Dissertation

Designing for Emotions -
arguments for an emphasis on affect in design

Ausgeführt zum Zwecke der Erlangung des akademischen Grades
eines Doktors der technischen Wissenschaften

unter der Leitung von
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Eingereicht an der Technischen Universität Wien
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Wien, am 19. 10. 04

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Designing for Emotions -
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Doctoral thesis submitted in October 2004 at

Vienna University of Technology

Design and Assessment of Technology Institute

Vienna, Austria

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ABSTRACT

Our everyday life is full of emotional experiences. We constantly act - either conscious or uncoscious - on base of emotions. Until now, research in Human Computer Interaction (HCI) did not reflect the influence of emotions. Yet numerous other scientific fields researched this theme in recent years. The goal of this dissertation is to relate the findings in these fields to those in Human Computer Interaction in order to present a theroretical framework for the practical implementation of new forms of interaction that acknowledge the importance of emotional involvement. Hereby I strive for presenting the available theories in their complexity rather than simplifying them. I do not cover the *strong* emotions like love, hatred and fear but rather concentrate on *weak* emotions such as liking something, immersion and fun.

This dissertation is organised into several sections that cover central aspects of the topic. The text is accompanied by several examples from art, architecture, and my own artistic practice. Art has always nourished an emotional link between the audience and the art piece. Therefore design and thus interaction design can learn a lot from art in this regard. Especially in media art some instruments have been developed over the last years that foster the playful interaction with serious content.

Human activity is often analysed in terms of *problem solving* behaviour. I present different theories from psychology and cognitive science on this issue. An important point for the development of emotions is the relation between the expected and the actual outcome of an activity. The *Theory of Inquiry* by John Dewey acknowledges this fundamental fact and will thus be followed throughout this dissertation. His theory explains human activity as interactive process. In order to provide a background for the extension of this theory into interactivity, I examine different modalities of perception. Even on this level of cognition, humans tend to be more than receivers in the communication with their surroundings - they rather inquire their environment interactively. Emotions shape this inquiry and are shaped by it.

In order to transform the insights of the analysis of problem solving behaviour into practical knowledge, scientific disciplines are examined that already have acknowledged the interrelations between emotions and cognition. Scores of media theorists commented the interactive aspects of communication. Other disciplines of science that embrace emotions are narratology and ludology. Narratology is closely related to the concept of metaphors and treats problem solving as a narrative process. Ludology focuses on games as problems of diverse characteristics. Both disciplines are examined on their applicability on user interface design. The result of this examination is that the interface should rather be an instrument - in the sense of musical instruments - than a tool. The prime goal should be that it is learnable rather than trivial.

In the last chapters, possibilities are described to translate the theoretical findings into practical design projects using *design instruments*. Rather than developing yet another generic design method, I focus on outlining design instruments. Especially in the case of projects that should affect the emotional side of the user design has to abandon strict methods. Instead, design has to be seen as an open and holistic process. This also calls for a stronger involvement of the end-user in the design process.

ACKNOWLEDGEMENTS

Thank you: Daniel Aschwanden, Jeebesh Bagchi, Atle Barcley, Ute Meta Bauer, Laura Beloff, Erich Berger, Christine Böhler, Andy Best, Christiane Erharter, Thomas Grill, Tom Haberfellner, Jürgen Hagler, Reni & Jogi Hofmüller, Derek Holzer, Eva Hornecker, Hans Knöll, Jochen Koubek, Christoph Leitner, Sabine Maier, Michael Mastrototaro, Erich Möchel, Peter Mörtenböck, Monica Narula, Renate Oblak, Simone M. Paischer, Ian Pedigo, Jörg Pflüger, Eva-Maria & Werner Pichlmair, Maria & Rainer Pichlmair, Michael Pinter, Peter Purgathofer, Wilfried Reinthaler, Lorenz Seidler, Shuddhabrata Sengupta, Michael Strohmann, Klaus Taschler, Annie Wan, Yosi Wanunu, Vitus Weh, the Office for Contemporary Art Oslo, the Art Department of the Bundeskanzleramt, the Art Department of the City of Vienna, the Artelier Nord Oslo.

INTRODUCTION

When I started working on my master's thesis, my research interests were focused on the qualities of good user interfaces. Back then I tried to pin down the essence of good interaction design to a handful of concepts. I described those concepts mostly concerning one single device: a Nokia mobile phone that features an easily understandable interface comparable to no other interface I have never seen before or afterwards. I still use this phone, telling myself that I do it for its good interface; Being honest, I have to admit that I still use it because it feels like *mine*. I kept talking to people on why they bought a specific mobile phone and the answers provided can be boiled down to a number of aspects that people liked: Some bought their phone on basis of technical capabilities (which they do not necessarily use or need). Some bought it out of an economic decision. A last group of people emphasised the role of aesthetics in the decision-making process. For sure, most consumers fall into all three categories to varying degrees; yet one thing is remarkable: for many people, aesthetic qualities overrule all others - at least to a certain (existential) boundary. They neglect products that might work better for them. Donald Norman discusses this habit in his recent book ‹Emotional Design›:

> »Most of us just decide on something, but if asked why, often don't know: ‹I just felt like it›, one might reply. A decision has to ‹feel good› or else it is rejected, and such feeling is an expression of emotion.«
> (Norman 2004)

What Norman states here is that good product design has to acknowledge not only how the product is characterised in terms of *functionality*, but also in terms of likability. People not only want to accomplish their task but also want to like how they accomplish it. A content user is not one who reaches the goal first, but who felt best in reaching the goal. On this stage of decision making, emotions play the role of unconsciously summarising an infinite problem space. When buying a mobile phone, neither technological nor economic decisions include the others, yet emotional decisions have the power to embrace all important factors. Here, emotions play the role of cognitive short-cuts in decision making as described by Sloman (2001). This is also the reason, why I stick to my mobile phone.

Other - even more striking - arguments that caused me rethink the role of emotions are: emotions are a qualitative aspect of almost every task we carry out. Because decision making is an aspect of problem solving and problem solving is so often accompanied by emotions, I felt the need to reconsider fundamental aspects of human behaviour.

After writing my master's thesis, I was mainly working on (media) art productions. That shifted my interest gradually toward ever more complex views of reality. Art is a complicated matter that works via the whole palette of modalities of human cognition. Art works do not need to make sense, yet if they fail to do so, they at least have to *work*: They have to provide a rewarding experience, upon that *sense* is introduced by the audience. In my opinion, the borders between art and design are blurred: from architects bringing in their very personal attitudes to artists focusing on qualitatively high production values and economic decisions, a cultural industry emerges, dwelling the borderland between art and design. Borders between art and science are - especially in the media art sector - constantly crossed anyway, as are those between art and technology. Every new technology is embraced by the media art scene, a process that sometimes looks as if it is a race for being the first to make art out of a new development. What I learned from my art projects is that there is a link between art and more serious design projects and also design thinking in general. One of the tasks of this dissertation is to uncover this link.

Since art focuses on the emotional response of the audience even more than product design, it seems adequate to work upon design in the light of insights gained from art. As already mentioned, the role of the audience is crucial in every art production. Each person in the audience has to make a personal decision: it has to accept the art piece or refuse it. There is no dichotomy between *art* and *not art*, but between the very personal expression of *good art* and *bad art*. This qualitative decision is taking into account aesthetic as well as functional (and even economic) aspects: it is an emotional decision that bears resemblance to the decision of acquiring a product. This brings the fundamental factor into play that I missed out in my master's thesis: the role of the audience, respectively the user. As the emotional aspects of problem solving are centred around the subject as much as they are around the object, I have to treat both as equally important in the course

of the interaction that is taking place. This means that design has to take into account that there is a human, a user bringing attitudes and instincts with her - a deeply emotional being.

Norman, D. (2004): *Emotional Design*. Basic Books, New York.

Sloman, A. (2001): *Beyond Shallow Models of Emotion*. Cognitive Processing, Vol. 2, Issue 1, pp. 177–198.

CHAPTER OUTLINE

The general organising principle of this dissertation is focused on three central aspects of the field of investigation: Perception, Representation and Interactivity. After an introduction into the state of research in the field of emotions, given in the section *Emotions*, the human side of the problem is covered. This is accomplished through the notion of *perception*, thus the chapter holds this name. The focus of the next section is on *representation*: the qualities of the device or tool - the world. The following section is about *interactivity*, the link between the subject and the object side. Instead of a synopsis, a whole additional section, entitled *Design*, was written to cover the findings of the first three sections and interconnect them, arriving at a model of how design might interact with emotions. Every section starts with an overview of the different areas of research that affect it and of the historic developments in the field. The sections are organised into several chapters. The following outline does not cover each chapter but gives an overview of each section.

Emotions

The section *Emotions* gives an introduction into the scientific research in the field. It discusses several aspects of emotions and different approaches in research. The fundamental work of John Dewey (1894, 1895, 1938) forms the central line of thought that is followed through all this dissertation, as it describes not only emotions, but the whole process of understanding around the interaction of the human with the world by utilizing tools as instruments. The triad of mind, action and world forms the basis of all further thinking in this book. Additionally, the affect system is explained in respect to the recent findings of Damasio (1994) and Cacioppo & Gardner (1999). The chapter *Solving Problems* discusses approaches in cognitive science following Sloman (2001), Hayes-Roth & Hayes-Roth (1979) and Johnson-Laird (1983). It questions the usefulness of the concept of mental models. The following three sections are organised around this principle as perception focuses on the mind, representation on the world (presented as a tool), and interactivity on the action.

Perception

In this chapter I discuss key human senses: vision, hearing and haptics (in that order). Beside brief coverage of the biological aspects of the senses, a decent overview of past - mostly based on Déscartes (1628, 1637) put in contrast to constructivism (Foerster & Glaserfeld 1992) - and present theories - following Barry (1997) - on the matter of perception is given. This is accomplished by describing what happens in the subject as well as regarding the perceived object. Another focus is the relation between these sensual modalities. As all senses are connected with each other (see Massaro (1987) and McGurk & MacDonald (1976)), they form a unity of impressions. While separating each sense into its own chapter is useful for pragmatic reasons, it should not lead to the thought that the senses are this nicely separated as cognitive processes.

Representation

This section covers aspects of the world and how it presents itself to the beholder. After giving an introduction to basic aspects of communication and semiotics (following Peirce (1935) and Saussure (1916)), and metaphors (as memes (Dawkins 1976, 1993) and in language (Lakoff & Johnson 1980), I arrive at a picture of representation that embraces the process of perception. Communication forms the starting point as representation is not about the physical qualities of an object but about what it *means*. Communication theory leads to media theory, thus a brief overview on current trails in media theory is given (based on McLuhan (1964) and leading to Manovich (2001)). Architecture plays a significant role as one of the oldest and most reflected design disciplines. Thus, a treatment of the *architecture of the virtual* follows that serves two purposes: it highlights the inherently indirect manner of representation in mediated environments and it brings the haptic qualities of architecture into play (following Benjamin (1968) and Novak (2004)). This leads to a discussion of navigation (Manovich 2001) - and thus to the following two chapters. First, *playing games* is discussed as it refers to the haptic qualities again and brings to the notions of immersion and identification about (Bolter & Gruisin 1999, Wallenstein 2003 and Taylor 2003). Second, the navigation of narrative spaces is explored following Marie-Louise Ryan (2001a). This trajectory focuses playing games as well as setting up narratives to acts of problem solving and roots them in everyday life. Thus, we arrive at interactivity as the prime method of understanding.

Interactivity

Many aspects of interactivity have already been covered in the previous chapters. Therefore, I give an overview of some very basic workings of interactivity - *gestures*, *affordances* and *constraints* - in this section. Current trails in user interface design and human computer interaction are discussed (as a conflict between arguments by Norman (1990) and Fujihata (2001)). During this chapter the fundamental question is again: How do we solve problems? This part of the book is very practical and it puts an even stronger emphasis on real world examples that underline my theories than previous chapters.

Design

The last section of this book brings all theories and observations of the previous sections together. As problem solving forms the centre of attention, the difficulties in creating predefined methods (as those of Alexander (1964), that are based on the workings of ancient Greek geometers, as can be seen in Hintikka & Remes (1974)) for problem solving are discussed. These difficulties have their origin in the nature of problems themselves. Again, Dewey's ‹Theory of Inquiry› (1938) is the main source of inspiration - especially in the reading of Gedenryd (1998). The solution found in this section is that design should focus on the process (Lawson 1980). Emotions only arise if the user is able to bring in his personal attitude. Different classes of emotional immersion occur on different levels. On each level of design, these must be acknowledged in order to successfully produce an intriguing product - in order to make people understand, and provide them the pleasure of interaction that sets an interactive product apart from others. In the last chapters I summarise all concepts of this dissertation to arrive at an elaborate description of the workings of emotions in interaction architecture (leading to concepts like *Ambiguity* discussed by Gaver & Beaver (2003)) that hopefully yields results in other domains, too, as it challenges many existing theories on how humans understand, interact and solve problems.

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EMOTIONS

»Sometimes the truth of a thing is not so much in the think of it, but in the feel of it.« Stanley Kubrick

Researchers of many areas of science propose their own view on emotions. Emotions are a biologic function, thus evolution theory tries to describe why they were developed. Although some scientists refuse emotions to have functionality above very primitive mechanisms of instinct (Sloman 2001) it is likely that they also serve other purposes. The next chapter will give an overview of theories of emotion in different scientific disciplines. This overview will then serve as a starting point for a more detailed view on what lies behind emotions and how to deal with this omnipresent matter.

Early examples for theories of emotions are those of Dewey (1894, 1895) and Mead (1895). They cover the connection between affect, emotions and attitude. From them I will depart and arrive at recent research into emotions. Brave & Nass (2003) provide a good overview of current research into emotions. Brave separates emotions into the categories mood, emotion, attention, sentiment and memory. Some researchers concentrate on attention and its implications (Yamasaki et al. 2002, Pessoa et al. 2002). Angrilli (1997) researches in subjective perception of time. Peter Desmet (2004) concentrats on value and emotions and product emotions. Related to value is the concept of reward (Blood & Zatorre 2001). Another area of research is consciousness (Ellis & Newton 2000a & 2000b, Georgalis 2000). Even Aristotle's view of emotions is researched (Nieuwenburg 2002).

There is a plethora of papers on attention and how to focus it in computer sciences (e.g. Buxton & Gaver 1994). Picard (1997 & 2002) is surely the most active researcher into computers having (or posing) emotions - others are Fulda (1998) and Chella (2000). Picard collaborates with Kapoor (2001) in this subject. She also works on detecting the emotional state of the user (Reynolds & Picard 2001).

As often, there is no final definition of emotions. The following quotes are meant to give an outline of how emotions are seen rather then defining the term. Thus, I will not comment them, but let them stand on their own.

Ralph Ellis and Natika Newton propose a definition of emotions (although they agree that it is a difficult task to define them) as:

> »(a) the state arises from a self-motivating drive to attain a particular holistic equilibrium in the face of real or imagined environmental circumstances;
>
> (b) the state includes or is associated with an implicit or explicit representation of the conditions needed for the desired goal, such that the representation can play a role in bringing about the goal (e.g. by serving as an initiator of and guide to action).«
> (Ellis & Newton 2000b, p. 5)

Nietzsche comments on emotions indirectly by writing on the qualities of strong feelings:

> »Alle *stärkeren* Empfindungen bringen ein Miterklingen verwandter Empfindungen und Stimmungen mit sich: sie wühlen gleichsam das Gedächtnis auf ... So bilden sich angewöhnte rasche Verbindungen von Gefühlen und Gedanken, welche zuletzt, wenn sie blitzschnell hintereinander erfolgen, ... als *Einheiten* empfunden werden. ... Auch hier, wie so oft, verbürgt die Einheit des Wortes Nichts für die Einheit der Sache.« (Nietzsche 2000, Paragraph 14, italics his)

> »All *stronger* feelings trigger related feelings and affective states: they perturb the mind. ... Thus, learned fast links between feelings and thoughts, that are after all, rapidly following each other, ... are considered as *unity*. Here, as so many times, the unity of the word does not ensure the unity of the matter.« (Nietzsche 2000, Paragraph 14, my translation, italics his)

In the following chapters I will discuss theories of emotions. Without devaluing the above statements, I will focus on the *weaker* emotions from now on. This means, that the above strong emotions - such as *grief, tragedy* and *romantic love* - will not be part of this dissertation. Instead, I concentrate on emotional attitudes such as *liking* something, general *well-being* and *satisfaction*. While some negative feelings will be touched, the prime interest is to provide constructive hints on how to nourish the development of design practices that allow for positive emotions. In order to provide the necessary background, the next chapter will start with a historical overview of theories of emotions.

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THEORIES OF EMOTIONS

»Any system of signs must be explored not only in terms of its meaning, but in its ‹asemiotic› or arepresentational component as well, i.e. as a regime of desire and affect, an organisation of force relations, rather than as a linguistic or ‹mental› structure...« Bogard, 2000

Life is shaped by emotions. They are one of the centres of our everyday experience. Emotions play a key role in decisions we take in our lives, affect nearly everything we do. Still, they are barely understood. Everyone knows them, yet few can give an exact definition what they are. Research on theories of emotions is undertaken in various branches of science: cognitive science (Simon 1967, Oatley & Johnson-Laird 1987, Sloman 1998 & 2001), neuroscience (LeDoux 1995, Damasio 1994, Cacioppo & Gardner 1999, Pessoa et al. 2002), philosophy (Baudrillard 1979, Nieuwenburg 2002) and cultural sciences (Mesquita et al. 1997, Russell 1994). There is a discussion about terminology (Read & Sloman 1993), means and methods (Schwartz & Stone 1998, Litt 1998). It is very hard to see through the fog of war between the battles that rage in order to formulate a theory of emotions. In computer sciences, the influence of cognitive science is strong - especially via the joint field of human computer interaction and artificial intelligence and its heritage. Research reaches from the measurement of user responses to expression for computers (Reynolds & Picard 2001, Picard 1997, 2002) and design theory (Norman 2004).

In contrast to Rationalism

The assumption that higher forms of human existence - rational decision making - are subject to being »highjacked by the pirates of emotion« (Cacioppo & Gardner 1999) dates back to the ancient Greek philosophers. Since then, the main efforts in understanding our thinking started from the assumption that emotions are primitive, hindering our development towards a rational and objective being (although it is neglected that animals have emotions). While there are still some scientists that view emotions as a disruptive force in rational thought (Sloman 2001), others disagree and see this argument as an oversimplification (Berntson et al. 1993). Currently more and more evidence is found that emotions play a significant and constructive role in our experiences.

The notion of emotion itself is seen as too vague by nearly all participants of the discussion - it includes aspects of experiential, behavioural, sociodevelopmental and biological phenomena. Constructivists approach this problem traditionally by breaking it down into smaller units (e.g. Brave & Nass 2003) while others demand a more holistic view, stating that emotion is ubiquitous in our life:

> »Research over the past two decades on cognition and emotion provides further evidence for the ubiquity of emotion, with the influence of emotion extending to all aspects of cognition and behaviour.« (Cacioppo & Gardner 1999, p.195)

There are some very basic aspects of emotions upon which most researchers agree: First of all, emotions are relative (as opposed to absolute). We do not like something or not, we like something *more than* something else (see Brendl & Higgins 1995 and Shah 1998, and especially Medvec 1995). Secondly, they are individual (Kahnemann 1993) and subject to interaction with our perception and our personal situation (Schwartz & Strack 1998). Thirdly, emotions are based on an underlying system of affect. While some scientists even attest a number of emotions to be »basic«, separation between affect and emotion seems to be the agreed approach.

Cacioppo & Gardner outline asymmetry in emotional perception. What they term the *positivity offset* is a »tendency for there to be a weak positive (approach) motivational output at zero input, an intercepting difference in the affective system« (Cacioppo & Gardner 1999, p. 205). The positivity offset is what makes us curious about a new environment. It is what puts us in a position that makes us experience our surroundings and learn from it. Evidence of this bias towards a positive approach is found in many areas as *unrealistic optimism* or *positivity bias* (Brinthaupt 1991, Hoorens & Buunk 1993, Pulford & Colman 1996, Regan et al. 1995), although it is opposed by a negativity bias, as Cacioppo et al. (2004) summarise:

> »Species with a positivity offset and a negativity bias enjoy the benefits of exploratory behaviour and the self-preservative benefits of a predisposition to avoid, scrutinize, and withdraw from threatening

> events. These features represent only the rudimentary operations of an affect system, however. A heterarchical organization of the neural components constituting the affect system provides a rich repertoire of processing operations that vary in their speed, contextual control, and behavioral flexibility.« (Cacioppo et al. 2004)

The Body and Affect

At the advent of psychology - in the late 19th century - emotions were discussed as an important and significant part of our lives. Dewey and Mead developed a theory of emotions based on Darwin's theory of evolution. Prior to them, Charles Darwin himself tried to bring emotions in coherence with his theories about evolution. In his book ‹The Expression of Emotions in Man and Animals› he connects emotions to the body in a very direct manner and lays the ground for later theories on emotions:

> »Most of our emotions are so closely connected with their expression that they hardly exist if the body remains passive -- the nature of the expression depending in chief part on the nature of the actions which have been habitually performed under this particular state of mind« (Darwin 1880, p.239).

Thus, Darwin first links emotions to habit and then expression to emotions. While expression is only the externalised bodily reaction in a state of emotional charge, he also deals with purely internal reflections of the body: »A man, for instance, may know that bin [*sic*] life is in extremest peril, and may strongly desire to save it; yet as Louis XVI said when surrounded by a fierce mob, ‹Am I afraid? Feel my pulse.› So a man may intensely hate another, but until his bodily frame is affected he cannot be said to be enraged.« (Darwin 1880, p.239)

Hunt and Campell (1997) conclude that the affect system that underlies the emotional system seems to have developed out of the evolutional need to distinguish between hostile and hospitable. On this very basic level of cognition »rudimentary reflexes for categorising and approaching or withdrawing from certain classes of stimuli« (Cacioppo & Gardner 1999, p. 199) exist. One remarkable feature

in this context is the extent to which they can shape affective categorisations through learning. We are able to adapt our attentional and cognitive resources to a situation. And we learn to put our affective conditions into an appropriate state. There is evidence that affective perception and processing is handled completely different than classification and discrimination in non-evaluative situations (see Cacioppo & Gardner (1999) and Cacioppo & Berntson (1999) for details).

John Dewey undertook several studies on affect (Dewey 1894). He tried to bring the James-Lange theory of emotional discharge in accordance with Darwin's theory of evolution. Thereby he arrived at describing emotions as »the reduction of movements and stimulations originally useful into attitudes.« (Dewey 1894, p.569). They are separated from instinct (that still serves a purpose) and represent an attitude: an attitude is a state of mind towards some stimuli. So emotions - or affect - are a state of mind towards a stimuli, that stems from originally purposeful bodily actions and reactions, now separated from their purpose and transformed into something more generally useful, a standpoint - an attitude.

Attitude and Gefühlston

To transform an action into an attitude one has to try where the action leads to. This behaviour can often be observed at little children. They try out how specific actions lead to results in the world before they store them as habits. In this view, only tested and proven actions (and reactions) might turn into emotions. Thus, emotions are not predefined or fully inherited - they have to be (at least partially) learned. Learning them is an intuitive process that a child runs through. The knowing of the results of an act is also perceived by George Mead:

> »In the simple instinctive act that lies behind every emotion ... These stimuli in the form in which we can study them, seem to be more or less rhythmical repetitions of those moments in the act itself which call forth especially the vaso-motor response. In this form they are recognized as aesthetic stimuli ... It is under the influence of stimuli of this general character that the emotional states and their physiological parallels arise. The teleology of these states is that of giving the organism an evaluation of the act before the coordination that leads to the particular reaction has been completed.« (Mead 1895, p.163)

In this statement Mead describes two characteristics that seem to be necessary to encourage emotions: First, there is a relation between a desired or expected reaction and what is happening. Second, there is a clear emphasis on vaso-motor or haptic impressions. Emotions therefore have to do with acting instead of happening. And they are very closely related to our body.

John Dewey further elaborated this concept in the second part of ‹The Theory of Emotion›, published in the same year as Mead's book quoted above. He terms the concept behind the prediction of outcomes of an act *Gefühlston*:

> »It [Gefühlston] is interest read backward: That represents the complete identification of the habits with a certain end or aim. The tone of sense-feeling represent the reaction, the incorporate identification, of the successful ends into the working habit. It is not, as I have hitherto indicated, habit as habit which becomes feelingless; it is only the habit which serves as mere means, or serial stimulus.« (Dewey 1895, p.31)

If we let ourselves be guided by emotions, we are not acting in regard of interests, but in regard of feeling - or Gefühlston. We choose not an outcome, but an action (as a habit). This certainly puts us in radical contrast to the rational behaviour described by Déscartes. It abandons the idea of analysis of a situation followed by synthesis. I will cover the relation between rationalism and emotions in far greater detail later in this dissertation. For now, it should be sufficient to understand that the emotive act works as experimental synthesis on-the-fly according to Dewey. Since we can never know the outcome of an action but act as if we knew, there is certainly a situation of evaluation and struggle. John Dewey summarises the relations between affect, emotions, interest and Gefühlston as:

> »To sum up:-- certain movements, formerly useful in themselves, become reduced to tendencies to action, to attitudes. As such they serve, when instinctively aroused into action, as means for realizing ends. But so far as there is difficulty in adjusting the organic activity represented by the attitude with that which stands for the idea or end, there is temporary struggle and partial inhibition. This is reported as Affect or emotional seizure. Let the coordination be effected in one act, instead of in a successive series of mutually exclusive stimuli, and we have interest. Let

such coordinations become thoroughly habitual and hereditary, and we have Gefühlston .« (Dewey 1895, p.32).

Theories of Emotions

There are three aspects of emotions agreed upon by many scientists:
- Emotions occur as a tension between intended, desired or expected and actual outcome of an action.
- Emotions are relative, not absolute.
- Emotions are to a vast degree organic.

In this dissertation I will discuss some biologic facts behind emotions in the discussion of perception, yet I will not put them into the centre of attention. I will acknowledge the relative aspects of emotions. And I will focus on the tension between intended and actual outcomes since activity forms the basis of interactivity. Therefore, by analysing and shaping interactivity, we are able to understand and affect emotions in human habit.

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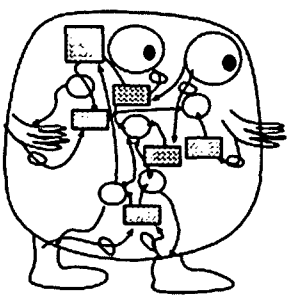
SOLVING PROBLEMS

»If you think that you have a way of solving the problems I'm talking about without using logic, I wish you well. «
Bringsjord, 2001

As explained in the previous chapter, the concept of emotions has been discussed in various scientific disciplines. One aspect of emotions seems to be that they affect our capacity and modalities of solving problems. Understanding problem solving is the primary concern of cognitive science as problem solving is a fundamental act in life. Including affect, attitude or any other form of emotions in a theory of problem solving hinders the cognitive scientist from formulating human life as completely rational. Sloman deals with this problem by assigning fundamental purposes to emotions:

> »It doesn't follow that emotions somehow contribute to intelligence: rather they are a side-effect of mechanisms that are required for other reasons, e.g. in order to overcome resource limits ...« (Sloman 2001, p.17)

Hereby, intelligence is the capability of solving problems. When I explained this view to my girlfriend, her answer was: »Which resource limit do they overcome, when I am hesitating on the jumping pad 3 meters above the water and there is no rational reason for not jumping« (Paischer 2004). The decision whether I jump or not is mostly emotional - and the act of jumping is in this case in no way a rational act. In fact, going for a swim carries only faint rational ballast. Our everyday duty of overcoming resource limits and acting exceptional almost all the time deserves a more prominent role in a theory of problem solving, much more than Sloman is apt to grant.

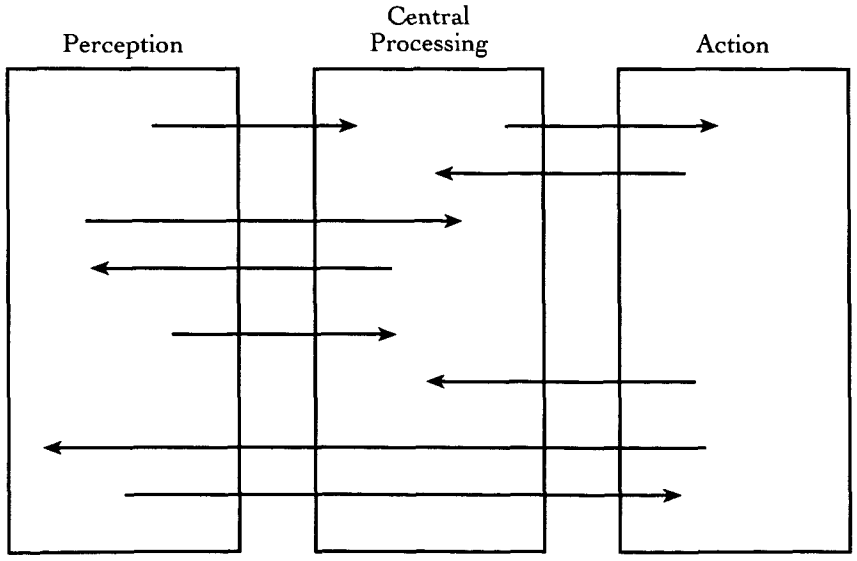


a model of the human as a deterministic system that sloman entitles an »unstructured mess«.

source: sloman 2001

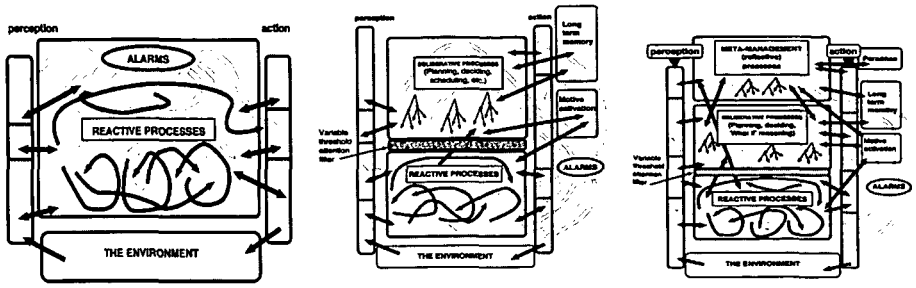
Beside cognitive science, there is another scientific discipline concentrated on examining how our brain works: neuroscience. Neuroscience (and its sub-domains neurobiology and neuropsychology) is examining the brain as a biological object, thus neuroscience forms theories on the base of measurements of brain activity and the analysis of the structure of neural networks on a biological level. Cognitive sciences on the other hand take the brain as a black box and carry out experiments and apply scientific logic to construct their theories. Ayesh (2002) summarises that Locke's epistemological theory (Locke 1689, Turner 1990 and Ayers 1993) and approaches to cognitive psychology (Wilkes 1997) are still the main influences on cognitive sciences, with logic being considered the basis of human actions. Thus, our habits are explained as constantly inferring new theories from acquired knowledge and perception. This concept of separating the mind into different domains can be roughly summarised using the following diagram:

The *Three Towers* were first published by Nilsson (1998). In his writings, he also refers to the middle tower as 'model tower'. Behaviour is hereby defined as acting upon a perceived model. In this context, *model* means a logical and functional image of the world: an image that is constructed out of our memory and perception and brought into coherence with the world. Therefore the model is inferred from an assumed and experienced reality. A model is something one can test out ideas on. By doing so, one simulates a process. The mind is first tests decisions on the model and - if they lead to the desired results - carries out the according action



the human cognitive system depicted as *the three towers* by nilsson. the middle tower is sometimes also referred to as *model tower.*

source: sloman 2001



sloman`s solution to the »unstructured mess« (see previous images): a system made up of multiple interacting layers.

source: sloman 2001.

in reality. Therefore, decision making is the basis of action, with all actions being decided on the basis of a *mental model.*

Decart's Error

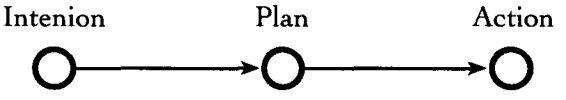
While Locke was an important source of inspiration, the person most influential for Cognitive Science is Déscartes. In his Works ‹Regulae ad Directinem Ingenii› (Déscartes 1628) and ‹Discourse de la Méthode› (Déscartes 1637), he ultimately explains the purpose of his theory - that is nowadays referred to as *rationality* - as:

> »For this discipline claims to contain the primary rudiments of human reason, and to extend to the eliciting of truths in every field whatsoever.« (Déscartes 1628, IV)

Thus he is claiming general validity for his theory of rationality. His chain of argumentation begins at the assumed *rational being* and identifies logical methods of the mind as the foundation of rationality. That way, well-crafted thinking can go beyond the borders of perception to reach at the real truth. Gedenryd summarises this attitude: »Good thinking is thinking that follows a method; a particular procedure« (Gedenryd 1998, p. 35). Déscartes mentions geometry and arithmetic (Déscartes 1930, p. 104) as the only sciences that act on the basis of such thinking, and are therefore free of error and uncertainty. All other sciences are then in a state of inconsistency and distortion and therefore should apply his methods in order to generate knowledge and thus to gain the same validity that his method provides for geometry and arithmetic. Gedenryd simplifies this theory to what he terms a *folk-psychology model* of activity:

Here, action happens on the basis of planning. The plan is designed according to an intention that is based on a model. Gedenryd notes that »in order to realise

the connection between thinking and action, a part of thinking must produce the plan that is passed on to action« (Gedenryd 1998, p. 38). This model holds up against Déscartes claim for rationality as it is a rational method. It is a schema of the free will, hence it explains how we carry out our free will. In regard of the Three Towers it is a more elaborate description of the middle tower's connection to the right one. The notion of the plan and method is the connection between Déscartes and the cognitive scientists: both see the only way for acquiring truth in the conscious application of logic on perceived phenomena and the resolution of knowledge by methods that guarantee coherence by application of rules. To summarise: If I craft my methods according to the rules that Déscartes provides, I am able to gain *real* knowledge and truth. Cognitive scientists go one step further by inferring that reasoning not subject to this ordered process has to be considered as »a side-effect of mechanisms that are required for other reasons, e.g. in order to overcome resource limits« (Sloman 2001). Sloman is talking about emotions in this very sentence. Thus, affective or emotional behaviour - as the counterpart to rational behaviour - is legitimised through incapabilities of the rational mind.



the triad of intention, plan and action following gedenryd` folk psychology of action.

source: gedenryd 1998

This reasoning leads directly to one of the main problems in cognitive sciences: Subjects in experimental situations continually misbehave in regard to the rationalistic model. The actual intramental performance of the mind can rarely cope with the expected. Numerous evidences for this so-called *cognitive limitations* have been found: Gedenryd gives a extensive list (Gedenryd 1998, p. 203). Analysis of concept formation (Bruner 1956), planning (Hayes-Roth & Hayes-Roth 1979), comprehension of complex sentences and syllogistic reasoning (Johnson-Laird 1983), attention span, memorising, mental models and mental simulation (Norman 1986) have showed all too clearly that our mind is simply not capable (or willing) to fulfil the requirements of intramentality. A popular example of how cognitive science deals with this problem can be found in the famous article »The magical number seven, plus or minus two: Some limits on our capacity for processing information« (Miller 1956). In this paper, Miller describes the restriction of our *working memory* as only being able to memorise seven *chunks* of infor-

mation, whereby a chunk may be any type of data, be it small or large, complex or simple. Through the notion of working memory, Miller translates the problem of cognitive limitations to *memory limitations*. The studies of Chomsky and other linguists and psychologists are also in this rationale. Newell and Simon (1972) even define psychology as the science of describing mental limitations when they declare the experiments they undertake to serve the following two purposes:

> »1. To the extent that behaviour is precisely what is called for by the situation, it will give us information about the task environment...
>
> 2. To the extent that the behaviour departs from perfect rationality we gain information about the psychology of the subject, about the nature of the internal mechanisms that are limiting his performance« (Newell & Simon 1972, p. 56)

In this view, no space is left for the actual behaviour: while behaving rational only yields results about the task environment, behaving irrational merely shows the *limitations* of the subject. According to Gedenryd, »there also seems to be a division of labour between different disciplines: one sets up the theories, the other documents how people fail to follow them« (Gedenryd 1998, p.206). He focuses the problem behind cognitive limitations using the following sarcastic logical inference:

> »The mind is a computer
> It does not perform like a computer
> <- The mind is a *malfunctioning* computer« (Gedenryd 1998, p. 207)

Given this view of the mind, cognitive theory can only fail to deliver a working model of the human problem solving behaviour, as fundamental habits - affective and emotional reactions - are seen as symptoms of the lack of possibilities to solve a problem rationally. If nearly all capabilities of a system are exceptions to the expected behaviour, the model on which the expectations were built should be in question and not the system, a perception cognitive science mostly fails to see. Thus, the propositions of the cognitive sciences lead to a dead end, here. Therefore I will abandon most of these theories and follow more promising approaches, although they are less structured, elaborate and rational.

Solving Problems

Summarising, it can be said that contemporary cognitive science lacks a theory of how our mind works that acknowledges how we solve problems. The reason for this deficiency is that it regards crucial habits of humans as limitations of the individual rather than as limitations of the theory. As cognitive science does not come up with a model that embraces emotional aspects of human habits it can neither offer a starting point for researching the emotional nor for researching design or problem solving habits. A closer inspection of the ways we solve problems is needed in order to arrive at an alternative theory. John Dewey's theory of inquiry (1938) forms such an alternative, as it approaches human behaviour from a different side and acknowledges the »pirates of emotion« (Cacioppo & Gardner 1999, p. 194). It will be discussed in the next chapter.

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THE THEORY OF INQUIRY

»Je ne cherche pas; je trouve.«
Pablo Picasso

In his later works, John Dewey established a theory of inquiry that embraces all aspects of life (1938). It is a pragmatic cognitive theory aware of the problems that were introduced by a too rationalistic view of our habits:

> »The environment in which human beings live, act and inquire, is not simply physical. It is cultural as well. Problems which induce inquiry grow out of the relations of fellow beings to one another, and the organs for dealing with these relations are not only the eye and ear, but the meanings which have developed in the course of living, together with the ways of forming and transmitting culture with all its constituents of tools, arts, institutions, traditions and customary beliefs.« (Dewey 1938, p.42)

Dewey is especially focused on *instruments* and *tools*. In his theory the human mind establishes its view of the world in accordance to experiments it carries out in the physical and cultural environment. Individuals test out their capabilities against their surroundings in order to find out the characteristics of themselves and the world. This view of the behaviour of humans is in radical contrast to the ancient Greek view of the rational and objective:

> »The authors of the classic logic did not recognise that tools constitute a kind of language which is in more compelling connection with things of nature than are words, nor that the syntax of operations provides a model for the scheme of ordered knowledge more exacting than that of spoken and written language.« (Dewey 1938, p. 94)

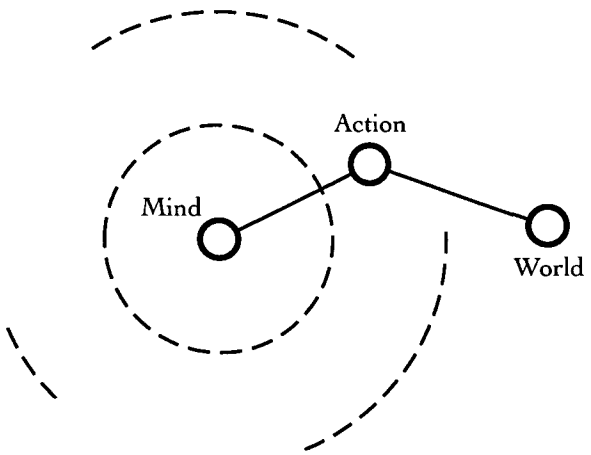
The theory of inquiry does not require a full-fledged mental model of the world in the human mind. Instead, the picture of the world is gradually refined according to needs of a specific action - this is why the above model of cognition is termed *interactive cognition*. While humans are still goal-driven, the dynamics of the proc-

ess of reaching a goal is acknowledged. Currently there are a number of scientists working on similar or refined concepts of interactive cognition: Rousselet et al. (2004) work on parallelism and serialism in the temporal domain of cognition. David Lykken (1997) links happiness to *doing* rather than to *being*. Knud Thomsen (1999) works on models of cyclic cognition and refers to ART (Adaptive Resonance Theory) models for neural networks (Grossberg 1988) as providing alternative models for the same mechanisms. David Chalmers introduces active externalism as »two-way interaction« (Clark & Chalmers 1998) where consciousness itself »extends outside the head« (Clark & Chalmers 1998). For sure, there are other - even more prominent - proponents of interactive cognition.

