

Eriksson, T. and J. Westin (2010). "Imaging the Sanctuary of Hercules Victor". *Archeomatica*(2). p. 58-62.

Eriksson T. (2010). "Being native – distance, closeness and doing auto/self-ethnography". *ArtMonitor*(8). p. 91-100.

Eriksson, T., M. Sunnerstam and G. Karlsson (2010). Environmental Science Investigation using a virtual lab. Paper presented at the *Engineering Education in Sustainable Development*, Göteborg, Sweden.

Eriksson T. (2010). A poetic of virtuality – inventing, spawning, establishing and stabilizing new visual signs through intertextuality. Paper presented at the *World Congress on Communication and Arts (WCCA)*, Guimarães, Portugal.

Eriksson T. (2010). Self- and auto-ethnography – a methodology for observing, analyzing and writing on the personal creative practice. Paper presented at the *World Congress on Communication and Arts (WCCA)*, Guimarães, Portugal.

BIBLIOGRAPHY

References

- Aarseth, E. (2007). "Doors and Perception: Fiction vs. Simulation in Games." *intermedialités* 9. p. 35-44.
- Adams, T. (2007). "Space to Think." *The Observer*. August 12th, 2007.
- Agre, P. (1998). Designing Genres for New Media: Social, Economic, and Political Contexts. *Cybersociety 2.0: Revisiting Computer-Mediated Communication and Community*. S. Jones. Thousand Oaks, SAGE Publications.
- AIST. (2006). *True 3D Display using Laser Plasma in the air*.
http://www.aist.go.jp/Portals/0/resource_images/aist_e/aist_today/2006_21/pdf/2006_21_p13.pdf.
- Allen, J. F., D. K. Byron, M. Dzikovska, G. Ferguson, L. Galescu and A. Stent (2001). "Toward Conversational Human-Computer Interaction." *AI Magazine* 22(4). p. 27-37.
- Alvesson, M. (1999). Methodology for close up studies : struggling with closeness and closure. *Working paper series / Institutet för ekonomisk forskning, Lunds universitet, 1999:4*. Lund,: 23 bl.
- Anderson, J., L. Rainie and M. Duggan (2014). *Digital Life in 2025*. Pew Research Center.
- Andersson, S. (1986). Hermeneutikens två traditioner - om skillnaden mellan Schleiermacher och Gadamer. *Kunskapens villkor*. S. Selander. Lund, Studentlitteratur.
- Andrew, D. (1984). *Concepts in Film Theory*, Oxford, Oxford University Press.
- Aristotle and S. H. Butcher (1961). *Poetics*. New York, Hill and Wang.
- Arnman, A. (2005). *Hellraiser Om Clive Barkers film*. Lund, Ellerströms förlag.
- Artaud, A. (1958). The Alchemical Theater. *The Theater and Its Double*. A. Artaud. New York, Grove Press.
- Atkinson, P. (1992). *Understanding Ethnographic Texts*. London, Sage.
- Atkinson, P. (1997). "Narrative turn or blind alley." *Qualitative Health Research* 7(3). p. 325-344.
- Atkinson, P. and M. Hammersley (1989). *Ethnography: principles in practice*. London, Routledge.
- Austin, A. (2001). "Frankie and Johnny: Shelley, Gibson, and Hollywood's Love Affair with the Cyborg." *Romanticism on the Net* 21.
<http://www.erudit.org/revue/ron/2001/v/n21/005958ar.html>
- Badmington, N. (2004). *Alien chic: Posthumanism and the other within*. London, Routledge.

- Bardzell, J., J. Bolter and J. Löwgren (2010). "Interaction Criticism: Three Readings of an Interaction Design, and What They Get Us." *Interactions* 17(2). p. 32-37.
- Barlow, J. P. (1996). *A Declaration of the Independence of Cyberspace*.
<https://projects.eff.org/~barlow/Declaration-Final.html>.
- Barsalou, L. (2008). "Grounded Cognition." *Annual Review of Psychology* 59(1). p. 617-645.
- Barthes, R. (1977). *Image Music Text*. London, FontanaPress.
- Barthes, R. (1981). *Camera lucida : reflections on photography*. New York, Hill and Wang.
- Barthes, R. (1999a). Rhetoric of the image. *Visual culture; the reader*. J. Evans and S. Hall. London, SAGE Publications Ltd.
- Barthes, R. (1999b). Myth today. *Visual culture; the reader*. J. Evans and S. Hall. London, SAGE Publications Ltd.
- Baudrillard, J. (1981). *Simulacra and Simulation*. Ann Arbor, University of Michigan Press
- Baudrillard, J. (1983). *Simulations*. New York, Semiotext(e).
- Baudrillard, J. (1990). *Seduction*. London, Macmillan.
- Baudrillard, J. (1993a). *Symbolic Exchange and Death*. London, Sage Publications.
- Baudrillard, J. (2002). *Screened Out*. London, Verso.
- Baudrillard, J. (2008). *Fatal Strategies*. New York, Semiotext(e).
- Baxter, S. (2012). *The Science of Avatar*. New York, Orbit.
- Baym, N. (1998). The Emergence of On-Line Community. *Cybersociety 2.0: Revisiting Computer-Mediated Communication and Community*. S. Jones. Thousand Oaks, SAGE Publications.
- Behar, R. (1996). *The Vulnerable Observer: Anthropology that Breaks Your Heart*. Boston, Beacon.
- Belkom, E. v. (1998). William Gibson Interview. *Northern Dreamers: Interviews with Famous Science Fiction, Fantasy and Horror Writers*. E. v. Belkom. Kingston, Quarry Press.
- Benedikt, M. (1991). *Cyberspace: First Steps*. Cambridge, Mass., The MIT Press.
- Bethke, B. (1997). *The Etymology of "Cyberpunk"*.
http://www.brucebethke.com/articles/re_cp.html.
- Bethke, B. (1998). *Foreword to Cyberpunk: a short story by Bruce Bethke*.
<http://www.infinityplus.co.uk/stories/cpunk.htm>.
- Bingham, N. (1999). Unthinkable complexity? Cyberspace otherwise. *Virtual Geographies - bodies, space and relations*. M. Crang, P. Crang and J. May. London,

Routledge.

Biocca, F. (1997). "The Cyborg's Dilemma: Progressive Embodiment within Virtual Environments." *Journal of Computer Mediated Communication* 3(2).
jcmc.indiana.edu/vol3/issue2/biocca2.html

Bjurbom, M. (2005). *Några råd till dig som skriver långfilmsmanus*. Trollhättan, Film i Väst.

Bochner, A. and C. Ellis (2000). Autoethnography, Personal Narrative, Reflexivity: Researcher as Subject. *Handbook of qualitative research*. N. Denzin and Y. Lincoln. Thousand Oaks, Sage.

Bochner, A. and C. Ellis (2006). Communication as autoethnography. *Communication as ... : Perspectives on theory*. G. Shepherd, J. S. John and T. Striphos. Thousand Oaks, CA, Sage.

Boda, D., L. Brohult, E. Mörner, T. Nilsson and R. Pixell (2009). "Uppkopplade prylar En rapport om Internets framtid och hur apparaterna går online." *SE:s Internetguide*. 19.

Bolter, J. D. (1984). *Turing's Man: Western Culture in the Computer Age*. London, Duckworth.

Bolter, J. D. (2000). Remediation and the Desire for Immediacy. *Convergence* 6(1). p. 62-71.

Bolter, J. D. and R. Grusin (2000). *Remediation Understanding New Media*. Cambridge, Mass., The MIT Press.

Boorstin, D. (1962). *The image: a guide to pseudo-events in America*. New York, Athenaeum.

Borer, M. I. (2002). The Cyborgian Self: Toward a Critical Social Theory of Cyberspace. *Reconstruction*.

Bordwell, D. (1985). *Narration in the Fiction Film*. London : Methuen.

Bordwell, D. (2006). *Historical Poetics of Cinema*.
https://archive.org/stream/Historical_Poetics_of_Cinema_d_Bordwell/Historical_Poetics_of_Cinema_d_Bordwell_djvu.txt

Bordwell, D. (2007). *Poetics of cinema* New York, Routledge.

Bordwell, D. and K. Thompson (2003). *Film Art: An Introduction*. New York, McGraw-Hill.

Borgmann, A. (2001). Information, Nearness, and Farness. *The Robot in the Garden: Telerobotics and Telepistemology in the Age of the Internet*. K. Goldberg. Cambridge, Mass., The MIT Press.

Boşnak, M. (2001). "The Nocturnal Future as Alienated Existence: Blade Runner." *Journal of Economic and Social Research* 3(2). p. 73-97.

- Bould, M. (2003). "What Kind of Monster Are You?, Situating the Boom?" *Science Fiction Studies* 30(3). p. 394-416.
- Brand, S. (1995). "We owe it all to the hippies." *TIME Magazine Domestic*. 145(12). http://members.aye.net/~hippie/hippie/special_.htm
- Brannick, T. and D. Coghlan (2014). "In Defense of Being "Native": The Case for Insider Academic Research." *Organizational Research Methods* 17(3). p. 59-74.
- Brannigan, M. (2002). *There Is No Spoon: A Buddhist Mirror. The matrix and philosophy : welcome to the desert of the real*. W. Irwin. Chicago, Open Court.
- Branzell, A. (1992). The searching picture. *The International Conference on Theories and Methods of Design*. Göteborg, Sweden.
- Bricken, M. (1991). "Virtual reality learning environments: potentials and challenges." *ACM SIGGRAPH Computer Graphics*. Computer Graphics 25, p. 178-184.
- Bring, S., R. McKenzie and D. Sutton. (2007). *The state of the real - aesthetics in the digital age*. London, I.B. Tauris.
- Broderick, D. (1995). *Reading by Starlight*. London, Routledge.
- Brooks, K. (2009). *There is Nothing Virtual About Immersion: Narrative Immersion for VR and Other Interfaces*. Motoral Labs/Human Interface Labs.
- Bruner, E. (1993). Introduction: the ethnographic self and the personal self. *Anthropology and Literature*. P. Benson. Urbana, University of Illinois Press.
- Bruno, G. (1987). "Ramble city: postmodernism and Blade Runner." *October* 41. p. 61-74.
- Bryant, A. and G. Pollock (2010). *Digital and other virtualities - renegotiating the image*. London, I. B. Tauris.
- Bryx, A. and G. Genosko (2004). "The Matrix Decoded: Le Nouvel Observateur Interview With Jean Baudrillard." *International Journal of Baudrillard Studies* 1(2). http://www2.ubishops.ca/ baudrillardstudies/vol1_2/genosko.htm
- Buchanan, R. (1989). Declaration by Design: Rhetorics, Argument, and Demonstration in Design Practice. *Design Discourse: History, Theory, Criticism*. V. Margolin. Chicago, University Of Chicago Press.
- Buckland, W. (2006). *Directed by Steven Spielberg: poetics of the contemporary blockbuster*. New York, Continuum,
- Bukatman, S. (1993). *Terminal Identity: The Virtual Subject in Postmodern Science Fiction*. Durham, Duke University Press.
- Bukatman, S. (1997). *Blade Runner*. London, British Film Institute.
- Burnett, R. M. (2002). *The Making of Tron*. (dvd) Buena Vista Home Entertainment.