Emotions and the Theory of Inquiry

The theory of inquiry postulates that »we live and act in connection with the existing environment, not in connection with isolated objects, even though a singular thing may be crucially significant in deciding how to respond to total environment« (Dewey 1938, p. 68). This holistic view is in contrast to scientific logic, as the latter fails to cover the qualitative aspects of a problem:

> »...both the history of science and the present state of science prove that the goal of the systematic relationship of facts and conceptions to one another is dependent upon elimination of the qualitative as such and upon reduction to non-qualitative formulation.« (Dewey 1938, p. 65)



the intrinsic connection between mind, action, and world. gedenryd`s interpretation of *the theory of inquiry* by john dewey.

source: gedenryd 1998

Yet all emotional experiences lie in the qualitative aspects rather than in the quantitative. In order to understand these qualitative factors, Dewey opposes prevailing methods of examination of human behaviour:

> »In everyday living, men examine;. . . ; they infer and judge as ‹naturally› as they reap and sow, produce and exchange commodities. As a mode of conduct, inquiry is as accessible to objective study as are these other modes of behaviour. Because of the intimate and decisive way in which inquiry and its conclusions enter into the management of all affairs of life, not study of the latter is adequate save as it is noted how they are affected by the methods and instruments of inquiry that currently obtain.« (Dewey 1938, p. 102)

Given this statement, it seems only natural that media theory unwillingly embraced this approach. Above all, Marshall McLuhan is examining media as instruments that shape human communication. He perceived and discussed a plethora of media according to their effects on society and the individual. Even his daring theory of media as extensions to the human body (McLuhan 1964) can be read as an investigation into the mechanisms of inquiry. Given the above definition of tools as materials of inquiry (in an act of communication) that constitute our picture of the world, media is merely a new term for these tools. In Dewey's view, facts, perception, ideas and concepts are not independent pre-existing entities but materials for inquiry - instruments of thought. Even affect plays his role as an instrument of inquiry in our human existence.

We have seen above (➢ Attitude and Gefühlston) that emotions are structured around the experience of a difference in expected and effective outcome. If the underlying principles of action (the habit that leads from a starting point to an outcome) are changed, the models of emotion change, too. Building a theory of emotion on top of scientific logic and cognitive sciences leads to the problems described in the ➢ last chapter. Thus I propose a different theory of emotions that is based on how we act in regard to the theory of inquiry. As inquiry is a gradual process, emotions can be addressed on the microscopic level of perception. On the macroscopic level, emotions manifest as attitude, ever changing and unstable yet still structured to a certain degree.

In the next chapters I will investigate how specific media affect the senses and how perception works. They will give an introduction to the fundament for triggering emotional situations: human perception. I will analyse mechanisms that lead to interpretations of impressions from outside the mind in order to understand how emotions are generated. Therefore the primary senses that transmit information about our immediate surroundings (i.e. seeing, hearing and touching) are examined. While I briefly outline the biological fundament of the senses, I will focus on discussing them as tools of inquiry.

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PERCEPTION

When we wake up, we see light in the room around us. We stand up from bed and are able to balance our body in order to walk. We hear our surroundings. And we got a taste in the mouth and smell the fresh coffee. Our senses guide us through our lives. Joy and happiness as well as all grieve and anger is before all transmitted to our mind through perception, a process that - according to the traditional view of cognitive science - connects our mind with the world. Goldstein describes this connection in the following words:

> »Perception is based not on direct contact with the environment but on the brain's contact with electrical signals that represent the environment. We can think of these electrical signals as forming a code that signals various properties of the environment to the brain« (Goldstein 1989, p.50).

True, an important part of the perceptive process takes place in the eye and the nervous system. This translation of a stimulus to a representation that we act upon is subject for the following chapters.

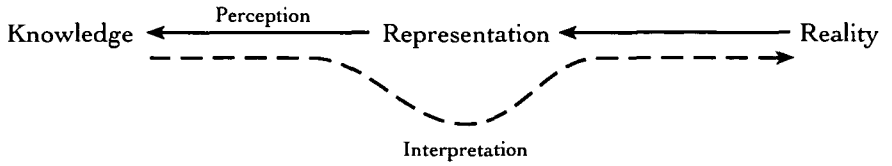
One of the earliest discussions of perception is undertaken by Plato in the 'Theaithetos'. Here, Socrate speaks:

> »Wenn ich wahrnehme, nehme ich Etwas wahr - es ist unmöglich, wahrzunehmen ohne daß da etwas wäre, das wahrgenommen wird; der Gegenstand, sei er nun süß, bitter oder von anderer Eigenschaft, muß Beziehung haben zu einem Wahrnehmer« (Platon 400 BC)

> »If I perceive, then I perceive *something* - it is not possible to perceive without something being there that is perceived; the Object, be it sweet, bitter or from different quality, must have a relation to the perceiver.« (Platon 400 BC, my italics and translation)

This view of absolute objectivism in perception was put to question by scepticists before and after Plato. Democrite was one of the earliest thinkers to mention that we cannot perceive what *really* is there (see Capelle 1968). About five hundred years later, Sextus Empiricus describes Pyrrhon's school of thought and thereby denies that we can ever compare our perceived environment with reality. And as experience is the only way to acquire knowledge about what is not yet experienced we cannot find out if experience alters the view of what is real. Déscartes on the other hand favoured the objectivistic approach to end up at a situation where the only thing remaining to be said is *cogito ergo sum*. This statement translates to »true beyond question is only the perceiving of the beholder« according to Glaserfeld (1992, p. 10, my translation).

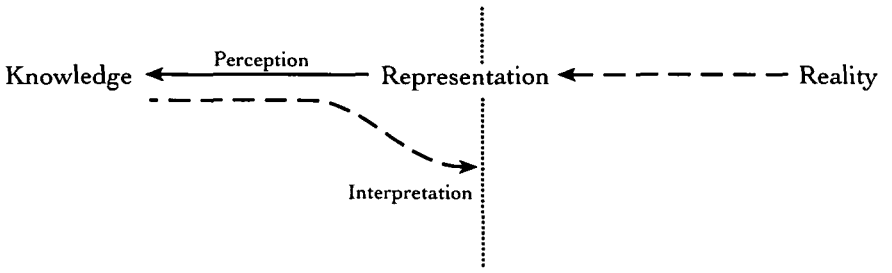
the relation between knowledge, representation and reality following déscartes writings. proper perception (following a method) leads to reality.



Despite Déscartes elaborate argumentation, the concept of objective knowledge remains questioned by many philosophers. Locke reduces perception of reality to a small number of primary characteristics:

> »... concerning our knowledge of the existence of things, and how we come by it. I say, then, that we have the knowledge of our own existence by intuition; of the existence of God by demonstration; and of other things by sensation.« (Locke 1689, IX.3)

immanuel kant denies all possibilities of perceiving reality, therefore emphasizing the role of the individual and its perception.



Hume describes the relation between cause and effect as sustained by the perceiver (see Glaserfeld 1992). Kant (1787) even relegates time and space to be

creations of the perceiving subject along with the *Dinglichkeit* (thing-being) and thus the structure of reality itself (see also Glaserfeld 1992).

Contemporary theories on perception either follow the line proposed by the philosophers mentioned above (c.f. Glaserfeld, Popper and Foerster) and thus result in constructivism - or at least scepticism - or they simply leave out the question of reality and focus on the impression that the perceiver has - be it reality what he sees or not. Yet the philosophic question can never be fully separated from the discourse around perception as the concept of empiricism forms the basis of the other prominent scientific approach in this area: medicine. In this dissertation I follow both lines of thought, leaving out most purely philosophical questions.

Beside these ontological questions, another line of thought shall act as a starting point for the discussion of perception in this dissertation: An impression rarely happens solely between the object and the spectator. John Dewey (1938) outlined the prominent role that the surrounding of an impression plays:

> »In actual experience, there is never any such isolated singular object or event; an object or event is always a special part, phase, or aspect, of an environing experienced world – a situation . . . . There is always a field in which observation of this or that situation object or event occurs.« (Dewey 1938, p. 67)

This situation is normally described using the notion of *context*, where context is the sum of all the features surrounding the object or event perceived. Context occurs around perceived objects and events in manifold ways. In the following, I will discuss context in respect to visual perception.

The Role of Context

A representation of a past process or event is called a *document*. It documents something that happened in a specific way when seen from one specific viewpoint. Many documents form a documentation. It matters in what context a documentation is presented. This context is merely a narrative factor. Barry describes it as follows:

> »When a still visual image exists apart from other images (that is, not part of a sequence of accumulated meaning beyond the individual frame), the visual takes on the emotional valence not only of the gestalt created by the interaction of the elements but also the feel of the immediate surroundings as well. (An exquisite oil portrait hung in a mahogany panelled library, for example, has a totally different affective valence from the same portrait hung in a public restroom).« (Barry 1997, p.149)

A published photo carries the credibility of the photographer and the place it is published, be it a magazine or a public restroom. Part of what is inferred and how it is inferred comes from the spectator's interaction with the presentation context of the image.

There are additional generators of context, one of them is the technology used in order to generate an impression, as it also affects the way the impression is interpreted. Issues that are seen as internal to the subject presented (and that affect our emotional tendencies when reading the impression) are often by-products of the production process and thus external to the content. The exact way a painting is done in style and variables like light, angle, perspective and sharpness in photography form a narrative factor, constructed by the author (with intention or by chance). They also determine our emotional attitude to an image to a certain degree.

According to Atkinson (1993), context is part of a relevance hierarchy in perception. His model is - by decision or just by chance - used in order to taylor information representation in media, where the hierarchy orders impressions between foreground and background. Lennox describes the role of context in this hierarchy as:

> »From the perspective of considering perceptual significance, ‹context› would seem to be of a very low order of urgency, and we would expect ‹context information› to be almost beneath notice, a sort of ‹perceptual background›, unless it is somehow ‹wrong›.« (Lennox 2001, p. 3)

The reason of existence for such a hierarchic system is the ability to react to the right sensation in a situation of urgency - an artefact of instinct that still shapes our vision of the world. Lennox relates this hierarchy to selective attention and postulates that »primitive feature detectors do not, of themselves, ‹judge› *importance*, merely *presence*.« (Lennox 2001, p.3, italics his). When the rock that will fall on your head is very close, it is clear that presence converges with importance. In any specific case, this hierarchy will be different between any two subjects unless a certain threshold is exceeded (yet maybe even then). This common sense feature of perception also affects the separation between foreground and background in pictures. Koffka mentions that a figure has to be segregated from its field and kept in a state of equilibrium in order to perceive a foreground (Koffka 1935).

Perception

This chapter provided an introduction to the vast field of theories about perception. It drew partly from phenomenology and partly from psychology. Epistemological issues were explained around Déscartian and Kantian models, as well as around radical constructivism. It was shown that context plays a role in how we perceive our environment, as we never see/hear/feel one particular entity separated from its surroundings. Different theories about how context affects sensual experience were covered.

The matter of perception is too complicated to be discussed in a single chapter, therefore the next chapters will focus on different aspects of perception. They are divided following different sensual modalities: visual, aural and tactile. I left out all other senses as they currently play no role in human computer interaction and are rarely designed for.

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Dissertation

Designing for Emotions -
arguments for an emphasis on affect in design

Ausgeführt zum Zwecke der Erlangung des akademischen Grades
eines Doktors der technischen Wissenschaften

unter der Leitung von
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Designing for Emotions -
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Doctoral thesis submitted in October 2004 at

Vienna University of Technology

Design and Assessment of Technology Institute

Vienna, Austria

Supervisor: Peter Purgathofer

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ABSTRACT

Our everyday life is full of emotional experiences. We constantly act - either conscious or uncoscious - on base of emotions. Until now, research in Human Computer Interaction (HCI) did not reflect the influence of emotions. Yet numerous other scientific fields researched this theme in recent years. The goal of this dissertation is to relate the findings in these fields to those in Human Computer Interaction in order to present a theroretical framework for the practical implementation of new forms of interaction that acknowledge the importance of emotional involvement. Hereby I strive for presenting the available theories in their complexity rather than simplifying them. I do not cover the *strong* emotions like love, hatred and fear but rather concentrate on *weak* emotions such as liking something, immersion and fun.

This dissertation is organised into several sections that cover central aspects of the topic. The text is accompanied by several examples from art, architecture, and my own artistic practice. Art has always nourished an emotional link between the audience and the art piece. Therefore design and thus interaction design can learn a lot from art in this regard. Especially in media art some instruments have been developed over the last years that foster the playful interaction with serious content.

Human activity is often analysed in terms of *problem solving* behaviour. I present different theories from psychology and cognitive science on this issue. An important point for the development of emotions is the relation between the expected and the actual outcome of an activity. The *Theory of Inquiry* by John Dewey acknowledges this fundamental fact and will thus be followed throughout this dissertation. His theory explains human activity as interactive process. In order to provide a background for the extension of this theory into interactivity, I examine different modalities of perception. Even on this level of cognition, humans tend to be more than receivers in the communication with their surroundings - they rather inquire their environment interactively. Emotions shape this inquiry and are shaped by it.

In order to transform the insights of the analysis of problem solving behaviour into practical knowledge, scientific disciplines are examined that already have acknowledged the interrelations between emotions and cognition. Scores of media theorists commented the interactive aspects of communication. Other disciplines of science that embrace emotions are narratology and ludology. Narratology is closely related to the concept of metaphors and treats problem solving as a narrative process. Ludology focuses on games as problems of diverse characteristics. Both disciplines are examined on their applicability on user interface design. The result of this examination is that the interface should rather be an instrument - in the sense of musical instruments - than a tool. The prime goal should be that it is learnable rather than trivial.

In the last chapters, possibilities are described to translate the theoretical findings into practical design projects using *design instruments*. Rather than developing yet another generic design method, I focus on outlining design instruments. Especially in the case of projects that should affect the emotional side of the user design has to abandon strict methods. Instead, design has to be seen as an open and holistic process. This also calls for a stronger involvement of the end-user in the design process.

ACKNOWLEDGEMENTS

Thank you: Daniel Aschwanden, Jeebesh Bagchi, Atle Barcley, Ute Meta Bauer, Laura Beloff, Erich Berger, Christine Böhler, Andy Best, Christiane Erharter, Thomas Grill, Tom Haberfellner, Jürgen Hagler, Reni & Jogi Hofmüller, Derek Holzer, Eva Hornecker, Hans Knöll, Jochen Koubek, Christoph Leitner, Sabine Maier, Michael Mastrototaro, Erich Möchel, Peter Mörtenböck, Monica Narula, Renate Oblak, Simone M. Paischer, Ian Pedigo, Jörg Pflüger, Eva-Maria & Werner Pichlmair, Maria & Rainer Pichlmair, Michael Pinter, Peter Purgathofer, Wilfried Reinthaler, Lorenz Seidler, Shuddhabrata Sengupta, Michael Strohmann, Klaus Taschler, Annie Wan, Yosi Wanunu, Vitus Weh, the Office for Contemporary Art Oslo, the Art Department of the Bundeskanzleramt, the Art Department of the City of Vienna, the Artelier Nord Oslo.

INTRODUCTION

When I started working on my master's thesis, my research interests were focused on the qualities of good user interfaces. Back then I tried to pin down the essence of good interaction design to a handful of concepts. I described those concepts mostly concerning one single device: a Nokia mobile phone that features an easily understandable interface comparable to no other interface I have never seen before or afterwards. I still use this phone, telling myself that I do it for its good interface; Being honest, I have to admit that I still use it because it feels like *mine*. I kept talking to people on why they bought a specific mobile phone and the answers provided can be boiled down to a number of aspects that people liked: Some bought their phone on basis of technical capabilities (which they do not necessarily use or need). Some bought it out of an economic decision. A last group of people emphasised the role of aesthetics in the decision-making process. For sure, most consumers fall into all three categories to varying degrees; yet one thing is remarkable: for many people, aesthetic qualities overrule all others - at least to a certain (existential) boundary. They neglect products that might work better for them. Donald Norman discusses this habit in his recent book ‹Emotional Design›:

> »Most of us just decide on something, but if asked why, often don't know: ‹I just felt like it›, one might reply. A decision has to ‹feel good› or else it is rejected, and such feeling is an expression of emotion.«
> (Norman 2004)

What Norman states here is that good product design has to acknowledge not only how the product is characterised in terms of *functionality*, but also in terms of likability. People not only want to accomplish their task but also want to like how they accomplish it. A content user is not one who reaches the goal first, but who felt best in reaching the goal. On this stage of decision making, emotions play the role of unconsciously summarising an infinite problem space. When buying a mobile phone, neither technological nor economic decisions include the others, yet emotional decisions have the power to embrace all important factors. Here, emotions play the role of cognitive short-cuts in decision making as described by Sloman (2001). This is also the reason, why I stick to my mobile phone.

Other - even more striking - arguments that caused me rethink the role of emotions are: emotions are a qualitative aspect of almost every task we carry out. Because decision making is an aspect of problem solving and problem solving is so often accompanied by emotions, I felt the need to reconsider fundamental aspects of human behaviour.

After writing my master's thesis, I was mainly working on (media) art productions. That shifted my interest gradually toward ever more complex views of reality. Art is a complicated matter that works via the whole palette of modalities of human cognition. Art works do not need to make sense, yet if they fail to do so, they at least have to *work*: They have to provide a rewarding experience, upon that *sense* is introduced by the audience. In my opinion, the borders between art and design are blurred: from architects bringing in their very personal attitudes to artists focusing on qualitatively high production values and economic decisions, a cultural industry emerges, dwelling the borderland between art and design. Borders between art and science are - especially in the media art sector - constantly crossed anyway, as are those between art and technology. Every new technology is embraced by the media art scene, a process that sometimes looks as if it is a race for being the first to make art out of a new development. What I learned from my art projects is that there is a link between art and more serious design projects and also design thinking in general. One of the tasks of this dissertation is to uncover this link.

Since art focuses on the emotional response of the audience even more than product design, it seems adequate to work upon design in the light of insights gained from art. As already mentioned, the role of the audience is crucial in every art production. Each person in the audience has to make a personal decision: it has to accept the art piece or refuse it. There is no dichotomy between *art* and *not art*, but between the very personal expression of *good art* and *bad art*. This qualitative decision is taking into account aesthetic as well as functional (and even economic) aspects: it is an emotional decision that bears resemblance to the decision of acquiring a product. This brings the fundamental factor into play that I missed out in my master's thesis: the role of the audience, respectively the user. As the emotional aspects of problem solving are centred around the subject as much as they are around the object, I have to treat both as equally important in the course

of the interaction that is taking place. This means that design has to take into account that there is a human, a user bringing attitudes and instincts with her - a deeply emotional being.

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CHAPTER OUTLINE

The general organising principle of this dissertation is focused on three central aspects of the field of investigation: Perception, Representation and Interactivity. After an introduction into the state of research in the field of emotions, given in the section *Emotions*, the human side of the problem is covered. This is accomplished through the notion of *perception*, thus the chapter holds this name. The focus of the next section is on *representation*: the qualities of the device or tool - the world. The following section is about *interactivity*, the link between the subject and the object side. Instead of a synopsis, a whole additional section, entitled *Design*, was written to cover the findings of the first three sections and interconnect them, arriving at a model of how design might interact with emotions. Every section starts with an overview of the different areas of research that affect it and of the historic developments in the field. The sections are organised into several chapters. The following outline does not cover each chapter but gives an overview of each section.

Emotions

The section *Emotions* gives an introduction into the scientific research in the field. It discusses several aspects of emotions and different approaches in research. The fundamental work of John Dewey (1894, 1895, 1938) forms the central line of thought that is followed through all this dissertation, as it describes not only emotions, but the whole process of understanding around the interaction of the human with the world by utilizing tools as instruments. The triad of mind, action and world forms the basis of all further thinking in this book. Additionally, the affect system is explained in respect to the recent findings of Damasio (1994) and Cacioppo & Gardner (1999). The chapter *Solving Problems* discusses approaches in cognitive science following Sloman (2001), Hayes-Roth & Hayes-Roth (1979) and Johnson-Laird (1983). It questions the usefulness of the concept of mental models. The following three sections are organised around this principle as perception focuses on the mind, representation on the world (presented as a tool), and interactivity on the action.

Perception

In this chapter I discuss key human senses: vision, hearing and haptics (in that order). Beside brief coverage of the biological aspects of the senses, a decent overview of past - mostly based on Déscartes (1628, 1637) put in contrast to constructivism (Foerster & Glaserfeld 1992) - and present theories - following Barry (1997) - on the matter of perception is given. This is accomplished by describing what happens in the subject as well as regarding the perceived object. Another focus is the relation between these sensual modalities. As all senses are connected with each other (see Massaro (1987) and McGurk & MacDonald (1976)), they form a unity of impressions. While separating each sense into its own chapter is useful for pragmatic reasons, it should not lead to the thought that the senses are this nicely separated as cognitive processes.

Representation

This section covers aspects of the world and how it presents itself to the beholder. After giving an introduction to basic aspects of communication and semiotics (following Peirce (1935) and Saussure (1916)), and metaphors (as memes (Dawkins 1976, 1993) and in language (Lakoff & Johnson 1980), I arrive at a picture of representation that embraces the process of perception. Communication forms the starting point as representation is not about the physical qualities of an object but about what it *means*. Communication theory leads to media theory, thus a brief overview on current trails in media theory is given (based on McLuhan (1964) and leading to Manovich (2001)). Architecture plays a significant role as one of the oldest and most reflected design disciplines. Thus, a treatment of the *architecture of the virtual* follows that serves two purposes: it highlights the inherently indirect manner of representation in mediated environments and it brings the haptic qualities of architecture into play (following Benjamin (1968) and Novak (2004)). This leads to a discussion of navigation (Manovich 2001) - and thus to the following two chapters. First, *playing games* is discussed as it refers to the haptic qualities again and brings to the notions of immersion and identification about (Bolter & Gruisin 1999, Wallenstein 2003 and Taylor 2003). Second, the navigation of narrative spaces is explored following Marie-Louise Ryan (2001a). This trajectory focuses playing games as well as setting up narratives to acts of problem solving and roots them in everyday life. Thus, we arrive at interactivity as the prime method of understanding.

Interactivity

Many aspects of interactivity have already been covered in the previous chapters. Therefore, I give an overview of some very basic workings of interactivity - *gestures, affordances* and *constraints* - in this section. Current trails in user interface design and human computer interaction are discussed (as a conflict between arguments by Norman (1990) and Fujihata (2001)). During this chapter the fundamental question is again: How do we solve problems? This part of the book is very practical and it puts an even stronger emphasis on real world examples that underline my theories than previous chapters.

Design

The last section of this book brings all theories and observations of the previous sections together. As problem solving forms the centre of attention, the difficulties in creating predefined methods (as those of Alexander (1964), that are based on the workings of ancient Greek geometers, as can be seen in Hintikka & Remes (1974)) for problem solving are discussed. These difficulties have their origin in the nature of problems themselves. Again, Dewey's ‹Theory of Inquiry› (1938) is the main source of inspiration - especially in the reading of Gedenryd (1998). The solution found in this section is that design should focus on the process (Lawson 1980). Emotions only arise if the user is able to bring in his personal attitude. Different classes of emotional immersion occur on different levels. On each level of design, these must be acknowledged in order to successfully produce an intriguing product - in order to make people understand, and provide them the pleasure of interaction that sets an interactive product apart from others. In the last chapters I summarise all concepts of this dissertation to arrive at an elaborate description of the workings of emotions in interaction architecture (leading to concepts like *Ambiguity* discussed by Gaver & Beaver (2003)) that hopefully yields results in other domains, too, as it challenges many existing theories on how humans understand, interact and solve problems.

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EMOTIONS

»Sometimes the truth of a thing is not so much in the think of it, but in the feel of it.« Stanley Kubrick

Researchers of many areas of science propose their own view on emotions. Emotions are a biologic function, thus evolution theory tries to describe why they were developed. Although some scientists refuse emotions to have functionality above very primitive mechanisms of instinct (Sloman 2001) it is likely that they also serve other purposes. The next chapter will give an overview of theories of emotion in different scientific disciplines. This overview will then serve as a starting point for a more detailed view on what lies behind emotions and how to deal with this omnipresent matter.

Early examples for theories of emotions are those of Dewey (1894, 1895) and Mead (1895). They cover the connection between affect, emotions and attitude. From them I will depart and arrive at recent research into emotions. Brave & Nass (2003) provide a good overview of current research into emotions. Brave separates emotions into the categories mood, emotion, attention, sentiment and memory. Some researchers concentrate on attention and its implications (Yamasaki et al. 2002, Pessoa et al. 2002). Angrilli (1997) researches in subjective perception of time. Peter Desmet (2004) concentrats on value and emotions and product emotions. Related to value is the concept of reward (Blood & Zatorre 2001). Another area of research is consciousness (Ellis & Newton 2000a & 2000b, Georgalis 2000). Even Aristotle's view of emotions is researched (Nieuwenburg 2002).

There is a plethora of papers on attention and how to focus it in computer sciences (e.g. Buxton & Gaver 1994). Picard (1997 & 2002) is surely the most active researcher into computers having (or posing) emotions - others are Fulda (1998) and Chella (2000). Picard collaborates with Kapoor (2001) in this subject. She also works on detecting the emotional state of the user (Reynolds & Picard 2001).

As often, there is no final definition of emotions. The following quotes are meant to give an outline of how emotions are seen rather then defining the term. Thus, I will not comment them, but let them stand on their own.

Ralph Ellis and Natika Newton propose a definition of emotions (although they agree that it is a difficult task to define them) as:

> »(a) the state arises from a self-motivating drive to attain a particular holistic equilibrium in the face of real or imagined environmental circumstances;
>
> (b) the state includes or is associated with an implicit or explicit representation of the conditions needed for the desired goal, such that the representation can play a role in bringing about the goal (e.g. by serving as an initiator of and guide to action).«
> (Ellis & Newton 2000b, p. 5)

Nietzsche comments on emotions indirectly by writing on the qualities of strong feelings:

> »Alle *stärkeren* Empfindungen bringen ein Miterklingen verwandter Empfindungen und Stimmungen mit sich: sie wühlen gleichsam das Gedächtnis auf ... So bilden sich angewöhnte rasche Verbindungen von Gefühlen und Gedanken, welche zuletzt, wenn sie blitzschnell hintereinander erfolgen, ... als *Einheiten* empfunden werden. ... Auch hier, wie so oft, verbürgt die Einheit des Wortes Nichts für die Einheit der Sache.« (Nietzsche 2000, Paragraph 14, italics his)

> »All *stronger* feelings trigger related feelings and affective states: they perturb the mind. ... Thus, learned fast links between feelings and thoughts, that are after all, rapidly following each other, ... are considered as *unity*. Here, as so many times, the unity of the word does not ensure the unity of the matter.« (Nietzsche 2000, Paragraph 14, my translation, italics his)

In the following chapters I will discuss theories of emotions. Without devaluing the above statements, I will focus on the *weaker* emotions from now on. This means, that the above strong emotions - such as *grief, tragedy* and *romantic love* - will not be part of this dissertation. Instead, I concentrate on emotional attitudes such as *liking* something, general *well-being* and *satisfaction*. While some negative feelings will be touched, the prime interest is to provide constructive hints on how to nourish the development of design practices that allow for positive emotions. In order to provide the necessary background, the next chapter will start with a historical overview of theories of emotions.

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THEORIES OF EMOTIONS

»Any system of signs must be explored not only in terms of its meaning, but in its ‹asemiotic› or arepresentational component as well, i.e. as a regime of desire and affect, an organisation of force relations, rather than as a linguistic or ‹mental› structure...« Bogard, 2000

Life is shaped by emotions. They are one of the centres of our everyday experience. Emotions play a key role in decisions we take in our lives, affect nearly everything we do. Still, they are barely understood. Everyone knows them, yet few can give an exact definition what they are. Research on theories of emotions is undertaken in various branches of science: cognitive science (Simon 1967, Oatley & Johnson-Laird 1987, Sloman 1998 & 2001), neuroscience (LeDoux 1995, Damasio 1994, Cacioppo & Gardner 1999, Pessoa et al. 2002), philosophy (Baudrillard 1979, Nieuwenburg 2002) and cultural sciences (Mesquita et al. 1997, Russell 1994). There is a discussion about terminology (Read & Sloman 1993), means and methods (Schwartz & Stone 1998, Litt 1998). It is very hard to see through the fog of war between the battles that rage in order to formulate a theory of emotions. In computer sciences, the influence of cognitive science is strong - especially via the joint field of human computer interaction and artificial intelligence and its heritage. Research reaches from the measurement of user responses to expression for computers (Reynolds & Picard 2001, Picard 1997, 2002) and design theory (Norman 2004).

In contrast to Rationalism

The assumption that higher forms of human existence - rational decision making - are subject to being »highjacked by the pirates of emotion« (Cacioppo & Gardner 1999) dates back to the ancient Greek philosophers. Since then, the main efforts in understanding our thinking started from the assumption that emotions are primitive, hindering our development towards a rational and objective being (although it is neglected that animals have emotions). While there are still some scientists that view emotions as a disruptive force in rational thought (Sloman 2001), others disagree and see this argument as an oversimplification (Berntson et al. 1993). Currently more and more evidence is found that emotions play a significant and constructive role in our experiences.

The notion of emotion itself is seen as too vague by nearly all participants of the discussion - it includes aspects of experiential, behavioural, sociodevelopmental and biological phenomena. Constructivists approach this problem traditionally by breaking it down into smaller units (e.g. Brave & Nass 2003) while others demand a more holistic view, stating that emotion is ubiquitous in our life:

> »Research over the past two decades on cognition and emotion provides further evidence for the ubiquity of emotion, with the influence of emotion extending to all aspects of cognition and behaviour.« (Cacioppo & Gardner 1999, p.195)

There are some very basic aspects of emotions upon which most researchers agree: First of all, emotions are relative (as opposed to absolute). We do not like something or not, we like something *more than* something else (see Brendl & Higgins 1995 and Shah 1998, and especially Medvec 1995). Secondly, they are individual (Kahnemann 1993) and subject to interaction with our perception and our personal situation (Schwartz & Strack 1998). Thirdly, emotions are based on an underlying system of affect. While some scientists even attest a number of emotions to be »basic«, separation between affect and emotion seems to be the agreed approach.

Cacioppo & Gardner outline asymmetry in emotional perception. What they term the *positivity offset* is a »tendency for there to be a weak positive (approach) motivational output at zero input, an intercepting difference in the affective system« (Cacioppo & Gardner 1999, p. 205). The positivity offset is what makes us curious about a new environment. It is what puts us in a position that makes us experience our surroundings and learn from it. Evidence of this bias towards a positive approach is found in many areas as *unrealistic optimism* or *positivity bias* (Brinthaupt 1991, Hoorens & Buunk 1993, Pulford & Colman 1996, Regan et al. 1995), although it is opposed by a negativity bias, as Cacioppo et al. (2004) summarise:

> »Species with a positivity offset and a negativity bias enjoy the benefits of exploratory behaviour and the self-preservative benefits of a predisposition to avoid, scrutinize, and withdraw from threatening

events. These features represent only the rudimentary operations of an affect system, however. A heterarchical organization of the neural components constituting the affect system provides a rich repertoire of processing operations that vary in their speed, contextual control, and behavioral flexibility.« (Cacioppo et al. 2004)

The Body and Affect

At the advent of psychology - in the late 19th century - emotions were discussed as an important and significant part of our lives. Dewey and Mead developed a theory of emotions based on Darwin's theory of evolution. Prior to them, Charles Darwin himself tried to bring emotions in coherence with his theories about evolution. In his book ‹The Expression of Emotions in Man and Animals› he connects emotions to the body in a very direct manner and lays the ground for later theories on emotions:

»Most of our emotions are so closely connected with their expression that they hardly exist if the body remains passive -- the nature of the expression depending in chief part on the nature of the actions which have been habitually performed under this particular state of mind« (Darwin 1880, p.239).

Thus, Darwin first links emotions to habit and then expression to emotions. While expression is only the externalised bodily reaction in a state of emotional charge, he also deals with purely internal reflections of the body: »A man, for instance, may know that bin [*sic*] life is in extremest peril, and may strongly desire to save it; yet as Louis XVI said when surrounded by a fierce mob, ‹Am I afraid? Feel my pulse.› So a man may intensely hate another, but until his bodily frame is affected he cannot be said to be enraged.« (Darwin 1880, p.239)

Hunt and Campell (1997) conclude that the affect system that underlies the emotional system seems to have developed out of the evolutional need to distinguish between hostile and hospitable. On this very basic level of cognition »rudimentary reflexes for categorising and approaching or withdrawing from certain classes of stimuli« (Cacioppo & Gardner 1999, p. 199) exist. One remarkable feature

in this context is the extent to which they can shape affective categorisations through learning. We are able to adapt our attentional and cognitive resources to a situation. And we learn to put our affective conditions into an appropriate state. There is evidence that affective perception and processing is handled completely different than classification and discrimination in non-evaluative situations (see Cacioppo & Gardner (1999) and Cacioppo & Berntson (1999) for details).

John Dewey undertook several studies on affect (Dewey 1894). He tried to bring the James-Lange theory of emotional discharge in accordance with Darwin's theory of evolution. Thereby he arrived at describing emotions as »the reduction of movements and stimulations originally useful into attitudes.« (Dewey 1894, p.569). They are separated from instinct (that still serves a purpose) and represent an attitude: an attitude is a state of mind towards some stimuli. So emotions - or affect - are a state of mind towards a stimuli, that stems from originally purposeful bodily actions and reactions, now separated from their purpose and transformed into something more generally useful, a standpoint - an attitude.

Attitude and Gefühlston

To transform an action into an attitude one has to try where the action leads to. This behaviour can often be observed at little children. They try out how specific actions lead to results in the world before they store them as habits. In this view, only tested and proven actions (and reactions) might turn into emotions. Thus, emotions are not predefined or fully inherited - they have to be (at least partially) learned. Learning them is an intuitive process that a child runs through. The knowing of the results of an act is also perceived by George Mead:

> »In the simple instinctive act that lies behind every emotion ... These stimuli in the form in which we can study them, seem to be more or less rhythmical repetitions of those moments in the act itself which call forth especially the vaso-motor response. In this form they are recognized as aesthetic stimuli ... It is under the influence of stimuli of this general character that the emotional states and their physiological parallels arise. The teleology of these states is that of giving the organism an evaluation of the act before the coordination that leads to the particular reaction has been completed.« (Mead 1895, p.163)

In this statement Mead describes two characteristics that seem to be necessary to encourage emotions: First, there is a relation between a desired or expected reaction and what is happening. Second, there is a clear emphasis on vaso-motor or haptic impressions. Emotions therefore have to do with acting instead of happening. And they are very closely related to our body.

John Dewey further elaborated this concept in the second part of ‹The Theory of Emotion›, published in the same year as Mead's book quoted above. He terms the concept behind the prediction of outcomes of an act *Gefühlston*:

> »It [Gefühlston] is interest read backward: That represents the complete identification of the habits with a certain end or aim. The tone of sense-feeling represent the reaction, the incorporate identification, of the successful ends into the working habit. It is not, as I have hitherto indicated, habit as habit which becomes feelingless; it is only the habit which serves as mere means, or serial stimulus.« (Dewey 1895, p.31)

If we let ourselves be guided by emotions, we are not acting in regard of interests, but in regard of feeling - or Gefühlston. We choose not an outcome, but an action (as a habit). This certainly puts us in radical contrast to the rational behaviour described by Déscartes. It abandons the idea of analysis of a situation followed by synthesis. I will cover the relation between rationalism and emotions in far greater detail later in this dissertation. For now, it should be sufficient to understand that the emotive act works as experimental synthesis on-the-fly according to Dewey. Since we can never know the outcome of an action but act as if we knew, there is certainly a situation of evaluation and struggle. John Dewey summarises the relations between affect, emotions, interest and Gefühlston as:

> »To sum up:-- certain movements, formerly useful in themselves, become reduced to tendencies to action, to attitudes. As such they serve, when instinctively aroused into action, as means for realizing ends. But so far as there is difficulty in adjusting the organic activity represented by the attitude with that which stands for the idea or end, there is temporary struggle and partial inhibition. This is reported as Affect or emotional seizure. Let the coordination be effected in one act, instead of in a successive series of mutually exclusive stimuli, and we have interest. Let

such coordinations become thoroughly habitual and hereditary, and we have Gefühlston .« (Dewey 1895, p.32).

Theories of Emotions

There are three aspects of emotions agreed upon by many scientists:
- Emotions occur as a tension between intended, desired or expected and actual outcome of an action.
- Emotions are relative, not absolute.
- Emotions are to a vast degree organic.

In this dissertation I will discuss some biologic facts behind emotions in the discussion of perception, yet I will not put them into the centre of attention. I will acknowledge the relative aspects of emotions. And I will focus on the tension between intended and actual outcomes since activity forms the basis of interactivity. Therefore, by analysing and shaping interactivity, we are able to understand and affect emotions in human habit.

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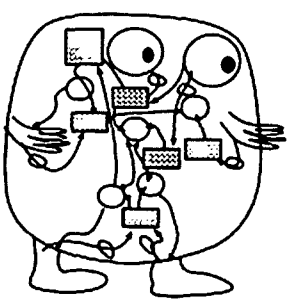
SOLVING PROBLEMS

»If you think that you have a way of solving the problems I'm talking about without using logic, I wish you well. «
Bringsjord, 2001

As explained in the previous chapter, the concept of emotions has been discussed in various scientific disciplines. One aspect of emotions seems to be that they affect our capacity and modalities of solving problems. Understanding problem solving is the primary concern of cognitive science as problem solving is a fundamental act in life. Including affect, attitude or any other form of emotions in a theory of problem solving hinders the cognitive scientist from formulating human life as completely rational. Sloman deals with this problem by assigning fundamental purposes to emotions:

> »It doesn't follow that emotions somehow contribute to intelligence: rather they are a side-effect of mechanisms that are required for other reasons, e.g. in order to overcome resource limits ...« (Sloman 2001, p.17)

Hereby, intelligence is the capability of solving problems. When I explained this view to my girlfriend, her answer was: »Which resource limit do they overcome, when I am hesitating on the jumping pad 3 meters above the water and there is no rational reason for not jumping« (Paischer 2004). The decision whether I jump or not is mostly emotional - and the act of jumping is in this case in no way a rational act. In fact, going for a swim carries only faint rational ballast. Our everyday duty of overcoming resource limits and acting exceptional almost all the time deserves a more prominent role in a theory of problem solving, much more than Sloman is apt to grant.

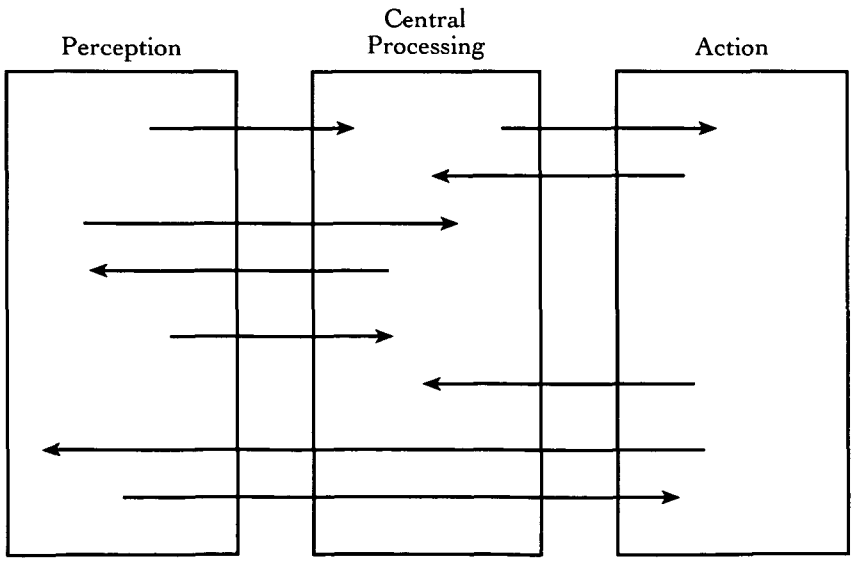


a model of the human as a deterministic system that sloman entitles an »unstructured mess«.

source: sloman 2001

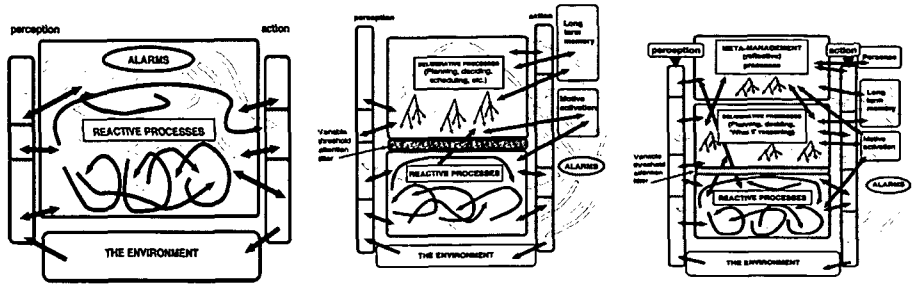
Beside cognitive science, there is another scientific discipline concentrated on examining how our brain works: neuroscience. Neuroscience (and its sub-domains neurobiology and neuropsychology) is examining the brain as a biological object, thus neuroscience forms theories on the base of measurements of brain activity and the analysis of the structure of neural networks on a biological level. Cognitive sciences on the other hand take the brain as a black box and carry out experiments and apply scientific logic to construct their theories. Ayesh (2002) summarises that Locke's epistemological theory (Locke 1689, Turner 1990 and Ayers 1993) and approaches to cognitive psychology (Wilkes 1997) are still the main influences on cognitive sciences, with logic being considered the basis of human actions. Thus, our habits are explained as constantly inferring new theories from acquired knowledge and perception. This concept of separating the mind into different domains can be roughly summarised using the following diagram:

The *Three Towers* were first published by Nilsson (1998). In his writings, he also refers to the middle tower as 'model tower'. Behaviour is hereby defined as acting upon a perceived model. In this context, *model* means a logical and functional image of the world: an image that is constructed out of our memory and perception and brought into coherence with the world. Therefore the model is inferred from an assumed and experienced reality. A model is something one can test out ideas on. By doing so, one simulates a process. The mind is first tests decisions on the model and - if they lead to the desired results - carries out the according action



the human cognitive system depicted as *the three towers* by nilsson. the middle tower is sometimes also referred to as *model tower*.

source: sloman 2001



sloman`s solution to the »unstructured mess« (see previous images): a system made up of multiple interacting layers.

source: sloman 2001.

in reality. Therefore, decision making is the basis of action, with all actions being decided on the basis of a *mental model.*

Decart's Error

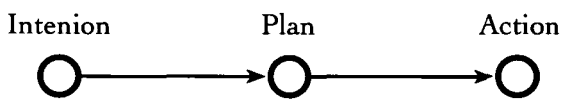
While Locke was an important source of inspiration, the person most influential for Cognitive Science is Déscartes. In his Works ‹Regulae ad Directinem Ingenii› (Déscartes 1628) and ‹Discourse de la Méthode› (Déscartes 1637), he ultimately explains the purpose of his theory - that is nowadays referred to as *rationality* - as:

> »For this discipline claims to contain the primary rudiments of human reason, and to extend to the eliciting of truths in every field whatsoever.« (Déscartes 1628, IV)

Thus he is claiming general validity for his theory of rationality. His chain of argumentation begins at the assumed *rational being* and identifies logical methods of the mind as the foundation of rationality. That way, well-crafted thinking can go beyond the borders of perception to reach at the real truth. Gedenryd summarises this attitude: »Good thinking is thinking that follows a method; a particular procedure« (Gedenryd 1998, p. 35). Déscartes mentions geometry and arithmetic (Déscartes 1930, p. 104) as the only sciences that act on the basis of such thinking, and are therefore free of error and uncertainty. All other sciences are then in a state of inconsistency and distortion and therefore should apply his methods in order to generate knowledge and thus to gain the same validity that his method provides for geometry and arithmetic. Gedenryd simplifies this theory to what he terms a *folk-psychology model* of activity:

Here, action happens on the basis of planning. The plan is designed according to an intention that is based on a model. Gedenryd notes that »in order to realise

the connection between thinking and action, a part of thinking must produce the plan that is passed on to action« (Gedenryd 1998, p. 38). This model holds up against Déscartes claim for rationality as it is a rational method. It is a schema of the free will, hence it explains how we carry out our free will. In regard of the Three Towers it is a more elaborate description of the middle tower's connection to the right one. The notion of the plan and method is the connection between Déscartes and the cognitive scientists: both see the only way for acquiring truth in the conscious application of logic on perceived phenomena and the resolution of knowledge by methods that guarantee coherence by application of rules. To summarise: If I craft my methods according to the rules that Déscartes provides, I am able to gain *real* knowledge and truth. Cognitive scientists go one step further by inferring that reasoning not subject to this ordered process has to be considered as »a side-effect of mechanisms that are required for other reasons, e.g. in order to overcome resource limits« (Sloman 2001). Sloman is talking about emotions in this very sentence. Thus, affective or emotional behaviour - as the counterpart to rational behaviour - is legitimised through incapabilities of the rational mind.



the triad of intention, plan and action following gedenryd` folk psychology of action.

source: gedenryd 1998

This reasoning leads directly to one of the main problems in cognitive sciences: Subjects in experimental situations continually misbehave in regard to the rationalistic model. The actual intramental performance of the mind can rarely cope with the expected. Numerous evidences for this so-called *cognitive limitations* have been found: Gedenryd gives a extensive list (Gedenryd 1998, p. 203). Analysis of concept formation (Bruner 1956), planning (Hayes-Roth & Hayes-Roth 1979), comprehension of complex sentences and syllogistic reasoning (Johnson-Laird 1983), attention span, memorising, mental models and mental simulation (Norman 1986) have showed all too clearly that our mind is simply not capable (or willing) to fulfil the requirements of intramentality. A popular example of how cognitive science deals with this problem can be found in the famous article »The magical number seven, plus or minus two: Some limits on our capacity for processing information« (Miller 1956). In this paper, Miller describes the restriction of our *working memory* as only being able to memorise seven *chunks* of infor-

mation, whereby a chunk may be any type of data, be it small or large, complex or simple. Through the notion of working memory, Miller translates the problem of cognitive limitations to *memory limitations*. The studies of Chomsky and other linguists and psychologists are also in this rationale. Newell and Simon (1972) even define psychology as the science of describing mental limitations when they declare the experiments they undertake to serve the following two purposes:

> »1. To the extent that behaviour is precisely what is called for by the situation, it will give us information about the task environment...
>
> 2. To the extent that the behaviour departs from perfect rationality we gain information about the psychology of the subject, about the nature of the internal mechanisms that are limiting his performance« (Newell & Simon 1972, p. 56)

In this view, no space is left for the actual behaviour: while behaving rational only yields results about the task environment, behaving irrational merely shows the *limitations* of the subject. According to Gedenryd, »there also seems to be a division of labour between different disciplines: one sets up the theories, the other documents how people fail to follow them« (Gedenryd 1998, p.206). He focuses the problem behind cognitive limitations using the following sarcastic logical inference:

> »The mind is a computer
> It does not perform like a computer
> <- The mind is a *malfunctioning* computer« (Gedenryd 1998, p. 207)

Given this view of the mind, cognitive theory can only fail to deliver a working model of the human problem solving behaviour, as fundamental habits - affective and emotional reactions - are seen as symptoms of the lack of possibilities to solve a problem rationally. If nearly all capabilities of a system are exceptions to the expected behaviour, the model on which the expectations were built should be in question and not the system, a perception cognitive science mostly fails to see. Thus, the propositions of the cognitive sciences lead to a dead end, here. Therefore I will abandon most of these theories and follow more promising approaches, although they are less structured, elaborate and rational.

Solving Problems

Summarising, it can be said that contemporary cognitive science lacks a theory of how our mind works that acknowledges how we solve problems. The reason for this deficiency is that it regards crucial habits of humans as limitations of the individual rather than as limitations of the theory. As cognitive science does not come up with a model that embraces emotional aspects of human habits it can neither offer a starting point for researching the emotional nor for researching design or problem solving habits. A closer inspection of the ways we solve problems is needed in order to arrive at an alternative theory. John Dewey's theory of inquiry (1938) forms such an alternative, as it approaches human behaviour from a different side and acknowledges the »pirates of emotion« (Cacioppo & Gardner 1999, p. 194). It will be discussed in the next chapter.

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THE THEORY OF INQUIRY

»Je ne cherche pas; je trouve.«
Pablo Picasso

In his later works, John Dewey established a theory of inquiry that embraces all aspects of life (1938). It is a pragmatic cognitive theory aware of the problems that were introduced by a too rationalistic view of our habits:

> »The environment in which human beings live, act and inquire, is not simply physical. It is cultural as well. Problems which induce inquiry grow out of the relations of fellow beings to one another, and the organs for dealing with these relations are not only the eye and ear, but the meanings which have developed in the course of living, together with the ways of forming and transmitting culture with all its constituents of tools, arts, institutions, traditions and customary beliefs.« (Dewey 1938, p.42)

Dewey is especially focused on *instruments* and *tools*. In his theory the human mind establishes its view of the world in accordance to experiments it carries out in the physical and cultural environment. Individuals test out their capabilities against their surroundings in order to find out the characteristics of themselves and the world. This view of the behaviour of humans is in radical contrast to the ancient Greek view of the rational and objective:

> »The authors of the classic logic did not recognise that tools constitute a kind of language which is in more compelling connection with things of nature than are words, nor that the syntax of operations provides a model for the scheme of ordered knowledge more exacting than that of spoken and written language.« (Dewey 1938, p. 94)

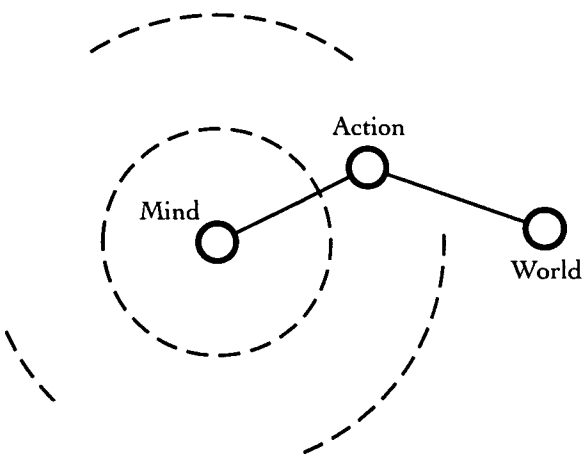
The theory of inquiry does not require a full-fledged mental model of the world in the human mind. Instead, the picture of the world is gradually refined according to needs of a specific action - this is why the above model of cognition is termed *interactive cognition*. While humans are still goal-driven, the dynamics of the proc-

ess of reaching a goal is acknowledged. Currently there are a number of scientists working on similar or refined concepts of interactive cognition: Rousselet et al. (2004) work on parallelism and serialism in the temporal domain of cognition. David Lykken (1997) links happiness to *doing* rather than to *being*. Knud Thomsen (1999) works on models of cyclic cognition and refers to ART (Adaptive Resonance Theory) models for neural networks (Grossberg 1988) as providing alternative models for the same mechanisms. David Chalmers introduces active externalism as »two-way interaction« (Clark & Chalmers 1998) where consciousness itself »extends outside the head« (Clark & Chalmers 1998). For sure, there are other - even more prominent - proponents of interactive cognition.

Emotions and the Theory of Inquiry

The theory of inquiry postulates that »we live and act in connection with the existing environment, not in connection with isolated objects, even though a singular thing may be crucially significant in deciding how to respond to total environment« (Dewey 1938, p. 68). This holistic view is in contrast to scientific logic, as the latter fails to cover the qualitative aspects of a problem:

> »...both the history of science and the present state of science prove that the goal of the systematic relationship of facts and conceptions to one another is dependent upon elimination of the qualitative as such and upon reduction to non-qualitative formulation.« (Dewey 1938, p. 65)



the intrinsic connection between mind, action, and world. gedenryd`s interpretation of *the theory of inquiry* by john dewey.

source: gedenryd 1998

Yet all emotional experiences lie in the qualitative aspects rather than in the quantitative. In order to understand these qualitative factors, Dewey opposes prevailing methods of examination of human behaviour:

> »In everyday living, men examine;. . . ; they infer and judge as ‹naturally› as they reap and sow, produce and exchange commodities. As a mode of conduct, inquiry is as accessible to objective study as are these other modes of behaviour. Because of the intimate and decisive way in which inquiry and its conclusions enter into the management of all affairs of life, not study of the latter is adequate save as it is noted how they are affected by the methods and instruments of inquiry that currently obtain.« (Dewey 1938, p. 102)

Given this statement, it seems only natural that media theory unwillingly embraced this approach. Above all, Marshall McLuhan is examining media as instruments that shape human communication. He perceived and discussed a plethora of media according to their effects on society and the individual. Even his daring theory of media as extensions to the human body (McLuhan 1964) can be read as an investigation into the mechanisms of inquiry. Given the above definition of tools as materials of inquiry (in an act of communication) that constitute our picture of the world, media is merely a new term for these tools. In Dewey's view, facts, perception, ideas and concepts are not independent pre-existing entities but materials for inquiry - instruments of thought. Even affect plays his role as an instrument of inquiry in our human existence.

We have seen above (➢ Attitude and Gefühlston) that emotions are structured around the experience of a difference in expected and effective outcome. If the underlying principles of action (the habit that leads from a starting point to an outcome) are changed, the models of emotion change, too. Building a theory of emotion on top of scientific logic and cognitive sciences leads to the problems described in the ➢ last chapter. Thus I propose a different theory of emotions that is based on how we act in regard to the theory of inquiry. As inquiry is a gradual process, emotions can be addressed on the microscopic level of perception. On the macroscopic level, emotions manifest as attitude, ever changing and unstable yet still structured to a certain degree.

In the next chapters I will investigate how specific media affect the senses and how perception works. They will give an introduction to the fundament for triggering emotional situations: human perception. I will analyse mechanisms that lead to interpretations of impressions from outside the mind in order to understand how emotions are generated. Therefore the primary senses that transmit information about our immediate surroundings (i.e. seeing, hearing and touching) are examined. While I briefly outline the biological fundament of the senses, I will focus on discussing them as tools of inquiry.

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PERCEPTION

When we wake up, we see light in the room around us. We stand up from bed and are able to balance our body in order to walk. We hear our surroundings. And we got a taste in the mouth and smell the fresh coffee. Our senses guide us through our lives. Joy and happiness as well as all grieve and anger is before all transmitted to our mind through perception, a process that - according to the traditional view of cognitive science - connects our mind with the world. Goldstein describes this connection in the following words:

> »Perception is based not on direct contact with the environment but on the brain's contact with electrical signals that represent the environment. We can think of these electrical signals as forming a code that signals various properties of the environment to the brain« (Goldstein 1989, p.50).

True, an important part of the perceptive process takes place in the eye and the nervous system. This translation of a stimulus to a representation that we act upon is subject for the following chapters.

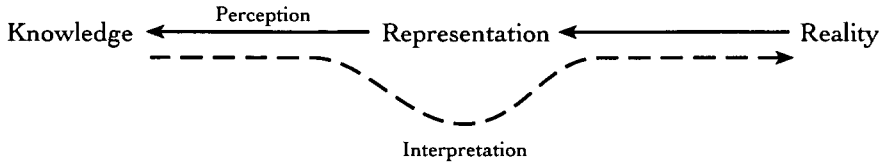
One of the earliest discussions of perception is undertaken by Plato in the 'Theaithetos'. Here, Socrate speaks:

> »Wenn ich wahrnehme, nehme ich Etwas wahr - es ist unmöglich, wahrzunehmen ohne daß da etwas wäre, das wahrgenommen wird; der Gegenstand, sei er nun süß, bitter oder von anderer Eigenschaft, muß Beziehung haben zu einem Wahrnehmer« (Platon 400 BC)

> »If I perceive, then I perceive *something* - it is not possible to perceive without something being there that is perceived; the Object, be it sweet, bitter or from different quality, must have a relation to the perceiver.« (Platon 400 BC, my italics and translation)

This view of absolute objectivism in perception was put to question by scepticists before and after Plato. Democrite was one of the earliest thinkers to mention that we cannot perceive what *really* is there (see Capelle 1968). About five hundred years later, Sextus Empiricus describes Pyrrhon's school of thought and thereby denies that we can ever compare our perceived environment with reality. And as experience is the only way to acquire knowledge about what is not yet experienced we cannot find out if experience alters the view of what is real. Déscartes on the other hand favoured the objectivistic approach to end up at a situation where the only thing remaining to be said is *cogito ergo sum*. This statement translates to »true beyond question is only the perceiving of the beholder« according to Glaserfeld (1992, p. 10, my translation).

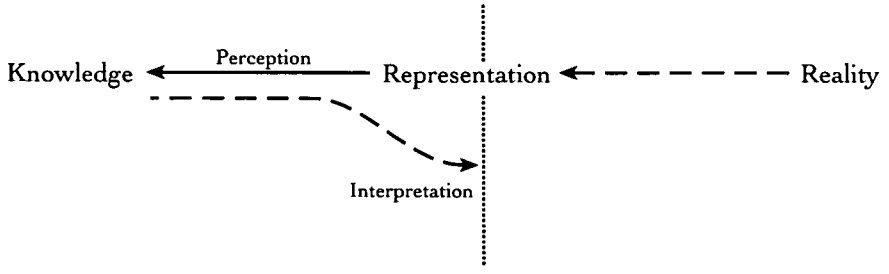
the relation between knowledge, representation and reality following déscartes writings. proper perception (following a method) leads to reality.



Despite Déscartes elaborate argumentation, the concept of objective knowledge remains questioned by many philosophers. Locke reduces perception of reality to a small number of primary characteristics:

> »... concerning our knowledge of the existence of things, and how we come by it. I say, then, that we have the knowledge of our own existence by intuition; of the existence of God by demonstration; and of other things by sensation.« (Locke 1689, IX.3)

immanuel kant denies all possibilities of perceiving reality, therefore emphasizing the role of the individual and its perception.



Hume describes the relation between cause and effect as sustained by the perceiver (see Glaserfeld 1992). Kant (1787) even relegates time and space to be

creations of the perceiving subject along with the *Dinglichkeit* (thing-being) and thus the structure of reality itself (see also Glaserfeld 1992).

Contemporary theories on perception either follow the line proposed by the philosophers mentioned above (c.f. Glaserfeld, Popper and Foerster) and thus result in constructivism - or at least scepticism - or they simply leave out the question of reality and focus on the impression that the perceiver has - be it reality what he sees or not. Yet the philosophic question can never be fully separated from the discourse around perception as the concept of empiricism forms the basis of the other prominent scientific approach in this area: medicine. In this dissertation I follow both lines of thought, leaving out most purely philosophical questions.

Beside these ontological questions, another line of thought shall act as a starting point for the discussion of perception in this dissertation: An impression rarely happens solely between the object and the spectator. John Dewey (1938) outlined the prominent role that the surrounding of an impression plays:

> »In actual experience, there is never any such isolated singular object or event; an object or event is always a special part, phase, or aspect, of an environing experienced world – a situation . . . . There is always a field in which observation of this or that situation object or event occurs.« (Dewey 1938, p. 67)

This situation is normally described using the notion of *context*, where context is the sum of all the features surrounding the object or event perceived. Context occurs around perceived objects and events in manifold ways. In the following, I will discuss context in respect to visual perception.

The Role of Context

A representation of a past process or event is called a *document*. It documents something that happened in a specific way when seen from one specific viewpoint. Many documents form a documentation. It matters in what context a documentation is presented. This context is merely a narrative factor. Barry describes it as follows:

> »When a still visual image exists apart from other images (that is, not part of a sequence of accumulated meaning beyond the individual frame), the visual takes on the emotional valence not only of the gestalt created by the interaction of the elements but also the feel of the immediate surroundings as well. (An exquisite oil portrait hung in a mahogany panelled library, for example, has a totally different affective valence from the same portrait hung in a public restroom).« (Barry 1997, p.149)

A published photo carries the credibility of the photographer and the place it is published, be it a magazine or a public restroom. Part of what is inferred and how it is inferred comes from the spectator's interaction with the presentation context of the image.

There are additional generators of context, one of them is the technology used in order to generate an impression, as it also affects the way the impression is interpreted. Issues that are seen as internal to the subject presented (and that affect our emotional tendencies when reading the impression) are often by-products of the production process and thus external to the content. The exact way a painting is done in style and variables like light, angle, perspective and sharpness in photography form a narrative factor, constructed by the author (with intention or by chance). They also determine our emotional attitude to an image to a certain degree.

According to Atkinson (1993), context is part of a relevance hierarchy in perception. His model is - by decision or just by chance - used in order to taylor information representation in media, where the hierarchy orders impressions between foreground and background. Lennox describes the role of context in this hierarchy as:

> »From the perspective of considering perceptual significance, ‹context› would seem to be of a very low order of urgency, and we would expect ‹context information› to be almost beneath notice, a sort of ‹perceptual background›, unless it is somehow ‹wrong›.« (Lennox 2001, p. 3)

The reason of existence for such a hierarchic system is the ability to react to the right sensation in a situation of urgency - an artefact of instinct that still shapes our vision of the world. Lennox relates this hierarchy to selective attention and postulates that »primitive feature detectors do not, of themselves, ‹judge› *importance*, merely *presence*.« (Lennox 2001, p.3, italics his). When the rock that will fall on your head is very close, it is clear that presence converges with importance. In any specific case, this hierarchy will be different between any two subjects unless a certain threshold is exceeded (yet maybe even then). This common sense feature of perception also affects the separation between foreground and background in pictures. Koffka mentions that a figure has to be segregated from its field and kept in a state of equilibrium in order to perceive a foreground (Koffka 1935).

Perception

This chapter provided an introduction to the vast field of theories about perception. It drew partly from phenomenology and partly from psychology. Epistemological issues were explained around Déscartian and Kantian models, as well as around radical constructivism. It was shown that context plays a role in how we perceive our environment, as we never see/hear/feel one particular entity separated from its surroundings. Different theories about how context affects sensual experience were covered.

The matter of perception is too complicated to be discussed in a single chapter, therefore the next chapters will focus on different aspects of perception. They are divided following different sensual modalities: visual, aural and tactile. I left out all other senses as they currently play no role in human computer interaction and are rarely designed for.

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Platon (400 BC): *Theaithetos.* Quoted in: Glaserfeld 1992, p.12.

VISUAL PERCEPTION

»Thinking in pictures ... approximates more closely to the unconscious processes than does thinking in words, and is unquestionable older than the latter both ontogenetically and phylogenetically.«
Freud, 1960

According to neurobiological research, the process of seeing has several stages: First the light enters the pupil and gets focused and projected onto the foveal area. There, about 126 million receptors - 120 million rods and 6 million cones - transduce the light into electrical signals. This signals are transmitted to the lateral geniculate nucleus (LGN) through the optical nerve by neurones. Roughly, the LGN roughly consists of two parts: The upper layers of it are the parvo-cellular layers that are responsible for colour, contrast and spatial resolution, while the lower layers - the magno-cellular layers - are dedicated to movement, depth and spatial resolution. The next station of the signal is the primary visual cortex that is connected to the LGN. Here four parallel working areas are known by now: one for motion, one for colour, two for form (Zeki 1992, p.73). According to some neuroscientists, the brain ends up with a mental representation of the outside world, suitable to survive on base of it. This is the mental image. Others deny the mental image in favour of more parallelistic and spontaneous models - one of them is J. J. Gibson (1979), whose theories will be discussed in the section about ➢ Affordances.

Some cognitive theories of visual perception assume that people have a memory for primitive shapes so that they are recognisable nearly independent of the situation. These *templates* are tested and matched against the objects in view. The reason why such a system should exist is simple: It would greatly speed up recognition of dangerous situations in the world, working as an unconscious part of perception that we use in every move we make. Of course the nervous system is much more complex. Research by Gerald Edelmann shows that memory is far from static. It is more or less a continuously changing and evolving open system (Edelmann 1992). Other experiments indicate that experience is located in different areas of the brain based on the character of experience. This is what makes it difficult to talk about traumatic events - the link to the language centre of the brain is missing on a neural level.

Obviously the nervous system is very complicated. Numerous experiments were conducted in order to understand the process of seeing, yet still grave aspects are not fully understood. Based on the research documents that are available, some general things may be said to serve as a starting point for this chapter: What we perceive is shape, space, contrast and colour. Borders between different parts of the image are immediately recognised (a fact that stops us from running into trees and allows us to grab the remote control). Movement is seen as a phenomenon of change between impressions over time, and this change does not have to be continuous. Colours are cultural and instinctive codes: Red is dangerous since blood is red (and blood is red since it is taken as a dangerous colour), as is yellow together with some contrasting darker stripes (and vice versa, again).

Images

There are several layers of presentation that account to the perception of an *image*. Since we continuously explore the world around us through our gazes, the first layer is always that of the surrounding world - the physical world (or what we take for it). The second layer is then a picture that lies in front of us, depicting a different world. While the surface of that picture is part of the real world, the content or depth is part of its own world. This latter world may have its own dimensions and rules. Yet we still apply at least some rules we are used to from the real world upon that virtual world. Deleuze describes his abstract concept of virtuality in the following words:

> »... the virtual consists of the differential elements and relations along with the singular points which correspond to them. The reality of the virtual is structure. We must avoid giving the elements and relations which form a structure an actuality which they do not have, and withdrawing from them a reality which they have. We have seen that a double process of reciprocal determination and complete determination defined that reality: far from being undetermined, the virtual is completely determined.« (Deleuze 1994, p.209)

What Deleuze might mean is that the virtual is determined in itself rather then in the outer world. The reality of the virtual he defines as structure. The image

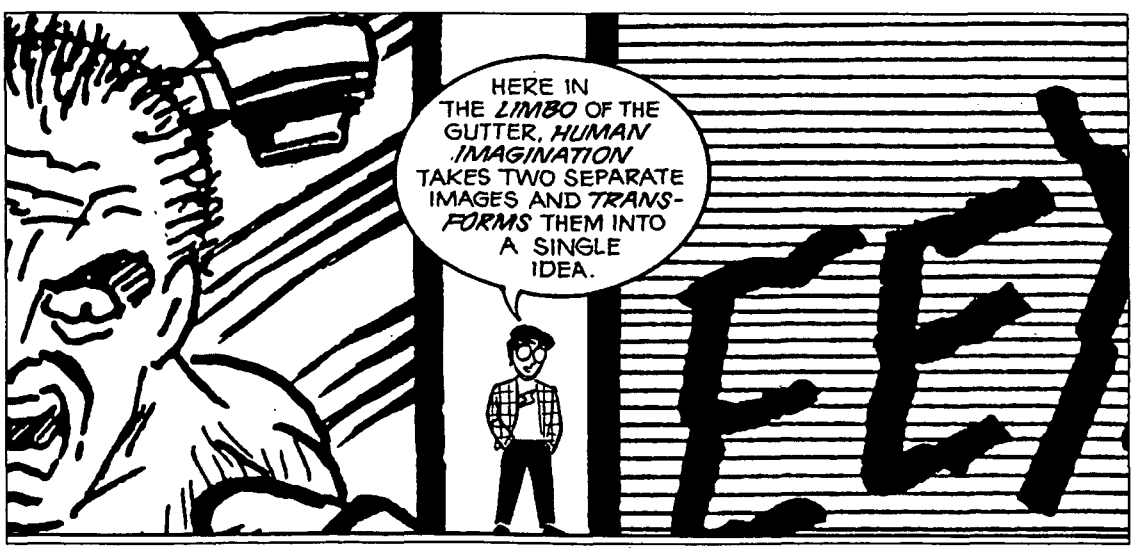
may be seen as if it were a window to a different world according to Leon-Battist Alberti (1435). The fact that this shape is usually rectangular happens due to tradition, as Lev Manovich notes:

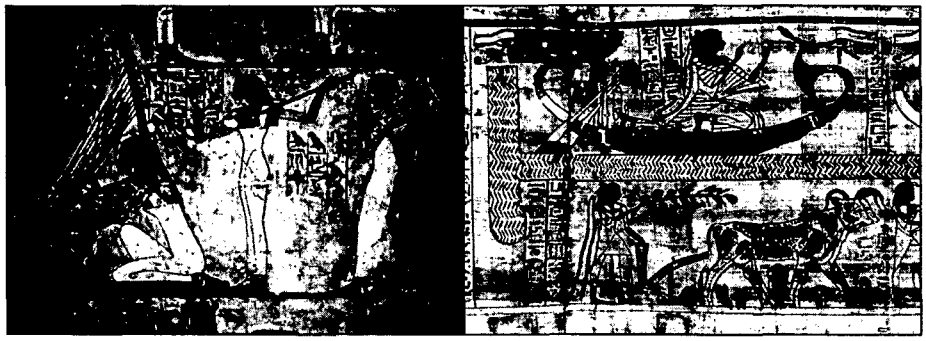
> »Cinema itself inherited this framing from Western painting. Since the Renaissance, the frame acted as a window onto a larger space which was assumed to extend beyond the frame. This space was cut by the frame's rectangle into two parts: the part which is inside the frame, and the part which is outside« (Manovich 2001, p.88).

It is important for many images to have this window capabilities: The world exists even where we can not see it because of the limits of the frame. Jacques Aumont states that »The onscreen space is habitually perceived as included within a more vast scenographic space. Even though the onscreen space is the only visible part, this larger scenographic part is nonetheless considered to exist around it« (Aumont 1992, p.13). Even if there is only a black circle drawn on a white sheet of paper, that circle does not lie on a rectangular plate, but in infinite space. It is important to state that this interpretation is not innate. It has to be learned - at least to a certain degree. Children's paintings are often applied to the plate from above. It takes years for children to learn of the space that is on hand. Characteristics of their images resemble those of mosaics, frescoes and cave paintings. It is not surprising that those are way older than the frame. But it stays an interesting contradiction, that a frame or boundary is needed in order to create space. In order to see the window as what it is, the frame has to be part of the outer - the real - world.

the frame is the border of the panels that set up a comic. imagination happens between the panels.

source: mccloud 1994, p. 66.



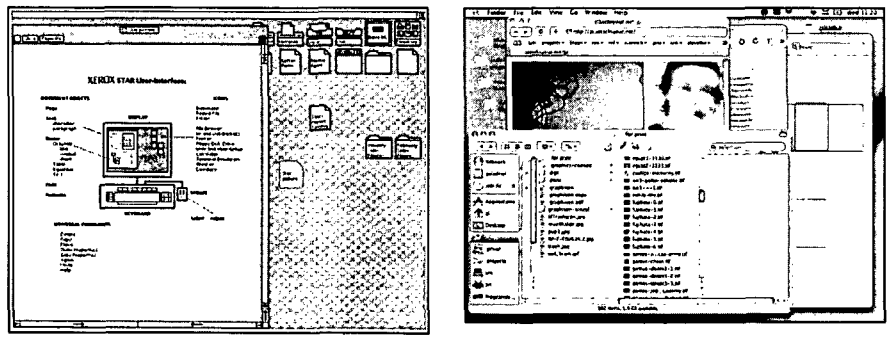


an example of a spatial narrative: an egyptain wall painting (left) and a papyrus painting (right).

source: belser 2003

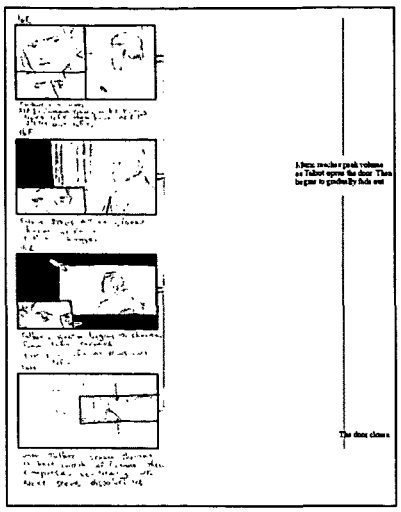
An image might have arbitrary dimensions. The common cases are 2D, 2.5D and 3D. The development of three-dimensional representations took thousands of years and went through the 2D and 2.5D stages. Perspective is something that was introduced not earlier than in the renaissance. According to Manovich (2001), the chain of development is as follows: Early paintings had a spatial narrative and were based on 2 or 2.5 dimensions. The spatial narrative has to be read by moving the eye. Egyptian paintings are examples of spatial narratives. It is not linear as the narrative of books and movies. This view of narration was developed further until the beginning of the 20th century, where it was diminished in favour of the linear narrative that is present in most media we use nowadays. Yet it still survived in certain enclaves like comics and Ikea construction plans, and it is about to return.

The re-approach of parallel time has reached cinema and television: In the series *24*, parallel events appear on a split screen. Time is happening at a fixed pace in this series: It is done in real time (except the usual 5 minute commercial breaks of American television that were left out in Austria, what resulted in a slightly too fast real-time). Also, the Hollywood movie *Hulk* by Ang Lee (2003) used multiple frames at the same time for some scenes. A further example is the movie *Timecode* by Mike Figgis (2000), that features four different plots taking place in four



the xerox star from 1981 (left) featured the first window interface. osx (right) by apple is a contemporary decendant.

source: www-cg-hci.informatik.uni-oldenburg.de (left), screenshot (right)

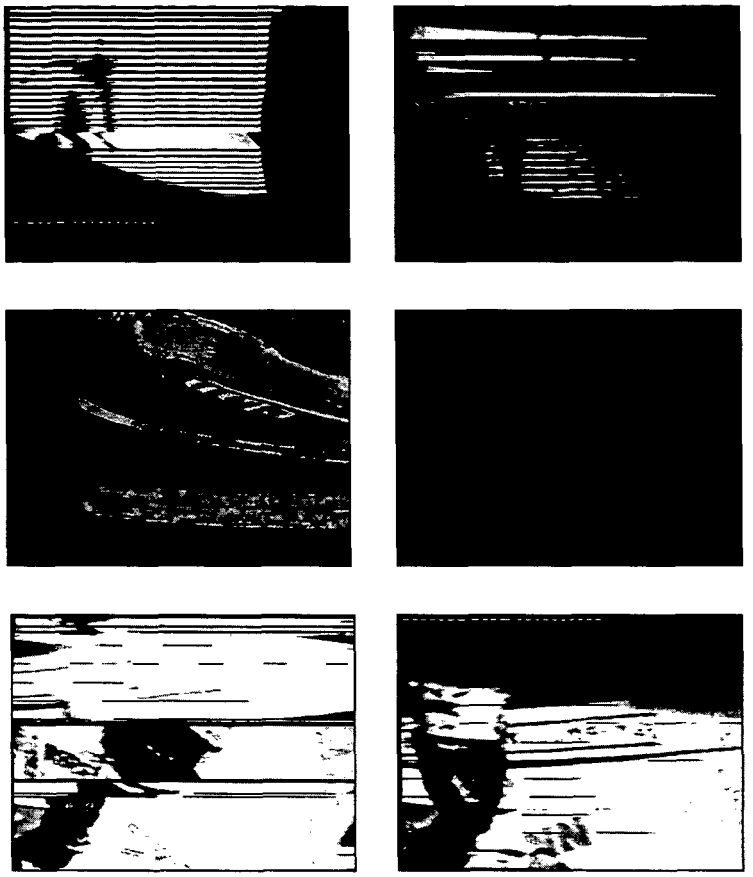


a page from the storyboard of the movie *hulk* (left). the movie uses a spatial narrative: several panels show different aspects of the same scene at the same time. another example of spatial distribution in film is the movie *timecode* (bottom). here, four plots take place at the same time.

source: an internet fan site (left) and www.offoffoff.com (bottom)

segregated areas of the screen. Contemporary painting seems to still refuse this development. Since changes in our system of creating structure out of impressions started at the plain image and found their way through the moving image to the interactive it seems logical that the origin of this shift back to spatial narrative starts in the interactive media. Also, our computer screens developed from single focus applications to parallel systems. The invention that established our current mode of work is the windowing system.

Frames, windows and screens have in common that they form a stage in front of the audience (Laurel 1991). Manovich notes it as »At the same time, it imprisons the spectator through perspective model or other techniques, so she and the painting form one system.« (Manovich 2001, p.112). The main point here is not the perceptive viewpoint but the optional character of the position. The involvement that is needed in order to participate in the system and the necessity of taking a standpoint form a moral identification. Other than in the direct interaction of physical space or simulation, in a framed and indirect world the moral viewpoint is ultimately forced upon the audience. One of the sources of power that strong visual art pieces employ is therefore, that they enforce a specific moral standpoint and play with the process of identification by the spectator, both even the ground for emotional reactions.



abstraction for the sake of aesthetics. images of the video live stream *abstractv* (2002). the video was distorted using analogue video editing technologies. the resulting image was transmitted via video-stream to an art gallery in riga as part of an international streaming event called *gaisma pills*.

Manovich continues to examine the relation between the standpoint of the viewer and the objects depicted in the image:

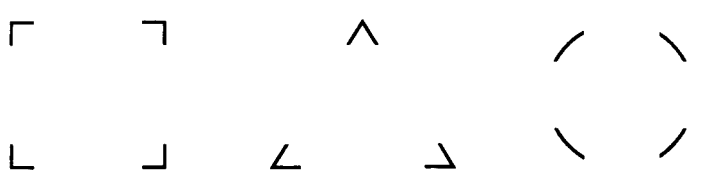
> »Therefore if in the simulation tradition the spectator exists in a single coherent space — the physical space and the virtual space which continues it - in the representational tradition the spectator has a double identity.« (Manovich 2001, p.112).

This double identity is asymmetrical: There is a real and an imaginary part. The real part forms a raison d'être for the imaginary (or virtual) one. And the imaginary one forms a *Doppelgänger* for the real. During this dissertation the situation of involvement and immersion will be regarded in several chapters.

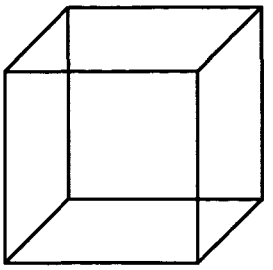
Abstraction

Marshall McLuhan (1964) separates the media landscape into cold and hot media. While hot media overload the senses with impressions (and in most cases are based on one single sense), their cold counterparts stimulate the senses just slightly. Examples of hot media are cinema and literature, while cold media are comics and television. Cold media tend to emphasise the rough, plastic and tactile. According to his theories sculpture is closer to television than cinema is. All cold media have in common that they are based on a lot of involvement by the audience (McLuhan 1964). Still images demand this engagement too, as long as they are to a certain degree abstract.

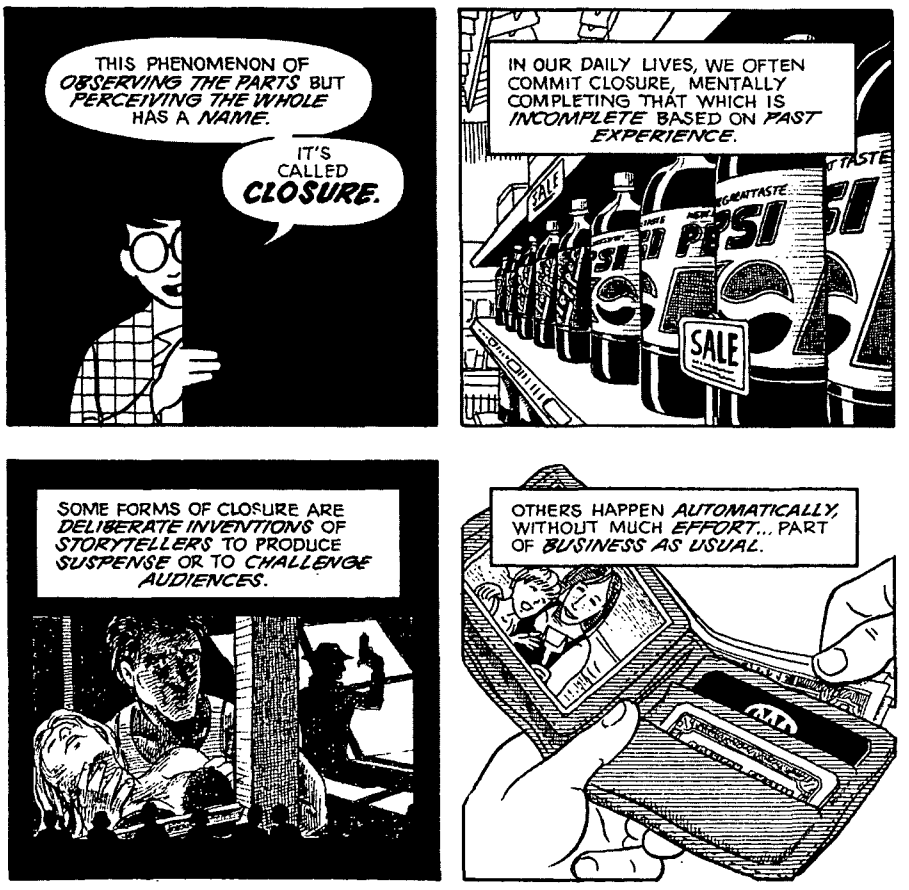
Every image bears a certain level of abstraction as long as it is modelled after some real world model. Due to the lack of dimensions, the space generated can not be the same as the space that is pictured. Yet we perceive this latter space in the image. As suggested by the Gestalt psychologist, perception can be seen as a holistic process. There is evidence, that what we see is composed of a number of hints that are then filled out with more information. We fill gaps and add missing information in images easily, as can be seen in the following example:



Most people even tend to construct a third dimension when there are only hints for it to be seen (as this cube is printed on a two dimensional paper surface and thus two dimensional itself):



The mechanism that enables this process is often referred to as *closure*. Closure is what makes us recognise other people (even if they've grown a beard in the meantime) and what makes us pick the usual coke in the supermarket, although the label is not looking towards us. Closure is also one of the most widely used techniques in movies and photography. According to McCloud, closure is the



scott mccloud explains closure as a basic and everyday habit. he emphasizes the many occassions we put it to use every day.