- Butz, A, C. Endres and M. Schmitz (2008). A survey of human-computer interaction design in science fiction movies. Proceedings of the *2nd international conference on Intelligent Technologies for interactive entertainment*. Brussels, Belgium.
- Caldwell, J. T. (2008). *Production culture: industrial reflexivity and critical practice in film and television*. Durham, N.C., Duke University Press Books.
- Caldwell, J. T. (2009a). *Production Studies: Cultural Studies of Media Industries*. New York, T & F Books US.
- Caldwell, J. T. (2009b). *Audiovisuality in the Era of Digital Convergence*. (lecture) Copenhagen.
- Campanella, T. (2001). Eden by Wire: Webcameras and the Telepresent Landscape. *The Robot in the Garden: Telerobotics and Telepistemology in the Age of the Internet*. K. Goldberg. Cambridge, Mass., The MIT Press.
- Campbell, D. and D. Fiske (1959). "Convergent and discriminant validation by the multitrait-multimethod matrix." *Psychological Bulletin* 56. p. 81-105.
- Campbell, J. (1949). *The Hero with a Thousand Faces*. New York, Pantheon Books.
- Canny, J. and E. Paulas (2001). Tele-Embodiment and Shattered Presence: Reconstructing the Body for Online Interaction. *The Robot in the Garden: Telerobotics and Telepistemology in the Age of the Internet*. K. Goldberg. Cambridge, Mass., The MIT Press.
- Card, O. S. (1988). *Characters & Viewpoint*. Cincinnati, Writer's Digest Books.
- Carlshamre, S. (2005). På spanning efter berättelsen. Om narratologi, Propp och undersagans morfologi. *Berättarboxen*. M. Valentin. Göteborg, Fabel Förlag.
- Carlsson, S. (1999). *Interview with Dane Davis, Sound Designer, "The Matrix"*. <http://www.filmsound.org/editorsnet/matrix1.htm>.
- Carlsson, W. (2003). *A Critical History of Computer Graphics and Animation*. <https://design.osu.edu/carlson/history/lessons.html>.
- Carr, N. (2010). *The Shallows: What the Internet Is Doing to Our Brains*. New York, W. W. Norton & Company.
- Carravetta, P. (1998). The Reasons of the Code: Reading Eco's A Theory of Semiotics. *Cultural Semiosis: Tracing the Signifier*. H. Silverman. New York, Routledge.
- Castronova, E. (2007). *Exodus to the virtual world : how online fun is changing reality*. New York, Palgrave Macmillan.
- Chan, M. (2008). "Virtually Real and Really Virtual: Baudrillard's Procession of Simulacrum and The Matrix." *International Journal of Baudrillard Studies* 5(2). http://www2.ubishops.ca/baudrillardstudies/vol-5_2/v5-2-melanie-chan.html
- Charmaz, K. and R. Mitchell (1996). "The Myth of Silent Authorship: Self, Substance, and Style in Ethnographic Writing." *Symbolic Interaction* 19(4). p. 285-302.

- Chion, M. (1994). *Audio-Vision: Sound on Screen*. New York, Columbia University Press.
- Chung, H. J. (2012). "Media Heterotopia and Transnational Filmmaking: Mapping Realand Virtual Worlds." *Cinema Journal* 51(4). p. 87-109.
- Clarke, A. (1972). *The Lost Worlds of 2001*. London, Sidgwick and Jackson.
- Clark, A. (2003). *Natural-Born Cyborgs: Minds, Technologies, and the Future of Human Intelligence*. Oxford, Oxford University Press.
- Cleland, K. (2009). Intimate Encounters: the Mixed Reality Paradigm and Audience Responses. Proceedings of the *Digital Arts and Culture Conference*. Irvine, California.
- Clifford, J. (1986a). Introduction: Partial Truths. *Writing culture : the poetics and politics of ethnography : a School of American Research advanced seminar*. J. Clifford and G. Marcus. Berkeley, University of California Press.
- Clifford, J. (1986b). An Ethnographic Allegory. *Writing culture : the poetics and politics of ethnography : a School of American Research advanced seminar*. J. Clifford and G. Marcus. Berkeley, University of California Press.
- Clifford, J. and G. Marcus (1986). *Writing culture : the poetics and politics of ethnography : a School of American Research advanced seminar*. Berkeley, University of California Press.
- Clute, J. (1995). *Science Fiction the Illustrated Encyclopedia*. London, Dorling Kindersley.
- Coate, J. (1992). Cyberspace Innkeeping: Building Online Community. *Reinventing Technology, Rediscovering Community: Critical Explorations of Computing as a Social Practice*. P. Agre and D. Schuler. Greenwich, Conn., Ablex.
- Codognet, P. (2003). Artificial Natura and Natural Artifice. *The Cinematic Imagery after Film*. P. W. Jeffrey Shaw. Cambridge, Mass., The MIT Press.
- Cody, M. J., P. Wendt, D. Dunn, J. Pierson, J. Ott and L. Pratt (1997). Friendship formation and creating communities on the Internet: Reaching out to the senior population. Paper presented at the *Annual Meeting of the International Communication Association*. Montreal, Canada.
- Coffey, P. (1999). *The ethnographic self*. London, Sage.
- Cohen, A. P. (1994). *Self Consciousness: An Alternative Anthropology of Identity*. London, Routledge.
- Cole, S. (1992). Anthropological lives: the reflexive tradition in a social science. *Essays on Life Writing: From Genre to Critical Practice*. M. Kadar. Toronto, University of Toronto Press.
- Collins, K. (2005). Dead Channel Surfing: Cyberpunk and industrial music. *Popular Music* 24(2). p. 165-178.
- Constable, C. (2006). "Baudrillard reloaded: interrelating philosophy and film via The Matrix Trilogy." *Screen* 47(2). p. 233-249.

- Corrington, R. S. (1992). *Nature and Spirit: An Essay in Ecstatic Naturalism*. New York, Fordham University.
- Corrington, R. S. (2000). *A Semiotic Theory of Theology and Philosophy*. Cambridge, Cambridge University Press.
- Corso, J. (2014). What Does Greimas's Semiotic Square Really Do? *Mosaic* 47(1). p. 69-89.
- Crang, M., P. Crang and J. May (1999). *Virtual Geographies - bodies, space and relations*. London, Routledge.
- Creswell, J. (2003). A Framework for Design. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. J. Creswell. Thousand Oaks, SAGE Publications.
- Croghan, P. (2010). "Simulation, History and Experience in Avalon and Military-Entertainment Technoculture." *Digital Icons: Studies in Russian, Eurasian and Central European New Media* 4. p. 99-113.
- Csicsery-Ronay, I. (1992). "The sentimental futurist: Cybernetics and art in William Gibson's *Neuromancer*." *Critique* 33(3). p. 221-240.
- Csikszentmihalyi, M. (1997). *Finding flow - the psychology of engagement with everyday life*. Basic Books.
- Culkin, F. J. (1967). A Schoolman's Guide to Marshall McLuhan. *The Saturday Review* (March 18th, 1967). p. 51-53.
- Dahlkvist, J. (2010). *Babylon 5: Förändrade förväntningshorisonter. Möjliga världar: tekniken, vetenskapen och science fiction*. M. Godhe and J. Ramsten. Stockholm, Carlsson bokförlag.
- Damer, B., S. Gold and J. d. Bruin (1999). Steps toward Learning in Virtual World Cyberspace: TheU Virtual University and BOWorld. Proceedings of *The Fifteenth Twente Workshop of Language Technology*. Enschede, The Netherlands.
- Danet, B. (1998). *Text as Mask: Gender, Play, and Performance on the Internet. Cybersociety 2.0: Revisiting Computer-Mediated Communication and Community*. S. Jones. Thousand Oaks, SAGE Publications.
- Davis, E. (1998). *TechGnosis: Myth, Magic, and Mysticism in the Age of Information*. New York : Three River Press.
- Debord, G. (1967). *La Société du spectacle*. Paris, Buchet-Chastel.
- Deleuze, G. (1968). *Difference and Repetition*. New York, Columbia University Press.
- Deleuze, G. (1992). "Postscript on the Societies of Control." *October* 59. p. 3-7.
- Denzin, N. (1978). *The Research Act: A Theoretical Introduction to Sociological Methods*. New York, McGraw-Hill.
- Denzin, N. K. (1989). *Interpretive Biography*. Newbury Park, CA, Sage.