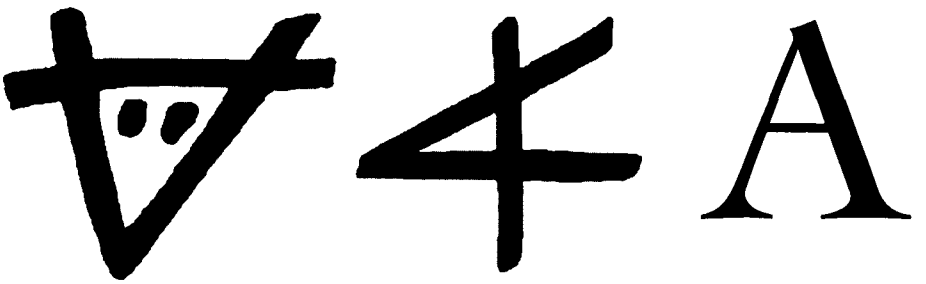
source: mccloud 1994, p. 63.

»phenomenon of observing the parts but perceiving the whole« (McCloud 1994, p. 63). In this context closure only refers to the subconscious part of recognition. On the content level, closure - as fuzzy classification of impressions - is called cartoonification (Ramachandran & Blakeslee 1998, see also Lennox 2001).

Icons, Letters and Symbols

Developed out of the still image is the icon. An icon depicts (represents) a certain object or process. If images are continuously abstracted they turn into (cartoonified) icons. Certain features relevant for understanding the meaning of the icon are emphasised. Once the icon is detached from its original meaning - and thus read without thinking of its origin - it becomes a symbol. Symbols stand for themselves or at least for something different than the icon they originate from. Letters are symbols that have developed out of icons:

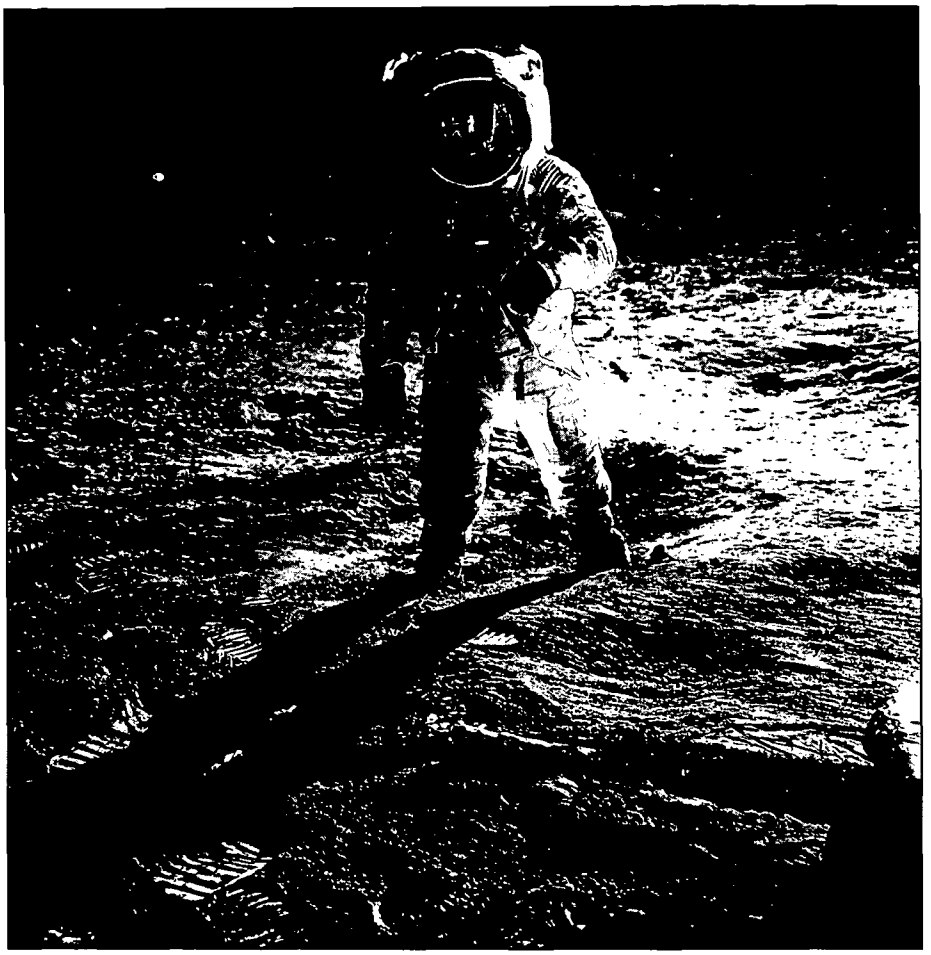
Writing occurs in many forms today: There is handwriting, printed words, the use of words in comics, paintings and movies, and in electronic form. The Latin alphabet that i use to write this sentence is based on a set of capital letters that gained its specific form because it was necessary to be able to carve them into stone.



the development of the letter *a* from depicting a clearly visible ox (left) over the phoenician form (middle) to its current form in the latin alphabet (right).

source: modelled after several internet sources

According to McLuhan (1962) a rise and fall of syntax in writing can be observed. He sees a lack of syntax in later forms of writing like headlines and telegraphic notes. This lack of syntax is also to be found in contemporary paintings that involve words. When he is talking about a lack of syntax, I would call the emerging replacement for it an *intuitive syntax* - there are no formalised rules to be known, but there is still some system. McLuhan then states that photography



beside the fact that pictures of men landing on the moon were widely used for propagandistic purposes, this image also clearly underlines diana arbus` statement above. the photographer is always present in a photo.

source: nasa website

also lacks this syntax, a fact that I doubt. Since the successful reading of a photography is the outcome of a learning process, the syntax has to be learned. But the widespread use of the syntax in our cultural environment makes it possible that we internalise it until it becomes completely invisible. Yet as long as there is language in a medium it will always involve a syntax.

There are numerous examples of the symbolic power of images. They all take their strength from the intuitive way they can be read. This comes from cultural agreements. Cultural agreements arise as soon as their application provides the individual with a certain ease of survival. The basic symbols we immediately recognise in images are based on ancient achievements: recognition of emotions in facial expressions and body language, and recognition of the laws of physics. But there are also more abstract relationships to be read in images: There is always a time axis in images, although we do not use or need it in all of them. Western civilisation reads images from left to right. It is comics again, that make use of this - as well as paintings and photography. Since the direction of reading comes

from our direction of writing, it is no surprise that eastern civilisations read images from right to left. And as soon as time is involved, a process might be seen in images. The spatial reading of images or a story was never fully abandoned. But there is even more once the creation of the image is taken into account, as Diane Arbus noted:

> »When you go to the movies and you see two people in bed, you're willing to put aside the fact that you perfectly well know that there was a director and a cameraman and assorted lighting people all in that same room, and the two people in bed weren't really alone. But when you look at a photograph, you can never put that aside.« (Diane Arbus, source lost)

The same is true for paintings: the role of the artist and his thoughts and the reason why he takes a certain standpoint are important for the audience. Yet comics (again) seem to fall into another category. Maybe this is part of the reason why photography and painting are taken more serious as an art form than film and comics are. It has to be noted that video falls into the author-aware category, too - and it is also taken as a serious art form nowadays. Obviously there are forms of expression that emphasise authorship more than others. The question is if this is due to the technological and economical circumstances of production or the medium itself.

The degree of perceived authorship is independent of the mechanism of the frame described above, since all the technologies mentioned utilise a screen or frame. Yet if the authorship is strong, the audience has to identify with it - it is put in place of the author. This leads to a completely different sensation than if the audience is separated and thus forced to select it's own standpoint. Claudio Guillén says about the position of the author and the relation to the generated self:

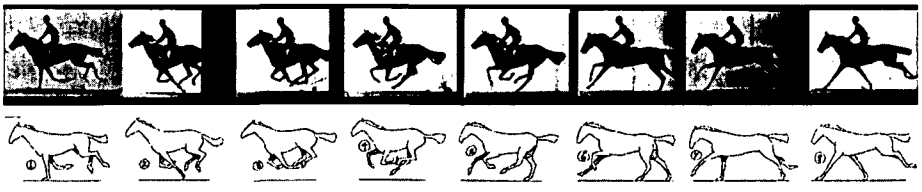
> »There is hardly an act in our daily experience, rooted in life itself, that is as likely as the writing of a letter to propel us toward inventiveness and interpretation ... he 'I' who writes may not only be pretending to act upon a friend .... but acting also upon himself, upon his evolving mirror image.« (Guillén 1994, p.2)

While other communication technologies do not emphasise the identification with the created object this much, there is still a position to be taken in regard of it, as an author. Even if the technology used is documentary (and thus claims to be objective) - as photography - the situation of the audience when viewing it is different than the situation it was created in. It is a snapshot - a documentation of a now spatially and temporarily fixed moment - thus it has to be reconstructed by the audience in order to come to life again. Much of the secret of art comes from the inability to reconstruct this point of origination by the audience in its full extent. A little oversimplified: If I cannot reconstruct the situation that led to a document, I need to either blame myself or grant the author supremacy. Please note that I use the word *document* in this sentence for I am referring to a documentary object. Further investigation of the matter is necessary before this theory may be applied on arbitrary objects.

Moving Images

»The photoplay obeys the laws of the mind rather than those of the outer world.«
Münsterberg, 1916

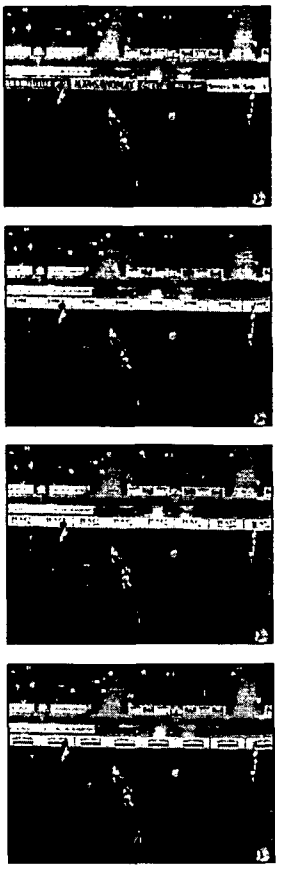
Motion in visual perception is experienced on two different layers: First there is the movement of the beholder and second the movement in the world. The movement of our eyes and head is hardly perceived as an activity as it is such a basic habit and thus unconscious. The movement of objects is perceived as a change in the pictures we see. Causality is inferred from happening motion, thus movement can be discussed as a narrative experience (➢ *Navigating the Narrative*). Documenting movement always means showing change. One way to document motion in comics is to arrange images of the same entity in space. Film uses the same technique yet it does not distribute the images over space but reuse the same space again and again.



the famous photographic study of the gallop of a horse by eadweard muybridge (top) and images illustrating the animation of a horse (bottom). interestingly, rearranging muybridge's photos leads to similar pairs of images.

source: www.uweb.ucsb.edu/~julius/Film/timeline/muybridge.htm (top) and whitaker & halas 1981 (bottom)

The transition of the still image to a moving image as a technological process is based on the affinity towards seeing motion that inhabits us. On the biological side, there is no difference between real movement and the impression of movement that happens in film. This illusion allows an experience fundamentally different from still images: As perceived movement and thus perceived time are registered, space is created. When there is time and space, all parameters exist to turn an illusion into a simulation. By definition a simulation is closer to reality than an abstract representation. Thus, it is possible for film to change the way we perceive reality. Béla Bálasz notes about movies that »the mentality of the people ... is to a great extent the product of this art, an art that is at the same time a vast industry« (Balász 1970, p.17). He warns us to better understand film art, because the »mental health of ... nations« (ibid.) depends on film. When Balász talks about film, he refers to television as well as cinema.



a virtual advertisment for a soccer game: ad content is altered in real time.

source: (lost) google image search

The production technology involved in film making is different for cinema and video (resp. television). While cinema is mostly based on analogue media, video is nowadays developing towards being completely digital. This allows cheaper ways of producing and manipulating images. Nowadays, even cinema movie makers are starting to shoot scenes using digital cameras and transfer them to analogue media later - after special effects were applied, cutting and colour correction took place. In this case it is only the mode of presentation that stays analogue.

There are other technological differences between cinema and television. Broadcasted television is still to a large degree produced live, creating a feeling of reality that is not present in cinemas any more. News are an interesting example here: While the speakers are broadcasted live, there are snippets of recorded material interleaved with the live broadcast. This dichotomy results in a blurred perception of reality: What is placed between the live parts is still granted the guarantee of being reality. The light of reality shines through time. It is no wonder that recent technological inventions greatly extend the possibilities of live-editing. Recently a technology has been invented that enables the editor to place custom advertisement banners in a scene. They appear as if they were in place for real, and not created and applied afterwards, fully dissolving in reality:

> »Virtual advertising has so far been a novelty feature of live sports, where football players tackle each other in front of make-believe bill-

> boards and soccer players run across plausibly real trademarks. For example, the games of three Major League Baseball teams—the San Francisco Giants, Philadelphia Phillies and San Diego Padres—include virtual ads this season.« (Eliott 1999)

There are also cultural differences in the way television pictures are consumed and cinema movies are. While 50 years ago, a TV set had an average of more than two viewers, nowadays the development goes into the direction of having one or more TV set per user. Contrary to this, going to the cinema is a social habit. Not only is it done in groups, there are also dozens to hundreds of other people in the same room watching the same movie at the same time. It is an interesting fact that television programs like game shows, the audience is placed in the studio while the user is sitting in front of the TV screen, alone. Also in soap operas, the visually invisible audiences laughter creates a group experience for the viewer. A process of social substitution takes place. The group is placed in the virtual and the individual can chose to participate or not by just pressing a button on the remote control. The authority of participation is up to the user.

When Marshall McLuhan describes media as cold and hot, he decides television to be cold and cinema to be hot (McLuhan 1964). Cold media encourage participation. In cold media, the user is playing a far more active role than in hot media. The user is involved in the action. He is taking part in what is happening. The experience is based as much on the user as it is based on what is presented. The activity the user is participating in is a basic form of interactivity. In cinema on the other hand the movie is merely presented to the user and the situation is perceptually enriched through the massive screen and surround sound. The remote control is only the last argument for this theory: Television is not about one channel - it is about interaction with a pool of proposed entertaining situations. Thus, the television experience is composed of the designed content (movies, live broadcasts, advertisement breaks, etc.), the media-inherent presentation layer (the analogue screen and sound), the controllable interaction layer (via the remote control) and the layer of social interaction. Through the latter, television also forms a base of everyday life indirectly: Outside the world of the media experience, talking about things happening primary in television is more common than talking about things happening in computer games or on web sites. Shows like *Starmania* (the Austrian equivalent to the omnipresent *Idol* shows) successfully

deliver content for everyday casual conversation. When television was about documenting an event in the beginning, the event is now generated in television and documented outside of this media.

Another difference between cinema and television is the way, time is expressed and inherently present. While television uses a continuous and seemingly real-time flow, cinema creates a time bubble that in most cases describes a long time span in a very short period. Since there is no correlation between the actual time and the time presented, a state of timelessness is achieved even though a great amount of passing time is presented. This detachment between different experiences of time emphasises the passive role of the audience in cinema. The limited ability to produce this state in television results in a different language of presentation. Barry notes that in television »most drama take place inside rooms and buildings, and human problems become the focus of conflict« (Barry 1997, p.162). Even if the plot develops over a longer time span, it is not perceived in some cases. Television series are usually shown once a day on working days. The approach of the user is to see them as if what happens happened on the one day that lay between the current and the last episode. Therefore a correlation is perceived between time in television series and real-time.

Beside the differences in timing, there are differences between cinema and television in the way space is generated and experienced as landscape. Landscape painting evolved in the 17th century in the Netherlands. The methods employed were those of traditional oil painting. After a difficult start (the first painters that purely painted landscapes like Jacob van Ruisdael and Meindert Hobbema could barely make a living out of it (Berger 1972)) it grew a key discipline and contributed numerous innovations to painting. But painters as Rembrandt, Constable, Turner and Monet not only revolutionised the craft and art form, but lead to a development away from material and bodily to more abstract and disembodied themes. They introduced desired vagueness into painting. The cultural background that lead to the rise of landscape painting and its descendants was that of a forming understanding of ecology - the conclusion that the environment as a whole can not be owned. The symbol for something that is not to be owned is vastness: The vastness of the skies and the landscape ... and the cinema screen. The reproduction of a scenery seeming endless is not possible in television, yet widely used in cinema. This ethereal manifestation can not happen on the narrow

an example of a painting by one of the first landscape painters, jakob van ruijsdael: the mills of wijk at duurstede, around 1670. an interesting detail of this painting is that the mill is to be seen from a different perspective than the landscape.

source: belser 2003

screen of a television set. For sure this is one of the reasons why cinema is reported as *magic*. The spectator is not watching a closed space from close distance, but is placed into an endless landscape - he is thus confronted with an environment as a vast and vague surrounding that is not to be owned.

Visual Perception

Visual perception plays a significant role in how we perceive our environment. There has been a lot of research into how we maintain the status of being informed about what happens around us. I started this chapter with a brief introduction on how our visual system works on a neurological level. Then I explained several concepts of how visual perception takes place and how different media affect perception. I ended up with a description of the relationship between a specific perceived image and its context. By cause I did not try to give a simple or full description of the process of visual perception but rather focus on the difficulties and problems of the matter in order to arrive at a rather vague, yet holistic, model of perception open enough for the concepts that will be explained in the following chapters.

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AUDITORY PERCEPTION

Results in neuroscience indicate that the many areas of the cortex are interconnected in parallel at several levels (Millar 1994). There are also multiple connections between more peripheral and more central areas (Ramachandran & Blakeslee 1998). This leads to a split view of our surroundings: When seeing, there is not one ‹what and where›, but many of them (Atkinson 1993) and it seems like there is no reason to suppose that processes in the auditory domain are less complicated. Construction of reality is again an active - and interactive - process: »We can no longer think of perception in terms of a unidirectional sense-data stream within a hierarchical organisation of processing functions« (Lennox 2001). Parallelism as it happens in sound perception can not be described in such a linear way, and the actual performance humans have in processing sonic information is indeed overwhelming. Bill Buxton gives a good example of our auditory capabilities:

> »This can be seen in driving a car. Consider that driving a car at 80 m.p.h. on a motorway is a critical task in which error could result in death. Nevertheless, one can perform the task, with the radio on, while holding a conversation with the passenger. Despite concentrating on the conversation, one can still monitor what is on the radio and, if of sufficient interest, interrupt the conversation to point out a favourite melody. While all of this is going on, one could well be passing another car and, in the process, changing gears. A clicking sound confirms that the turn signal is working, and if the car has a manual transmission, audio cues (rather than the tachometer) will most likely determine when to shift. And throughout all of this, one is immediately aware if the engine starts to produce some strange noise, or if an ambulance siren is audible.« (Buxton 1989, p.1.3)

In fact it seems to be the case that the auditory surroundings largely shape our image of a situation. The reverb and echo that the walls of a room throw back on us are important to navigate in space. Barbara Shinn-Cunningham mentions that »in the absence of these basic auditory cues, situational awareness is severely degraded« (Shilling & Shinn-Cunningham 2000, p.4.2).

Sound provides the ground for many experiences: e.g. the perception of spatial properties (as described above) or spoken communication and aesthetic pleasure (e.g. music). This chapter will outline the importance of sound as an experience always present.

Organic Factors

John Dewey remarks that »The connection of the ear with the vital and out-going thought and emotion are immensely closer and more varied than those with the eye« (Dewey 1984, p.218f). Our perception of sound is regarded as a primary mean of presence. Dewey refers to the spatial property of proximity in order to explain the immediacy of the aural senses. Coyne states that »Unlike the objects of the sense of sight, sound is, as indicated by Dewey, ubiquitous, non-sequential, non-spatial, and all-enveloping. There are no organic physical accoutrements for shutting out sound« (Coyne 1995, p.42). While sound itself can be seen as non-spatial, our perception of sound is mostly spatial. Déscartes argues that the human experience is primary that of a subject in an object world (and presence arises as an internal process). In contrast, Derrida roots presence in the experience of a world of involvement not reflected. Sound forms one of the bases of this involvement, simply because it is there.

Even those aspects of auditory impression that are hardly supposed to be related to central functions of cognition are proven to be more relevant than expected: Anne Blood and Robert Zatorre used positron emission tomography to study neural mechanisms underlying intensely pleasant emotional responses to music. In their study on 10 subjects they used pieces such as Rachmaninoff 's *Piano Concert No. 3* and Barber's *Adagio for String*. Their results show that the perception of music affects several regions of our brains:

> »Cerebral blood flow changes were measured in response to subject-selected music that elicited the highly pleasurable experience of "shivers-down-the-spine" or "chills." Subjective reports of chills were accompanied by changes in heart rate, electromyogram, and respiration. As intensity of these chills increased, cerebral blood flow increases and decreases were observed in brain ... structures [that] are known to be

> active in response to other euphoria inducing stimuli, such as food, sex, and drugs of abuse.« (Blood & Zatorre 2001)

The crucial point thereby is that »this finding links music with biologically relevant, survival-related stimuli via their common recruitment of brain circuitry involved in pleasure and reward« (Blood & Zatorre 2001). According to Blood and Zatorre, music stimulates brain structures that play a vital role in our everyday life. Is music so powerful because it is linked to them or did music evolve because it is so powerful that it even played a role in the development of the brain? Both might be true. But music is only part of the sound that surrounds us everyday.

Surrounded by Sound

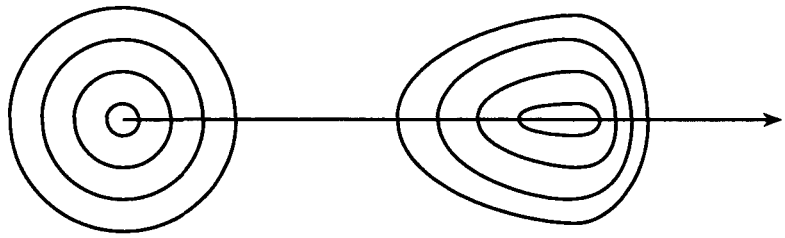
Barry Truax (1998) recommends to examine audio as separated into several partially overlapping dimensions.

- First, there is the dimension of *environment*: Acoustic information is a key hint for navigation in space. Unconsciously, we rely strongly on reflection of sound along walls to determine characteristics of the space that surrounds us. Barry Truax describes this as *soundscape ecology*, »...the study of the effects of the acoustic environment, or soundscape, on the physical responses or behavioural characteristics of those living within it« (Truax 1998).
- Second, there is a dimension of *ambience vs focus*: »The background sound of an environment in relation to which all foreground sounds are heard, such as the ‹silence› of an empty room, conversation in a restaurant, or the stillness of a forest. Ambience is actually comprised of many small sounds, near and far, which generally are heard as a composite, not individually« (Truax 1998). While focused sounds are heard as one perceptible union.
- I would add the dimension of *aesthetics*: Pseudo-intrinsic reading of a sound based on cultural education and (arguable) inherited instincts. Another dimension is that of *information*: Here the mechanisms that enable us to speak and communicate are taken into account.

Sound in Motion

The physical effect termed *Doppler Effect* is crucial to the perception of movement. This effect happens when a sound source passes by the listener. The sound waves emitted in the direction of movement are contracted, while those emitted in the

opposite direction are stretched. The results is a change of frequencies of sound perceived while the source passes by. The change of frequency carries information about the relative position, the direction, the speed and even acceleration of the object:



when the source of a sound moves, the doppler effect happens as the waves are compressed in direction of movement and deflated in the other direction.

Ambience is a part of the environment. All that is not actively perceived is ambience. While environment surrounds us, ambience is what builds the background in the environment. As soon as we concentrate on a specific part of the ambience, it is not ambient any more. While the amount of information in the sound itself does not change by concentrating, the amount of perceived information does. This process is analogous to *looking closer* or *focusing*. Although all sounds have an origin, this process does not necessary have to be locative. Focused sound is a primary mean of mediating information - it is what telephones and spoken words are based on. Ambient sound is considered widely as a secondary mean of mediating information. The dichotomy between foreground and background that was explained in the last chapter occurs again. Again, the closer and more urgent a sound gets, the more the impression changes from *presence* into *importance*.

This feature can be authored by intention as Lennox explains - and it is referred to as *cartoonification* as in the visual case:

> »Classifying the spatial characteristics of sounds in terms of the way in which our perceptual systems grade information-stimuli for action not only allows us to extract the most important psycho-acoustic cues, but also allows for a drastic reduction in the signal bandwidth. For instance, an audio source that is distant enough and of such character as to afford little attention does not need to, and should not, be accurately defined in terms of localisation, proximity or indeed signal quality.

This process of abstraction we call *cartoonification*. It is a way of increasing information bandwidth while at the same time reducing the signal bandwidth.« (Lennox 2001, italics mine)

The Role of Audio in Media

Sound plays a vital role in how we perceive the narrative and the situational context in movies. In conjunction with images, sound alters not only what is seen but the image also alters what is heard. Barbara Shinn-Cunningham quotes George Lucas, the author of the Star Wars series of movies, to have stated that sound is 50% of the movie experience (Shilling & Shinn-Cunningham 2000, no reference to the original source). The unity of sound and vision seems to be an ancient dream of our culture:

»The quest for an audiovisual ‹unity of the senses› is an ancient one, which extends at least as far back as the Classical Greek philosophers who developed tables of correspondence between colors and musical pitches.« (Levin 2000, p.121).

This unity of the senses is so desirable simply because it is a part of our everyday lives (see also Eisenstein 1942): As Klatzky points out (Klatzky 2000), the link between acoustic feedback and perception of material is a strong one. We not only touch a surface for haptic impressions but we also anticipate the clank when we bounce against a surface. According to research by Massaro as well as McGurk and MacDonald audio can modulate or even override visual cues - and complement haptic ones (Massaro 1987; McGurk & MacDonald 1976). Thus, sound is related to all other senses.

While audio is nowadays regarded as important for movies and computer games, it is rarely the focus of scientific investigation when it comes to user interfaces. Bill Buxton outlines the impoverished situation of audio in information processing:

»Likewise, I believe that we are seriously disabled in terms of our ability to function in the domain of information systems due to the impover-

ished use of sound. So let us pick a term that captures the full sensory richness of the user. Let us pursue perceptualisation, rather than visualisation. And in so doing, we now open up the possibility of building upon the skills of musicians and sound designers as well as visual artists.« (Buxton 1994).

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HAPTIC PERCEPTION

»To think of technology and, in particular, computation, is to think of hard tactile surfaces. It is to think of a tangible, object-based relationship between the subject and her machine.«
Pierce, 2001

We constantly receive haptic impressions from our surroundings. Material is felt when touched, as surfaces always have a haptic quality: Floors we walk on and chairs we sit upon, tables we use and computer keyboards we work with. While early Greek philosophers believed that even our visual sense is based on feedback mechanisms - our eyes sending out gazes that get reflected on surfaces like in a ray tracing program - the haptic senses are indeed vastly used as feedback mechanisms as we have to touch something actively in order to retrieve information about it.

Brewster and Brown split the sense of touch in two parts: *kinaesthetic* and *cutaneous*. Kinaesthetic is a »term to describe the information arising from forces and positions sensed by the muscles and joints« (Brewster & Brown 2004), while cutaneous perception »refers to the mechanoreceptors contained within the skin, and includes the sensations of vibration, temperature, pain and indentation« (Brewster & Brown 2004). The (male) skin has an average of 2 square meters, and is therefore the largest organ of our body. (Montague 1971). The kinaesthetic sense is also involved in muscle memory and *spring locked modes*, as discussed by Jeff Raskin (2000). A spring locked mode is a discrete state of an interface that is physically maintained. Pressing the ‹Control› button of the keyboard puts the computer into a spring locked mode (as dragging with the mouse does since a mouse key is pressed). While modes should be avoided, experiments showed that spring locked modes impose no additional load on the cognitive system (Raskin 2000).

One of the characteristics of our sense of touch is that it is always there. Especially the cutaneous sense delivers a constant background of information to us. Although perception theory reflects this, it usually does not affect design this much. Designers rarely chose a material only because of haptic properties, but every designer has those haptic properties in mind when choosing. Form affects

the haptic experience as the outline of an object determines whether we expect it to be hard or soft. A material or colour might mediate hardness or softness. A same shape might seem hard or soft - and the same is true for colours. Yet this is not a triangle of power but a complex multidimensional system. Situation and context as well as memorised experiences (think of cold and hot) also influence how we predict the haptic qualities of an object. And - as explained in the chapter ➢ *Theories of Emotions* - the expected experience is a crucial ingredient to emerging emotions.

Another hint for the potential in emotional haptic perception can be found by looking at the many uses of the words *feeling* and *touching*. Something *touches us* or even *touches our heart*. *Don't touch me* is a synonym for *leave me alone*. If something is *touching*, it affects us subliminal, but not only by haptic senses. Lakoff and Johnson see the primary source of metaphors in the sense of touch (Lakoff & Johnson 1980): The sense of containment (that is the separation between inside and outside) is first established through touch, maybe simply because touch is the first sense to develop. Lakoff and Johnson see three principles for the establishment of metaphors and thus language: *containment*, *balance* and *force* or *power*. All of those acknowledge the tactile senses: Distinction between inside and outside as cutaneous and force as kinaesthetic perception. While balance represents a somewhat more complex relationship, if we take the balance of our body as the prime sense of balance, it is quite haptic, too. Maybe this is in fact one of the reasons why haptic information processing is so diminished: Because we constantly need our haptic senses for maintaining stability and monitoring our body. If loud headphones were the only way to hear music, music would not have succeeded.

Tactile Interfaces

There is a long tradition of haptic information displays that had it's advent in the beginning 16th century:

> »The first known example of a watch fitted to a finger ring dates from 1542, and later examples are quite sophisticated: King George III was given a finger ring a half inch in diameter in 1764, and a French watchmaker built a ring watch with a calendar in 1779. But one of the

> more interesting ring watches was one of Queen Elizabeth's: Its alarm consisted of a small needle that scratched her finger« (Martin 2002).

There have been numerous applications of haptic interfaces in the past (see Bruton 1976, Landes 1983, Sobel 1995 for more examples from the domains of watches and history). While tactile feeling always plays a role in our daily duty it is not regarded as a component for directed information transportation. William Buxton recapitulates, concerning computer systems:

> »Look dominates, feel is impoverished and sound, while used, is almost a ‹throwaway›. In short, the balance is out of all proportion with human makeup and capabilities« (Buxton 1994).

The fact that haptic interaction is one of the main means of interfacing computers it is rarely perceived as important. Even the mouse and the keyboard are - while clearly featuring haptic qualities in their use - primarily discussed as interfaces with visual feedback. The tactile qualities of these instruments are regarded as a physical side-effect rather than as intended. Media theory is stuck in discussing the mouse in regard to the display rather than in regard to our body. HCI research in this area is largely centred around helps for visually or physically impaired persons. As one of his tributes to User Interface Design William Buxton constantly emphasises the role of tactile senses in perception simply because it is always there. Buxton further noticed:

> »An interesting attribute of most human-computer interaction is that it uses a different sensory modality in each direction of communication: primarily visual from computer to human, and motor/tactile from human to computer. This is almost taken for granted. But it is contrast to almost all human-human communication« (Buxton 1994).

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REPRESENTATION

»DOING with IMAGES makes SYMBOLS.«
Alan Kay

At the beginning of the twentieth century, the collected papers of Charles Sanders Peirce (1935) were published posthumously. He had worked on them contemporaneously with Ferdinand de Saussure. Together they initiated what today we call Semiotics, the science of signs. Saussure examined signs as composed out of a *signifier* - a sound or object - and a *signified* - the entity it represents. Saussure (1916) explained that signs are »arbitrary in nature, their use deriving from convention and the necessarily collective social nature of communication« (Barry 1997, p.118). Roland Barthes continued this line of thought and ended at a very structuralistic view: He divided signs into natural ones (that are what they show) such as photographs, and cultural signs that suggest a specific interpretation based on a cultural agreement (Barthes 1964).

Peirce identified three classes of signs: *iconic*, *indexical* and *symbolic*. The first of them - the *iconic signs* (or *icons*) - look like what they are. They rely on resemblance. Examples are portraits, naturalistic landscape paintings and photographs. An *indexical sign* is dependent on an existential relationship. It is a sort of evidence that stands for something else. A weathercock that indicates the direction of the winds is an indexical sign. Also watches are indicating time based on indexical signs. The relation is indirect yet stringent: There is the overall agreement that it is the wind that changed the direction of the cock. The third class of signs are the *symbols*. Symbols feature abstract associations between what they look like and what they stand for. Their interpretation is based on convention, not necessity. While the origin of every symbol might be found in indexical signs it is called a symbol only after its meaning has been detached from the original. It needs to be abstracted. Symbols are often only decipherable in one cultural sphere (as a language is, or the letters it is written in). Each symbol carries a history of representation, association and relation with it. It is important to understand that Peirce noticed that signs may be seen as falling into several of his classes at the same time. What is a sparkling object to a child is a diamond ring to a grownup. Clearly, the theories of Peirce can be applied to different media.

A *representation* is something (an object) that stands for something else (another object) - it is therefore not a presentation (that is present). Obviously every symbol is a representation, but also the indexical signs described above fall into this category. Even an icon depicts something else, it just looks like the thing represented. One significant characteristics of the term representation is that it means re-presentation - to present again. It is built on a present that was already experienced. Present means something that was there in time and space. So the most primitive interpretation of the term *representation* is that of a reference in time. Since representations are typically simplified, they are a key to a reaction in mind based on resemblance. If we consider Peirce's three classes of images in relation to the term representation, we find that *icons* are representations of something similar to them. If they are visual they are identifiers of objects. *Indexical signs* are often representations of actions: The clock depicts progress of time, the weathercock the direction of the winds. A sonic sign can also be read as a representation of an action (e.g. a closing door sound stands for the action of closing a door - cultural connotation left out in the moment). Signs may also stand for a relationship other than the causal, the *symbol* is a completely abstracted representation. There is no visual resemblance any more. It represents something defined by a cultural agreement.

Lev Manovich always uses the term representation as a deliberate opposition to other terms in his book ‹The Language of New Media›. He states that »depending on which term it is opposed to, the meaning of representation changes« (Manovich 2001, p.41). Thereby he is talking about the changing meaning of the word, not about a specific representation. Umberto Eco writes about the iconic representations that »an image possesses none of the actual properties of the object represented« (Eco 1976, p.594). Other comments on semiotics also refer to more abstract sources of association. Pierre Paolo Pasolini, director of symbol-overloaden movies, argues that »meaning of the image is fundamentally found in the world of the unconscious« (in Barry 1997, p.121). This results in a very poetic view and leads to a holistic approach to the theory of interpretation of a representation. Other occurrences of holistic theories of perception can be found in the works of the Gestalt psychologists Wertheimer (1938), Köhler (1938) and Koffka (1935). Their works focus on how a whole is constructed out of perceptual parts. Aristotle defines the *whole* as something that is a type of *unity* (Aristotle 330 BC, p.120). *Gestalt* refers to a »configuration that is so inherently unified that its

properties cannot be derived from the individual properties of its parts« (Barry 1997, p.42). In the Section on ➢ *Perception* I discussed Gestalt theory and its implications. Gestalt theory leaves the trails of structuralist views of perception. They deny the existence of a direct connection between sensation and interpretation by shifting their emphasis towards aspects that are innate and inherent in the configurations of entities. The central message of the gestalt theory is that the key to perception lies in the relationship between several parts of a whole. This fact is essential for many media to work, e.g. comics are solely built on it. Scott McCloud defines them as »based on a simple idea: The idea of placing one picture after another to show the passage of time« (McCloud 2000, p.1). To him »the heart of comics lies in the space between the panels« (McCloud 2000, p.1). In his earlier book ‹Understanding Comics› (1994), he elaborated the theory of comics in greater detail.

Metaphoric Representation

When Peirce talks about symbols as being pointers to something else, he leads us to a special kind of symbol: the *metaphor*. According to Lakoff and Johnson the essence of metaphor is »understanding and experiencing one kind of thing in terms of another« (Lakoff & Johnson 1980, p.5). The role of the metaphor is according to them a very central one, as »our ordinary conceptual system, in terms we both think and act, is fundamentally metaphorical in nature« (Lakoff & Johnson 1980, p.3). Metaphors are based on specific interrelationships between meaning and what Gombrich calls cultural conventions:

> »Cultural conventions react back on their users, they are handed down by tradition as the potential instruments of the minds – which sometimes determine not only what can be said but also what can be thought or felt.« (Gombrich 1971, p.257).

Ted Nelson defines metaphors - in the context of user interfaces - as »implicit comparison, or ... a free floating idea with a handle (such as a picture or a catchword)« (Nelson 1990). This definition merely shifts the focus from experience to ideas. While Lakoff & Johnson's definition focuses on the act of cognition, Nelson's focuses on the content. This approach is typical for a designer. In psychology and linguistics there are even more types and definitions of metaphors, all of

them sharing the key elements described above. They will be discussed in the ➢ next chapter.

What comes along with symbols is the act of communication itself. Reading a symbol means interpretation, which always is a communication process. This introduces an additional cognitive layer: *context*. Dey defines context as »any information that can be used to characterise a situation of an entity« (Dey 2002, p.3). While this definition focuses on functional aspects of context, others refer to context as a kind of »surrounding content«. The context determines the interpretation of a symbol without being part of the symbol itself. The concept of context was explained in more detail in terms of the visual and the aural senses in the ➢ last chapters.

In the following chapters, I will discuss the issue of representation in regard of several areas of science that deal with it, namely Linguistics, Phenomenology, Architecture, Media Theory, Philosophy and Ludology. Perception formed the base for the last chapters. The implications as well as the dynamics of perception as an interactive task will be discussed in the next chapters. Thus, all of them form starting points for departure into the matter of how materials and tools affect cognition as the representation and what the beholder perceives in it can not be discussed in terms of sensual experience alone.

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METAPHORS AND MEANING

»What therefore is truth? A mobile army of metaphors, metonymies, antropomorphisms; in short a sum of human relations which became poetically and rhetorically intensified, metamorphosed, adorned, and after long usage seem fixed, canonic and binding; truths are illusions of which one has forgotten that they are illusions; worn out metaphors which have become powerless to affect the sense, coins which have theirs obverse effaced and now are no longer of account as coins but merely as metal«
Nietzsche, 1974

I already highlighted the importance of the notion of *metaphor* in the introductory chapter of this section. In this chapter, I will present a historical and structural analysis of metaphors and related concepts. I will further discuss metaphors in relation to specific acts, such as the act of communication and the act of understanding the world. This chapter builds on the theories of perception that were introduced earlier. In order to understand, how emotions affect human behaviour it is necessary to delve deeper into the matters that control both: behaviour and how it is communicated.

A metaphor »consists in giving the thing a name that belongs to something else« (Aristotle 330 BC, p.1457), According to Aristotle. This means literally *talking in terms of* something. There are diverse kinds of metaphors, whose definitions are sometimes contradictory. These include *trope*, a very figurative metaphor as when referring to someone as ‹cold›; *metonymy*, a metaphor that »usually involves direct physical or causal associations« (Lakoff & Johnson 1980, p.39); and *ellipsis* - where we deliberately omit words in a sentence.

User interface metaphors are a common mean of communication with computers. The reason that metaphors are so important to user interfaces is that mediated communication is almost always base on metaphors systems. All but the most abstract computational resources are named after objects from reality. Think of Files, Folders, Windows, Variables, Functions and Applications - of Bits and Bytes. Davidson (1979) even goes as far as asserting the metaphor to *be* literal language. The implication is that literal language is metaphorical by nature. He ultimately states that »Metaphors mean what the words in their most literal

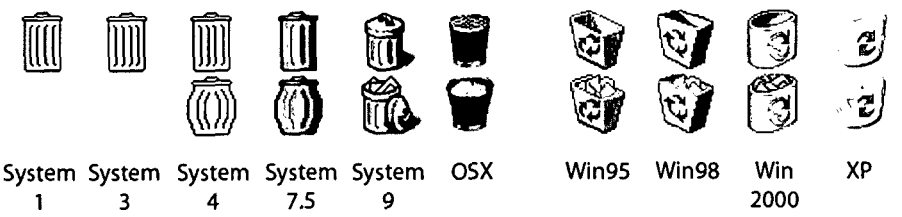
interpretation, mean, and nothing more« (Davidson 1979, p.30). If this view is widened to that of every communication happening through metaphors, further investigation into the matter is sufficiently justified.

Hutchins (1989) argues that our understanding of computers is built on layers of metaphors. The tasks a user performs are based on a high level of abstraction: She manipulates files in windows, not thinking about bits and bytes. Between a file and the bits it consists of are the levels of data structures and variables. Metaphors are used as a way to map everyday knowledge on an unfamiliar domain. Thus structures and groups of data are integrated to higher level familiar units. According to Prante (2001), our orientation in mediated information is based on *coherence*:

> »... coherence means contiguity (*there are defined relations*). Coherent *display*, both visual and auditory, of a body of information is known to facilitate comprehension and perception in an adequate way. ... Coherence is also emphasised with respect to metaphors we use to partially structure one experience in terms of another« (Prante 2001, p.2).

Hutchins and Prante share the view of a computer as an interrelated metaphor system. A successful interaction works coherent through all the layers of abstraction.

Hutchins then lays out a system of *mappings* where a mapping is a kind of lose metaphor. He describes two kinds of mappings: *conceptual mappings* and *perceptual mappings*. *Conceptual mapping* is what happens in the desktop metaphor: Events and Objects of the computer reality are mapped onto a model. The model used is the desktop, where a concrete item is chosen from the model for every abstract item on the computer. Files thus stand for structures of data and folders for bundles of data groups. The trash-can is a mapping of the delete function onto an object that additionally introduces error tolerance and transparency. Consistency between several aspects of this metaphor system is maintained, yet the notion of applications is not part of the same model world. According to Hutchins, there seems to be evidence that a mental model is created by the user by drawing from real world experience and extrapolating knowledge into the mixed reality that is the interface.



the development of the trash can system icon of the macintosh operating system (left) and the recycle bin of the windows operating system (right).

source: wichary 2004

Perceptual mappings appear at a different cognitive level: They are established between the model and the perceptible part of the interface (be it visual or acoustic). So while the functionality of the trash-can is part of the conceptual mapping, the actual look (and feel) is part of the perceptual mapping. Obviously, maintaining consistency between conceptual and perceptual mappings is the key to a working and understandable interface. According to Hutchins (1989), metaphors are thus mappings between terms from different territories. To summarise, the relation between *delete* and *trash can* is a conceptual mapping, while that between *computer trash can* and *real trash can* is a perceptual. These aspects of interaction are to be examined on their validity in other domains than the computer interaction.

Metaphors in Language

Most theories about metaphors have their origin in analysis of written (as in Lambert's case) or spoken (as in Lakoff & Johnson's case) language. The term metaphor has its root in linguistics. Since the concept of metaphors is difficult to grasp in language, theories about them rarely ever leave the territory of linguistics. Lambert, an 18th century philosopher, made an attempt to analyse the hypothetic aspects of semiotics in language. In his book ‹Von dem Hypothetischen der Sprache der Semiotik› (Lambert 1764), the third part of ‹Neuer Organon›, he builds a system of language that results in the presence of metaphors. He does so by separating three classes of words. The first and most basic class consists of words that depict a perceivable object as a whole or notions of type and kind that can be synthesised out of similar features of two or more terms. The mental image of the object corresponds to the term if all its constituting features can be analysed in a systematic process. All words, Lambert describes as *abstract* fall into a second class. In his notion, they always refer to the more bodily words of the first class. They are derived in a metaphorical manner, where metaphors are means to »make unknown or even unperceivable things imaginable through known ones« (»unbekanntere oder auch gar nicht in die Sinne fallende Dinge durch bekan-

ntere vorstellig zu machen« (Lambert 1764, p.192, translation mine)). Lambert refers to the most abstract of the abstract terms as *transcendental*. Transcendental terms reverb to different meanings in the *intellectual world* (*intellektualwelt*) and the *bodily world* (*körperwelt*) through similar features (e.g. *growing knowledge* would be such a metaphor). Lambert describes two principles that make communication possible: co-operation and context. If two speakers (Lambert focuses on spoken language) are *good willing* (*der gute Wille*) and context is taken into account, communication is successful. In his view, the development of language is a historical process of gradually metaphorising communication. This development leads to the third class of words, which are *termini technici* or artificial words. They only work if they are designed and used in regard of their context, and even then they are an easy subject to misinterpretation.

The base on which Lambert builds his theories is the human ability for comparison. Through finding similarities and differences, knowledge arises. Metaphors are means of mapping the abstract onto the concrete bodily. This is the starting point for Lakoff and Johnson's theory of metaphors. For them, the basis of language lies in categories we build according to our everyday life. The effect of language is to conserve these. »Even language pertaining to more complex aspects of our experience retains the vestige of theses basic experiential terms - seeing, hearing, touching and making« (Coyne 1995, p.265). Through seeing our bodies as *containers* we generate the first possibility for distinction: in and out, interior and exterior. A similar schema is that of the *journey*: Every small child knows what a journey is, once it has undertaken the first. The metaphor of the journey forms one of the basic rules about causality and intention (Lakoff & Johnson 1980). Other basic structures are derived from paths, links, balance, up-down orientation and part-whole relationships. All these work because they are *experiential gestalts*, creating and existing in a context of meaning. Thus, Lakoff and Johnson pay tribute to contextual and situational aspects of metaphors. These theories indicate that human cognition must not be reduced to abstract reasoning, but is deeply rooted in our bodies.

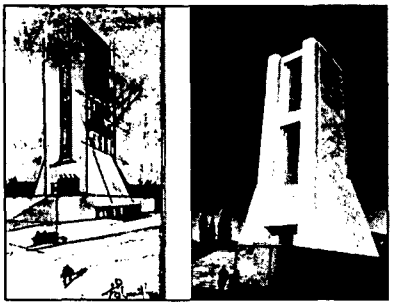
Rooting metaphors in bodily expressions renders the distinction between conceptual and perceptual mappings as seen by Hutchins obsolete - or it reduces the relevance of these qualities. Insisting on a clear separation between root domain and target domain fails to acknowledge the focus of the metaphor: the automa-

tism of *difference as likeness*. The metaphor *creates* the similarity rather than only bringing it to light (see Black 1962 & 1979). The connection between the metaphor and our perception lies in this intrinsic unity. When the delete command is assigned to the *trash can metaphor*, it is drawn from a completely abstract domain to a concrete representational domain. Yet the view of the delete command is generated through the metaphor by this act of assignment. So the concept behind delete is expressed purely metaphoric. Try it; it is impossible to describe ‹delete› to someone without comparison or analogies. Your first idea about this totally abstract operation will be metaphorical. Yet the perceptual mapping that tells us that the icon we see is a trash can relies on perceptual functions and thus does not deserve the word ‹metaphor›. The image of a trash can is not a metaphor for a trash can, but simply ... an image of a trash can, regardless of the level of abstraction. The interaction with the image again is a mapping of the operation and not of the perception. The similarity between the physical act of throwing an object away and that of erasing of files vanishes completely once keyboard short-cuts are used, while the functional aspects still work.

Metaphors in Communication

So why do we use metaphors? We use metaphors because they are useful in communication to refer to something that our communication partner understands. We talk to make things clear. It is intrinsic to the act of communication to try to be understood by all participants. Without that, what happens simply is not communication.

Richard Dawkins introduced an interesting view using a completely different perspective; The theory of *memes*. Memes are chunks of information resembling genes. In his extension to Darwin's theory of evolution, Dawkins proposes a view of evolution of communication driven by memes. The name *meme* hereby refers to mimesis, memory and genes. In his popular book ‹The Selfish Gene› (1976), he accurately outlines an inverted form of understanding the development of culture. It is not mankind that constitutes culture, but culture that constitutes mankind. It is the memes that spread across earth, reproduce, mutate and are subject to selection. The analogy gets even more convincing once bearing in mind that the actual process of mutation happens at the moment of reproduction. So communication is only what memes use to reproduce across hosts. And since failure of transmis-



a building by antonio sant`elia, an italian futurist that bears a high symbolica value in order to trigger an emotional stimulus. it was designed as a power station building building (left) and carried out 15 years after his death by guiseppe teragni as the ‹Monumento ai caduti(1931-1933)› (right).

source: www.unknown.nu (left), www.citta-materia.org/italia_travel/980306_03.html (right)

sion is intrinsic to communication, mutation happens. This can be observed as ideas spreading the world. They mutate gradually and only survive if they are fit enough. Good ideas stay in the memory of a population far longer than a living being exists. The concept of ‹God› serves as a good example. God is a concept that obviously (since it still exists and is even widespread) works out quite well despite having numerous mutations constantly rivalling for dominance.

> »The haven all memes depend on reaching is the human mind, but a human mind is itself an artefact created when memes restructure a human brain in order to make it a better habitat for memes. The avenues for entry and departure are modified to suit local conditions, and strengthened by various artificial devices that enhance fidelity and prolixity of replication: native Chinese minds differ dramatically from native French minds, and literate minds differ from illiterate minds. What memes provide in return to the organisms in which they reside is an incalculable store of advantages --- with some Trojan horses thrown in for good measure. . .« (Dennett 1992)

But one can go even further and describe human abilities in terms of memes. Language itself then becomes a meme. The ability to speak is actually reproduced by teaching children. Specific ways of speaking arise in specific populations (this is called language as in national language). Mutation happens every time a new container for the meme of speech takes its role as a host - every person develops her specific tongue. Selection can be perceived in forms of language that decline, while some aspects of them survive. You would barely understand someone that is but 5 generations older than you, yet you may still be able to read Latin. Even the darwinistic concept of isolation can be observed: If there is no alternative at hand, a meme might prevail despite the fact that it would not have survived in a situation of conflict. So taking the idea of the evolution of memes

for granted leads to an inverted view of why culture is as it is; Culture becomes the active part that shapes us (and is reshapes itself) continuously. This concept will become important in the following chapters, where I will talk about cultural agreements and other concepts on which our understanding of communication is founded. Seen from this angle, media is merely a mean of transmission for memes. Mass media then results in the widespread deployment of memes, and even human creativity may be subject to Darwinian theory (Dennett 2004). If all cultural products are subject to selection and mutation, design might still look as if it were intentional and purposeful. Yet the survival of a specific design, and the fact that a specific design arises, is grounded in the surrounding culture. Design is not a process to be seen separate from other activities in culture, but a process that shapes specific aspects of a culture and only develops in coherence with it:

> »Think of them [Memes] as entering the brains of culture members, making phenotypic alterations thereupon, and then submitting themselves to the great selection tournament--not the Darwinian genetic fitness tournament (life is too short for that) but the Dawkinsian meme-fitness tournament. It is their fitness as memes that is on the line, not their host's genetic fitness, and the environments that embody the selective pressures that determine their fitness are composed in large measure of other memes.« (Dennett 1998)

In our everyday life, this communication with our culture is largely based on metaphors, as Lakoff and Johnson (1980) argue. One of the basic functions a metaphor serves is to hide specific attributes of the source domain, while emphasising others, according to them. This asymmetry creates the possibility of blurring exact notions intentionally. It allows the user to shape how something is understood in very subtle ways. When suppressing features, this characteristic is referred to as *shadowing*. In his article on the representation of the war in Iraq, Underhill analyses the use of metaphors in order to reach the goal of acceptance of a war (Underhill 2003). He introduces the notion of the *switch* on a metaphorical level; a switch is what happens when name A becomes name B while name C becomes name A (and all of them still maintain their original meaning). In his analysis of articles found in The Economist, he brought several of these switches to light: War is associated with new metaphors like *trying to eradicate terrorism*, *cultural competition*, *making peace*, *crime fighting* and *reaching a destination*. Meanwhile,

the older metaphors of war still exist and are used, e.g. *a film, a game, surgery, lighting a fire, defence*. What politicians try to install is not only a new view of war, but also a new view of terrorism and peace. By linking *fighting terrorism* to *war* and asserting sameness to *fighting crime* and *terrorism*, war gets justified as it is fighting the criminal - an act agreed upon as rightful. Manipulating metaphors always affects both parts of the domain - the term and the meaning. While Underhill agrees that the switch was not the sole rhetorical strategy in use, it was still one of the most powerful. When war becomes a film and making peace becomes war, this switch tends »to obscure or blur the definitions of many of the concepts which are fundamental for liberal democracies. The structuring of our societies depends in part on our ability to define exactly what we mean by words like, crime, citizen, law, order, terrorism, terrorist, soldier, nation, regime and war« (Underhill 2003, p.163). Note that he says *define* and not *find out*. His ultimate conclusion is therefore:

> »... in examining my corpus of protometaphors, drawn from *The Economist*, however, I am forced to side with the philosophers in denouncing the sophists who (wittingly or unwittingly) used metaphor to manipulate the representation of war in order to promote it.« (Underhill 2003, p.163, italics his).

So if mass media has the power to shape the view of things, one of the possibilities to do so is by subverting metaphors. Thus, metaphors are indeed important for the shape of our society. They are so, partly because:

> »This alliteration [the active blurring of meanings in order to reach a goal] served to foreground selected phrases that hyped up the apology for war, and gave the arguments for war a sonorous power which, like poetry or advertising jingles, acts on our irrational unconscious. What resounds, somehow seems to us to be apt and right« (Underhill 2003, p.162).

This dangerous link between several established images also dominates many other realms of media. Ann Marie Seward Barry extensively comments on the movie *Top Gun*, starring Tom Cruise in the role of the ultimate gun fighting air cowboy Maverick. The film was greatly supported by the U.S. Navy and thus

poster for the hollywood movie *top gun* (left) and the use of the metaphor of the pilot in contemporary media (right).

source: www.gratisweb.com/scott01t/caratulas_de_tony_scott_01.htm (left), lost (right)

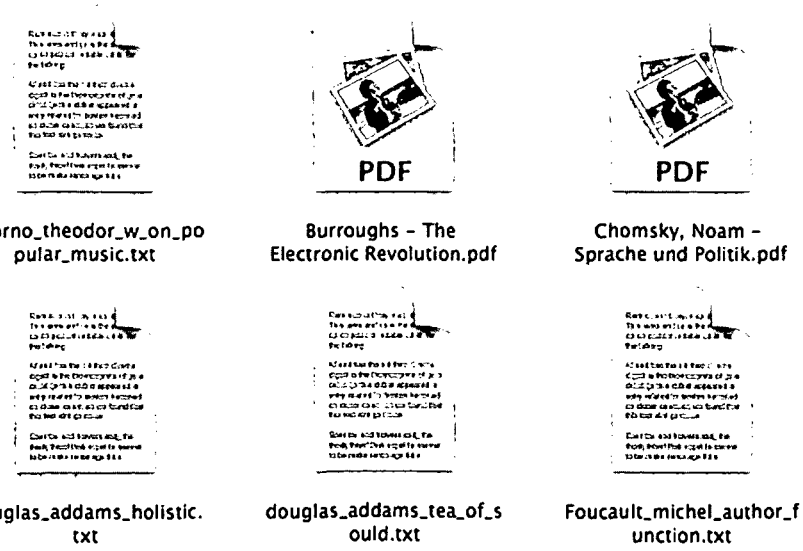
shaped as a propaganda tool to a vast degree. The switch that can be seen in this movie is that of war becoming an aggressive game and sexuality becoming war. To speak with the words of J. Hoberman: »Top Gun doesn't posit sex as aggression, it reformulates aggression as sex« (Barry 1997, p.234). The way the movie is shot and cut also resembles this sexuality-aware view of the content, with a style close »to Eisenstein's montage, that is, to a rapid bombardment of sensual images edit to the rhythm of pulsating music« (Barry 1997, p.235). Barry continues to compare the film to »an adrenaline rush« full of »high-tech potency« and »streamlined phallic symbols« (all Barry 1997, p.235) . According to her, it is composed out of »images of power which, rather than inviting sensuality, imply an autoerotic male bonding« (Barry 1997, p.239). Beside the fact that this statement clearly indicates her believe in sublime unconscious mental processes as they were discussed by Underhill above, this is also a commitment to the difference between male and female sensual habits. Yet even the offensive movie images of Top Gun cannot compare to reality. At the site where Top Gun was filmed - Miramar Naval Air Station - the entertainment consisted of »a disk jockey each evening, a stripper for Friday evening, two strippers for Saturday evening, and pornographic movies shown throughout the weekend. Behaviour included group »ball walking«, entertaining underage females, strippers performing ... sadomasochistic and lesbian acts, and open sexual intercourse.« (Barry 1997, based on US Department of Defence 1992, p. E55f) The conclusion Barry draws is that »although Top Gun as a film cannot be held especially responsible for any of the particular occurrences ... it is clear from the testimony of those involved that it was a significant catalyst in crystallising and glamorising a masculine image

that was as degrading on one side as it was seemingly heroic on the other« (Barry 1997, p.249).

Neil Postman summarises the changes that emerging technologies bring to our lives in a convenient way:

> »... new technologies ... alter those deeply embedded habits of thought, which give to a culture its sense of what the world is like ... such changes are expressed in changed meanings of old words ...« (Postman 1992, p.12)

I would even expand this statement to include images and ideas. Metaphors - be they words or images - are always the first victims of this development. Before they are settled they are an easy target for shifts in meaning. By changing a metaphor, the words that form the basis of it are also changed in meaning. This is what happened in the case of the war in Iraq merely by metaphoric association of the term *war* with something else, the term itself changed its meaning and the public changed its position towards the term and the concept. New technologies work on similar principles. If we had not developed computers, what would the comparison between mind and computer look like? Terms like *memory, archive* and *document* that were chosen for their new technological representations affect the original meanings through their newly gained ones. They work as levers for cultural changes, and new metaphors can be built through them that are even



icons for different documents. icons highlight specific aspects of the signified while diminishing others.

further from the original meaning but still connected and associated (*wired*) in our brains. Consider *Organisational Memory* as such a term; as Ackerman lays out, »the metaphor suggests that capabilities present in social or human reality (such as a memory) are also present in technology under consideration« (Ackerman 1994, p.3) - an assumption that cannot be met by technology. On the other hand, terms like *digital library* shadow the social factor of the original signified (i.e. the library in this case). Common definitions are - as Ackerman notes - neglecting the social elements of the word *library* and therefore:

> »... restrict the meaning of the metaphorical referent to that narrow conception [ed.: of library as point for storage and retrieval]. That is, we do not see the technology as restricted because we redefine the social phenomenon to include only what is technically possible«. (Ackerman 1994, p.4)

Metaphors and Meaning

The concept of the metaphor has its origins in ancient Greek philosophy as Aristotle was the first to formalise the term. Metaphors have certain capabilities as they allow knowledge to be transposed from one domain to a different one. Yet this chance also bears the risk of inducing a wrong estimation about the target domain. Metaphors are filters that highlight specific characteristics of the entity concerned with while they shadow others. As the experience of new media is largely based on conscious or unconscious construction by the user (as explained in the last chapters), metaphors are basic means of directing this constructions and are actively put to use for this specific purpose.

Another concept that was examined in this chapter is the notion of the meme. The theory of memes postulates that information is transmitted in cultural organisms just like genes are in biological. Thus, memes spread across a culture and shape how individuals perceive certain informations. Memes form an interesting starting point for further investigation of how cultural conventions appear. Metaphors may emerge and fertilise as memes.

In the next chapter I will discuss a different view of how humans interact with information bodies. Media science concentrates on the interaction between

media, messages and its receivers respectively senders. Thus, media theory forms a vast body of research to be explored in order to understand the workings of emotions. Some aspects of media were already highlighted in this and the previous chapters, yet the next chapter will give a historical and detailed overview of some important concepts in media theory and how they relate to the theme of this dissertation.

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PERSPECTIVES IN MEDIA THEORY

Media theory is a vast field of research. The plethora of media available in our culture lead to a mass of interpretations of how they work. The influences on media theory come from diverse areas: cybernetics, social sciences, film theory, architecture theory, anthropology, psychology, philosophy, and others. Questions circle around how individuals, families, genders, groups, cultures deal with media influences. Media was always there, yet the introduction of *electronic mass media* (beginning maybe with the radio) changed the landscape of media. As means for altering the perception of reality by the masses, mass media was always exploited and furthered by the military (via e.g. *America's Army*, GPS) and propaganda divisions (via e.g. the *Volksempfänger*, *Top Gun*). In this chapter I will highlight some of the common approaches in media theory from the works of proponents of the field such as Marshall McLuhan, Jaques Derrida and Lev Manovich in order to give an overview of the problems that arise in this area of research. Before I can focus on specific theories, I need to discuss some crucial and more general approaches to the area of media theory as a whole, namely the difference between pragmatic and rationalistic approaches and that between positivistic and objectivistic approaches.

Pragmatism and Rationalism

The discrepancy between pragmatism and rationalism is most easily demonstrated using an example. I will do so by examining how proponents of both approaches refer to differences between written and spoken words.

McLuhan and Ong both point out that there is a difference between the aural primal culture and the manuscript culture emerging later (McLuhan 1962, Ong 1971). Coyne explains that

> »For McLuhan, the aural culture was characterised by a field of incessant speech and chatter; there was also an immediacy of human experience. With writing, life became less engaging and less immediate, thought could be spatialised, and notions of objectivity could be developed.« (Coyne 1995, p. 114)

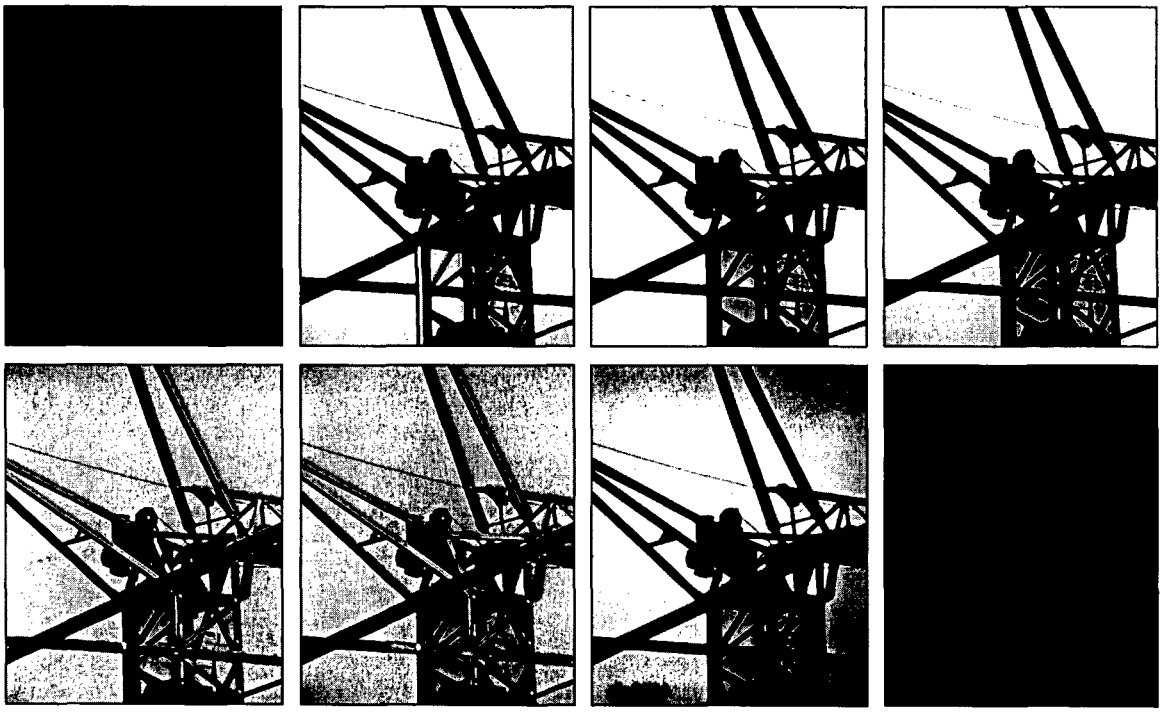
Derrida on the other hand roots writing and speech in the same class of communication named ‹protowriting› or ‹archiwriting›. Protowriting is firstly characterised by signs, that may be uttered, drawn, written or gestured, and secondly by the possibility of these signs to be repeated - uttered by someone else, copied or mimicked. Third, protowriting builds on sign sequences that can be disseminated later - they can be transferred from one context to another partly or as a whole. Fourthly, protowritten sign sequences are detached from their originator. They are applicable without knowing the context and intentions of the originator.

Coyne points out that »these are usually features we associate with writing« (Coyne 1995, p. 116), where texts can be repeated, copied, assembled, disseminated and distributed. Derrida refuses to assign the above attributes to language since language is already defined as a system of signs. Obviously, protowriting is a practice of language. The point Derrida tries to make is to negate the immediacy of aural communication forms by associating them with the same context as visual forms. The striking similarity to Dawkins memes is that memes are also functioning detached from their originator - they only exist if they are repeated. Parts of memes might always form new memes (therefore they can be disseminated) and memes consist of signs. The main difference between protowriting and memes is the emphasis and relevance of mutation. Memes do not stay the same when repeated, they gradually evolve. When applied to a new context, memes change their meaning even more. On the other side the concept of protowriting describes aspects of communication that stay the same over all acts of communication.

While the role of language (in every form) is per se that of a means of communication, it serves - according to Halliday (1994) - three different meta-functions: In its interpersonal function, it constitutes and negotiates social identities and relations. There, language is »organised as an interactive event [in which] the speaker adopts for himself a particular speech role, and in doing so assigns to the listener a complementary role which he wishes him to adopt in his turn« (Halliday 1994). On the other hand, language »helps to construct reality from a particular viewpoint« (Koller 2003). The third textual metafunction of language is »creating relevance to context« (Halliday 1994).

On the other hand, Dewey saw writing as a distorted way of speaking when he postulated that »the connections of the ear with vital and out-going thought and emotion are immensely closer and more varied than those of the eye« (Dewey 1984, p.235). The starting point for the departure from the aural culture according to this theory was Plato. Earlier thinking emphasised operations with lower proximity, thus the change took place in terms of how space is perceived and used. In the immediacy of speech, »means and ends coalesce« (Coyne 1995, p.115). The relation between means and ends corresponds to the rationalistic view of means being the predecessor and of superior influence to ends. Therefore Dewey (and McLuhan as well) trace the origins of rationalism back to the ancient Greeks. Coyne describes ends as »something we want« (Coyne 1995, p.31), which in turn brings the notion of the desire into view. Rationalism therefore seems to postulate fulfilment of necessity and desire through technology. The car is the solution to a need for mobility. The pragmatists on the other hand acknowledge the change that the car caused in our need for mobility. In their view, »rules, formulas, frames, plans, scripts and semantic networks are not forms of knowledge but tools for research« (Coyne 1995, p.48). The important point is that the emotion *desire* occurs as driving force behind our activities, and that expected (or even intended) outcomes (*something we want*) are put in relation to actual outcomes. While rationalism states that the intended outcome is subject to planning happening beforehand, pragmatism sees planning as a tool for inquiry of how to fulfil the desire.

If Dewey and McLuhan discuss changing attitudes in cultures, they just *describe* the situation. Something else comes into play when Derrida actively tries to bridge the differences that Dewey and McLuhan point out. First, even if we accept protowriting as the ancestor or abstract essence of writing and speech, there is no reason to reject cultural changes and their relation to the use of writing and reading. Second, reflecting human development from an anthropological standpoint focuses on the experiment and research rather than on the conceptual perfection. A simple and concise concept as protowriting does not yield more relevance only because of its simplicity than a more complicated. I fear the weak point here is that a concept that is limited to such a degree (for aesthetic purposes) can never acknowledge the qualitative aspects of the experience of writing or speaking.



for the installation ‹horizon› i filmed a crane for a whole day and stretched the scene over the duration of the entire exhibition. the narrative was purely temporal.

Positivism and Objectivism

Not only the approach toward the exploration of the science of communication varies. When reading works of media theory, some trajectories of thought become visible in the various writings. On the basic level of method, there is the positivistic and the objectivistic approach. Habermas describes the *positivistic* approach of the nomologic sciences as »... controlling the utilisation of behaviouristic information under the illusionistic view of reducing the practical command over history to technical command over objectified processes« (Habermas 1968, p. 166, my translation, german original: »... Verwertung der erfahrungswissenschaftlichen Informationen unter dem illusionären Gesichtspunkt, als ließe sich die praktische Beherrschung der Geschichte auf die technische Verfügung über vergegenständlichte Prozesse zurückführen«). The *objectivistic* approach of hermeneutic science is somewhat contrary, in that it »... extracts sterilised knowledge from the reflexive acquisition of active traditions and locks up history in the museum in exchange« (Habermas 1968, p. 166, my translation, german original: »... entzieht sterilisiertes Wissen der reflektierten Aneignung wirkender Traditionen und sperrt stattdessen Geschichte ins Museum«). Different schools of thought emerged that largely fall into these two groups, although blends between these two approaches are found and can lead to an even worse scientific dignity.

Space as Interface

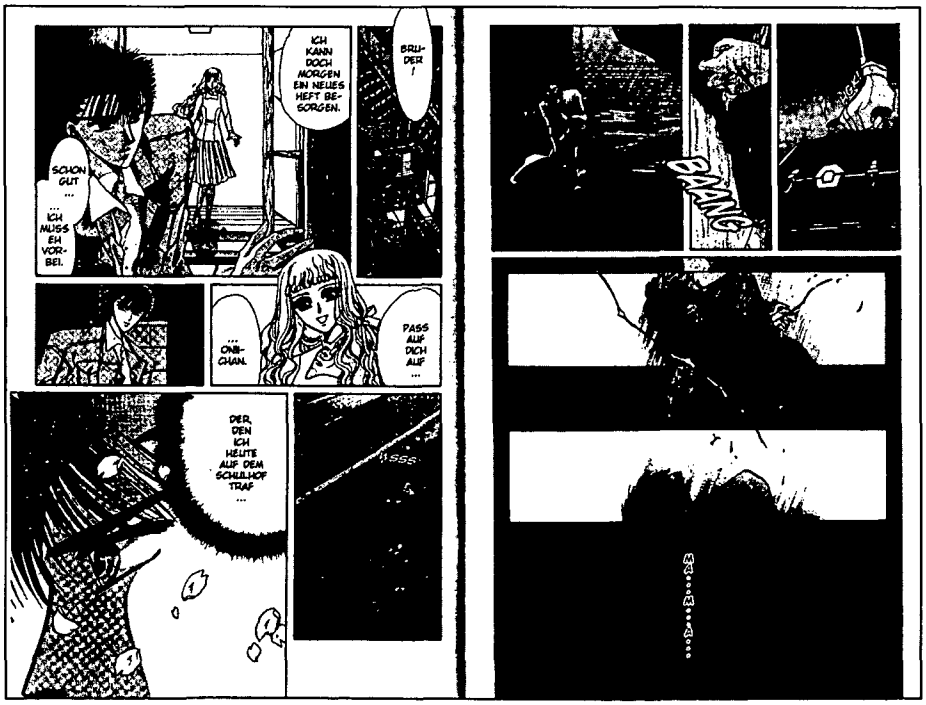
Lev Manovich frequently argues using terms like *navigation*, *dimension* and *space*. He clearly situates his theories between architecture, culture and narratology - referring to the current narrative forms as *databases*, explaining:

> »Many new media objects do not tell stories; they don't have beginning or end; in fact, they don't have any development, thematically, formally or otherwise which would organize their elements into a sequence. Instead, they are collections of individual items, where every item has the same significance as any other.« (Manovich 2001, p.194)

He describes the development of new media as one that began in cinema and that correlates the position of the user in a new media environment with that of a person in space(s). Culture influences what he terms the *cultural interface*, and »the language of cultural interfaces is largely made up from the elements of other,

already familiar cultural forms« (Manovich 2001, p.81). Manovich mentions that »In the 1980's many critics have described one of key's effects of 'postmodernism' as that of spatialisation: privileging space over time, flattening historical time, refusing grand narratives« (Manovich 2001, p.86). He follows their line of argumentation when he states: »it can be said that modern painters which belong to this tradition worked to articulate the particular philosophical concept in their painting — that of space-medium« (Manovich 2001, p.221). He finds the origin of this concept in words of the Russian art historian Pavel Florensky from around 1920, quoting him: »The spacemedium is objects mapped onto space... We have seen the inseparability of Things and space, and the impossibility of representing Things and space by themselves.« (Manovich 1993, p.26). He did not read his own writings, otherwise he would have known that his whole book tries to do exactly this: separate things from space. Unfortunately it fails but it does so in a very compelling way.

There is another media theorist who sees his origin in the analysis of spatial situations: Paul Virilio. Virilio formulates his theories in military terms. The contradiction of being a trained soldier during the Algerian war of independence (1954-1962) and a practising Christian at the same time greatly affected his work. Virilio rejects Nietzsche and Marx as well as the structuralists Levy-Strauss and Lacan (Armitage 2000). His theories are built on a fundament shaped through



images from the comic *X*, showing the spatial qualities of comics.

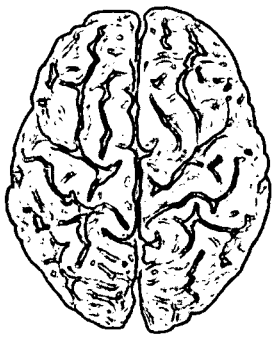
source: shiro 1992

a military perception of the landscape of cities. In his works, the military, the industrial and the entertainment development correlate (as *military-entertainment complex*). He writes about cities and their exposition and over-exposition. The individual is in a situation where faith in perception is a »slave to the faith in the technical sight line« (Virilio 1988). The industrial separation of representation and modes of perception is seen in video screens and other devices that are based on *indirect light*. This perspective conforms to Foucault's (1977) *surveillance societies* and Deleuze's (1995) *control societies*. Another concept by Virilio worth being mentioned is: *dromology* - the science of time and how it affects and is affected by our current habits - »revealing the dromological and political conditions of the twenty-first century« (Armitage 2000).

Postmodernists like Foucault, Deleuze and Guattari - who's writings often refer to Nietzsche and Freud (although they doubt the theories of the latter) - defer human existence to sexuality, power and automation (in the case of Deleuze and Guattari often described in technological terms). They form a school of thought that works with contradictory meanings, diffusion and »unintelligible« (Dawkins 1998) language. Thus they are in radical contrast to pragmatic media theorists like Marshall McLuhan. The road McLuhan takes is to such a strong degree generic and autonomous that it is difficult to relate him to any school of thought (beside the abstract notion of pragmatism), though. Similarities to other authors arise in his use of (pop-)cultural experiences and his foundation in historical terms. His theories influenced media theory more than anyone else's, although his polemic approaches and his isolation often hinders his works from entering the academic arena. There is one similarity to the French Postmodernists: Nearly all his work is very controversial. This is partly due to the fact that his approach is to such a vast degree holistic. Positivistic holistic theories that want to yield relevance easily lead to contradictions, but blurred within conflicting observations in his books there lies a basic truth that can hardly be misunderstood. His fundamental book ‹Understanding Media› (1964) oscillates around the ideas that the media is the message and that technology is an extension of our body - two aspects of media that shaped thought about media for centuries. In his book ‹The Global Village› (1989), released post mortem, he tried to approach the origins of his own thoughts through cognitive science, and fails.

marshall mcluhan›s model of the left and the right hemisphere of the brain and their functionality.

source: modelled after mcluhan 1989, my translation from german



The heritage of new media is discussed in many ways. While Manovich clearly points out that he sees a lot of aspects of cinema in new media, Virilio argues »that cinema and television have nothing in common. There is a breaking point between photography and cinema on the one hand and television and virtual reality on the other hand.« (Kroker 2001). One of the key characteristics that photography and cinema share is that they are not distributed in real time. New media turned into a real-time medium (as television is) after the invention of the internet. Here, distribution and consumption correspond. This induces certain modes of operation that both media share: The patterns of *browsing* and *surfing*. Occasions where this behaviour appeared (in varying degrees) before the advent of television were e.g.: the marketplace, the library and to a certain degree the newspaper and the radio. Bolter and Gruisin describe these new ways of navigation as »fragmentation, indeterminacy, and heterogeneity and... emphasiz[ing] process or performance rather than the finished art object« (Bolter & Gruisin 1999), terming it *hypermediacy*. Looy summarises hypermediacy as:

> »Hypermediacy urges the user not only to look at the interface, but also to actively participate in the meaning generation process by offering her multiple channels and paths which she may choose to engage in.« (Looy 2003)

Perspectives in Media Theory

Theories about new media vary in many aspects as some of the researchers favour a pragmatic and others a rationalistic approach. Some researchers use positivistic and others objectivistic methods. As described in terms of protowriting, the different approaches to a problem vastly shape the outcome. Rationalists - dividing and conquering all aspects of a problem until only atomic meanings are left - fail,

just as the pragmatists attempts do - that have to rely on less general features. What we can learn from media theory in regard of emotions is that the active role of the user is in the centre of attention, while many characteristics are inherited from older media. Most media theorists - and even the French Postmodernists - acknowledge this central role of the individual.

To summarise, media theory proposes a prominent role of the user in the generation of meaning in mediated environments. The author merely provides hints and entities, that essentially all have the same significance as an interface. It is up to the user to construct a context out of the proposed situation. Thus, authoring in new media merely means shaping the direction a user goes rather than leading him there. I will continue to examine media theory in the next chapter, as it contributes to the quest for understanding how a participant gets emotionally involved in a situation.

In the next chapter I will relate some of the concepts of this chapter to virtual space. This introduces new concepts of how humans deal with media into the discussion and focuses even more on interactive practices than this chapter.

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ARCHITECTURE OF THE VIRTUAL

When something is taken for something else, and especially if virtuality is taken for reality, it is usually referred to as an *illusion*. Deleuze explains that »by contrast, the virtual is not opposed to the real; it possesses a full reality by itself. The process it undergoes is that of actualisation« (Deleuze 1994, p.211), whereby he refers to Massumi describing the virtual as »the future past of the present: a thing's destiny and condition of existence« (Massumi 1993, p.37). In this regard the concept of the virtual is closer related to the *new* in *new media* than to the *media*. Therefore the virtual is a temporal rather than a spatial or existential problem. If the virtual is taken for real, time is *actualised* - an affirmative process takes place. According to Roe (2003), the concept of virtual reality does not conform to this view. Yet the term virtual is also used for denoting something that does not exist but is referred to. In my opinion virtual reality fits well into this concept of virtuality, because the impression of virtual reality is that of not being able to separate between the virtual and the real. If an illusion is virtuality taken for reality, then an illusion is the coming-into-being of something that can not be. If virtual reality is a virtual representation of reality it acts as a re-presentation, a return into presence.