- Dery, M. (1996). *Escape Velocity: Cyberculture at the End of the Century*. New York, Grove Press.
- Dibbell, J. (1996). A Rape in Cyberspace; or How an Evil Clown, a Haitian Trickster Spirit, Two Wizards, and a Cast of Dozens Turned a Database into a Society. *High Noon on the Electronic Frontier: Conceptual Issues in Cyberspace*. P. Ludlow. Cambridge, Mass., The MIT Press.
- Dick, P. K. (1978). *How to Build a Universe That Doesn't Fall Apart Two Days Later*. http://deoxy.org/pkd_how2build.htm
- Diggle, A. (2014). William Gibson Interview. *Conversations with William Gibson*. P. Smith. Mississippi, University Press of Mississippi.
- Diggle, A. and I. Ball (2014). An Interview with William Gibson: Virtual Light Tour. *Conversations with William Gibson*. P. Smith. Mississippi, University Press of Mississippi.
- Dijk, J. v. (1997). The Reality of Virtual Communities. *Trends in Communication I*. J. Groebel. Amsterdam, Boom Publishers.
- Disch, T. (1998). *The dreams our stuff is made of*. New York, The Free Press.
- Djurcilov, S., K. Kim, P. F. J. Lermusiaux and A. Pang (2001). Volume rendering data with uncertainty information. *Data Visualization '01*. D. Ebert, J. Favre and R. Peikert. Berlin, Springer-Verlag.
- Doel, M. and D. Clarke (1999). Virtual worlds: simulation, suppletion, seduction and simulacra. *Virtual Geographies - bodies, space and relations*. M. Crang, P. Crang and J. May. London, Routledge.
- Doyle, D. (2009). Embodied Presence: The Imaginary in Virtual Worlds. Proceedings of the *Digital Arts and Culture Conference*. Irvine, California.
- Dreyfus, H. (2001). Telepistemology: Descartes's Last Stand. *The Robot in the Garden: Telerobotics and Telepistemology in the Age of the Internet*. K. Goldberg. Cambridge, Mass., The MIT Press.
- Duncan, J. (2010). "Legacy System." *Cinefex* 124. p. 28-57.
- Dyson, F. (1998). "Space", "Being," and other Fictions in the Domain of the Virtual. *The Virtual Dimension: Architecture, Representation, and Crash Culture*. J. Beckmann. New York, Princeton Architectural Press.
- Dyson, E., G. Gilder, George Keyworth and A. Toffler (1994). *Cyberspace and the American Dream: A Magna Carta for the Knowledge Age*. The Progress & Freedom Foundation. <http://www.pff.org/issues-pubs/futureinsights/fi1.2magnacarta.html>
- Eco, U. (1973). *Il costume di casa*. Milano, Bompiani.
- Eco, U. (1976). *A Theory of Semiotics*. Bloomington, Indiana U.P.
- Eco, U. (1982). Critique of the Image. *Thinking Photography*. V. Burgin. London,

Macmillian Publishers Ltd.

Eco, U. (1985). Articulations of the Cinematic Code. *Movies and Methods: volume 1*. B. Nichols. Berkeley, University of California Press.

Educause (2006). *7 things you should know about... Virtual Worlds*.
<http://www.educause.edu/library/resources/7-things-you-should-know-about-virtual-worlds>

Educause (2008). *7 things you should know about... Second Life*.
<http://www.educause.edu/library/resources/7-things-you-should-know-about-second-life>

Ehlschlaeger, C., A. Shortridge and M. Goodchild (1997). "Visualizing Spatial Data Uncertainty Using Animation." *Computers & Geosciences* 23(4). p. p. 387-395.

Ellis, C. (2004). *The Ethnographic I*. Walnut Creek, CA, AltaMira.

Ellis, C. (2007). "Telling Secrets, Revealing Lives Relational Ethics in Research With Intimate Others." *Qualitative Inquiry* 13(1). p. 3-29.

Epperson, K (1995). *Patterns of social behavior in computer-mediated communications*. Rice University.

Eriksson, D. (2013). *Fair Use och citaträtten: En komparativ studie av svensk och amerikansk upphovsrätt*. Lunds Universitet.

Eriksson, T. (2003). The Virtual Film Crew. In the proceedings of the *6th Annual International Workshop on Presence*. Aalborg, Denmark.

Eriksson, T. and M. Spante (2004a). The Computer Mediated Movie Producer – leadership in Online collaborative communities. In the proceedings of the *Winter International Symposium on Information and Communication Technologies*. Cancun, Mexico.

Eriksson, T. and M. Spante (2004b). Desktop VR and Filmmaking – a case study of how web3D models and chat can be used in the product design process. In the proceedings of the *Winter International Symposium on Information and Communication Technologies*. Cancun, Mexico.

Eriksson, T. and M. Sunnerstam (2008). Environmental Science Investigation – Challenges and opportunities. Paper presented at *All our futures - Education Waking to Threat, Hope and Possibility*. Plymouth, UK.

Eriksson, T., M. Sunnerstam and G. Karlsson (2010). Environmental Science Investigation using a virtual lab. Paper presented at the *Engineering Education in Sustainable Development*. Göteborg, Sweden.

Eriksson, T., S. Sundström and E. Thelander (2004). The Virtual Film Crew Project – work in progress on Film Making Using Online Communities, Computer Mediated Communication and Collaborative VR. In the proceedings of the *8th World Multiconference on Systemics, Cybernetics and Informatics*. Orlando, Florida.

- Erion, G. and B. Smith (2002). Skepticism, Morality, and The Matrix. *The matrix and philosophy: welcome to the desert of the real*. W. Irwin. Chicago, Open Court.
- Evans, J. and S. Hall (1999). *Visual culture; the reader*. London, SAGE Publications Ltd.
- Farnell, R. (1998). "Posthuman Topologies: William Gibson's 'Architexture' in Virtual Light and Idoru." *Science-Fiction Studies* 25(3). p. 459-480.
- Farstad, B. (2010). Sf-litteratur som "vetandet om det möjliga" och heuristisk metod. *Möjliga världar: tekniken, vetenskapen och science fiction*. M. Godhe and J. Ramsten. Stockholm, Carlsson bokförlag.
- Fauer, J. (2006). *Cinematographer Style*. (dvd) T-Stop Productions.
- Favro, D. (2006). In the eyes of the beholder. *Imaging Ancient Rome: Documentation, Visualization-Imagination*. L. Haselberger., J. Humprey and D. Abernathy. Proceedings of the 3rd Williams Symposium on Classical Architecture, Rome.
- Ferdig, R. (2014). Developing a Framework for Understanding the Relationship Between Religion and Videogames. *Online - Heidelberg Journal for Religions on the Internet* 5. p. 68-85.
- Fernandez, J. and M. Herzfeld (1998). In search of meaningful methods. *Handbook of Methods in Cultural Anthropology*. B. H. Russell. Walnut Creek. CA, AltaMira.
- Fernie, E. (1995). *Art History and its Methods: A critical anthology*. London, Phaidon.
- Fielding, J. (2009). "Reassessing The Matrix/Reloaded." *The Journal of Religion and Film* 7(2). <https://www.unomaha.edu/jrf/Vol7No2/matrix.matrixreloaded.htm>
- Flichy, P. (2007). *The Internet Imaginaire*. Cambridge, Mass., The MIT Press.
- Flick, U. (2009). *An Introduction to Qualitative Research*. London, Sage.
- Flueckiger, B. (2008). Digital Bodies. *Visual Effects. Filmbilder aus dem Computer*. B. Flueckiger. Marburg, Schueren.
- Fontana, P. (2003). Finding God in The Matrix. *Taking the red pill : science, philosophy and religion in the matrix*. G. Yeffeth. Chichester, Summersdale.
- Ford, J. (2003). Buddhism, mythology, and The Matrix. *Taking the red pill : science, philosophy and religion in the matrix*. G. Yeffeth. Chichester, Summersdale.
- Foucault, M. (1975). *Surveiller et punir*. Paris, Gallimard.
- Foucault, M. (1999). Panopticism. *Visual culture; the reader*. J. Evans and S. Hall. London, SAGE Publications Ltd.
- Frasca, G. (2003). Simulation versus Narrative: Introduction to Ludology. *Video/Game/Theory*. M. J. P. Wolf and B. Perron. New York, Routledge.
- Freitas, N. d. (2002). "Towards a definition of studio documentation: working tool and transparent record." *Working Papers in Art and Design Studies* 2.

<http://www.herts.ac.uk/research/ssahri/research-areas/art-design/research-into-practice-group/production/working-papers-in-art-and-design-journal/volume-2-research-into-practice-2002>

Fren, A. d. (2009). Disarticulating the Artificial Female. Proceedings of the *Digital Arts and Culture Conference*. Irvine, California.

Friedberg, A. (2006). *The Virtual Window: From Alberti to Microsoft*. Cambridge, Mass., The MIT Press.

Friedman, N. (1990). "Autobiographical sociology." *The American Sociologists* 21(1). p. 60-66.

Friebs, G. M., V. A. Zerris, C. L. Ojakangas, M. R. Fellows and J. P. Donoghue (2004). "Brain–Machine and Brain–Computer Interfaces." *Stroke* 1. p. 2702-2705.

Gadamer, H.-G. (1989). *Truth and method*. London, Sheed and Ward.

Geertz, C. (1973). *The interpretation of cultures; selected essays*. New York, Basic Books.

Geertz, C. (1998). "Deep hanging out." *New York Review of Books*. 45.

Geimer, P. (2007). "Image as Trace Speculations about an Undead Paradigm." *diff e r e n c e s : A Journal of Feminist Cultural Studies* 18(1). p. 7-28.

Gelernter, D. (1992). *Mirror Worlds*. Oxford, Oxford University Press.

Genette, G. (1980). *Narrative discourse : an essay in method*. Ithaca, N.Y., Cornell U.P.

Genette, G. (1997). *Paratexts: Thresholds of interpretation*. Cambridge, Cambridge University Press.

Genuth, I. (2006). The Return of the 3D Crystal Ball. *The Future of Things*.
<http://thefutureofthings.com/3029-the-return-of-the-3d-crystal-ball/>

Giddens, A. (1991). *Modernity und Self-Identity: Self and Society in the Late Modern Age*. Stanford, CA, Stanford University Press.

Giger, H. R. (1979). *Giger's Alien*. London, Titan Books.

Godhe, M. (2010a). "Literature of estrangement": Några linjer i feministisk utopi- och sf-forskning. *Möjliga världar: tekniken, vetenskapen och science fiction*. M. Godhe and J. Ramsten. Stockholm, Carlsson bokförlag.

Godhe, M. and J. Ramsten (2010b). Introduktion. *Möjliga världar: tekniken, vetenskapen och science fiction*. M. Godhe and J. Ramsten. Stockholm, Carlsson bokförlag.

Goldberg, K. (2001). Introduction: The Unique Phenomenon of a Distance. *The Robot in the Garden: Telerobotics and Telepistemology in the Age of the Internet*. K. Goldberg. Cambridge, Mass., The MIT Press.

Gombrich, E. (1998). Style. *The Art of Art History: A Critical Anthology*. D. Preziosi. Oxford, Oxford University Press.