Batchen (1991) pursued an archaeology of photography and found that photography emerged from virtuality to reality at a moment in time where culture was already in discourse over the desire for photography. The period in time where photography was not there - yet the desire existed - was that of coming-to-presence of photography. During this period the virtual photography already existed, but it was not actual. While all this seems to be just another viewpoint or understanding of cultural behaviour, it might help in predicting what the future will be. If we look at products that are virtual by now, we at least get an impression of what the future will bring. When Geoffrey Batchen (1991) constructed a theory that explains the circumstances for inventions successfully happen, his work is strongly influenced by Foucault's search for regularity in discursive practice. According to Foucault a society has to develop a certain mode of communication in order to establish an environment that nurtures a certain development. Batchen feels the necessity of the »appearance of a regular discursive practice for which photography is the desired object« (Batchen 1991, p.15) in the late eighteenth cen-

tury. Based on Foucault, Batchen therefore argues that a society has to be ready for an invention for it to appear - there has to be a desire for a certain technology. With desire comes expectation, and with expectation come emotions:

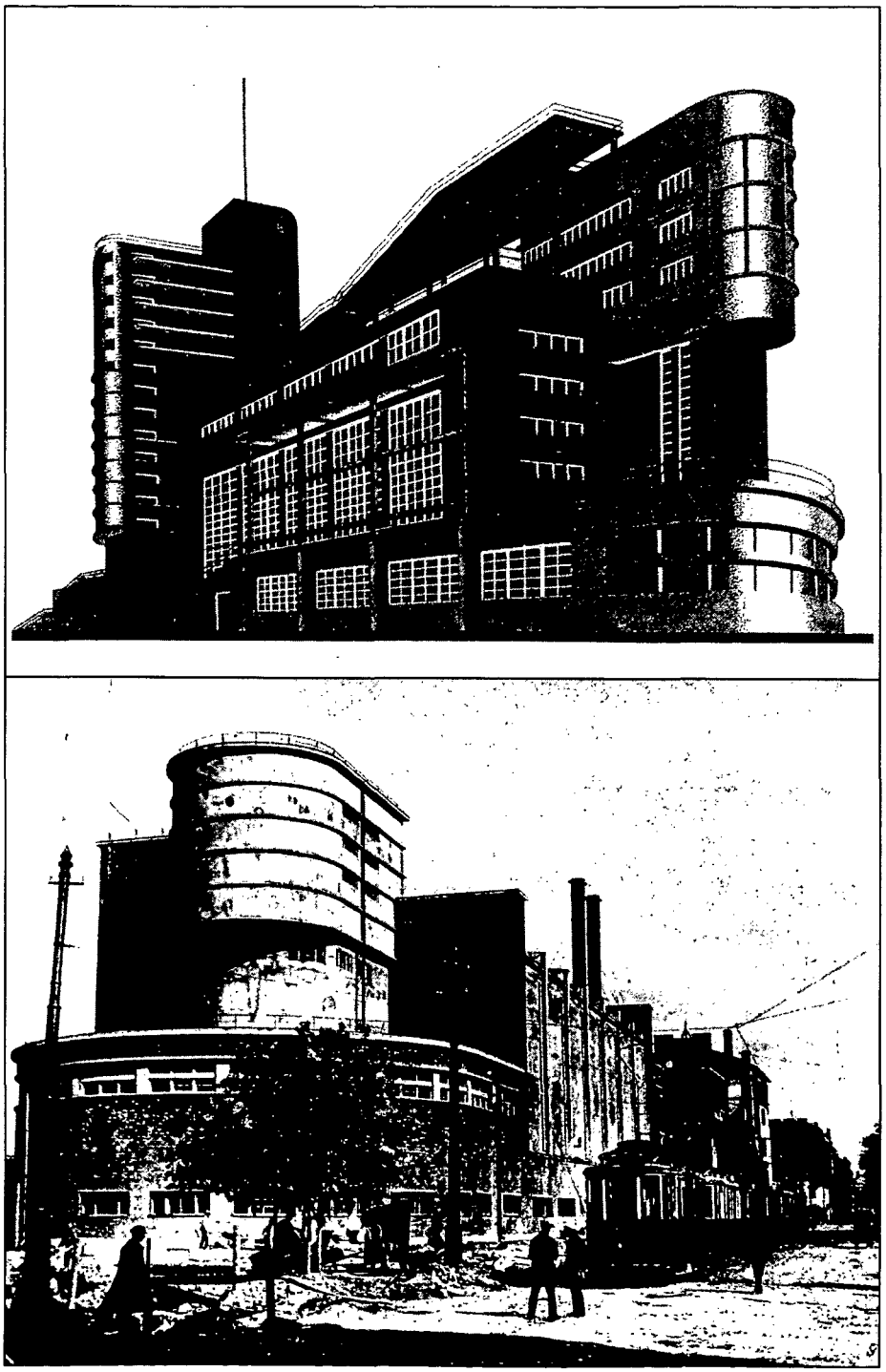
> »In the last two decades of the eighteenth century, Batchen finds increasing evidence of a desire that might be called photographic, a desire that is figured in the fields of literature, philosophy, and aesthetic criticism« (Roe 2003).

Before photography could be invented, it already existed *virtually* - it was existing as a possibility rather than as reality. Although this is a trail worth following, it is also useful to see it the other way round: What discursive practice is necessary before an invention in order to make it gain a sufficient important role within the economical constraints of the originator. The question then is not only what makes the virtual enter the real but also what makes it survive in the competition called society. This conception of the virtual yields the conclusion that the virtual cannot become reality but will only have been its own reality afterwards.

Lev Manovich discusses the language of new media along a trajectory that starts at the still image and follows the notion of space and how it is used in navigation, to arrive at the digital cinema as that which is yet-to-come. Philip Roe sees the hologram as the yet-to-come. Both of them refer to Derrida as a source of inspiration, who's theories are often based on space and time (see e.g. Derrida 1994) using terms as *arrival* and *to come* in relation to the virtual. Spatial and temporal metaphors form the base of media theory since they form the base of our perception. The title ‹The Architecture of New Media› would be better suited for Manovich's ‹The Language of New Media›. Architecture seems to play the role for media theorists that linguistics played for (especially german) philosophers (maybe except Nietzsche and his followers) in the nineteenth and twentieth century. Perhaps this is also the reason why the frame and the screen turned into a window - an architectural term - nowadays. When dealing with designed surroundings, metaphors are often taken from architecture.

Architecture as shaped Environment

The changes that new media brought us manifest more in the attitude that the surrounding layer of virtuality imposes on our life than in the change that communicative processes have undergone and still undergo. But I need to describe the virtual in more detail before we can approach more pragmatic questions such as; If there is a virtual world, what is the architecture and how is it laid out (in



an utopic building by jakov cernichov, drawn 1933 (above) and the factory ‹krasnoe znamja› by erich mendelsohn (below). the original drawing appeared in the book ‹architekturnye fantazii› by cernichov 1933.

source: cernichov 1995

terms of *designed*)? There has been a lot of discussion about creating and designing virtual worlds. In this chapter I will provide the virtual ground on which the materials are built - the virtual domain that is shared by all virtual goods. On the boundary between art, design and functionality lies architecture, the prime area of investigation in design theory (Lawson 1980, Gedenryd 1998) and one of the oldest and most controversial forms of art. Architecture in the context of new media means building a virtual environment for real inhabitants.

A Note on Immersive Environments

The role of the virtual as the latent what-will-be was described as representing a desire and a possibility. The virtual in virtual reality stands for a simple *as if*. The aim of virtual reality therefore always was to simulate reality as detailed as possible, the resulting simulacra modelled after the original we call world. As many aspects as possible were reconstructed on an artificial ground by methods of mapping and translating objects and actions into the virtual with a mapping function determined largely by technical possibilities. In the first years of virtual reality the hologram was leading the way; The user was surrounded completely by a virtual world and all real that still had to exist in it was treated as a distortion of the illusion. The aim therefore was to simulate a different reality than the one that the user knew. Since the user always brought in his archaic knowledge of the real world and applied it on the virtual, the efforts of completely detaching those two worlds were futile.

In recent years, the interest in complete illusions decreased. Upcoming themes like *augmented reality* and *pervasive computing* show clearly that the tendency now goes toward integration of mediated experience in the real world, a situation many refer to as *mixed reality*. In the area of the immersive interfaces, the ancestors of these technologies are the panorama of the 18th century and the illusion spaces of the 16th century. Gaudenzio Ferrari designed the most famous illusion space in 1518-1522 at Sacro Monte, the *Calvary* (Grau 2004, p. 98). Man-sized sculptures dressed in real gowns and equipped with real tools were shown along with a two-dimensional fresco in the background for an audience that mostly consisted of pilgrims. Grau notes:

the ‹cave› of the ars electronica center. an immersive environment for four projectors that produce stereoscopic images and a sound system.

source: www.aec.at

> »This example [the calvary] of a Mixed Reality used all means available at the time to create the deception of real presence with the effect that the monks, who guided the pilgrims around the complex, were constantly obliged to remind the visitors that this was not the real Jerusalem.« (Grau 2004, p.98)

Illusions if this kind were used primarily for education and entertainment - and for propaganda. Strangely enough, contemporary computer games serve the very same purposes: entertainment, education and propaganda. The immersive character of such illusions manifests in the inseparable character of the media and the message, as Grau points out:

> »Immersion is produced when art work and image apparatus converge, or when the message and the medium form an almost inseparable unit. Then, in a moment of calculated *totalisation*, the art work, for a limited time, permits conscious perception to become unconscious illusion.« (Grau 2004, p. 98)

The relation between the conscious and the unconscious is hereby regarded as equivalent to that between perception and illusion. Closure also works on the border between the media and the message, since it is subject to the form (representation) of the message and makes use of the context, that is clearly related to the content of the message. Therefore only the term totalisation is unique to immersion in the above statement. While this might be the case on a physical level, non-immersive experiences feel as total as the immersive ones on a phenomenal level. Immersive experiences do not have to rely on immersive technologies. The difference again comes to light as a possibility: In an immersive environment, all

games feature aspects of immersive environments. the military is a strong sponsor of developments in both fields. ‹america´s army› was used to recruit for the army.

source: www.americasarmy.com/gallery

vother immersive environments are beyond reach, while in a non-immersive environment, other non-immersive ones are at hand. Immersion therefore acts as a border between reality and illusion. The mixed reality situation described above is in a way a crossbreed between immersive and non-immersive environments. A completely immersive environment would not only affect the visual sense but try to affect all senses. In McLuhan's terms this characterises a cold medium at first glance (McLuhan 1964), yet looking closer reveals that in a completely immersive environment the senses are affected far too strong to call it cold.

One weak point of immersive displays is that they enforce a standpoint on the user: His very own physical position. While this resembles the world how it *is*, it cannot compete with the use of media as a way of establishing parallel views. The compound character of most modern media does not fit well for immersive technologies. Examples of this compound character are web pages (text, images, movies, flash animations on the same page), newspapers (different stories on one page, mixed with images and advertisements), telephones (presence and telepresence simultaneously) and computer games (e.g. world map, head up display and detail map on one page). Different media technologies (that follow different rules) form one compound, and different entities of content react to each other.

If a link is established between imaginative and physical space, reality can be referred to as *augmented* reality. Technical devices leading to this situation are wearable computers as well as location based services (the Global Positioning System (GPS) and its applications) and to a certain degree telephones (mobile or not). Immersive technologies feature a reality detached from the physical world as much as possible and therefore exist in pure virtuality. It is an interesting coincidence that architecture visualisation is one of the prime business models of the virtual reality industries. Augmented reality on the other hand features a virtual layer on top of the physical world. Other forms of reality enrichment resemble windows in the physical world through which one might get a glimpse on a virtual world - with the interface as a border zone between two realms.

From Architecture to Visibility

Physical architecture has its own discourse and history of theory. It is not fully appropriate to use it on the virtual architecture, yet there are certain key insights that might be translated to the virtual domain. One of these is the relationship between tactile experience and visual perception. Walter Benjamin, the clever and empathic spectator of human dwelling, discusses this through the notion of appropriation:

> »Buildings are appropriated in a twofold manner: by use and by perception – or rather, by touch and by sight... On the tactile side there is no counterpart to contemplation on the optical side. Tactile appropriation is accomplished not so much by attention as by habit. As regards architecture, habit determines to a large extent even optical reception.« (Benjamin 1968)

What is the origin of this emphasis on the role of habit? In his discussion of Benjamin's position, Bogard extends the model of habitualised behaviour to include physical and social sense - and *visibility*:

> »In an important sense, tactile appropriation is not just another mode of reception on par with visualor optical appropriation. Rather, Benjamin argues, it constitutes the conditions of possibility for the latter, in the sense that habitualised behaviors which develop around the use of dwelling spaces, as routinised practices, organize perception. Architectural arrangements, in the social as much as the physical sense, determine what can and cannot be seen.« (Bogard 2000).

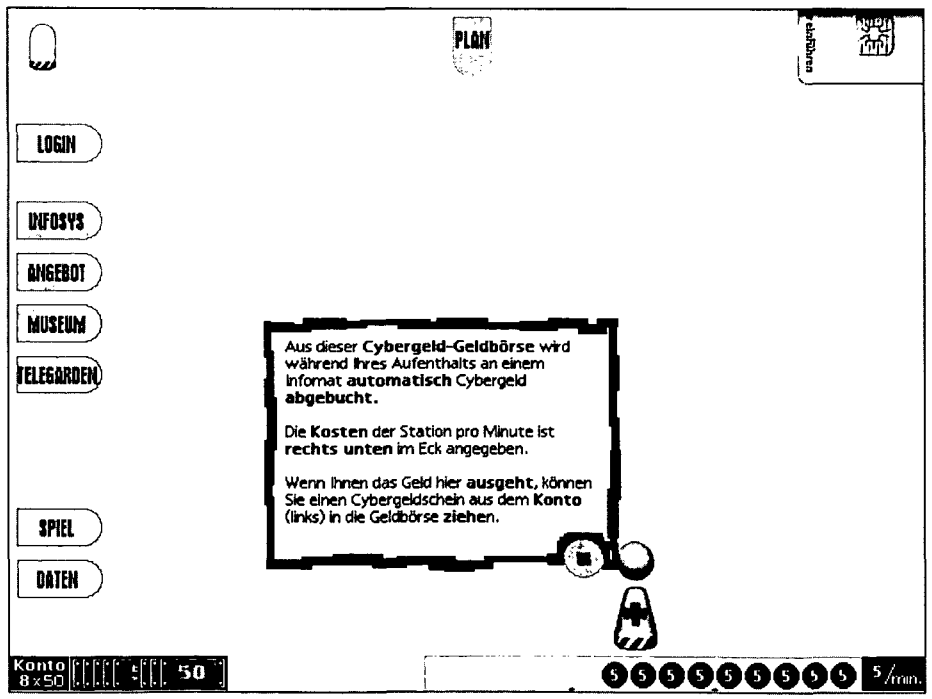
Again, the tactile role of inquiry is emphasised. Tactile senses are - as I have argued in the chapter ➢ *Haptic Perception* - almost exclusively based on feedback. Optical senses are usually not explained in terms of feedback, yet they act in the unity of the senses and what we perceive is - as I have shown earlier - subject to impressions by all senses. Classical approaches to Human Computer Interaction often lack this aspect. They demand visibility for all possible operations, the user might want to conduct, instead of accessibility:

> »A well-designed system makes everything relevant to a task visible on the screen. [...] A subtle thing happens when everything is visible: the display becomes reality. The user model becomes identical with what is on the screen. Objects can be understood purely in terms of their visible characteristics. Actions can be understood in terms of their effects on the screen. This lets users conduct experiments to test, verify and expand their understanding, the essence of experimental science.« (Smith 82, p.242)

The issue of visibility plays a crucial role in interaction design. I will follow this thread - concerning user interfaces - in the section ➢ *Interactivity*.

Exploring liquid Space

Interactivity introduces new aspects of the perception of space. As a virtual space changes on the fly, it cannot be appropriated as easily as the stable space of architecture. This fluid aspects of virtual architecture are acknowledged by the works of Marcos Novak (2003) when he talks of *liquid architecture*. Troy Innocent summarises Novak's liquid architecture:



the visitor information system of the ars electronica center. the system is located at the border between real and virtual space in a quite literal way: it resembles a glass plate that allows the visitor to see into virtuality.

source: igw

»These structures can only exist within the space of the computer – they are physically impossible in the real world. He combines constructed and generated geometry, parametric design, and user interaction with the forms in the space. These structures shift and change in response to this interaction, allowing the entire space to mutate from one configuration to the next.« (Innocent 2003)

The constant change in perceived space emphasises the need for (tactile) appropriation - as inquiry - even more. Feedback from the surrounding has to be elicited at every moment. This fluid spaces occur in every configuration of interaction with virtual spaces, yet they play the most prominent role as ingredient of computer games. The experience of exploring a virtual space is always emotional, as the workings of (re-)constructing the surrounding lead to the crucial aspects of emotions: expectation and experience.

From Architecture of the Virtual to playing Games

This chapter explained several theories about how virtual space (and the virtual as a property itself) may be described. Following the works of Derrida and Deleuze concerning the virtual as a coming into being, we arrived at the factual as constantly appropriated virtual. The same qualities were assigned to architecture by Benjamin and Manovich. The latter one extended this theory to virtual spaces.

a rendered sculpture by marcos novak.

source: novak 2003

Computer games and software that provides similar experiences (such as some applications of immersive displays or some media art pieces) can be discussed in terms of the role the user plays in a mediated environment. Bolter draws a line between the notion of *play* versus that of *game*, when defining their concepts as:

»Play is an open-ended territory in which make-believe and world-building are crucial factors. Games are confined areas that challenge the interpretation and optimizing of rules and tactics - not to mention time and space.« (Bolter 2003)

Hence the world-building functions such as inquiry are emphasised again as playing means constructing the world in an interactive way. Games fall into a

different yet related category in this notion, as they are concerned with acting in areas of constructed rules. Still, optimizing the rules is usually not part of the game, while optimizing the way the rules are applied (as strategy or tactics) is.

According to Wallenstein (2003) the terms *game* and *play* are contradictory. While a *game* »has a set of rules ... and a set of time span« (Wallenstein 2003, p. F21), *play* contains a moment of non-responsibility as seen in the phrases »this is mere play, he's playing around« (ibid, p. F21). It is even the case that playing around means »to ignore some rules« (ibid., p. F21). Wallenstein later tries to settle his theory of game in traditional philosophy, taking the following sentence as a starting point: »The unity of rule and deregulation, law and non-law, could ... constitute a new possibility of thought« (ibid., p. F21). I can not agree with this view of play, as *playing around* means finding out the rules and not ignoring them. If someone plays without goal with an object - such as a ball-pen - she tests out his motoric capabilities against physical forces (e.g. gravity, velocity, inertia). If someone plays around in the social sphere, she tests out social rules (e.g. how far she can go). In this regard, *to play* means *inquiring the rules*. A more detailed discussion of terms and structures concerning games and the act of playing will follow in the next chapter.

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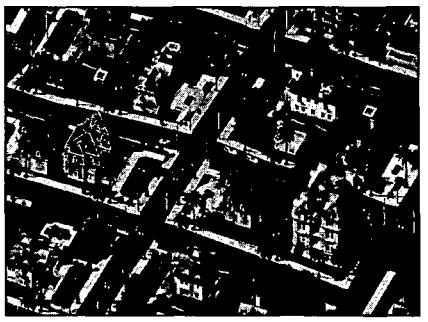
PLAYING GAMES

»The games of today are the user interface of tomorrow.«
Ted Nelson

Von Neumann & Morgenstern (the founders of mathematical economic game theory) define games as: »A Game consists in the entirety of the rules that describe it« (Neumann 1944, my translation, german original: »Das Spiel besteht in der Gesamtheit der Regeln, die es beschreiben«). When a game is perceived by a player at least two more components set up a game: the player and a representation of the game in the physical world. The rules apply to the objects of representation by affecting the way the players are allowed to use the representations. In many games the representation is modelled in accordance to a metaphor: In chess, there is the metaphor of kingdoms fighting each other; In First Person Shooters, the player even embodies a different person; In *Sim City* by Electronic Arts, the player acts as the major of a virtual town. While the rule set of chess reflects the game setting only on a very faint metaphorical level, the rules are part of the metaphor in *Sim City* as they are described in the same language that is used to lay out the story: While the towers are able to move in chess, the skyscrapers of *Sim City* stand still as expected (as long as no earthquake happens).

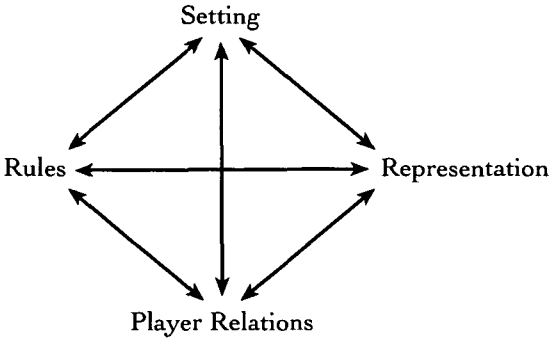


sim city by elctronic arts. the rules of the game are at the same time the narrative elements that tell the game story: towers stand still, while they move in chess.

source: simcity.ea.com

We can further distinguish more parts of games: beside *rules* and *representation* (the perceived interface of the game), they feature a *setting* (there is often a narrative background for rules and their use) and *player relations* (the interplay between the players). All of these different characteristics of a game are interrelated with each others. Thus, the *representation* depicts the setting (e.g. the king in chess is modelled after a king) and implies social factors as it also represents relation-

ships between players (e.g. that both sides of a chess game use the same pieces but different colours). The representation also reflects rules (e.g. the checkered board in chess). It even acts as a substitute for rules by imposing physical constraints (e.g. the border of a chess game and the physical size of figures). The *setting* of the game gives a narrative meaning to the rules (e.g. the king is the most crucial figure in playing chess). As context, it defines what the game proposes the user to see in the representation. Also, it shapes social interaction between the players (although rarely in chess). The *rules* affect the *player relations* by constraining the social interaction of the players (e.g. silence in professional chess games is a rule). As rules limit the degrees of freedom of the user, they can be regarded as constraints (see the chapter ➢ *Constraints and Requirements* for details).

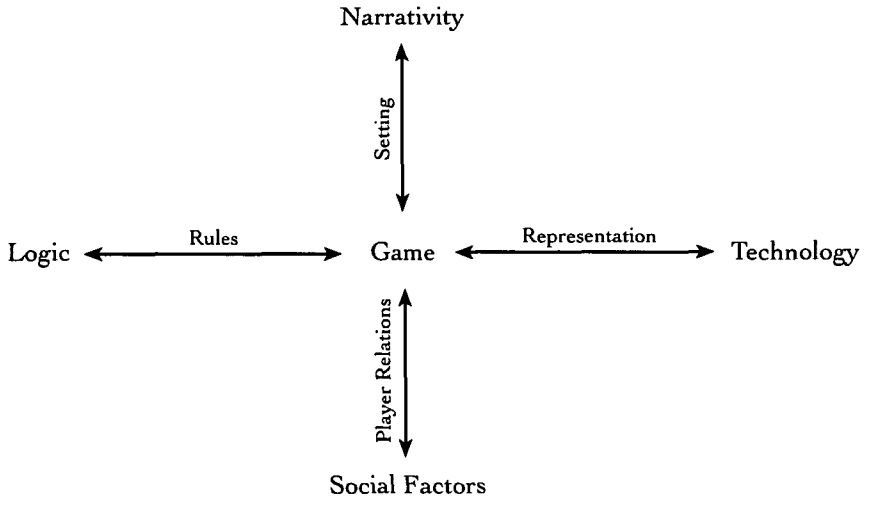


games take place between rules, settings, representation and player relations.

In a wider scope, rules are based on logic (as they set up arbitrary cause-effect pairs), settings are based on narrativity (as they tell a story) and representation is based on technology and perception (as it constitutes of perceived objects).

Playing a game means experiencing an interactive process characterised by the four components of games described above. The physical interaction with the representation forms the ground of the gaming experience as an experiment with the representations of the game in the real world. In digital media, games make use of a substitute reality as described in the section ➢ *Interactivity*. Also, ➢ *Perception* plays a big role on this level of interaction. Then, there is the level of the metaphorical (story, plot) experience as a narrative structure, where the player is part of the game world. Narrativity will be discussed in the next chapter: ➢ *Navigating the Narrative*.

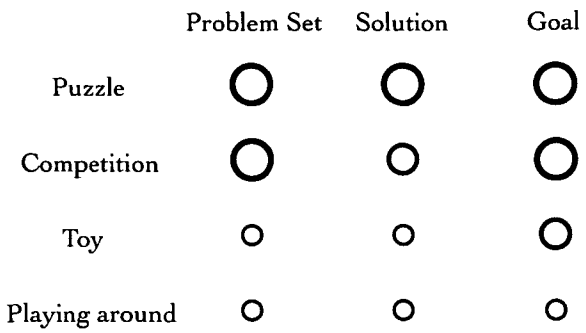
games and their relation to narrativity, technology, social factors and logic.



Some games focus on the lowest cognitive level: e.g. sports (at least in the honest Greek Olympic athletic tradition) and other dexterity based games as well as many child's games. The latter sometimes even only obey the rules of gravity (and education). While there are usually more rules than those imposed by the physical world, the latter can not possibly be overthrown. Obviously, it is not necessary for a game to expose all rules to the player: instead, the player might discover new rules on the fly, thereby getting drawn deeper into the matter through the necessity of constantly evaluating all experiences on the base of new rules. Wittgenstein (1963) even goes as far as describing art as a game whose rules are made up as it is in progress. Each new statement generates a context that affects the meaning of the perceived words and images.

Games as Toys and Puzzles

Different types of games put their emphasis on different aspects of the components mentioned above. Scott Kim (2004) separates games into three categories: toys, puzzles, and games. For Kim, the main characteristics of *games* is the »goal ... to beat another player (or in single-player games, to beat a score)« (Kim 2004). I will use the term *competition* for this type of games as the notion of game is already occupied by the meta-class of entertaining interactive experiences. He sees *toys* as games without a definite solution. Nearly all games where more than one player is involved tend to be of that kind. While there is no pre-thought solution, there is still often a definite terminating rule. On the other hand, *puzzles* are »toys with the goal of finding a solution« (Kim 2004). The main difference between



different types of games and their characteristics based on a revised version of kim's model. big circles indicate strong relations.

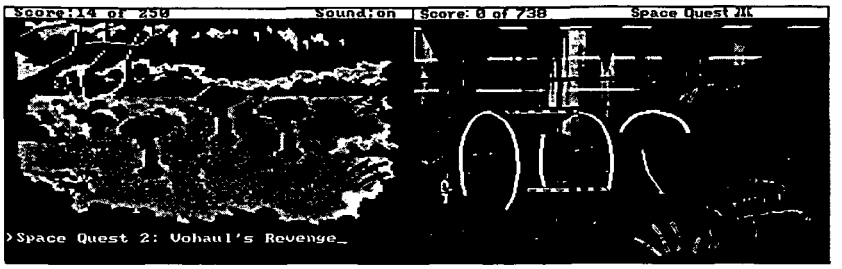
everyday problem solving and playing with puzzles is that puzzles are fun to solve while problems tend to be tedious, ambiguous or even unsolvable. What separates a puzzle from other mechanisms of games is that it is non-repeatable. Since there is only one (or at least a definite number of) solutions, it stays solved as long as we remember the solution. A puzzle is a straight question, and its solution is the correct answer.

In toys we see a reoccurrence of Rittel and Webber's *wicked problems* (Rittel & Webber 1973). Problems that have the characteristics that they cannot be fully described before they are solved. The act of playing is therefore an act of handling a wicked problem. Put more bluntly: Toys are designed in order to pose as wicked problems. They have to provide a continuous experience, and they have to be surprising throughout the entire act of playing. Like a landscape that gradually exposes more details to the onlooker, games have to provide more excitement and new challenges the deeper a player gets involved.

In our everyday life playing with puzzles has a different purpose than playing with toys. Playing with puzzles is a meditative process: Solitaire and Mah-jongg are puzzles, as crossword riddles are. They are usually played alone and in a state of contemplation. They seem to be so widespread in use since they allow the player to take off from the burdens of life. They are just entangling enough to make parts of our mind focus on them, while the rest can fall into unconsciousness. What happens is a kind of mental recreation. It does not matter for that purpose if they are played virtually or physically.

There are some differences between how the act of playing with toys and that of playing with puzzles is structured. One of these is that puzzles are (at least theo-

in the critical art project)(PIONEER that i carried out with machfeld, we set up a game in order to foster awareness of privacy and security issues in the age of wireless communication (see appendix a for details). the rules for the initial game were to find wireless networks using our equipment (logic). the game representation was the playing gear, the PSU (technology) and the game web site. we used the social factors of competition quite extensively. the setting was the city of vienna itself as game board (narrativity).



space quest I (left) and III (right) from sierra entertainment. an example of a compelling and rich story in a computer game.

source: screen shots

retically) interruptible at any point in time, while toys feature occasions where it is easier to interrupt the activity than on others. Furthermore, they differ in how complete the set of propositions is. While every piece of the complete picture has to be in reach when needed in puzzles, toys do not feature such a complete picture and therefore not every element of the possible interactions has to be in reach all the time. Eskelinen describes this situation in other media:

> »In literature, theatre and film everything matters or is conventionally supposed to matter equally - if you've seen 90% of the presentation that's not enough, you have to see or read it all (or everything you can).« (Eskelinen 2001)

While I doubt this in film (especially in productions of higher quality and art house movies) and even sometimes in contemporary literature, it might be true for games. Yet it is questionable if this is a limitation of the media or just a flaw of the games themselves: Early Sierra computer adventure games like *Space Quest I-III* and the first episode of *Leisure Suite Larry* featured environments where about 60% of the information at hand was not necessary in order to pursuit the story. Contrary to usual interfaces that are designed in order to keep the amount of dead ends as low as possible, these games feature a plethora of dead ends by design.

Mediated Games

Jean Baudrillard discusses mediated communication situations in game and play. He argues that mediation of a game affects the perception and the attitude towards its content:

> »Consider a game of computer chess. Where is the intensity of the game of chess, or the pleasure proper to computers? The one involves

> play, the other the ludic. The same applies to a soccer match that has been televised. Don't think that they are the same match: one is hot, the other cool - one is a game, with its emotional charge, its bravado and choreography, the other is tactile, modulated (playbacks, close-ups, sweeps, slow motion shots, different angles of vision, etc.).« (Baudrillard 1979)

What we see here is yet another aspect of game versus play. Again, expressing a game through a specific media leads to the situation that the perceived is altered by the media. The media emphasises certain aspects of the game while diminishing others (see McLuhan (1964) for cold and hot media and Dawkins (1998) for a detailed flaming of french postmodernists):

> »The televised match is, above all else, a televised event like ... the war in Vietnam, and is barely distinguishable from the latter. Thus, the introduction of colour television in the United States, which had been slow and difficult, only took off when one of the major networks decided to introduce colour to television journalism. It was the period of the war in Vietnam, and studies have shown that the ‹play› of colours, and the technical sophistication borne by this innovation, rendered the images of war more bearable to the viewing public. The ‹more› truth, the greater the ludic distantiation from the event.« (Baudrillard 1979).

I do not understand, what Baudrillard means with *ludic distatiation*, yet I assume that he refers to concepts that were already explained in this book: As we have seen in the section ➢ *Perception*, seeing things clearer leads away from involvement, while leaving things open (to closure) entangles the audience.

Immersion and Identification

The state of consciousness where a user is fully entangled into interaction is referred to as immersion. Bolter & Gruisin describe immersion as to »erase itself so that the user is no longer aware of confronting a medium, but instead stands in an immediate relationship to the contents of that medium« (Bolter & Gruisin 1999, p. 23). While I discussed the technical term of immersion in the chapter ➢ *The Architecture of the Virtual*, the psychological state of immersion refers to the same

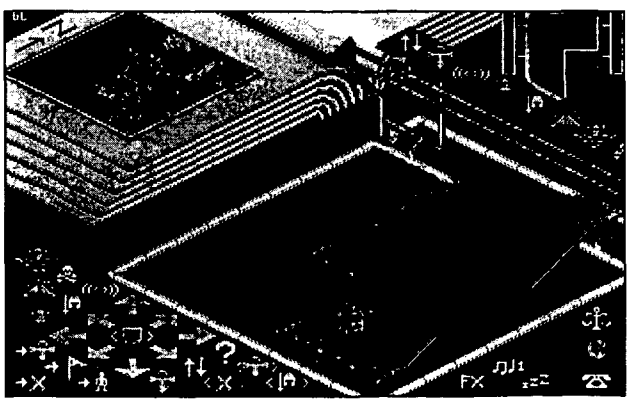
situation, yet it is reached through focusing the thought of the user rather than keeping the physical environment out of sight. Lev Manovich sees an opposition between information and immersion in new media as:

> »Along with surface versus depth, the opposition between information and ‹immersion› can be thought of as particular expression of the more general opposition characteristic of new media: between action and representation.« (Manovich 2001, p.192)

One of the reasons for this opposition is that immersion results in a specific standpoint of the participant, so that immersion prevents an objective view. The borders between action and representation are fluent, as a representation is also perceived in a rather active way in the form of an inquiry. The act of inquiry is even necessary in order to establish the link between the user and the matter: before all it allows immersion to take place.

Immersion means, that the user is getting part of the representation. Laurie Taylor explains the act of identification with the in-game representation of a player as:

> »This connection between the player and the player's position in the game space implies a type of identification, in that the player identifies sufficiently with objects or characters of the game space to function in response to that game space through a self-image that is inserted into the constructs of the game space and then internalised by the player (subject).« (Taylor 2003)



in populous (by bullfrog entertainment 1989, now owned by electronic arts), the player takes over the role of a god.

source: www.gamespy.com

While this view might be accurate when seen from the inside, i.e. from the standpoint of the player figure in the game (*the avatar*) it is more useful to see the avatar as a tool of the player in many cases. The experience of a game where the player incorporates an avatar and that where the avatar is not present (i.e. not presented) is not as different as one might expect when reading the above statement.

Lacan terms this a mirror stage, a position in which the user inhabits two bodies - one in the game and one in reality - but acts as one individual:

> »We have only to understand the mirror stage as an identification, in the full sense that analysis gives the term: namely, the transformation that takes place in the subject when he assumes an image ...« (Lacan 1977)

This mirror stage is present in every case involving the reception of a virtual architecture - an image, a computer game, a comic book. While this view is practical for transposing psychological concepts into mediated situations, it is not practical for our examination of the works of emotions. We will therefore concentrate on other aspects of interactivity.

Playing Games

Games belong to products that are aimed at stimulating an emotional response and they do so in several ways. First, they are designed (in the sense of form-giving) to be charming. Second, the interaction is designed to be stimulating, challenging and rich. Third, they often incorporate a reward concept on several levels: e.g. small achievements are rewarded immediately, while larger achievements are rewarded by winning the game. Fourth, many games are to a certain degree unpredictable - a situation that fosters the experienced tension. Fifth, games offer a social experience and have the power to embrace and focus all the deep feelings that shape our lives. Yet playing with games is still *only playing*.

In this chapter I discussed the notions of *play* and *game* as the act of playing and the structure in which playing takes place. Games are determined by their rules, yet not all rules might be known in advance. They can be separated into *toys* and *puzzles*, where puzzles are games with a defined end and toys do not feature such an end. Thus, puzzles emphasise the product, while toys emphasise the process.

Toys may be regarded as open processes (as discussed in the chapter ➢ *Solving Problems* in terms of Eco (Vizcaino 1999)), and they impose wicked problems (following Rittel & Webber 1973), as will be seen later in this book. The game constitutes as an interactive process between a physical representation, the player(s) and the rules. The representation is thereby often based on ➢ *metaphors* - and it tells a story that is *lived* by the players.

In the next chapter I will connect the theories about games that I discussed here with theories about narrativity. Problem solving behaviour will play a prominent role, again. An entertaining experience often takes place in the interplay between content (read as narrative) and playful interactive problem solving, thus linking these two aspects will provide a background for discussing more general issues of human computer interaction in regard of emotionalised states of the user.

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NAVIGATING THE NARRATIVE

»In narratology, events are divided into actions and happenings based on their agency, and into kernels and satellites based on their relative importance. There's also a difference between punctual acts and more durational actions, and that's about it« (Chatman 1978)

Discussing games as interactive activity lead to the ingredients of games: rules, representations and settings. Rules will be discussed in relation to constraints continually during the next chapters of this dissertation. The ➢ *Representation* was covered in earlier chapters and partly in the section ➢ *Perception*. This chapter is dedicated to the *setting* of a game. The setting is presented to the user as a narrative experience. Narrative structures are determined in terms of content, rather than form. Nearly every object can feature a narrative element. Everybody owns precious paraphernalia of everyday life for their story - they act as storage handles for personal history. On this very low level of *telling stories*, narrativity begins. In its purest and highest developed cultural form, narration is the sole experience of sensation. But what forms a narrative? What are the prime requisites necessary for something to be called a narrative? In this chapter I will explain how a narrative is constituted. I will put a certain emphasis on those parts of narratology that are important for digital media but argument on base of classical concepts.

Marie-Louise Ryan (2001a) gives an introduction into what comprises a narrative. I will follow her explanation throughout this chapter and connect it to themes previously discussed in this dissertation, on the fly. Her paper ‹Beyond Myth and Metaphor - The Case of Narrative in Digital Media› lists ten statements concerning what constitutes a narrative.

Her first statement about the structure of narration is: »Narrativity is independent of the question of fictionality« (Ryan 2001a). While this seems intuitively true, it could be read as targeted at literature scientists who still try to shape the theory of narration in accordance to literature. In contrast to this view, narrativity is particularly »not coextensive with literature nor the novel« (Ryan 2001a) as Ryan's second directive tells. These initial definitions of narrativity widen the scope in order to embrace all acts of narration. The next premise of Marie-Louise

Ryan reads: »Narrativity is independent of tellability« (Ryan 2001a). By separating narrativity from the act of storytelling, we are put in a position that allows a more general definition of narration:

> »A narrative is a sign with a signifier (discourse) and a signified (story, mental image, semantic representation). The signifier can have many different semioticm manifestations. It can consist for instance of a verbal act of storytelling (diegetic narration), or of gestures and dialogue performed by actors (mimetic, or dramatic narration).« (Ryan 2001a)

I already covered the role of the *signified* and the *signifier* in the chapter ➢ *Representation* in terms of Saussure (1916) and Peirce (1935). While I pursued the discourse concerning signs and symbols there, I focus on the process that is involved in developing semiotic (respectively semantic) meaning out of signified entities by participants here:

> »The narrativity of a text is located on the level of the signified. Narrativity should therefore be defined in semantic terms. The definition should be medium-free.« (Ryan 2001a)

The fact that the narrative can be seen as isolated from the medium origins in the thought that a narrative can obviously be translated between media, as it is the case when we get told a fairy tale instead of reading it. Although it is never the same story since the media of communication shapes the content (McLuhan 1964), the narrative basically stays the same or, at least, independent of the media (Murray 1997). Chatman referred to this when he wrote: »This transposability of the story is the strongest reason for arguing that narratives are indeed structures independent of any medium« (Chatman 1978). The understanding of narrativity is difficult, because even though it is media-independent there is the »fact that a narrative can never be viewed independently, *an sich*« (Juul 2001, italics his). Further evidence for the translatability of narrative structures can be found in Brooks' ‹Reading for the Plot› (1984):

> »Narrative may be a special ability or competence that [...] when mastered, allows us to summarise and retransmit narratives in other words and other languages, to transfer them into other media, while

> remaining recognisably faithful to the original narrative structure and message.« (Brooks 1984)

There are certain additional features of the narrative beyond translatability and media-independence. One of these is that narrativity is gradual: Something (a text, a tool, an object) is not either narrative or not, it might as well be narrative to a certain degree:

> »Narrativity is a matter of degree. Postmodern novels are less narrative than simple forms such as fables or fairy tales; popular literature is usually more narrative than avant-garde fiction.« (Ryan 2001a)

Manovich finds evidence for modern basic narratives in films as »a very basic narrative which is also quintessentially modern: a camera moving through space recording whatever is in its way« - a form of narrative that can be seen in nearly any contemporary Hollywood blockbuster. He also notes that postmodernism embraced certain kinds of narratives while rejecting others when he argues that »one of key's effects of ‹postmodernism› ... that of spatialisation: privileging space over time, flattening historical time, refusing *grand narratives*.« (Manovich 2001, p. 86, italics mine). By grand narratives I suppose he means what is commonly referred to as *utopias*. His quintessence of postmodernism in computed environments is therefore: »In short, time becomes a flat image or a landscape, something to look at or navigate through« (Manovich 2001, p.86).

In order to compare the movement through time in traditional texts and that through space in post-modern texts and hypertexts, Ryan's next argument proves worthy:

> »Narrative representation is constructed by the reader on the basis of the text. Not all texts lend themselves to a narrative interpretation.« (Ryan 2001a)

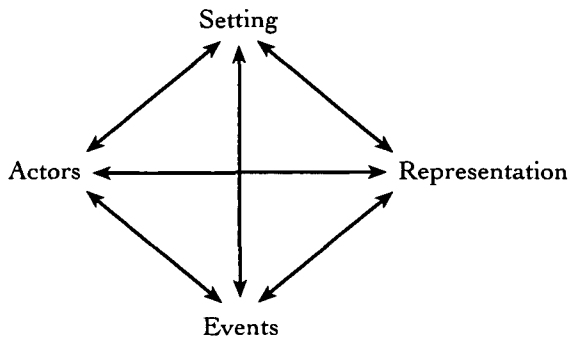
If the narrative is constructed by the reader, the way the reader navigates to arrive at new building blocks of his mental story is based on the text and on the reader. This view of perception as pragmatic constructivism is in perfect concordance with the theory of inquiry that is pursued in this book. Since inquiry means

gradual adaptation to a situation (using a tool-like mechanism), the construction of a representation based on a text (or another medium) might as well be seen as an inquiry of content.

Summarising, the building blocks of a narrative representation are thus:

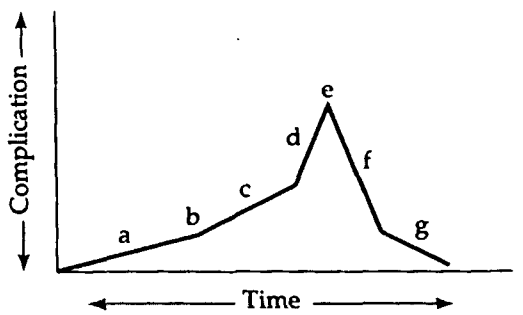
> »Narrative representation consists of a world (setting) situated in time, populated by individuals (characters), who participate in actions and happenings (events, plot) and undergo change.« (Ryan 2001a).

the narrative consists of a setting, actors, events and representations according to marie-louise ryan.



Dramatic representation

Brenda Laurel (1991) concisely describes Aristotle's (330 BC) concept of what constitutes a drama. Drama in this regard means a narrative acted out before an audience. Laurel analyses the drama in terms of six categories: Action (plot), Character, Thought, Language (Diction), Pattern and Enactment (Spectacle). If we strip the media-related parts of this model (enactment and language), four parts of a drama remain. Pattern means the way language (and song) is used in the drama (Mateas 2002) and therefore is also related to the medium. Since thought is inferred by the audience on the basis of perception, it does not qualify as a building block of the *representation* of the narrative. Instead, what drives the actor in the view of the author and the audience can be seen as a meta-building block of the narrative as it is not expressed directly - it is not represented or *present*. What remains of Aristotle's theory is covered by Ryan's definition of the representation of the narrative which goes even a step further in introducing the concept of a *world* (or *setting*). We might again see an effect of postmodernism in this mentioning of a space.



a. Exposition
b. Inciting incident
c. Rising action
d. Crisis
e. Climax
f. Falling action
g. Denouement

the dynamics of a drama in laurel`s model based on aristotelian dramatic theory.

source: laurel 1991

While the plot of a drama used to be linear in earlier times, nowadays - as can be seen in Manovich's explanations above - linearity vanishes. Instead, new forms of narratives are developed that restrict linearity to the way the audience navigates the narrative, opening new possibilities for telling stories:

> »The concept of a narrative structure that doesn't conform to the standard predictable beginning, middle, and end, that doesn't have the linear direction of the heroic journey or chronology of history, frees the writer to express and communicate complex ideas, values and attitudes that may have been previously repressed.« (Comte 2001)

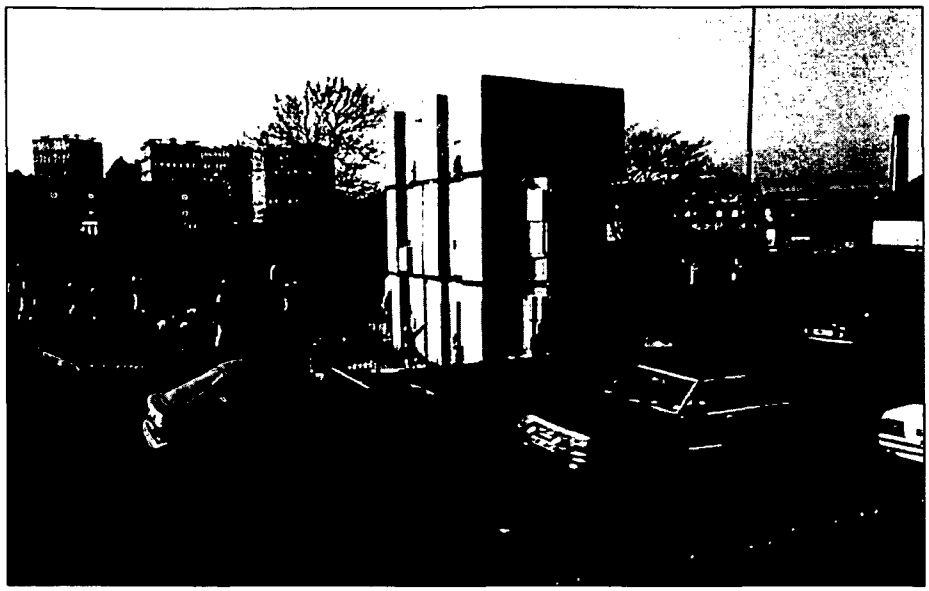
Thus, new developments in how a narrative can be expressed in a media not only affects the narrative structure but also the content - the signified.

Navigating life

Ryan sees a manifestation of narrative structures in our everyday life when she explains:

> »The most prominent reason for acting in life is problem-solving. It is therefore the most fundamental narrative pattern.« (Ryan 2001a)

Thus we arrive at a point where our everyday life is the most common narrative structure for all of us. It is a narrative without goal or predefined end, an open process that only lately found its complement in constructed narratives. Vizcaino (1999) explains this on the basis of Umberto Eco's definition of *open works*:



***house* by *rachel whiteread* is a memorial by all means; it was produced by casting concrete into a building and then removing the building itself. it literally depicts that there is something not there anymore.**

source: www.artistsineastlondon.org/image_bank/essay/

> »[The poetics of the open work], which considered the way modern music (Stockhausen, Berio, Boulez), modern writing (Mallarmé, Joyce), modern art (Calder, Pousseur) in relation to modern science (Einstein, Bohr, Heisenberg) now produce 'works in movement' and 'open works' works whereby the addressee becomes an active element in bringing a work to provisional completion, or where the work itself brings openness to the fore.« (Vizcaino 1999)

While modernity concentrated on memory (»in modernity memory is the key to personal and collective identity.« (Roth 1995, p.9)) and mind as the tools of problem solving by putting an emphasis on linear developments, the affinity towards haptic and spatial issues in postmodernity even manifest in the terms used to describe it: works in *movement* - and *open* works, both being spatial metaphors.

Space and Time

One of the reasons why the comparison between analogue and digital drama is so complicated is that the ways the audience takes part in the play differs greatly. In digital narratives the player moves through the narrative as navigating a space rather than following a line. This habit changes the organising principles of the experience itself:

> »It is the representations of the space and movement through that space rather than narrative that function as the organising principle around which ludic and aesthetic experiences takes place. In addition, whilst the forms of representation owe something to cinematic visualisation techniques they fail to take on board cinematography and continuity editing conventions.« (Flynn 2003).

In the above statement the heart of media theory manifests again as certain media emphasise aspects of underlying older media. It seems like a habit of cultural critics to concentrate on the lack of specific properties and aesthetics of *older* media in new ones. Cinema is still often regarded as inferior to theatre although far more people feel attracted by the movies than by plays. Comics are regarded as inferior to *real books* yet in the Japanese everyday life comics play a vital role that might be regarded superior to that of literature. This lack of appreciation can also be seen at computer games. They are continually treated according to what they cannot accomplish in contrast to traditional media (be it literature, theatre or film), rather than in terms of what they can achieve: a unique, rich and compelling interactive experience.

Even though I have problems with Flynn's above statement in regard of the attitude it shows towards the critique of computer games, it clearly outlines the importance of two aspect of all games: Time and Space. As movement is always a function on time and space, the role of time should be highlighted a bit more in order to shed a light on the workings of interaction in computer games. Christian Metz notes that »one of the functions of narrative is to invent one time scheme in terms of another time scheme« (Metz 1974). While only few dramas in theatre happen in real-time (Becket's ‹Waiting for Godot› being an exception), this is the common case in computer games. If the computer game does not feature real-time flow, the player determines the timing (as in turn-based games).

While the narrative bears a certain relationship to timing, there are also other relevant aspects of time, and especially real-time, as Crogan (2003) states: »The crucial point for our discussion of the experience of information is that speed is central to information processing.«, whereas Virilio goes even one step further in seeing acceleration as crucial to information itself:

still frames from my installation ‹inkubation› (2004). the narrative was constructed by the audience on base of hints. the setting of the installation resembled a cinema. the context obviously affected the interpretation of the visual impression.

»... whether it be speed of acquisition, transmission or computation, information is inseparable from its acceleration in energy terms – slowed up information being no longer even worthy of the name, but mere background noise.« (Virilio 1997)

The ways a player is incorporated into an interactive narrative therefore is structured by the experience of time and space. Both affect the narrative and play a role in how the audience perceives it.

The Audience enters the Stage

Ryan continues her definition of the narratives with what is more an advice for the production of consumable narratives than a fact in narratives, since it is partly contradictory to the earlier statements:

»Narrative representations must be thematically unified and logically coherent. Their elements cannot be freely permuted, because they are held together in a sequence by relations of cause and effect, and because temporal order is meaningful. The propositions of a narrative representation must be about a common set of referents (= the characters).« (Ryan 2001a)

While this last rule applies to classical storytelling, it violates the spatial principle of post-modern literature as well as that of computer games. Our will to see cause and effect in arbitrary observations causes us to apply the above to any sequence experienced. During my installation ‹incubation› I experienced this fact in the audience; some people waited for an end of the movie, where there was no end since the movie was arranged out of samples on the fly in real-time and without a predefined narrative structure.

Navigating the Narrative

In this chapter we have seen that the concept of the narrative is very fundamental to the discussion of central issues of interactivity. The narrative was explained starting from its building blocks as well as from human behaviour. An important point is the notion of (postmodern) ‹open works›, narrative forms that feature a conception concentrating more on the (open) process than on the product, as the

product is not known in advance. Again, human behaviour - in this case in narrative environments - relates to general theories on problem solving. In the last part of this chapter, we arrived at the situation that emerges once the player enters the digital stage. This situation will be examined in the next chapter in more detail.

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THE INTERACTIVE DRAMATIC EXPERIENCE

»Why are video games so much better designed than office software? Because people who design video games love to play video games. People who design office software look forward to doing something else on the weekend.«

Ted Nelson

Once the player or spectator enters the drama a couple of changes are introduced into the model of the narrative as discussed in the ➢ last chapter. Brenda Laurel describes interactive narratives (terming them *interactive drama*) as:

> »An ‹interactive drama›, then, is a first-person experience within a fantasy world, in which the user may create, enact, and observe a character whose choices and actions affect the course of events just as they might in a play. The structure ... enables first-person participation of the user in the development of the story or plot, and orchestrates system-controlled events and characters so as to move the action forward in a dramatically interesting way.« (Laurel 1986, p. 10-11)

A closer examination of the way the user interacts with the narrative leads to the role of the virtual, again. In the chapter ➢ *The Architecture of the Virtual* I discussed the virtual in terms of Derrida, Deleuze and Roe. Kwinter provides us with a good summary of the virtual from which any number of *actuals* can be extracted over time:

> »The virtual is gathered, selected - let us say incarnated – it passes from one moment event (or complex) to emerge – differently, uniquely – within another. Indeed the actual does not resemble the virtual, as something pre-formed or pre-existing itself. The relation of the virtual to the actual is therefore not one of resemblance but rather of difference, innovation, or creation (every complex, or moment-event, is unique and new).« (Kwinter 2001, p.8)

This view of how an experience is structured concentrates on the users participation rather than on how the drama is designed. Traditional theatre was in the

pleasant role of being able to concentrate on the play itself, since the audience served as a beholder of the actions and nothing more (surely not the only role it played). Thus traditional theories on drama concentrate on the narrative as a structure of telling stories and neglect any reflections on the audience and how it takes part in a play. Although the audience is involved in the drama in *lower* cultural fields such as jazz music and improvisation theatre (e.g. comedia del arte), until recently it was not regarded as a subject for *higher art*. If literature scientists now discuss interactive dramas, they do so in terms of higher art (and thus mostly still in terms of Aristotle) that provides no language for the description of what happens once the audience enters the stage. The transition of how the audience (the player in interactive art) is involved in the play - from being a passive beholder or spectator to playing an active role in the interactive narrative experience - is expressed concerning games in the following statement by Lunefeld:

> »Player accounts are structured around action, around environment, around activity. In this way, any model of connection based around identification with a single entity in the game world is perhaps oversimplified... Clearly, this demands a totally new framework within which to understand the relationship between player and game world. Even the notion of On-Line character as an identifiable and singular entity embodied by the player may be an oversimplification indicative of an implicit reliance on existent models of audience... this linkage is best considered as an experiential whole that synthesises, action, location, scenario, and not merely as a bond between subject and object within a world... On-Line, the player is both the goal and the act of attaining it.« (Lunefeld 2000)

It could be assumed that the inspiration for computer games - the most common form of interactive drama - comes from the *lower art* since *high art* never paid attention to involving the audience. The narratives in these art forms are constructed differently than its high counterpart. As interaction between the ones who carry out the action and those who merely perceive occurs, other qualities of dramas than a compelling narrative get emphasised. These may be regarded as being situated on a more haptic or primitive level of reflection. Bringsjord observes a lack of captivating narratives in digital entertainment:

»The movie T2, Dante's Inferno, Hamlet, Gibson's prophetic Neuromancer, the plays of Ibsen -- these things are dramatically compelling: they succeed in no small part because they offer captivating narrative, and all that that entails (e.g., engaging characters). There is no analogue in the interactive digital arena, alas.« (Bringsjord 2001)

Yet I find it hard to argue that the book ‹The Hitchhiker's Guide to the Galaxy› by Douglas Adams (1979) is taken as captivating narrative (as it indeed is by many readers) while the computer game of the same name, released by Infocom in 1984, is not, although it was done in cooperation with the author of the book. This computer game even was a text adventure and thus largely based on the same perceptual modalities as the book. As it included the complete storyline of the first volume of the novel and additional texts by the author, it stays mysterious to me why it is not regarded as an even superior narrative! It bears at least more compelling dramatics than Terminator 2 mentioned in the quote above (and contrary to Dante's Divine Comedy it is interesting without having to be familiar with the proponents of centuries of Italian history). The main difference between how a traditional narrative form is perceived in contrast to an interactive narrative structure lies in the characteristics of interactivity itself.

Tools of Thought

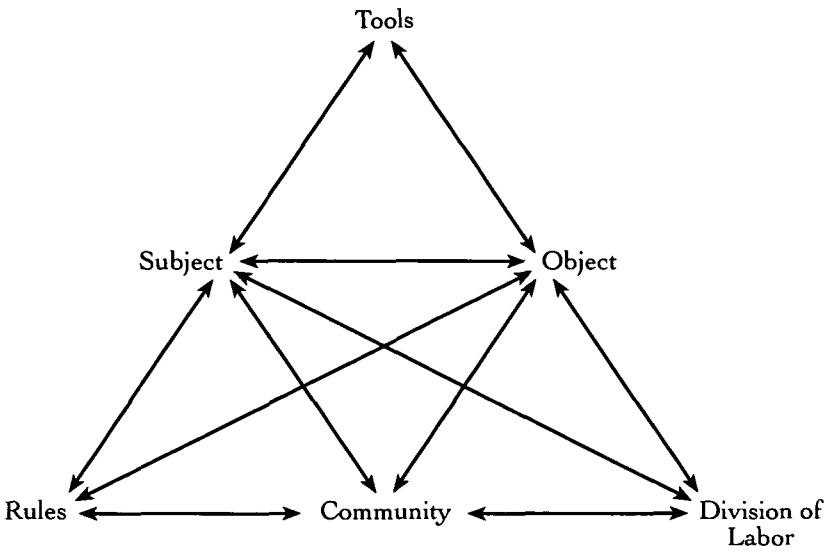
According to David Parlett formal games represent systems of ends and means (Parlett 1999). Assuming that end and goal are equal, this gives us a new viewpoint on games: The key element is not only the game as solvable or unsolvable riddle, but the structure and the process - the ends/goals and the means/tools. This pragmatic view once again leads us to the theory of inquiry, since it seems like all we can say is that interaction happens - an interplay with an artefact that leads to a certain end.

Vygotsky outlined 1978 that artefacts mediate in cognition. 24 years later, Squire brings the activity theorists into play and explains their view of how we understand our environment through artefacts as:

»... the minimal meaningful context is the dialectical relations between human agents (subjects) and that which they act upon (objects) as they

are mediated by tools, language, and socio-cultural contexts .« (Squire 2002)

Squire refers to the work of Engeström (1987, 1993, 1999) as the source for his theories. The principal layout of a meaningful context that is established by humans can be explained according to Engeströmian activity theory in terms of this illustration:



a diagram explaining activity theory following squire (2002), who refers to engeström (1987, 1993, 1999).

source: squire 2002

By acknowledging what was said so far, space can be seen as a means of inquiry of the narrative, and time as a characteristics of this inquiry. The interface then is an agency of inquiry and a tool for navigating the digital environment; on the interface level, inquiry happens with the interface being the tool. The player thus is subject to multiple modalities of inquiry at the same time, all of them inter-twined and many of them under constant change issued by the player, the tool, and the feedback between. This multitude of inquiries manifests as interactivity. The characteristics of the narrative and the ways it is navigated by these means of inquiry shape the perception of the digital experience and therefore the emotional factors of human computer interaction.

Inquiry and Comprehension

According to Marie-Laure Ryan, the »cornerstones of a phenomenology of reading, or, more broadly, of art experiencing« (Ryan 2001b) are immersion and interactivity. Immersion is experienced as a world to be explored and a body to be inhabited, while interactivity in interactive narratives is presented as a »game, language as a plaything, and the reader as the player« (Ryan 2001b).

Comprehension always happens through interactive inquiry of the proposed narrative structure. The ➢ next chapters will be dedicated to this fact and thus discuss interactivity. If the goal of a designer is to elicit emotions in the user, the experience has to be structured in order to allow for it to happen. This relation between the audience as player and the drama is discussed concerning the reader of a text by Wolfgang Iser:

> »... meaning must clearly be the product of an interaction between the textual signals and the reader's act of comprehension. And, equally clearly, the reader cannot detach himself from such interaction, on the contrary, the activity stimulated in him will link him to the text and induce him to create the conditions necessary for the effectiveness of that text.« (Iser 1978, p.9)

The interactive dramatic Experience

Once the player is immersed into a game he faces a situation that can be categorised as being in a position where the inquiry of her game surroundings is the prime mean of investigation. The construction of meaning is only possible through that inquiry. The mechanism of interactive inquiry was already discussed several times in this book, yet it hardly appeared in a comparably pure form - as emergence of the factual from a proposed virtual. The inquiry of spatial properties of the virtual space presented by the game was also examined here, establishing a link to earlier chapters of this dissertation.

The next chapters will discuss interactivity. As the design of the tools we work with influences our *Gefühlston*, crafting the interface (i.e. the place where interactivity happens) means crafting not only the emotional and functional side of the experience but also directions and possibilities of thought. Inquiry implies

activity between (*inter*) the mind and the matter. As working with tools and their interfaces is meant to serve as ways of solving problems, it is likely that there is a narrative structure implied. I will examine this aspect during the next chapters.

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INTERACTIVITY

»We shape the tools, but the tools re-shape us.«
Alan Kay

There are many different definitions of interactivity. Chris Crawford defines it as »a cyclic process in which two actors alternately listen, think, and speak« (Crawford 2002), where actors can be substituted with humans, computers and everything else capable of pretending to listen, think and speak. Alan Dix (1998) focuses more on human computer interaction when separating two modes of how interaction can happen:

> »By interaction we mean any communication between a user and computer, be it direct or indirect. Direct interaction involves a dialogue with feedback and control throughout the performance of the task. Indirect interaction may involve background or batch processing. The important thing is that the user is interacting with the computer in order to accomplish something.« (Dix 1998)

Beside analysing the components of interactivity concerning the characteristics of the task of interaction, other aspects of interactivity can be discussed. Brenda Laurel (1991) approaches the problem from a different direction:

> »I posited that interactivity exists on a continuum that could be characterised by three variables: frequency (how often you could interact), range (how many choices are available), and signification (how much choices really affected the matter).« (Laurel 1991)

While these metrics might yield some information about the interactivity of a task, Laurel later denies their significance in order to arrive at a far »more rudimentary measure of interactivity«: »You either feel yourself to be participating in the ongoing action of the representation or not« (Laurel 1991).

During the following chapters I will follow this last line of discussion as it directly addresses the matters discussed so far. The question that arises is: how

do emotions evolve - and how can a tool be designed to foster the development of an emotionalised state or attitude. When *feeling participating* is a crucial factor for interaction, an interface has to be designed to allow or even nourish *immersion*. In order to arrive at a well-structured view of the process of interactivity I will discuss several aspects of user interfaces. I will start off from the quest for invisibility that is a current strong force in HCI research. Then I will examine basic modalities of user interfaces, and later I will widen the view of how humans currently work with interfaces and have worked in the past in order to situate the aspects of interactivity discussed in the past chapters.

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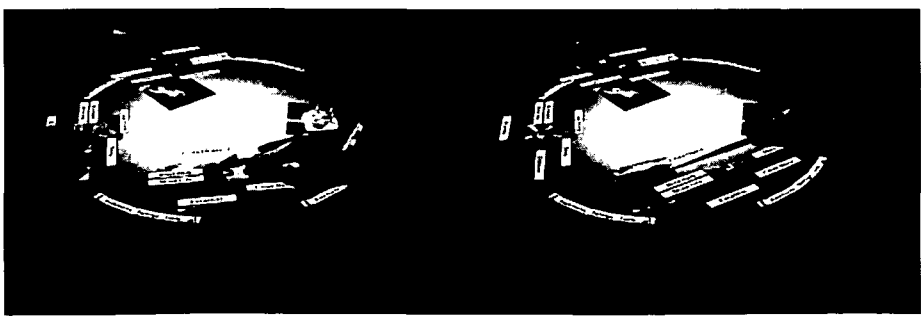
THE QUEST FOR INVISIBILITY

A prime goal of current user interface research is the invisibility of the interface, the leading thought being to allow the user to focus on the work rather than on the interface:

> »The real problem with the interface is that it is an interface. Interfaces get in the way. I don't want to focus my energies on an interface. I want to focus on the job. My tool should be just something that aids, something that does not get in the way, and above all, something that does not attract attention and energy to itself.« (Norman 1990)

The approaches toward unobtrusive interfaces differ. Some researchers favour *tangible* or *ubiquitous* interfaces (Reynolds & Picard 2001, Weiser 1993). Tangible interfaces are meant to be touched - they build upon hand-eye feedback. Close to the concept of tangible interfaces is that of interfaces that measure the state of the user. Measuring always implies a tangible part of the interface. Rosalinde Picard hereby focuses on »sensing and recognising the affective information communicated by the user in a way that is comfortable and reliable.« (Reynolds & Picard 2001).

In tangible interfaces the interpretation of information about the user can be enriched with information about the situation. This especially comes at hand in the case of mobile devices, since they undergo more different situations of use than fixed devices. Schmidt summarises his hopes about the development of future mobile devices:



a tangible interface: the diamondspin table by shen et al. virtual documents on the table can be rotated.

source: shen et al. 2004

> »We will be able to create (mobile) devices that can see, hear and feel. Based on their perception, these devices will be able to act and react according to the situational context in which they are used.« (Schmidt 2000)

Here, context means *context of use* as well as *context of outer situation*. The range of functionality that is described in this statement reaches from an automatically adjusted back light of a display to the presentation of location dependent data (see also ➢ *The Role of Context*). Another way to use tangible interfaces is *tangible displays*, presenting arbitrary information to the user as haptic impressions. Tangible means *not looking like a computer* in that case. Ubiquitous Computing follows the same trail. Mark Weiser, who invented the term *Ubiquitous Computing*, refines invisibility in user interfaces to the following:

> »A good tool is an invisible tool. By invisible, I mean that the tool does not intrude on your consciousness; you focus on the task, not the tool. Eyeglasses are a good tool -- you look at the world, not the eyeglasses. The blind man tapping the cane feels the street, not the cane. Of course, tools are not invisible in themselves, but as part of a context of use. With enough practice we can make many apparently difficult things disappear: my fingers know vi editing commands that my conscious mind has long forgotten. But good tools enhance invisibility.« (Weiser 1993).

The above statement is based on the assumption that problem solving is happening in the mind as *you focus on the task*. Invisibility would truly be an intriguing goal if that would be the case. The situation is different once inquiry is regarded and thus focusing on the tool and the task is of the same importance for reaching a goal.

Some researches simplify the concept of invisibility to disappearance in terms of the technological character of a device, as Norbert Streitz does when postulating that invisibility means »making the technology device character of computers disappear« (Streitz 2001). This statement largely reflects Weiser's words, since in technological use, the technology itself is the tool that has to disappear.

The goal of designing invisible interfaces is to ease the use of a technical device by utilising latent communication channels at hand, by shaping the quality of presented information, by adding additional information to a situation, and by working on data transmitted on the side-bands of usual interaction. One of the problems in the design process is simply that an invisible interface is not to be seen. According to the proponents of invisible computing, good design means that the design does not get in the way of the operation, as good interface design means that the interface does not get into the way. They want to establish a direct link between the user and the material.

While this approach to interface design might be suitable for some users in specific situations it leads to severe problems in others. Masaki Fujihata demands different qualities from interfaces:

> »... transparent interfaces never impose any stress on us. The result is that the man does not need any consciousness for the interface. I think this is a very poor interface, nothing new, nothing creative for the user as a human. I love using pencils, chalks, and brushes as a medium for expression, however, we need to be trained with these interfaces. Exercising interface is a part of the pleasure of expression. One should be conscious of the interface. I would like to say 'interface' must not be invisible.« (Fujihata 2001)

stills from masaki fujihata's locative media installation ‹field work› (2003).

source: fujihata 2004

Interestingly, this statement describes concisely how interfaces that generate an emotional attitude have to be constituted. In order to be able to *love* the interface - and therefore love the task of working with it - the interface cannot be invisible. Instead, it has to be learnable and satisfying to use - just as a car that triggers an emotional response is usually not invisible as an interface (it features loud engine noise and is always too big for the last unoccupied parking slot), and a stimulating movie depends on a complicated and conflict-laden plot (as interface to the meaning behind it). As mentioned in the chapters about perception, designing the interface in a way that demands active participation of the user leads to new possibilities of linking the user to the mediated content. Computer interfaces should also comply with this approach, and should therefore not try to be invisible but to propose an interesting and stimulating experience of interaction. Just as read-

ing a good book is not an unconscious task but a procedure oscillating between conscious and unconscious perception.

The Quest for Invisibility

We have seen in this chapter that interfaces that allow a satisfying, or even an emotionally involved working situation should not be invisible. If an interface is so easy to use that a user can immediately work with it, she will most likely not be able to have the pleasure of learning to manage her task. As humans we seek development and are eager to make things better everyday - interfaces that are invisible do not allow us to step further as they deny the joy of mastering them. Maybe we should learn how to build interfaces from those of musical instruments (Piringer 2001, Levin 2000).

In the next chapter I will analyse three basic aspects of interface design. The three aspects that I deal with were chosen because of a number of reasons; First of all they were already examined in my master's thesis; Second, they are in my regard fundamental to understand both - the workings of user interfaces and the chapters that follow. I deal with them in three rather separate sub-chapters and leave it to the reader to see the connections between them.

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BASIC MECHANISMS FOR USER INTERFACES

The approaches to user involvement described in the last chapters rely on very few concepts and mechanisms of user interface design. In this chapter I will provide an overview over some of the concepts that shape the rudimentary principles of human computer interaction. I picked three out of many aspects of interactivity as these three concepts formed the core of my master's thesis and I still regard them as central to interaction design. These concepts are explained in three rather separate sub-chapters, yet they build on each other. Gestures and other bodily interaction methods are explained first. Affordances propose a holistic view of the process of interaction on an atomic level. Constraints link gestures to feedback mechanisms and also work on a very basic level.

Gestures

An atomic bodily movement is referred to as *action*. Under certain circumstances a sequence of actions turns into a *gesture*. William Buxton describes gestures as:

> »A gesture is a sequence of human actions completed automatically once set in motion ... Combining a sequence of actions into a gesture relates to the psychological process called chunking, the combining of separate items of cognition into a single mental unit, a process that allows us to deal with many items as though they were one.« (Buxton 1986)

In my opinion, the relation to the notion of *chunking* has the character of a literal resemblance. Gestures have to be learned. A gesture can be built out of the same actions as another, yet result in a different outcome based on the domain where it is applied. Gestures always relate to context. Jones and LeBaron (2002) explain that the acting out and showing of gestures produces only low cognitive load. Thus gestures can be utilised parallel to spoken language:

> »[Gestures] have a low cognitive load, they take little time to prepare and relay, they can be made simultaneously with speech and they can

convey complex information in a very compact form.« (Bekker, Olson & Olson 1995, p.5)

In his later work, Buxton refines the above to something he calls *Natural Language* (in Buxton 1990). Natural Language is human-to-human communication minus verbal communication. It is domain-specific since the same symbol might stand for different concepts in different contexts. It is parallel in that regard that more than one language element can be used at the same time.

In interaction, gestures occur once we have learned them and are skilled enough to use them. When we do something for the first time (changing gear in a new car, executing a new application) every action has to be done separately: first one searches for an item, then carefully manipulates it very consciously. With some practice, the same actions can be performed with less concentration, as the sequence of actions turns into a gesture. In everyday life, gestures are something we apply continually to our surroundings.

Affordances

Affordances are intuitive possibilities to manipulate objects. They are visible and conceivable by the user, e.g. buttons are for pressing and knobs are for turning. Affordances are associations between action and reaction on a low cognitive level. Constructed affordances occur in all modern user interfaces, and the idea of the metaphor-based graphical user interface is largely based on this concept. Donald Norman (1990, 1998, 1999) defined affordances as follows:

»In designing visibility, each function and method of operation would be apparent - to most people in the culture for which it is intended - by merely looking at it. A control that has this attribute has come to be called an Affordance.« (Norman 1998)

The metaphoric transformation of an affordance from one medium to another is the paradigm of modern computer interface design. This fact immediately becomes apparent when you look at buttons. Affordances - just as gestures - need to be learned. Yet many of them are common in our lives, and were learned as children, therefore we are not recalling that they are indeed learned. The idea

behind translating affordances to the virtual is to keep the overhead of learning low. Not much has to be learned when everything you see is common or at least somehow *obvious*.

The original concept of affordances was introduced by J. J. Gibson (1979) and comes from phenomenology. While Gibson formulates a holistic concept of affordances, Norman reduces them to their cognitive functions. Because acting is divided into several steps in Norman's view, the unity between acting and perceiving that enables affordances vanishes. Djajadiningrat, Overbeeke und Wensveen (2002) point out a mistake in concentrating only on the interface object in the interaction, as interaction has to be seen in a wider scope. Therefore they introduce the notions of *Feedforward* and *Inherent Feedback*. Overbeeke and Wensveen (2003) develop the idea of affordances further and arrive at *irresistibles*, objects that provide the aesthetic feedback that fulfils the desire to touch them. This irresistible character is clearly related to emotions (and oscillates between desire and outcome again). Hummels describes the relation between the original concept of affordances and what Norman made out of it:

> »Unfortunately, Norman and many other researchers have [...] interpreted the concept of affordances narrowly. They relate it only to the perceptualmotor skills of the user and the characteristics of the environment, but they leave the intention and the feelings of the user outside the basic concept. In practice, the concept has become even narrower. An affordance is often considered simply as a physical characteristic of the environment ... Gibson's brilliance was the unity of subject and object, which naturally includes one's intentions and every action an organism is able to perform, including imagination« (Hummels 2000, p.1.21-1.22, see also Sanders 1997 and Smets 1995)

Donald Norman himself revised his conception of affordances in the meantime (Norman 2004). His orginial concept builds on mappings. The designer maps an affordance to a concept and thus creates a perceived affordance for the user. A mapping is the process of the constructing a mental link between an action and a reaction. Mappings are established by doing something rather than by thinking about it (even though acting *as if* might be sufficient in some cases). We only speak of a mapping if the resulting gesture and response is perceived as one inter-

active process (or, put more simple, as one interaction). Everyday affordances can be regarded as essentially widely established (or arguable an inherited) mappings.

Constraints and Requirements

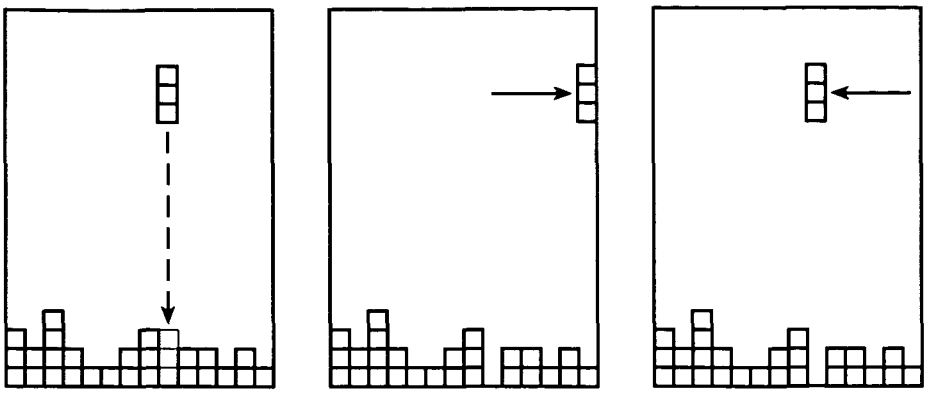
The concept of constraints is widely used in design theory. I will start to explain and discuss it in general terms and arrive at the traditional model later in this chapter. *Constraints* can act as restrictions of the user that serve a productive purpose. They can be implemented by decision. They also appear as results of technological deficits. Constrains can help to handle objects. In the natural world, the laws of physics provide a plethora of constraints, a part of which is used in a very practical way (e.g. tables would be very complicated to use were there no force of gravity). Keeping order would be hard without the physical fact that normally exactly one object occupies exactly one place in space. In media without such physical rules, constrains help the user to act by limiting her degrees of freedom but they have to be kept in mind at the design of content for the medium.

Constrains also play a prominent role in Gedenryd's thesis (Gedenryd 1998): In the chapter entitled ‹Interactive cognition› he explains the task of »doing for the sake of knowing« (that I will examine more closely in ➢ *The Interactive Design Process*) using a very basic situation in *Tetris*, the well known computer game. Here, the player moves the brick to the wall and back in order to make sure that the brick will fall into the gap below.

The original experiment on Tetris was carried out by Kirsh and Maglio (Kirsh & Maglio 1992). Their conclusion from letting subjects play Tetris was:

> »... certain cognitive and perceptual problems are more quickly, easily, and reliably solved by performing actions in the world rather than by performing computational actions in the head alone. We have found that some translations [i.e. left and right] and rotations are best understood as using the world to improve cognition.« (Kirsh & Maglio 1992)

By *using the world* they definitely mean *using constraints of the world*. While the *world* is in this situation virtual, constraints are still the mechanisms in use. By inter-



gedenryd's illustration of the tetris experiment originally carried out by kirsh and maglio. an example of the productive purpose of constraints.

source: gedenryd, 1998, p. 121

acting with borders of possibilities, the virtual world itself is understood or - to put it in more constructivistic words - generated. The situation is perceived as an interaction, since knowledge is created out of an action rather than contemplation. This affects both: the world as perceived, and the action. See also Clark & Chalmers (1998), Maglio & Wenger (2000).

Bryan Lawson discusses constraints in architecture in his design theory classic ‹How designers think› (1980, p.99ff). He separates them into various classes: *radical constraints* are those that the basic functionality of the building generates; *formal constraints* define formal visual organisation - proportion, form, colour, texture; *symbolic constraints* form the symbolic level of the resulting product. Lawson sees the use of constraints opposed to the use of criteria - predefined tests of success. *Criteria* is just another word for *requirements*, and both result from the analysis of a problem. Requirements focus on the product and define the process through the product since the test is always a test of the product rather than of the process. Contrary, constraints form the product through the process as they limit the problem space rather than the solution space (whereas requirements limit the latter). Most - if not all - requirements can be transferred into constraints whereby the problem solving process turns from solving a puzzle (as fully specified requirements turn any problem into a puzzle, see ➢ *Playing Games*) - the quest of searching for a solution until all requirements are met, to inquiry - the interactive process of bouncing against constraints until you arrive at the conscious idea that you are at the end of the process. These concepts will be discussed in the next chapter by relating problem solving habits to the creative act.

While Lawson talks about design processes and constraints in architecture, his models can be used in order to describe processes of everyday tasks, too. The

conflicting approaches via requirements and constraints vastly shape how any task of working is perceived. Constraints are fundamental ways of how the world is perceived, and thus their function lies behind all tasks - be they *design* tasks or what is considered as *use*. Any open process can only be shaped by constraints and not by requirements.

Mechanisms for User Interfaces

There are basic mechanisms in user interface design that shape the experience. A successful implementation of these guarantees more pleasure of interaction. In order to understand how a user uses an interface, the occurring cognitive processes must be understood. The section on ➢ *Perception* headed for this goal. The mechanisms discussed here were: *gestures*, *affordances* and *constraints*. *Gestures* are compound actions that impose a limited cognitive load on the subject. The are learned sequences of actions. Gestures usually cannot be stopped once set in motion. *Affordances* are mappings between actions and objects. They are inherent to the perception process of objects and make use of certain cognitive features. Successfully implementing an affordance means reducing the cognitive load of the user, because meaning is generated without effort. Affordances can be learned, just as gestures. *Constraints* are means to limit the degrees of freedom of the subject. Constraints are always present. Modelling constraints means easing the process of inquiry, as it means actively limiting the solution space. Carefully crafted constraints help to guide the user through the experience. The techniques in this chapter require to be crafted carefully in order to be implemented in a user interface. The act of design will therefore be discussed in the next section of this dissertation.

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DESIGN

»Logic (deductive logic) is an intricate game of figuring out what you've already said; it is virtually useless in everyday life, where deduction from explicitly stated premises almost never occurs.«
Ted Nelson

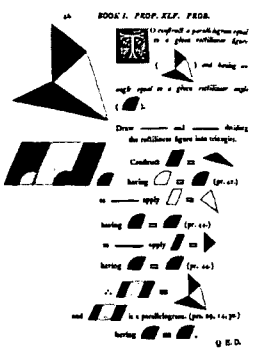
Design is as old as products are, yet the scientific discourse about design started in the 60ies of the twentieth century when the British Design Research Society and the American Design Methods Group conducted the first conferences about the methodology of design. Scientists and theorists focused on the procedure of design from the beginning, leaving out analysis of specific features of designed objects. Many of them worked towards a grand unified and generic design theory, a »normative scheme that specifies in detail a certain working procedure, the activities to perform, and also a specific order in which the activities should be carried out« (Gedenryd 1998, p.19).

In order to foster emotional entanglement, a certain design process can be established. A process that does not hinder the user from getting entangled and that gives the designer the possibility to bring in his own personal attitudes. The next chapters are dedicated to outlining such a process.

But what is design? The word design is noun and a verb - it describes the end product as well as the process. In this dissertation I focus on the process of design rather than on products. The traditional view describes design as the process of creating an entity with a functional goal. The design methodology then describes a way of accomplishing this goal. Refer to Purgathofer (2004) for a decent introduction into various views on design. A perfect starting point for departure into design thinking is expressed by Bryan Lawson, when he states:

> »The answer [to the question of what design *is*] is probably that we shall never really find a single satisfactory definition but that the searching is probably much more important than the finding« (Lawson 1980)

What happened to the world that made existing ways of designing goods seem obsolete? Why did design theorists after World War II emerge, trying to aban-



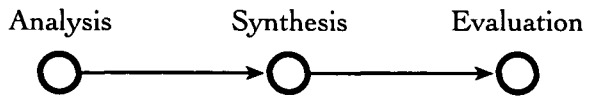
euclid`s ‹elements› in the remarkable edition by oliver byrne. the theoremes are expressed in pictoral rather than in textural form.

source: www.sunsite.ubc.ca/DigitalMathArchive/Euclid/byrne.html

don existing procedures of design by analysing and formalising them in order to build new design methods? Obviously, the production methods in the world had changed. Also, when the western world was recovering from the war, there was a push towards individuality. The resulting economic system was based strongly on automated mass production that delivered identical goods for individual customers. Separation of the task of designing a product and of manufacturing it was accomplished through automation. Design methods were introduced in hope of finding solutions to problems in a generic and formal way - and with the hope of automating the design process itself.