- Gombrich, E. (2002). *Art and illusion: a study in the psychology of pictorial representation*. London, Phaidon.
- Gordon, A. (2002). The Matrix: Paradigm of Post-Modernism or Intellectual Poseur? (Part II). *Taking the Red Pill: Science, Philosophy and the Religion in the Matrix*. G. Yeffeth. Chichester, Summersdale.
- Gordon, J. (1992). Joe Haldman: Cyberpunk Before Cyberpunk Was Cool? *The Celebration of the Fantastic*. D. Morse, M. Tymn and C. Bertha. Westport, Greenwood Press.
- Glaser, B. (1992). *Basics of grounded theory analysis: emergence vs forcing*. Mill Valley, CA, Sociology Press.
- Glaser, B. and A. Strauss (1967). *The discovery of grounded theory: strategies for qualitative research*. Chicago, Aldine.
- Glowski, J. M. (2006). *Charles A. Csurik - Beyond Boundaries, 1963 – present*. College of the Arts, The Ohio State University.
- Grant, G. (1990). "Transcendence Through Detournement in William Gibson's Neuromancer." *Science Fiction Studies* 17(1). p. 41-49.
- Grau, O. (2001). History of Telepresence: Automata, Illusion, and Rejecting the Body. *The Robot in the Garden: Telerobotics and Telepistemology in the Age of the Internet*. K. Goldberg. Cambridge, Mass., The MIT Press.
- Grau, O., Ed. (2003). *Virtual Art: From Illusion to Immersion*. Cambridge, Mass., The MIT Press.
- Grieve, G. P. and H. Campbell (2014). "Studying Religion in Digital Gaming: A Critical Review of an Emerging Field." *Online - Heidelberg Journal for Religions on the Internet* 5. p. 51-67.
- Gross, T. (1989). *National Public Radio: Fresh Air: February 1989 Terry Gross interviews author William Gibson*.
http://artlung.com/smorgasborg/William_Gibson_Interview.shtml.
- Gunn, J. (2003). The reality paradox in The Matrix. *Taking the red pill : science, philosophy and religion in the matrix*. G. Yeffeth. Chichester, Summersdale.
- Gunnarsson, M. (2002). *En plats vid sidan av*. University of Gothenburg.
- Gunning, T. (2007). "Moving Away from the Index: Cinema and the Impression of Reality." *Brown University and differences : A Journal of Feminist Cultural Studies* 18(1). p. 29-52.
- Gupta, S. and H.-W. Kim (2004). Virtual Community: Concepts, Implications, and Future Research Directions. Proceedings of the *Tenth Americas Conference on Information Systems*, New York.
- Guynup, S. (2002). *A Critique on 'Cyberspace: Proposals' / 'Digital Sensations'*.

http://www.infoamerica.org/documentos_pdf/benedikt_hillis.pdf

Hafner, K. and M. Lyon (1996). *Where Wizards Stay up Late*. New York, Touchstone.

Hall, S. (1980). Encoding/decoding. *Culture, Media, Language: Working Papers in Cultural Studies*. S. Hall, D. Hobson, A. Lowe and P. Willis. Birmingham, Routledge.

Handyside, F. (2004). "The Auteur as Imposter." *Film-Philosophy* 10(1). p. 15-20.

Hanson, M. (2005). *Building sci-fi moviescapes*. Oxford, Focal Press.

Hansson, G. (2004). Columbi enkrona. *Årsbok för konstnärligt FoU*. Stockholm, Vetenskapsrådet.

Haraway, D. (1991). A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century. *Simians, Cyborgs and Women: The Reinvention of Nature*. D. Haraway. New York, Routledge.

Hardwick, C. (2012). The Wachowskis and Tom Tykwer. (podcast) *Nerdist* (October 26th, 2012). <http://nerdist.com/nerdist-podcast-the-wachowskis-and-tom-tykwer/>

Harold, J. (2015). Literature, Genre Fiction, and Standards of Criticism. *nonsite.org*(3). <http://nonsite.org/article/literature-genre-fiction-and-standards-of-criticism>

Harris, R. (1987). *Reading Saussure: A Critical Commentary on the 'Cours de linguistique générale'*. London, Duckworth.

Haselberger, L. (2006). Imaging Ancient Rome: Documentation, Visualization-
imagination. *Journal of Roman Archaeology* 61.

Hayano, M. D. (1979). "Auto-ethnography: Paradigms, problems, and prospects." *Human Organization* 38. p. 113-120.

Hayles, N. K. (1993a). "Virtual Bodies and Flickering Signifiers." *October* 66. p. 69-91.

Hayles, N. K. (1993b). The Seductions of Cyberspace. *Rethinking Technologies*. V. A. Conley. Minneapolis, University of Minnesota Press.

Hayles, N. K. (1996). Embodied virtuality, or how to put bodies back into the picture. *Immersed in Technology: Art and Virtual Environments*. M. A. Moser and D. MacLeod. Cambridge, Mass., The MIT Press.

Hayles, N. K. (1999). *How We Became Post human: Virtual Bodies in Cybernetics, Literature, and informatics*. Chicago, Chicago University Press.

Heidbrink, S. and T. Knoll (2014). "Let's Talk Video Games! Introduction to the Special Issue on Religion in Digital Games." *Online - Heidelberg Journal for Religions on the Internet* 5. p. 1-4.

- Heim, M. (1993). *The metaphysics of virtual reality*. New York, Oxford University Press.
- Heuser, S. (2003). *Virtual geographies : cyberpunk at the intersection of the postmodern and science fiction*. Amsterdam, Rodopi.
- Higgins, H. (2009). *The Grid Book*. Cambridge, Mass., The MIT Press.
- Hileman, R. (1998). *Design Methods: seeds of human futures*.
<http://www.smsys.com/pub/dsgnmeth.pdf>
- Hillis, K. (1999). Toward the light 'within'. *Virtual Geographies - bodies, space and relations*. M. Crang, P. Crang and J. May. London, Routledge.
- Hishida, M. (1995). *Ghost in the Shell Interviews*. (dvd) Kodansha Ltd.
- Hollinger, V. (1991). Cybernetic Deconstructions: Cyberpunk and Postmodernism. *Storming the Reality Studio: A Casebook of Cyberpunk and Postmodernism*. L. McCaffery. Durham, Duke University Press.
- Holmberg, J.-H. (2010). Äventyret verkligheten. *Möjliga världar: tekniken, vetenskapen och science fiction*. M. Godhe and J. Ramsten. Stockholm, Carlsson bokförlag.
- Holmquist, L. E. (2000). *Breaking the Screen Barrier*. University of Gothenburg.
- Holt, N. L. (2003). "Representation, Legitimation, and Autoethnography: An Autoethnographic Writing Story." *International Journal of Qualitative Methods* 2(1). p. 18-28.
- Honigmann, J. J. (1976). "The personal approach in cultural anthropological research." *Current Anthropology* 17(2). p. 243-251.
- Horton, R. (2012). *Visualizing Tron*. (dvd) Walt Disney Studios Home Entertainment.
- House, H. (1956). *Aristotle's Poetics*. London, Rupert Hart-Davis.
- Hudson-Smith, A. (2002). 30 Days in ActiveWorlds – Community, Design and Terrorism in a Virtual World. *The Social Life of Avatars*. R. Shroder. London, Springer-Verlag.
- Hughes, J., V. King, T. Rodden and H. Andersen (1994). Moving Out from the Control Room: Ethnography in System Design. Proceedings of the 1994 ACM conference on Computer supported cooperative work, New York.
- Hurley, K. (1995). Reading like an alien: Posthuman identity in Ridley Scott's *Alien* and David Cronenberg's *Rabid*. *Posthuman bodies*. J. H. I. Livingston. Bloomington, Indiana University Press.
- Huyssen, A. (1981). "The Vamp and the Machine: Technology and Sexuality in Fritz Lang's *Metropolis*." *New German Critique* (24/25). p. 221-237.
- Ingram, S. and M. Reisenleitner (2006). "Polarizing Avalon: The European

- Virtuosity and Global Virtuality of Mamoru Oshii's Filmic Imaginary." *New Cinemas: Journal of Contemporary Film* 4(2). p. 129-138.
- Irwin, W. (2002). *The matrix and philosophy : welcome to the desert of the real*. Chicago, Open Court.
- Iversen, O. S. (2005). *Participatory Design Beyond Work Practices – Designing with Children*. University of Aarhus.
- Jick, T. (1979). "Mixing Qualitative and Quantitative Methods: Triangulation in Action." *Administrative Science Quarterly* 24. P. 602-011.
- Joe, S. K. (1997). Socioemotional use of CMC: Self-disclosure in computermediated communication. Paper presented at the *Annual Meeting of the International Communication Association*, Montreal, Canada.
- Johannisson, B. (2002). Enacting Entrepreneurship - Using Auto-Ethnography to Study Organization Creation. Paper presented at the conference *Ethnographic Organizational Studies*, St. Gallen, Switzerland.
- Johnson, C. (2004). "Top Scientific Visualization Research Problems." *IEEE Computer Graphics and Applications* 24(4). p. 13-17.
- Johnston, A. (1999). "William Gibson: Waiting for the Man." *Spike* (August 1, 1999). <http://www.spikemagazine.com/0899williamgibson.php>
- Jones, S. (1998). Information, Internet, and Community: Notes toward an Understanding of Community in the Information Age. *Cybersociety 2.0: Revisiting Computer-Mediated Communication and Community*. S. Jones. Thousand Oaks, SAGE Publications.
- Jonsson, B. (2002). "Sketching Now." *International Journal of Art & Design Education* 21(3). p. 246-253.
- Juul, J. (2005). *Half-Real: Video Games between Real Rules and Fictional Worlds*. Cambridge, Mass., The MIT Press.
- Kaveney, R. (2005). *From Alien to the Matrix - Reading Science Fiction Film*. New York, I.B.Tauris.
- Kearney, R. (1998). *Poetics of imagining : modern and postmodern*. New York, Fordham University Press.
- Keegan, R. (2009). *The futurist: the life and films of James Cameron*. New York: Crown Publishers.
- Kelle, U. (2005). "'Emergence' vs. 'Forcing' of Empirical Data? A Crucial Problem of 'Grounded Theory' Reconsidered." *Forum: Qualitative Social Research* 6(2). <http://www.qualitative-research.net/index.php/fqs/article/view/467>
- Kellner, D. (2009). Jean Baudrillard (1929-2007): A Critical Overview. *Baudrillard Now Current Perspectives in Baudrillard Studies*. R. Bishop. Cambridge, Polity.

- Kellner, D., F. Leibowitz and M. Ryan (1984). "Blade Runner A diagnostic critique." *Jump Cut* 29. p. 6-8.
- Kerman, J. (1992). Virtual Space and its Boundaries in Science Fiction Film and Television: Tron, "Max Headroom" and WarGames. *The Celebration of the Fantastic*. D. Morse, M. Tymn and C. Bertha. Westport, Greenwood Press.
- Knight, D. (1956). *In Search of Wonder: Essays on Modern Science Fiction* Chicago, Advent.
- Klastrup, L. (2002). A virtual world aesthetics: theorising multi-user textuality. Paper presented at the *Net/Work/Theory – Association of Internet Researchers Conference 3.0*, Maastricht, the Netherlands.
- Klastrup, L. (2003a). *Towards A Poetics of Virtual Worlds - Multiuser Textuality and The Emergence of Story*. Copenhagen University.
- Klastrup, L. (2003b). A Poetics of Virtual Worlds. In proceedings of the *Fifth International Digital Arts and Culture Conference*, RMIT, Melbourne, Australia.
- Klastrup, L. (2007). "Why Death Matters: Understanding Gameworld Experience." *Journal of Virtual Reality and Broadcasting* 4(3). <https://www.jvrb.org/past-issues/4.2007/1022>
- Klastrup, L. and S. Tosca (2004). Transmedial Worlds – Rethinking Cyberworld Design. In proceedings of the *International Conference on Cyberworlds 2004*. Los Alamitos, California.
- Kneale, J. (1999). The virtual realities of technology and fiction: Reading William Gibson's cyberspace. *Virtual Geographies - bodies, space and relations*. M. Crang, P. Crang and J. May. London, Routledge.
- Kolko, B. and E. Reid (1998). Dissolution and Fragmentation: Problems in On-Line Communities. *Cybersociety 2.0: Revisiting Computer-Mediated Communication and Community*. S. Jones. Thousand Oaks, SAGE Publications.
- Knudsen, C. J. S. (2004). *Presence Production*. Kungliga Tekniska Högskolan.
- Kramarae, C. (1998). Feminist Fictions of Future Technology. *Cybersociety 2.0: Revisiting Computer-Mediated Communication and Community*. S. Jones. Thousand Oaks, SAGE Publications.
- Krauss, R. (1985). Grids. *The Originality of the Avant-Garde and Other Modernist Myths*. R. Krauss. Cambridge, Mass., The MIT Press.
- Kress, G. and T. v. Leeuwen (1996). *Reading Images: The Grammar of Visual Design*. London, Routledge.
- Klynne, A. (1998). "Reconstruction of Knossos: Artists' Impressions, Archaeological Evidence and Wishful Thinking." *Journal of Mediterranean Archaeology* 11(2). p. 206-229.

- Kristeva, J. (1998). *Psychoanalysis and the Imaginary. Cultural Semiosis: Tracing the Signifier*. H. Silverman. New York, Routledge.
- Krämer, S. (2005). *Was eigentlich ist eine Spur? Zur Genealogie von Kulturtechniken*. Berlin.
- Lacey, N. (2000). *Blade Runner*. London, York Press.
- Lamantia, J. (2009). "Inside Out: Interaction Design for Augmented Reality." *UXmatters* 8. <http://www.uxmatters.com/mt/archives/2009/08/inside-out-interaction-design-for-augmented-reality.php>
- Landon, B. (1992). There's Some of Me in You: Blade Runner and the Production Realities of Adapting Science Fiction Literature into Film. *The Aesthetics of ambivalence: rethinking science fiction film in the age of electronic (re)production* B. Landon. Westport, Conn., Greenwood Press.
- Lanier, J. (2010). *You are not a gadget: a manifesto*. London, Allen Lane.
- Lanier, J. and F. Biocca (1992). "An insider's view of the future of reality." *Journal of Communication* 42(4). p. 150-172.
- Laurel, B. (1993). *Computer As Theatre*. Massachusetts, Addison-Wesley Professional.
- Lauzirika, C. d. (2007). *Dangerous Days: The Making of Blade Runner*. (dvd) Warner Home Video.
- Lavery, D. (2001). "From Cinescape to Cyberspace: Zionists and Agents, Realists and Gamers in The Matrix and eXistenZ." *Journal of Popular Film and Television* 28(4). p. 150-157.
- Lavie, S., K. Narayan and R. Rosaldo (1993). *Creativity/ Anthropology*. Ithaca, NY, Cornell University Press.
- Lee, F., D. Vogel and M. Limayem (2002). *Virtual Community Informatics: What We Know and What We Need to Know*. Hawaii International Conference on System Sciences, Hawaii.
- Lefebvre, H. (1991). *The Production of Space*. Oxford, Blackwell Publishers.
- Lennon, B. (2000). "Screening a Digital Visual Poetics." *Configurations* 8(1). p. 63-85.
- Levy, P. (1998). *Becoming virtual : reality in the digital age*. New York, Plenum Trade.
- Liljefors, M. (2006). I överklighetens gränsmarker: Om normala och speciella effekter i bilder. *Virtualiteter - Sex essäer*. R. Willim. Lund, Lunds Universitet.
- Lincoln, Y. (1995). "Emerging criteria for quality in qualitative and interpretive research." *Qualitative Inquiry* 1. p. 275-289.
- Ljungar-Chapelon, M. (2008). *Actor-Spectator in a Virtual Reality Arts Play: Towards new artistic experiences in between illusion and reality in immersive virtual environments*. University of Gothenburg.

- LoBrutto, V. (1992). *By design - Interviews with film production designers*. Westport, Conn., Praeger.
- Lombard, M. and T. Ditton (1997). "At the Heart of It All: The Concept of Telepresence." *Journal of Computer-Mediated Communication* 3(2). p. 6-21.
- Lorentz, P. (2014). "Socialization of Teenagers Playing The Sims: The Paradoxical Use of Video Games to Re-enchant Life." *Online - Heidelberg Journal for Religions on the Internet* 5. p. 279-300.
- Lotman, J. (1976). *Semiotics of Cinema*. Michigan, No. 5 Ann Arbor.
- Lovén, S. (2001). "Even Better than the Real Thing - Counterfeit realities and twentieth century dystopian fiction." *Human IT*(2-3).
<http://etjanst.hb.se/bhs/ith/23-01/sl.htm>
- Lovén, S. (2010). *Also make the heavens: virtual realities in science fiction*. Uppsala: Section for Sociology of Literature at the Department of Literature, Uppsala University.
- Lundequist, J. (1998). *Projekteringens teori och metod - en introduktion till designteorin*. Stockholm, Kungliga Tekniska Högskolan.
- Lundström, C., P. Ljung, A. Persson and A. Ynnerman (2007). "Uncertainty Visualization in Medical Volume Rendering Using Probabilistic Animation." *IEEE Transactions on Visualization and Computer Graphics* 13(6). p. 1648-1655.
- Lye, J. (2000). *The 'Death of the Author' as an Instance of Theory*.
<http://www.brocku.ca/english/courses/4F70/author.php>
- Maanen, J. V. (1988). *Tales of the Field: On Writing Ethnography*. Chicago, The University of Chicago Press.
- Malcolm, P. (2009). The Craft Association. *Production Studies - Cultural Studies of Media Industries*. M. J. B. Vicki Mayer, John T Caldwell. London, Routledge.
- Mandelbaum, D. G. (1973). "The study of life history: Gandhi." *Current Anthropology* 14(3). p. 177-206.
- Mann, S., J. Nolan and B. Wellman (2003). "Sousveillance: Inventing and Using Wearable Computing Devices for Data Collection in Surveillance Environments." *Surveillance & Society* 1(3). p. 331-355.
- Manovich, L. (2001). *The Language of New Media*. Cambridge, Mass., The MIT Press.
- Marcus, G. E. and M. M. J. Fischer (1986). *Anthropology as cultural critique : an experimental moment in the human sciences*. Chicago, University of Chicago Press.
- Marder, E. (1991). "Blade Runner's Moving Still." *Camera Obscura* 27. p. 88-107.
- Markoff, J. (2005). *What the Dormouse Said*. New York, Penguin Books.
- McCaffery, L. (1990). *Across the Wounded Galaxies: Interviews with Contemporary American Science Fiction Writers*. Urbana, University of Illinois Press.

- McCaffery, L. (1991). *Storming the Reality Studio: A Casebook of Cyberpunk and Postmodernism*. Durham, Duke University Press.
- McCloskey, D. N. and A. Megill (1987). The Rhetoric of History. *The Rhetoric of the Human Sciences: Languages and Argument in Scholarship and Public Affairs*. J. S. Nelson, A. Megill and D. N. McCloskey. Madison, WI, University of Wisconsin Press.
- McHale, B. (1992). "Elements of a poetics in cyberpunk." *Critique* 33(3). p. 149-175.
- McLuhan, M. (1964). *Understanding Media: The Extensions of Man*, London, Routledge.
- Menon, E. (2007). Virtual Realities, Techno-aesthetics and Metafictions of Digital Culture. *The state of the real - aesthetics in the digital age*. D. Sutton, S. Brind and R. McKenzie. London, I.B. Tauris.
- Merleau-Ponty, M. (1962). *Phenomenology of perception*. London, Routledge.
- Merrin, W. (2001). "To play with phantoms : Jean Baudrillard and the evil demon of the simulacrum." *Economy & Society* 30(1). p. 85-111.
- Merrin, W. (2003). "'Did You Ever Eat Tasty Wheat?': Baudrillard and The Matrix." *Scope* (May). <http://www.nottingham.ac.uk/scope/documents/2003/may-2003/merrin.pdf>
- Merton, R. K. (1968). *Social Theory and Social Structure*. New York, Free Press.
- Metz, C. (1974). *Film language; a semiotics of the cinema*. New York, Oxford University Press.
- Metz, C. (1985). On the Notion of Cinematographic Language. *Movies and Methods: volume 1*. B. Nichols. Berkeley, University of California Press.
- Miramax Films. (2003). *Avalon SFX*. Miramax Films.
- Milgram, P., H. Takemura, A. Utsumi and F. Kishino (1994). "Augmented Reality: A class of displays on the reality-virtuality continuum." *Telemanipulator and Telepresence Technologies* 2351. p. 282-292.
- Mitchell, T. (1996). *New Thinking in Design: Conversations on Theory and Practice*. New York, Van Nostrand Reinhold.
- Mitchell, W. (1998). Antitectonics: the Poetics of Virtuality. *The Virtual Dimension: Architecture, Representation, and Crash Culture*. J. Beckmann. New York, Princeton Architectural Press.
- Moere, A. V. (1998). *The Language of Cyberspace: An Architectural Approach*. K.U.Leuven University.
- Moere, A. V., H. Neuckermans and A. Heylighen (1998). "VR/search : An Architectural Approach to Cyberspace." *International Journal of Design Sciences and Technology* 7(1). p. 23-39.

- Montfort, N., P. Baudoin, J. Bell, I. Bogost and J. Douglass (2012). *10 PRINT CHR\$(205.5+RND(1)); : GOTO 10__*. Cambridge, Mass., The MIT Press.
- Moravec, H. (1988). *Mind children: the future of robot and human intelligence*. Cambridge, Mass., Harvard University Press.
- Morie, J. F. (2008). Ontological implications of Being in immersive virtual environments. *SPIE Electronic Imaging: The Engineering Reality of Virtual Reality* 6804. p. 1-12.
- Mossberg, F. (2006). Virtualitet som musikens gränssnitt: Om förändrade sätt att skapa musik. *Virtualiteter - Sex essäer*. R. Willim. Lund, Lunds Universitet.
- Moustakas, C. (1990). *Heuristic research: Design, methodology, and applications*. Newbury Park, CA, Sage.
- Mulvey, L. (1995). The Myth of Pandora: A Psychoanalytical Approach. *Feminism in the Cinema*. L. Pietropaolo, A. Testaferri. Bloomington, Indiana University Press.
- Mulvey, L. (1999). Visual Pleasure and Narrative Cinema. *Film Theory and Criticism : Introductory Readings*. L. Braudy, M. Cohen. New York, Oxford University Press.
- Murch, W. (2001). *In the blink of an eye : a perspective on film editing*. Los Angeles, Silman-James Press.
- Murphy, G. (2008). "Considering Her Ways: In(ter)secting Matriarchal Utopias." *Science Fiction Studies* 35(2). p. 266-280.
- Murray, J. (1997). *Hamlet on the Holodeck: the future of narrative in cyberspace*. New York, The Free Press.
- Mykhalovskiy, E. (1996). "Reconsidering table talk: Critical thoughts on the relationship between sociology, autobiography, and self-indulgence." *Qualitative Sociology* 19(131-151).
- Månsson, S.-A. (2005). Men's practices in prostitution and their implications for social work. *Social Work in Cuba and Sweden. Prospects and Achievements*. S.-A. Månsson, C. Cervantes. Göteborg: Department of Social Work, University of Gothenburg.
- Määttä, J. (2006). *Raketsommar – science fiction i Sverige 1950–1968*. Uppsala, Ellerströms.
- Määttä, J. (2010). Kognitiv marknadsföring: tre definitioner av science fiction. *Möjliga världar: tekniken, vetenskapen och science fiction*. M. Godhe, J. Ramsten. Stockholm, Carlsson bokförlag.
- Naremore, J. (2007). *On Kubrick*. London, British Film Institute.
- Nash, D. and R. Wintrob (1972). "The emergence of self-consciousness in ethnography." *Current Anthropology* 13(5). p. 527-542.
- Nathan, I. (2011). "Tron: Regeneration." *Empire*. (January). p. 66-76.

- Neale, M. (2000). *No Maps for These Territories*. (dvd) Mark Neale Productions.
- Negru, T. (2007). "Gadamer-Habermas Debate and Universality of Hermeneutics." *Cultura International Journal of Philosophy of Culture and Axiology*(7).
- Nelson, T. (1980). "Interactive Systems and the Design of Virtuality." *Creative Computing* 6(11). p. 94–106.
- Neumann, D. (1999). *Film Architecture*. Munich, Prestel.
- Newton, E. (1993). "My best informant's dress: the erotic equation in fieldwork." *Cultural Anthropology*. 8(1). p. 3-23.
- Nichols, B. (1985). *Style, Grammar, and the Movies*. *Movies and Methods: volume 1*. B. Nichols. Berkeley, University of California Press.
- Nielsen, J. (1998). *2D is Better Than 3D*. <http://www.nngroup.com/articles/2d-is-better-than-3d/>.
- Nielsen, J. (2006). Usability in the Movies: Top 10 Bloopers. *Jakob Nielsen's Alertbox*. <https://www.nngroup.com/articles/movies-usability-top-10-bloopers/>
- Nilsson, L. (2010). Säljande teknik i Hollywood: Sf-film som konsumtionsprodukt och arena för religiös reflektion. *Möjliga världar: tekniken, vetenskapen och science fiction*. M. Godhe, J. Ramsten. Stockholm, Carlsson bokförlag.
- Nixon, N. (1992). "Cyberpunk: Preparing the Ground for Revolution or Keeping the Boys Satisfied?" *Science Fiction Studies* 19(57). p. 219-235.
- Nordin, S. (2012). *Drottningen och filosofen: mötet mellan Christina och Descartes*. Stockholm, Atlantis.
- Norman, D. (2002). *The Design of Everyday Things*. New York, Basic Books.
- Novak, M. (1991). *Liquid Architectures in Cyberspace*. *Cyberspace: First Steps*. M. Benedikt. Cambridge, Mass., The MIT Press.
- Nusselder, A. (2009). *Interface Fantasy - a Lacanian Cyborg Ontology*. Cambridge, Mass., The MIT Press.
- Olivier, M. (2011). "Civilization Inoculated: Nostalgia and the Marketing of Emerging Technologies." *The Journal of Popular Culture* 44(1). p. 134-157.
- Olsen, L. (1992). *William Gibson*. San Bernardino, Calif., Borgo Press.
- Ortner, S. (2009). Studying Sideways: Ethnographic Access in Hollywood. *Production Studies - Cultural Studies of Media Industries*. V. Mayer, M. Banks, J. Caldwell. London, Routledge.
- Palumbo, D. (2014). *The Monomyth in American Science Fiction Films: 28 Visions of the Hero's Journey*. Jefferson, McFarland & Company.
- Patterson, R. (1982). The Making of Tron. *American Cinematographer* 63(8).

- Paul, I. A. (2010). "Desiring-Machines in American Cinema: What Inception tells us about our experience of reality and film." *senses of cinema* 56.
www.sensesofcinema.com/2010/feature-articles/desiring-machine
- Peirce, C. S. (1868). "Questions Concerning Certain Faculties Claimed for Man." *Journal of Speculative Philosophy* 2. p. 103-114.
- Peirce, C. (1902). Virtual. *Dictionary of Philosophy and Psychology*. J. M. Baldwin. Bristol, Thoemmes.
- Peirce, C. S. (1931-58). *Collected Writings (8 Vols.)*. Cambridge, MA, Harvard University Press.
- Pelias, R. J. (2003). The academic tourist: An autoethnography. *Qualitative Inquiry* 9(3). p. 369-373.
- Pellerin, M. (2002). Digital Imagery in Tron. *Tron special features*. (dvd) Walt Disney Productions.
- Peterson, L. (2011). *Values in Play Interactional Life with the Sims*. University of Gothenburg.
- Pierce, J. (1993). "The Literary Experience of Hard Science Fiction." *Science Fiction Studies* 20(2): 176-183.
- Piercey, R. (2004). "Ricoeur's Account of Tradition and the Gadamer-Habermas Debate." *Human Studies* 27. p. 259-280.
- Philips, S. (2010). *Exposed - Voyeurism, Surveillance, and the Camera since 1870*. San Francisco, San Francisco Museum of Modern Art.
- Pollack, N. (2011). Tron: remastered. *Wired UK* (January).
- Poole, S. (2000). *Trigger Happy : Videogames and the Entertainment Revolution*. New York, Arcade Publishing.
- Pope, R. (2008). "A Cyborg's Testimonial: Mourning Blade Runner's Cryptic Images." *Film-Philosophy* 12(2). p. 1-16.
- Popper, K. (1979). *Objective Knowledge: An Evolutionary Approach*. Oxford, Oxford University Press.
- Prasad, A. (2002). "The Contest Over Meaning: Hermeneutics as an Interpretive Methodology for Understanding Texts." *Organizational Research Methods* 5(12). p. 12-33.
- Pratt, M. L. (1986). Fieldwork in Common Places. *Writing culture : the poetics and politics of ethnography : a School of American Research advanced seminar*. J. Clifford, G. Marcus. Berkeley, University of California Press.
- Putnam, H. (1981). *Reason, Truth, and History*. Cambridge, Cambridge University Press.

- Rakkolainen, I. (2008). *Mid-air Displays Enabling Novel User Interfaces*. 1st ACM international workshop on Semantic ambient media experiences.
- Ramsten, J. (2010). SF-litteraturens gestaltungsproblematik. *Möjliga världar: tekniken, vetenskapen och science fiction*. M. Godhe, J. Ramsten. Stockholm, Carlsson bokförlag.
- Ransdell, J. (2003). *Passages from Peirce on: Collateral Observation*. <http://lyris.ttu.edu/read/archive?id=57101>.
- Raggett, D. (1994). Extending WWW to support Platform Independent Virtual Reality. *First International Conference on the World-Wide Web*. Switzerland.
- Reed-Danahay, D. (2001). Autobiography, Intimacy and Ethnography. *Handbook of Ethnography*. P. Atkinson. London, Sage Publications.
- Reid, R. A. (2000). *Ray Bradbury: a critical companion*. Westport, Conn., Greenwood Publishing Group.
- Rheingans, P. and S. Joshi (1999). *Visualization of Molecules with Positional Uncertainty*. Joint EUROGRAPHICS - IEEE TCVG Symposium on Visualization.
- Rheingold, H. (1991). *Virtual Reality*. London, Mandarin Science.
- Rheingold, H. (1993). *The Virtual Community*. Cambridge, Mass., The MIT Press.
- Ricœur, P. (1971). *From Text to Action: Essays in Hermeneutics*. London, Athlone.
- Ricœur, P. (1978). *The rule of metaphor : multi-disciplinary studies of the creation of meaning in language*. London, Routledge & Kegan Paul.
- Ricœur, P. (1984). *Time and narrative 1*. Chicago, University of Chicago Press.
- Riemer, J. (1977). "Varieties of opportunistic research." *Journal of Contemporary Ethnography* 5(4). p. 467-477.
- Robinet, W. (1992). "Synthetic Experience: A Proposed Taxonomy." *Presence* 1(2). p. 229-247.
- Rosell, G. (1990). *Anteckningar om designprocessen*. Stockholm, Tekniska högskolan.
- Rovira, J. (2005). "Subverting the Mechanisms of Control: Baudrillard, The Matrix Trilogy, and the Future of Religion." *International Journal of Baudrillard Studies* 2(2). http://www2.ubishops.ca/ baudrillardstudies/vol2_2/rovira.htm
- Russ, J. (1975). "Towards an Aesthetic of Science Fiction." *Science Fiction Studies* 2(6). p. 112-19.
- Russell, K. (2000). "Poetics and practice: studio theoria." *Working Papers in Art and Design Studies* 1. <http://www.herts.ac.uk/research/ssahri/research-areas/art-design/research-into-practice-group/production/working-papers-in-art-and-design-journal/volume-1-research-into-practice-2000>
- Ryan, M.-L. (1999). *Cyberspace, Virtuality and the Text. Cyberspace Textuality: Computer Technology and Literary Theory*. M.-L. Ryan. Bloomington, Indiana University

Press.

Ryang, S. (2000). "Ethnography or Self-cultural Anthropology?: Reflections on Writing About Ourselves." *Dialectical Anthropology* 25. p. 297-320.

Sangren, S. P. (1988). "Rhetoric and the authority of ethnography." *Current Anthropology* 29(3). p. 405-435.

Saussure, F. d. (1983). *Course in General Linguistics*. London, Duckworth.

Schacter, D., D. Addis and R. Buckner (2007). "Remembering the past to imagine the future: the prospective brain." *Nat Rev Neurosci* 8(9). p. 657-661.

Schneider, E. (1996). *alt.cyberpunk Frequently Asked Questions list*.
<http://www.faqs.org/faqs/cyberpunk-faq/>.

Schroeder, R., A. Huxor and A. Smith (2001). "Activeworlds: geography and social interaction in virtual reality." *FUTURES* 33. p. 569–587.

Seale, C. (1999). *The Quality of Qualitative Research*. London, Sage.

Sebeok, T. (1999). *Signs: An Introduction to Semiotics*. Toronto, University of Toronto Press.

Shapiro, M. (1998). *Style. The Art of Art History: A Critical Anthology*. D. Preziosi. Oxford, Oxford University Press.

Shedroff, N. and C. Noessel (2012). *Make It So: interaction design lessons from science fiction*. Rosenfeld.

Sheridan, T. (1992). "Musings on Telepresence and Virtual Presence." *Presence: Teleoperators and Virtual Environments* 1(1). p. 120-126.

Sikov, E. (2010). *Film Studies: An Introduction*. New York, Columbia University Press.

Silverman, K. (1985). *The Subject of Semiotics*, New York, Oxford University Press.

Silverman, H. (1998). *Cultural semiosis : tracing the signifier*. New York, Routledge.

Siner, L. (1992). "Skating across cyberpunk's brave new worlds: An interview with Lewis Shiner." *Critique* 33(3). p. 177-196.

Sjölie, D. (2013). *Human brains and virtual realities: Computer-generated presence in theory and practice*. Umeå University.

Skagestad, P. (1998). Peirce, Virtuality, and Semiotic. *Twentieth World Congress of Philosophy*. Boston, Massachusetts.

Slater, M. (2002). "Presence and the sixth sense." *Presence: Teleoperators and Virtual Environments* 11(4). p. 435-439.

Slouka, M. (1995). *War of the Worlds*. New York, BasicBooks.

Smejkal, F. (1974). *Surrealist Drawings*. London, Octopus Books Limited.

- Smith, P. (2014). Introduction. *Conversations with William Gibson*. P. Smith. Mississippi, University Press of Mississippi.
- Sonesson, G. (2001). "Iconicity strikes back : the third generation - or why Eco still is wrong." *VISIO* 9(3-4). p. 247-270.
- Sorensen, P. (1982). "Tronic Imagery." *Cinefex* 8. p. 4-35.
- Spante, M., M. Sunnerstam, C. H.-d. Voss, T. Eriksson and M. Axelsson (2009). The need for efficient and flexible educational imagery – when ambitious visualization products meet the context of actual learning environments. Paper presented at the *International Conference on Information Communication Technologies in Education*. Corfu, Greece.
- Spante, M., M. Sunnerstam, C. H.-d. Voss, T. Eriksson and M. Axelsson (2010). "Unlock the rigidity and design for flexibility." *US-China Education Review* 7(11).
- Sparkes, A. C. (2000). "Autoethnography and narratives of self: Reflections on criteria in action." *Sociology of Sport Journal* 17. p. 21-43.
- Springer, C. (1996). *Electronic Eros: Bodies and Desire in the Postindustrial Age*. Austin, University of Texas Press.
- Sontag, S. (1999). The image-world. *Visual culture; the reader*. J. Evans, S. Hall. London, SAGE Publications Ltd.
- Stefik, M. (1996). *Internet Dreams: Archetypes, Myths, and Metaphors*. Cambridge, Mass., The MIT Press.
- Sterling, B. (1987). Preface by Bruce Sterling. *Burning Chrome*. W. Gibson New York, Ace Books.
- Sterling, B. (1991). Preface from Mirrorshades. *Storming the Reality Studio: A Casebook of Cyberpunk and Postmodernism*. L. McCaffery. Durham, Duke University Press.
- Steuer, J. (1994). Defining virtual reality: Dimensions determining telepresence. *Communication in the age of virtual reality*. F. Biocca, M. Levy. Hillsdale, Lawrence Erlbaum Associates.
- Stivers, C. (1993). "Reflections on the role of personal narrative in social science." *Signs: Journal of Women in Culture and Society* 18(2) p. 408-425.
- Stone, R. A. (1991). Will the Real Body Please Stand Up?: Boundary Stories about Virtual Cultures. *Cyberspace: First Steps*. M. Benedikt. Cambridge, Mass., The MIT Press.
- Stork, D. (1997). *Hal's Legacy*. Cambridge, Mass., The MIT Press.
- Strathern, M. (1987). "Out of context: the persuasive fictions of anthropology." *Current Anthropology* 28(3). p. 251-281.
- Sundstedt, K. (1999). *Att skriva för film*. Stockholm, Ordfront förlag.

- Sutherland, I. (1965). *The Ultimate Display*. Information Processing Techniques Office, ARPA.
- Sutton, R. and B. Staw (1995). "What Theory is Not." *Administrative Science Quarterly* 40. p. 371-384.
- Suvin, D. (1979). *Metamorphoses of Science Fiction*. New Haven, Yale University Press.
- Svanberg, L. (2004). *The EDCF Guide to Digital Cinema Production*. Elsevier, Focal Press.
- Swartz, C. S. (2005). *Understanding Digital Cinema - A Professional Handbook*. Elsevier, Focal Press.
- Tarkovsky, A. (1986). *Sculpting in Time*. Austin, University of Texas Press.
- Tatsumi, T. (1986). "Eye to Eye: An Interview with William Gibson." *Science Fiction Eye* 1(1). p. 6-17.
- Taylor, G. D. (2004). *The machine that made science art : the troubled history of computer art 1963-1989*. University of Western Australia.
- Tedlock, B. (1991). "From participant observation to the observation of participation: the emergence of narrative ethnography." *Journal of Anthropological Research* 47(1). p. 69-94.
- Thomas, R. (1993). "Interviewing important people in big companies." *Journal of Contemporary Ethnography* 22(1). p. 80-96.
- Thompson, K. (1999). *Storytelling in the new Hollywood : understanding classical narrative technique*. Cambridge, MA, Harvard University Press.
- Todorov, T. (1977). *The Poetics of Prose*. Oxford, Blackwell.
- Toffoletti, K. (2007). *Cyborgs and Barbie Dolls: Feminism, Popular Culture and the Posthuman Body* London, I B Tauris.
- Tomas, D. (1991). Old Rituals for New Space: Rites de Passage and William Gibson's Cultural Model of Cyberspace. *Cyberspace: First Steps*. M. Benedikt. Cambridge, Mass., The MIT Press.
- Trier, L. v. (1995). *Dogme95*. <http://www.dogme95.dk>.
- Turkle, S. (1995). *Life on the Screen Identity in the Age of the Internet*. New York, Simon & Schuster.
- Vogler, C. (1985). *A Practical Guide to Joseph Cambell's The Hero with a Thousand Faces*. http://www.thewritersjourney.com/hero%27s_journey.htm.
- Wachowski, L. and A. Wachowski. (1999). *Chat with the Wachowski Brothers*. (log from online chat session)
<http://forums.thelastfreecity.com/viewtopic.php?f=46&t=6635>.
- Wagner, K. (2003). *Fotografi som digital bild: narration och navigation i fyra nordiska*

konstverk. University of Gothenburg.

Wall, S. (2006). "An Autoethnography on Learning about Autoethnography." *International Journal of Qualitative Methods* 5. p. 1-12.

Wallace-Wells, D. (2011). "William Gibson: The Art of Fiction No. 211." *Paris Review*. <http://www.theparisreview.org/interviews/6089/the-art-of-fiction-no-211-william-gibson>

Walther, B. K. (2003). Cinematography and Ludology: In Search of a Lucidography. Paper presented at the *spilforskning.dk Conference*, University of Southern Denmark.

Watkins, C. and S. Marenka (1994). *Virtual Reality Excursions with Programs in C*. Cambridge, Academic Press.

Watts, L. (2012). "Reconstructing the Future of the Mobile Telecoms Industry." *The Fibreculture Journal*(20). p. 33-57.

Watts, L. (2006). The Future is Boring and other tales from a Future Archaeologist. Performed at the *EASST Annual Conference*, Lausanne, Switzerland.

Weber, S. (2010). A Virtual Indication. *Digital and other virtualities - renegotiating the image*. A. Bryant, G. Pollock. London, I. B. Tauris.

Wershler-Henry, D. (1989). "Queen Victoria's Personal Spook, Psychic Legbreakers, Snakes, and Catfood: An Interview with William Gibson and Tom Maddox." *Virus*(23). p. 28-36.

Wertheim, M. (1998). The Medieval Return of Cyberspace. *The Virtual Dimension: Architecture, Representation, and Crash Culture*. J. Beckmann. New York, Princeton Architectural Press.

Wertheim, M. (1999). *The Pearly Gates of Cyberspace: A History of Space from Dante to the Internet*. New York, Norton.

Westin, J. and T. Eriksson. (2010). "Imaging the Sanctuary of Hercules Victor." *Archeomatica*(2). p. 58-62.

Whittle, D. (1996). *Cyberspace: The Human Dimension*. New York, W.H.Freeman & Co Ltd.

Whitwam, R. (2014). *Pulse laser used to create 3D display in mid-air*. <http://www.geek.com/science/pulse-laser-used-to-create-3d-display-in-mid-air-1608487/>.

Wiemker, M. and J. Wysocki (2014). "When people pray, a god is born... This god is you!": An Introduction to Religion and God in Digital Games." *Online - Heidelberg Journal for Religions on the Internet* 5. p. 197-223.

Willim, R. (2006a). Under ytan: Om digitala föreställningsvärldar och dold komplexitet. *Virtualiteter - Sex essäer*. R. Willim. Lund, Lunds Universitet.

- Willim, R. (2006b). *HEX. Virtualiteter - Sex essäer*. R. Willim. Lund, Lunds Universitet.
- Vinge, V. (2006). *Austin Game Conference keynote* (lecture). Austin Game Conference, September 7-8, 2006, Austin, Texas.
- Winograd, T. (1996). *Bringing Design to Software*. San Francisco, Addison-Wesley.
- Winter, S. and P. Johansson (2009). Digitalis filosofi Människor, modeller och maskiner. *SE:s Internetguide* 13.
- Witmer, B. and M. Singer (1998). "Measuring Presence in Virtual Environments: A Presence Questionnaire." *Presence* 7(3). p. 225-240.
- Wooley, B. (1992). *Virtual Worlds: A Journey in Hype and Hyperreality*. Massachusetts, Blackwell.
- Wahlström, O. (1990). "Skissmetoden." *Tidskrift för arkitekturforskning* 3(12). p. 166-176.
- Zagorac, A. (2009). *"A Splinter in Your Mind": Subjectivity, Hyperreality, and Religion in The Matrix*. Universität Wien.
- Zeltzer, D. (1992). "Autonomy, interaction and presence." *Presence* 1. p. 127-132.
- Žižek, S. (2002). *Welcome to the desert of the real!: five essays on 11 September and related dates*. London, Verso.
- Ödman, P.-J. (2007). *Tolkning, förståelse, vetande: Hermeneutik i teori och praktik*. Norstedts Akademiska Förlag.
- Özcan, O. and A. A. Ünlüer (2012). Re-reading String for Designing Interfaces in Animated Movies. Paper presented at the *Scandinavian Student Interaction Design Research Conference*, Göteborg, Sweden.

Fictional movies

This list includes movies that I have analyzed, as well as fictional movies that have informed the analysis.

- Amenábar, A. (1997). *Abre Los Ojos*. Lionsgate.
- Anderson, P. (2002). *Resident Evil*. Constantin Film.
- Anderson, P. (2010). *Resident Evil: Afterlife*. Sony Pictures.
- Blomkamp, N. (2009). *District 9*. TriStar Pictures.
- Boyle, D. (2007). *Sunshine*. 20th Century Fox.
- Branit, B. (2007). *World Builder*. Branit FX.
- Cameron, J. (1984). *The Terminator*. MGM.
- Cameron, J. (2009). *Avatar*. 20th Century Fox.
- Carpenter, J. (1981). *Escape from New York*. AVCO Embassy Pictures.
- Chung, P. (2003). Matriculated. *The Animatrix*. W. Brothers, Warner Bros.
- Clegg, T. (1976). Journey to Where. *Space: 1999*. Group 3.
- Cronenberg, D. (1999). *eXistenZ*. Buena Vista.
- Crowe, C. (2001). *Vanilla Sky*. United International Pictures.
- Ephron, N. (1998). *You've Got Mail*. Warner Bros. Pictures.
- Eubank, W. (2011). *Love*. Angels and Airwaves.
- Favreau, J. (2008). *Iron Man*. United International Pictures.
- Fleming, V. (1339). *The Wizard of Oz*. Metro-Goldwyn-Mayer.
- Graham, M., T. Jordan and A. Pharoah (2006). *Life on Mars*. BBC.
- Gustavson, E. (1999). *Sofies verden*. Svensk Filmindustri.
- Jones, A. (2003). Flight of Osiris. *The Animatrix*. W. Brothers, Warner Bros.
- Kamiyama, K. and M. Tachibana (2002). The Man Who Dwells in the Shadows of the Net - Chat! Chat! Chat! *Ghost in the Shell - Stand Alone Complex*. Bandai Visual Company
- Katleman, M., D. Martin and A. Zakrzewski (2008). *Life on Mars* (US). 20th Century Fox Television.
- Kawajiri, Y. (2003). Program. *The Animatrix*. W. Brothers, Warner Bros.
- Kershner, I. (1980). *Star Wars: Episode V - The Empire Strikes Back*. 20th Century Fox.
- Koike, T. (2003). World Record. *The Animatrix*. W. Brothers, Warner Bros.
- Kosinski, J. (2010). *Tron Legacy*. Walt Disney Pictures.

Kubrick, S. (1968). *2001: A Space Odyssey*. Metro-Goldwyn-Mayer.

Lang, F. (1927). *Metropolis*. Universum Film.

Leonard, B. (1992). *The Lawnmower Man*. New Line Cinema.

Leonard, B. (1995). *Virtuosity*. Paramount Pictures.

Lisberger, S. (1982). *Tron*. Walt Disney Productions.

Longo, R. (1995). *Johnny Nmemonic*. Columbia TriStar.

Lucas, G. (1977). *Star Wars: Episode IV - A New Hope*. 20th Century Fox.

Lucas, G. (1999). *Star Wars: Episode I - The Phantom Menace*. 20th Century Fox.

Lucas, G. (2002). *Star Wars: Episode II - Attack of the Clones*. 20th Century Fox.

Lucas, G. (2005). *Star Wars: Episode III - Revenge of the Sith*. 20th Century Fox.

Maeda, M. (2003). The Second Renaissance Part I. *The Animatrix*. W. Brothers, Warner Bros.

Maeda, M. (2003). The Second Renaissance Part II. *The Animatrix*. W. Brothers, Warner Bros.

Marquand, R. (1983). *Star Wars: Episode VI - Return of the Jedi*. 20th Century Fox.

McG (2009). *Terminator Salvation*. Sony Pictures Home Entertainment.

Menzies, W. C. (1936). *Things to Come*. London Film Productions.

Morimoto, K. (1995). *Magnetic Rose*. Studio 4°C.

Morimoto, K. (2003). Beyond. *The Animatrix*. W. Brothers, Warner Bros.

Mulcahy, R. (2007). *Resident Evil Extinction*. Sony Pictures.

Mårland, M. and B. Stein (2005). *Storm*. Breidablick Film AB.

Nakata, H. (2010). *Chatroom*. Ruby Films

Nevelidine, M. and B. Taylor (2009). *Gamer*. Lionsgate.

Nielsen, T. B. (1998). *Skyggen*. Zeitgeist.

Nolan, C. (2010). *Inception*. Warner Bros Pictures.

Oshii, M. (1995). *Ghost in the Shell*. Bandai Visual Company.

Oshii, M. (2001). *Avalon*. Miramax Films.

Ratner, B. (2006). *X-Men: The Last Stand*. 20th Century Fox.

Rusnak, J. (1999). *The Thirteenth Floor*. USA, Columbia Pictures.

Sandberg, D. (2015). *Kung Fury*. Laser Unicorn.

Scott, R. (1979). *Alien*. Twentieth Century-Fox Productions.

Scott, R. (1982). *Blade Runner*. Warner Bros. Pictures.

Scott, T. (2006). *Déjà Vu*. Touchstone Pictures.

Singh, T. (2000). *The Cell*, New Line Cinema.

Softley, I. (1995). *Hackers*. United Artists.

Spielberg, S. (2001). *A.I. Artificial Intelligence*. DreamWorks SKG.

Spielberg, S. (2002). *Minority Report*. Twentieth Century Fox.

Snyder, Z. (2013). *Man of Steel*. Warner Bros.

Turner, J. and L. Campbell (2001). *Space*. BBC.

Usborne, T. (2007). *Atom*. BBC.

Volckman, C. (2006). *Renaissance*. Pathé.

Wachowski, A. and L. Wachowski (1999). *The Matrix*. Warner Bros. Pictures.

Wachowski, A. and L. Wachowski (2003). *The Matrix Reloaded*. Warner Bros. Pictures.

Wachowski, A. and L. Wachowski (2003). *The Matrix Revolutions*. Warner Bros. Pictures.

Watanabe, S. (2003). A Detective Story. *The Animatrix*. W. Brothers, Warner Bros.

Watanabe, S. (2003). Kid's Story. *The Animatrix*. W. Brothers, Warner Bros.

Weir, P. (1985). *Witness*. Paramount Pictures.

Wilcox, F. (1956). *Forbidden Planet*. Metro-Goldwyn-Mayer.

Wiseman, L. (2012). *Total Recall*. Columbia Pictures.

Zemeckis, R. (1997). *Contact*. Warner Bros. Pictures.

Fictional literature

This list includes fictional literature that I have analyzed, as well as fictional literature that have informed the analysis.

- Baxter, S. (1994). *Ring*. London, HarperCollins.
- Baxter, S. (1998). *Darkness. Traces*. London, HarperCollins.
- Baxter, S. (2000). *Reality Dust*. Harrogate, PS Publishing.
- Baxter, S. (2002). *Dante Dreams. Phase Space*. London, Harper Collins.
- Baxter, S. (2002). *Touching Centauri. Phase Space*. London, HarperCollins.
- Baxter, S. (2006). *The Siege of Earth. Resplendent*. London, Gollancz.
- Baxter, S. (2005). *Transcendent*. London, Gollancz/Orion.
- Baxter, S. (2013). *Proxima*. London, Gollancz.
- Bradbury, R. (1951). *The Veldt. The Illustrated Man*. R. Bradbury. New York, Doubleday & Company.
- Bradbury, R. (1953). *Fahrenheit 451*. New York, Ballantine Books.
- Carroll, L. (1865). *Alice in Wonderland*. London, Macmillan.
- Cline, E. (2011). *Ready Player One*. London, Arrow books.
- Gibson, W. (1984). *Neuromancer*. New York, Ace.
- Gibson, W. (1986). *Burning Chrome. Burning Chrome*. London, Harper Collins.
- Gibson, W. and M. Swanwick (1986). *Dogfight. Burning Chrome*. London, Harper Collins.
- Gibson, W. (1986). *Fragments of a Hologram Rose. Burning Chrome*. London, Harper Collins.
- Gibson, W. (1986). *Count Zero*. London, Victor Gollancz.
- Gibson, W. (1988). *Mona Lisa Overdrive*. London, Victor Gollancz.
- Gibson, W. (1993). *Virtual Light*. London, Penguin Books.
- Gibson, W. (1996). *Idoru*. New York, Viking Press.
- Gibson, W. (1999). *All Tomorrow's Parties*. New York, Viking Press.
- Hamilton, P. (2007). *The Dreaming Void*. London, PanMacmillan.
- Huxley, A. (1932). *Brave New World*. London, Chatto & Windus.
- Nilsson, P. (2013). *Stjärnvägar : en bok om kosmos*. Stockholm, Norstedts.
- Reynolds, A. (2002). *Redemption Ark*. London, Gollancz.
- Shelley, M. (1818). *Frankenstein; or, The Modern Prometheus*. London, Lackington, Hughes, Harding, Mavor, & Jones.

Stephenson, N. (1992). *Snow Crash*. New York, Bantam Books.

Vinge, V. (1981). *True Names*. Round Rock, Texas, Dell.