Design Methods

Gedenryd notes that »contemporary design methods have their roots in the pattern of classical Euclidian geometry proofs« (Gedenryd 1998, p.26). He refers to Pappus of Alexandria, who wrote about the *analycmenos*, translated as ‹The Treasure of Analysis›, ‹The Art of Solving Problems› or ‹Heuristics›. The problems dealt with in this book were assumed as essentially being design problems, and the procedure proposed to solve them is the first known design methodology. Pappus' theories were written in order to provide »a special body of doctrines furnished for the use of those who, after going through the usual elements, wish to obtain the power of solving theoretical problems, which are set to them, and for this purpose only is it useful.« (Hintikka & Remes 1974, p.8). The book is - according to Pappus - based on the writings of Euclid (the ‹Elements›), Apollonius of Perga and Aristaeus the Elder. It »proceeds by the methods of analysis and synthesis« (Hintikka & Remes 1974, p.8).



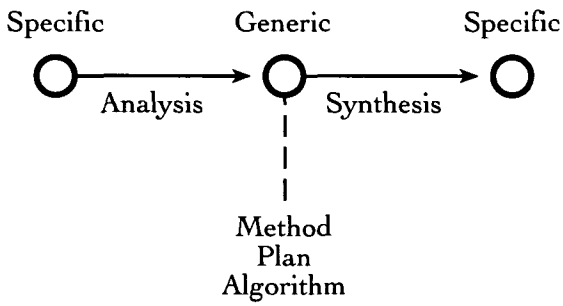
gedenryd´s summary of pappu´s general problem solving method.

source: gedenryd, 1998, p. 38

Analysis is a way of tracing back a path from the goal to the starting point. It takes the goal as accomplished and goes backward until it comes upon something that is already known - an existing proof or an atom (something that is not as-

sembled): »And we call such a method analysis, as being a solution backwards« (Hintikka & Remes 1974, p.9). Working in the opposite direction is called *synthesis*. It starts at the atoms or proven facts and goes through the steps which were discovered during analysis:

> »In synthesis, on the other hand, we suppose that which was reached last in analysis to be already done, and arranging in their natural order as consequences the former antecedents and linking them one with another, we in the end arrive at the construction of the thing sought. And this we call synthesis.« (Hintikka & Remes 1974, p.9)



in design theory, a specific problem is solved by issueing a generic plan and to develop a specific solution.

In a geometrical proof, the resulting product is the proof itself. It is constructed out of theorems that lead to it and were found using analysis and synthesis as methods. In order to accomplish this, we need to follow the order of first doing the analysis and then the synthesis strictly.

The step following synthesis is usually the *evaluation* of what has been accomplished. It is the testing out of the product. These three steps - analysis, synthesis, evaluation - form the basis of most design methodologies. They reflect the scientific approach to problem solving, coming from a mechanistic, mathematical view. In fact, Pappus designed that system in order to solve equations. Representations of modern design methods still stick to this ancient view of problems and problem solving (Jones 1963 & 1970, Alexander 1964, Cross 1984). Gedenryd mentions Alexander's ‹Notes on the Synthesis of Form› (1964) and Jones' ‹Design Methods› (1970) as »standing out in retrospect as the best exemplars and strongest representatives of the design methods era« (Gedenryd 1998). According to him

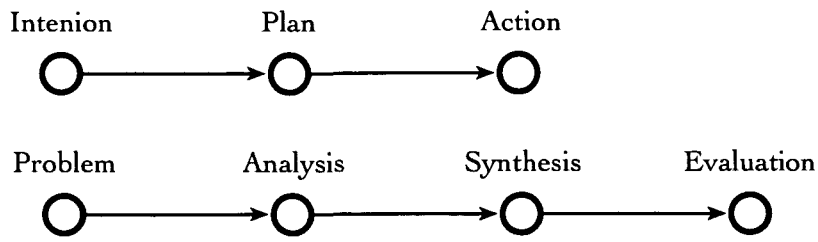
they stand out due to their clarity, scope, depth and coherence. All of them feature a *bottom up* design method describing the discrete steps of analysis, synthesis and evaluation.

While methods of proof might serve their purpose as an aid for laying out or publishing a proof by representing a concise and systematic approach, they cannot serve as the basis of a design process for even a mathematical solution. To speak with the words of Gedenryd: »Pappus' method describes the product and not the process« (Gedenryd 1998, p.62). They communicate an expert solution rather then *being* a way to the solution. Even in mathematical problem solving, one carries out tentative calculations as means of seeing what one has got or simply to test out parts of a possible solution during the phase that should be reserved to the analysis of the problem. The methods of analysis and synthesis might serve as methods of translating the disordered and distorted parts of the solution to something that someone else might be able to follow.

Modern design methods prefer a *top down* approach, where synthesis and analysis are going in opposite directions: Analysis is inferred from synthesis - the designer starts with requirements that are held equal to the axioms of analysis. So they act upon the delimiters of the goal just as Pappus' methods act on the constructed starting point. This aspect is expressed most clearly by Parnas and Clements:

> »Ideally we would like to derive our programs from a statement of requirements in the same sense that theorems are derived from axioms in a published proof. All of the methodologies that can be considered ‹top down› are the result of our desire to have a rational systematic way of designing software« (Parnas & Clements 1986)

Substitute programs and software with plans and objects and the main features of modern design methods are expressed in these two sentences. To summarise, the difference to the methods described before is the direction of analysis and synthesis: While Pappus refers to the analysis as going from theorems to axioms and synthesis as going from axioms to theorems, the modern method derives its design from requirements (that describe the end product), which are held equal to axioms although they »actually correspond to the proven theorems« (Gedenryd 1998, p.65).



gedenryd extends the scheme of *analysis-synthesis-evaluation* to a general scheme of how humans *do not* act. when we carry out an action, we would plan it upon our mental model in advance. the kirsh & maglio experiment of the last chapter shows clearly, that we do not do so.

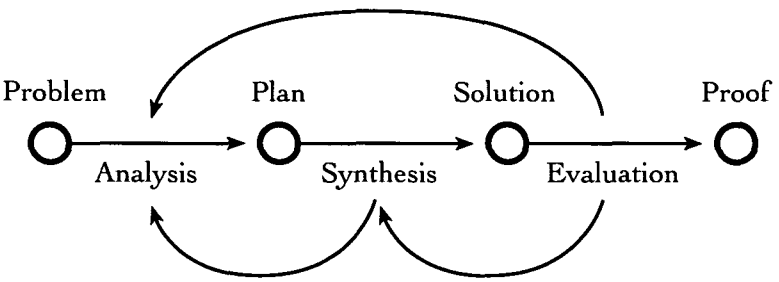
source: rework of graphics by gedenryd

On the other hand, Gedenryd goes so far as to substitute the above Analysis-Synthesis-Evaluation pattern with a more general view of human activity. This can be seen in the following diagram that shows the equivalency of the steps in these two concepts. Yet, if humans would act according to the Intention-Plan-Action scheme they would clearly need a mental model on which the plan can be developed. According to Gedenryd, this is one of the points that render the concept unusable in practical application. The other reason why he rejects these methods will be explained in more detail in the following paragraphs.

Notes on the Synthesis of Form

Christopher Alexander's ‹Notes on the Synthesis of Form› (1964) is maybe the most influential book on design methods ever written. Through the clarity of the content and the elaborate structure it quickly grew to the reference book for design theory. Alexander's motivation for writing the book was: ».. because we are self-conscious, we need to make explicit maps of the problem's structure, and therefore need first to invent a conceptual framework for such maps. This is all I have tried to do.« (Alexander 1964). During the time the book was published, it had been realised for the first time that design is a separate process from production. His very rational and objective methods stem from the effort of overcoming the unstructured approaches in design. A few years after publishing the book Alexander criticised the foundation of his own work when he said: »In short, my feeling about methodology is that there are certain mundane problems which it has solved - and I mean really incredible mundane.« (Alexander 1971). In 1980, Bryan Lawson describes Alexander's methods as »all the more remarkable since there is only one reported attempt to use the methods and that did not result in any obvious success« (Lawson 1980).

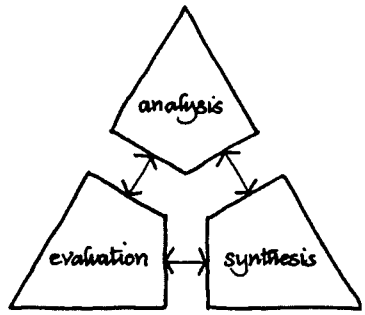
But why did Alexander's methods fail? As a quick summary, the proposal that Alexander made was to use the methods of the Greek geometers on design: analysis, synthesis and evaluation. By carefully acting them out after each other the design of a product gets crafted. Only after the complete process of the design of a product is understood the designer can start designing. Only after the problem is put in a formal, correct, coherent and complete form, the step of synthesis can be taken. Only after the synthesis results in a product, the design can be evaluated. Later design methods weaken this order of tasks by introducing circles and iterations into design, thereby making it cyclic. It was Horst Rittel and Andrew Webber who pinned the origin of severe lacks in design methods in the structure of problems themselves (Rittel & Webber 1973, also see Buchanan 1992). Rittel & Webber researched in planning theory. They defined *wicked problems* as problems that cannot be formalised in the ways Alexander and others demanded. Given the fact that the problem can not be fully formalised, how should design *methods* do but fail if a method is a way of solving formal problems?



the *analysis-synthesis-evaluation* pattern in reality: cyclic progression.

Bryan Lawson (1980) explains that there are *convergent* and *divergent* tasks in problem solving. A *convergent* task is one that has a predefined end point. Lawson mentions IQ Test questions as typical examples for leading to solutions that can be reached via convergent tasks. Yet, a simple mathematical problem might also do: Two apples plus two more apples are how many apples? A question on the colour of the apples yields a *divergent* task: There is no predefined situation when the answer will be complete and there is an infinite number of possible right answers (especially if the apples are as imaginary as the four above). The consequence of these different affordances of the tasks is that in this model, humans think in two different ways when solving problems. Guildford (1967) notes that real-world tasks rarely fall strictly into one or the other of the two above categories. Lawson states on the design task:

»From our analysis of design problems it is obvious that, taken as a whole, design is a divergent task ... Design clearly involves both convergent and divergent production thinking and studies of good designers at work have shown that they are able to develop and maintain several lines of thought parallel.« (Lawson 1980, p. 146)



bryan lawson`s final description of the relation between analysis, evaluation and synthesis: an interrelated inseparable system.

source: lawson 1980, p. 38

So design can be seen as the task of solving problems that are not fully known in advance. Problems are ends to means, since a fully specified problem implies the solution - it can be reached through convergent thinking. It is then a puzzle rather than a toy (see ➢ *Playing Games* for the distinction between puzzles and toys).

Wicked Problems

A practical mathematic problem is solved once calculated. A puzzle is solved once all parts are arranged. Mundane problems (or *tame problems* as Rittel and Webber call them (1973)) have a predefined solution - or at least a solution that can be formalised in advance. The case is different for *wicked problems*. Rittel and Webber mention ten characteristics of wicked problems:

»1. There is no definitive formulation of a wicked problem.
2. Wicked problems have no stopping rule.
3. Solutions to wicked problems are not true-or-false but good-or-bad.
4. There is no immediate and no ultimate test of a solution to a wicked problem.

5. Every implemented solution to a wicked problem has consequences.
6. Wicked problems do not have a well-described set of potential solutions.
7. Every wicked problem is essentially unique.
8. Every wicked problem can be considered a symptom of another problem.
9. The causes of a wicked problem can be explained in numerous ways.
10. The planner (designer) has no right to be wrong.« (Rittel & Webber 1973).

If a problem is not known in advance, design methods have to fail since they are built around methods of solving specified problems. Yet in the real world hardly any problem is fully formalisable in advance. Thus, design methods fail because they start on the wrong assumptions: They describe the product rather than the process (Gedenryd 1998, Chapter 2). Gedenryd outlines this fact following Pappus' argumentation (as found in Hintikka & Remes 1974) where he shows that what the Greek geometer described is a mathematical proof as a *result* or *document*, rather than as a *process*.

Why Design Methods fail

Gedenryd (1998) summarises the common properties of all design methods. Although none of the methods mentions all the following points, he argues that they are the »heart of design method thinking« (Gedenryd 1998, p.21):

»1. separation: The separation of the design process into distinct phases, with each individual activity being performed in isolation from the others.

2. logical order: The specification of an explicit order in which to perform these different activities.

3. planning: The pre-specification of an order in which to perform the activities within a phase.

4. product-process symmetry: The plan being organised so as to make the structure of the design process reflect the structure of the sub-components of the resulting design product.« (Gedenryd 1998, p.21)

We can see why every one of these properties is subject to failure: The *separation* of the design process into distinct phases can only succeed if these phases are not intertwined at all. Once there is any feedback happening and a prior phase of design has to be revisited (thereby violating the principle of *logical order*, too), the separation is rendered invalid - and according to Rittel & Webber this is always the case with wicked problems, as »every implemented solution to a wicked problem has consequences« (Rule 5, Rittel & Webber 1973). *Planning* within a phase can only be undertaken if there is a way to know when the plan is accomplished. Since »wicked problems have no stopping rule« (Rule 2, Rittel & Webber 1973), planning is impossible. *Product-process symmetry* fails because of many reasons. First of all it relies on the separation as described above. Yet, the real failure in product-process symmetry is that it needs an outline of the product in order to be established. In the case of a wicked problem, there can be no information about the product prior to the finished design, as »every wicked problem is essentially unique« (Rule 7, Rittel & Webber 1973).

Design

In this chapter I have outlined the history of design methods and several problems that occur once these are put to use. One of the major points is that the analysis-synthesis-evaluation model requires a fully formalised and understood problem in order to work. The problem has to be *given*. Additionally, the problem must have a right solution and a stopping rule that determines when it can be considered as solved. There has to be a test if it has been solved, and this test has to be known in advance. Crossword puzzles (as all puzzles) have this stopping rule. They are solved once every blank space is filled out with a letter. Most problems that are not constructed to be solved do not feature this stopping rule. An architect can not measure when he has solved the problem of building a shopping mall. He has to decide. This class of problems is called wicked problems. Wicked problems have several characteristics, and all of them resist algorithmic approaches of solving them. To summarise, there are several reasons why this ra-

tional approach of problem solving does not work on design problems. The main reason lies in the structure of real-world problems themselves.

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THE INTERACTIVE DESIGN PROCESS

The starting point for my critique of traditional design theories is the assumption that our mind works on base of mental models. The motivation for asserting a mental model is clear: it enables the individual to step beyond the immediate response of the world. Craik describes the value of mental models:

> »If the organism carries a ‹small-scale model› of external reality and of its own possible actions within its head, it is able to try out various alternatives, conclude which is the best of them, react to future situations before they arise, utilise the knowledge of past events in dealing with the present and future, and in every way to react in a much fuller, safer, and more competent manner to the emergencies which face it.« (Craik 1943)

Theories like those of Johnson-Laird (1983 & 1989) and Marr (1982) rely on intramental cognition: They are cognitive theories based on the concept of mental models. As explained in earlier chapters, strategies based on descriptions of the world - rather than on the world itself - fail to fully employ the powers of constraints. Additionally, they rely on regarding the world in a viewer-independent way. As we have seen in the chapters on perception, this generic approach does not acknowledge the unique qualities of the real world.

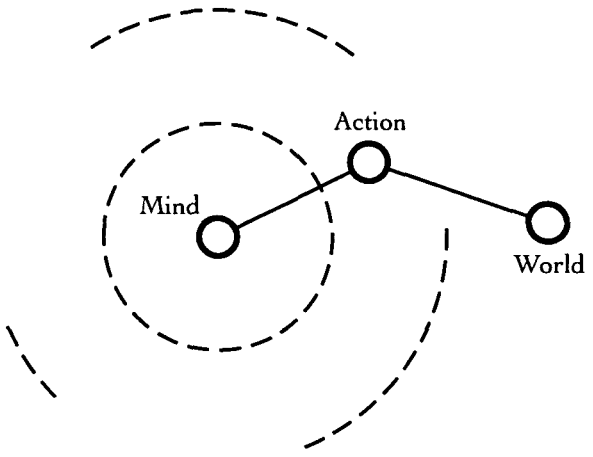
In the real world, problem solving is often approached in a different way. Gedenryd (1998) describes it as an inquiry: a dialogue between the problem solver and the matter to solve, where the problem solver de facto acts upon material. Sketching is one of the activities following this pattern, designing diagrams is another, and even discussions fall into this category. Having factual replies on concrete actions provides the designer with a finer grained view of her actions as the reactions come from a surrogate real-world representation. The detailed and precise representation opens possibilities for actions that a generic model does not, and the action on the real world leads to more concise perception of delimiters (what is not possible is not possible) than a mental model ever can. I therefore do not entirely deny mental models, yet insist - with Gedenryd and

Dewey - on the productive possibilities that lie in mechanisms working on externalised models.

Gedenryd even goes a step further in presenting findings of habits that can be read as denoting that we usually even act out things in real world with the aim of *generating knowledge*. He thereby refers to Dewey, who describes this habit as *doing for the sake of knowing*:

> »The rudimentary prototype of experimental doing for the sake of knowing is found in ordinary procedures. Then we are trying to make out the nature of a confused and unfamiliar object, we perform various acts with a view to establishing a new relationship to it, such as will bring to light qualities which will aid in understanding it. We turn it over, bring it into a better light, rattle and shake it, thump, push and press it, and so on. The object as it is experienced prior to the introduction of these changes baffles us; the intent of these acts is to make changes which will elicit some previously unperceived qualities, and by varying conditions of perception shake loose some property which as it stands blinds or misleads us.« (Dewey 1929, p. 87)

This act of *exploration* - of finding out new aspects of something in an interactive process - is what happens when a speaker asks questions in order to find out his own situation in a dispute. It is what programmers do sometimes, when confronted with a new programming language (when they apply the knowledge from a previously learned one to the new one, just to *find out*) or new problems. It also



the act of *doing for the sake of knowing* establishes a tight connection between the world and the mind over actions.

source: gedenryd 1998

resembles the process of appropriation of architecture as described by Benjamin in the chapter ➢ *The Architecture of the Virtual*: We touch and explore a building literally in order to understand its architecture.

Exploration can be seen as a method of limiting the amount of knowledge in use. It is a process of focusing and evaluating, an experiment without an aim. Exploration is the interactive process per se, since its sole purpose is to gain knowledge and test memorised knowledge against the real world, thus an act of evaluation and re-evaluation:

> »This is much of what an infant does when he explores the world around him, what an artist does when he juxtaposes colors to see what effect they make, and what a newcomer does when he wanders around a strange neighbourhood. It is also what a scientist does when he first encounters and probes a strange substance to see how it will respond.« (Schön 1983, p. 145)

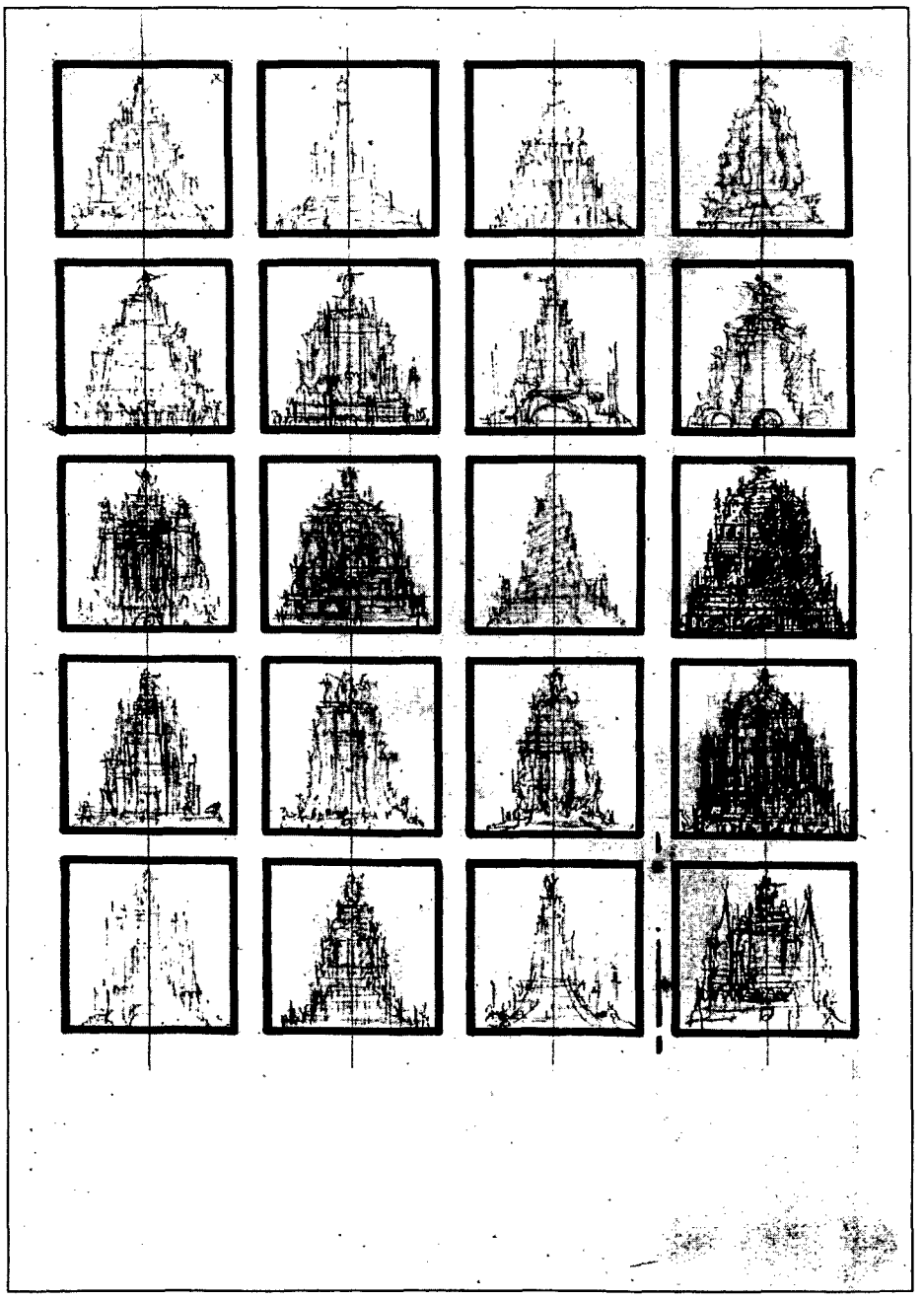
Exploration is a basic form of *experimentation*. When exploration is the aimless searching (while following sub-goals), experimentation is the process of getting to a self-assigned goal by experimenting. It is what happens if a small child tries to build a Lego house. In speech, it is the process of dialogue, where a speaker tries to make a point or find out something specific. It is driven by a certain goal, but the path to the goal is affected by the situation (and even the goal might change under circumstances).

As exploration, experimentation is based on evaluation. Evaluation is nothing else but simulation, the act of trying out with a certain expectation. While traditional simulation in cognitive science relies on an intramental simulacrum - a model of the real world on which the experiment is carried out - the experiments we are talking about here are acted out in reality:

> »Why are experiments (and simulation) in the physical world superior to models and simulations in the head? The reason is that you want to find out both what you *can* figure out and what you *can't* figure out, i.e. what you cannot simulate mentally. That is, you want to know also about the

effects of your actions that you cannot predict or foresee.« (Gedenryd 1998, p.129, italics his).

The mental model can never provide this kind of feedback. All it can ever lead is based on what we already know, it cannot provide us with information about what we can not predict. Design theories involve mechanisms to bypass this restrictions on a social level: e.g. teamwork and reviews, the aim of which is to provide us with different viewpoints while still maintaining a rational model.



a page of sketches by jakov cernichov. chernichov emphasises the value of sketches for research, experiment and education.

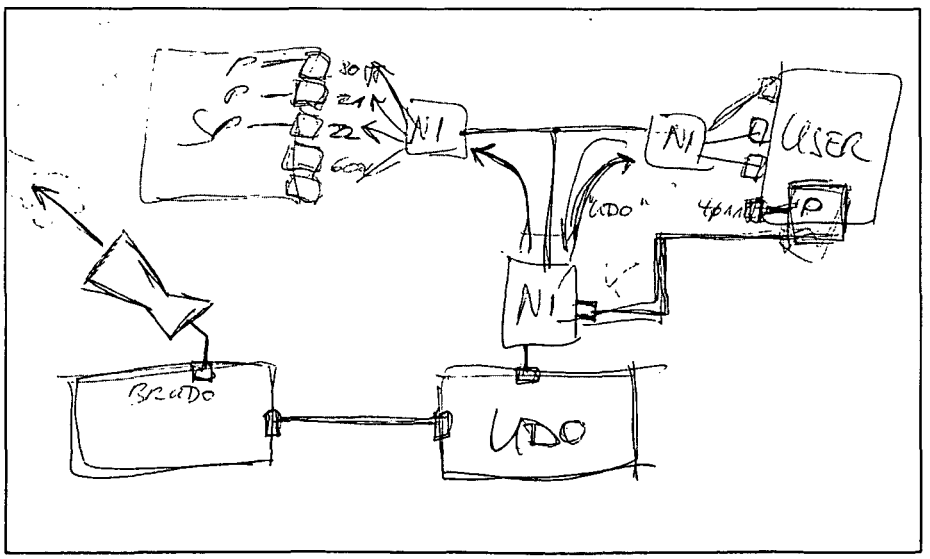
source: cernichov, 1995, illustration 175

Materials for Inquiry

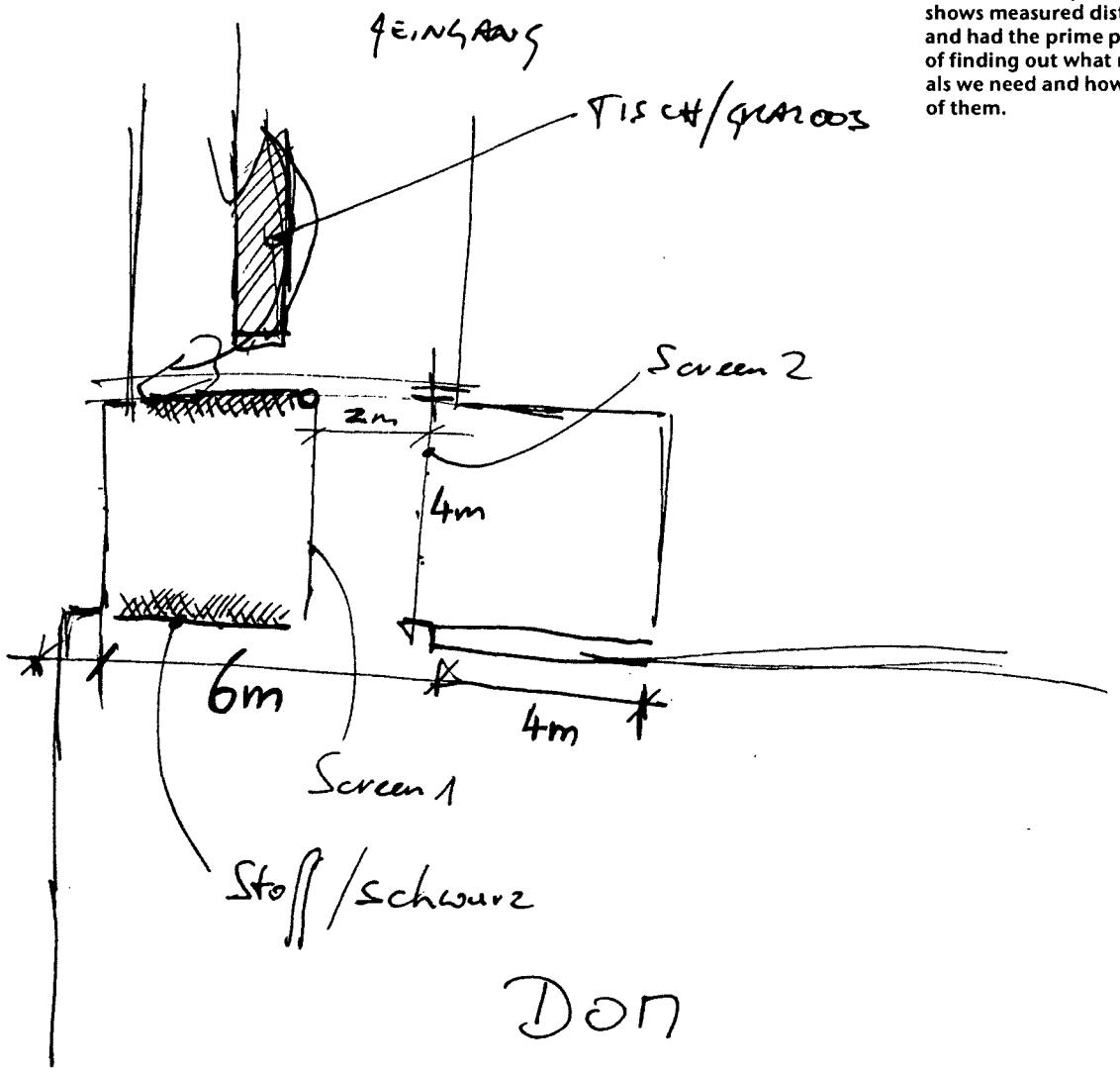
The last chapters have shown that traditional design methods rely on mental models and stringent patterns of analysis, synthesis and evaluation. So far, this chapter dealt with introducing a new approach to problem solving theory, the experiment in the real world. In order to design on base of this new approach, we need to develop surrogate realities for simulation: We have to create artefacts or *instruments* that allow real world problem solving on a scale smaller than the entire design problem. The instruments for these substitute realities Gedenryd discusses are *sketches*, *thumbnails*, *roughs*, *prototypes*, *scenarios* and *simulations* (Gedenryd 1998). When played through in that order, complexity (and therefore detail) increases from thumbnail to scenario. A thumbnail is a very rough representation and a scenario builds on a very detailed world for exploration. Gedenryd thus recommends to apply them in different stages of design. The more complex the design gets over time, the more complex the working model has to get. Authors of design books even explicitly advice the reader / designer to leave things as simple as possible in the beginning:

> »Construct the fist version completely by hand. Sketch the widgets, hand-letters as labels. Don't even worry about using a straight edge at first. Just get the ideas down on paper.« (Rettig 1994, p. 25)

This resembles the rules that regulate the idea generation process of *brainstorming*: No discussions during brainstorming - Note everything - Don't watch the



the very first sketch for *udo*, a project i did for graz 2003. the different boxes depict different subsystems.



a rough floorplan of the exhibition setup for *udo*. it shows measured distances and had the prime purpose of finding out what materials we need and how much of them.

form of the notes - Just get the ideas down on paper. Again, the heart of the design process is the layout of a situation (a structure) in which the techniques involved might evolve as good as possible. This structure is organised as a set of constraints. Thumbnails constrain the designer because they are small in size and thus not detailed. Rough constrain the designer by allowing only undetailed images. Prototypes constrain the designer through not providing all features of the final solution. Scenarios constrain the designer as they define a starting point, a landscape to dwell in. Even simulations actively constrain the designer as they never have the detail of the real product. All these tools work on different levels of abstraction - and their sole aim is to focus the decision making process through constraints. Sketches differ since they give the designer the opportunity to use constraints as an instrument - they allow for varying degrees of detail.

Dynamics of the Design Process

An important fact about design instruments is that the results of applying one technique affect both the domain of the problem and the solution's. As real world substitutes have the power to help finding out what the designer *does not know*, knowledge is injected into the design process. Thus, the problem domain might get extended or contracted. Consider e.g. an architect that has to design a building on a hill. An initial sketch of the landscape with just a block at the position of the building might yield information about how the road up the hill will have to be built. This information might then contribute a whole new problem set - how to build the road - to the problem domain or show that it is anyway best to build the house so close to the bottom of the hill that the existing road can be used and thus eliminate one aspect of the problem domain.

As tools moderate the interaction between the material and the subject, a design process can be defined based on these tools. Bryan Lawson (1980) proposes strategies and tactics as the means of working out a design process. Tools shape the direction of thoughts and are able to emphasise certain aspects of view whereas tactics usually aim at »controlling the direction and quality of thought« (Lawson 1980, p. 206). Tools impose a certain tactic upon the designer whereas certain tactics are best explored using specific tools. On the ground of these tactics, Lawson reviews Edward de Bono's (1967) concept of *lateral* and *vertical* thinking. In short words: Vertical thinking makes us dig a hole deeper and deeper, whereas lateral thinking makes us dig another hole somewhere else.

One of the strategies Lawson explores in detail is the *primary generator*, an initial idea that is followed through the whole design process (Lawson 1980, p. 193f). Other discussed tactics include e.g. the *generation of alternatives* (Lawson 1980, p. 215f). Tactics help either in keeping the design process on track, in deepening the understanding of a certain aspect of the design, or in finding other aspects in the design that need to be explored further. Generally, tactics and strategies (their long-term equivalents) help providing goals - but they will always rely on instruments and tools. Lawson uses the concept of strategies and tactics in order to embed practical tools into a process.

The Interactive Design Process

In this chapter design methods were discussed that acknowledge the inherent difficulties imposed by wicked problems. Starting from a more detailed cognitive theory on how we act in the real world facing a new problem (and design problems are always new) that was explained following Gedenryd's dissertation (built on e.g. Kirsh & Maglio's (1992) experiments and Dewey's ‹Theory of Inquiry›, 1938), an interactive way of problem solving was proposed and translated into a framework for the design process. In this process, design is managed via setting up an environment or structure for model-based problem solving using prototypes, controlled experiments and the like. Local design tactics and global design strategies as discussed by Lawson (1980) also depend on tool relationships.

The next chapter will be dedicated to finding out what (design) tactics are used by the user of a digital device in order to build a emotional relation to that device. The strategies discussed in this chapter will be applied to design situations that rely on user participation. Thus, proposals for a design process will be made that lead to products allowing positive emotional stimulis.

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EVERYBODY IS A DESIGNER

»A space can only be made into a place by its occupants. The best that the designer can do is put the tools into their hands.«
Harrison & Dourish, 1996

The last chapter ended with the description of an interactive design process, where the results of one step always have an effect on the next step, a design process that acknowledges that design is not solving a puzzle but resolving a contradictory situation. This implies that choices can not result in right or wrong solutions but rather in *good* or *bad* solutions. The aesthetic outcome also refuses to be judged in terms of *right* or *wrong*. Bryan Lawson (1980) summarises design processes as massively parallel. Gedenryd (1998) argues that every part of the design process is interacting with every other part, therefore there cannot be pre-existing goals that would be reachable using generic methods. Rather, design (as all authoring tasks) is an adaptive process - an interactive task - where every participating entity continually contributes to the overall goal, thereby biasing the process itself. Design is an inquiry, just as most acts of problem solving are (Purgathofer 2004, pp. 24-56).

The importance of instruments for shaping thoughts was first discovered by John Dewey (1938). Engeström (1993, 1999) contributed to activity theory that also proposes that interaction emerges between subject, object and tools. It is Gedenryd (1998) again who stresses the importance of choosing the right tool for the right task, according to the constraints the tool imposes upon the designer. Working actively with constraints seems to be a fruitful way in order to accomplish design goals. Once the designer hands over the product to the producer, the act of design is not over. Even when the customer holds the good in her hands, the design process is still ongoing with the user as the last designer of a product. She may misuse it for another purpose than it was designed for (think of the many uses a cigarette lighter is put to) or redesign it aesthetically. Design does not end before the product is disintegrated.

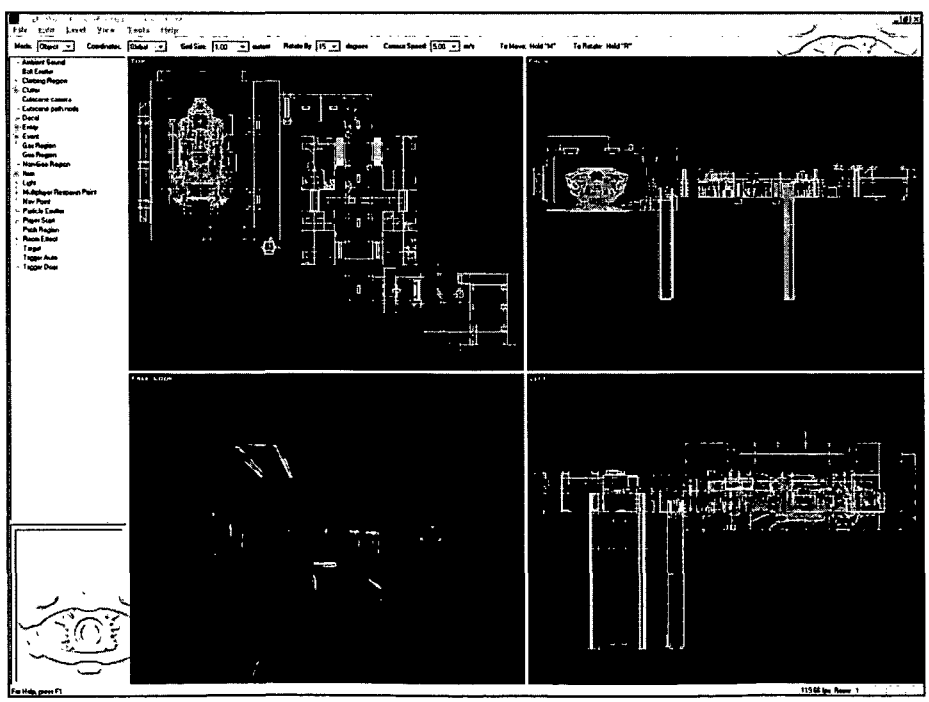
Designing the digital home

In the epilogue of ‹Designing Emotions›, Donald Norman concludes that:

> »We are all designers. We manipulate the environment, the better to serve our needs. We select what items to own, which to have around us. We build, buy, arrange, and restructure: all this is a form of design.« (Norman 2004)

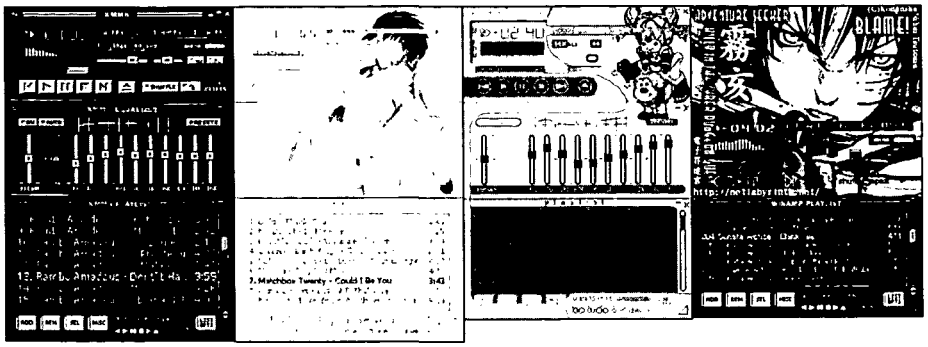
There is software that partly acknowledges the ideas outlined above by putting the user into the role of a designer - it does not separate authoring of the product from authoring of content using the software. All open source software falls into this category as it is possible for everyone to edit the source code of the software itself. Many first person shooters (as *Jedi Academy, Unreal Tournament, Red Faction* and *Quake*) offer level editors that make them customisable by the end user. So called modifications (short: *mods*) allow entirely changing the look (e.g. architecture, textures, models) and feel (e.g. gravity, material quality of surfaces) of a game. Partly due to this fact large communities gather around such products.

The root for these mechanisms is *customisation* - the possibility to shape a software product's look. *Skinning* is one method to achieve this: the pasting of images on



the level editor of red faction, a first person shooter game. level editors are a quite literal way of designing the digital home. in many cases, they also provide means of shaping interactive behaviour through scripting.

source: www.redfaction.com



four skins for winamp and one skin for the linux-based equivalent xmms that makes it look like winamp (leftmost). skinning is one of the most basic methods of personalisation through customisation.

source: (from left) users.verat.net/~urke_kg/linux/screens/xmms_with_winamp_skin.png, www.bigess.co.uk/images/winamp.jpg, www.flashbunny.com/img/rbwinamp.jpg, netlabyrinth.net/images/Killy03WinampScan.jpg

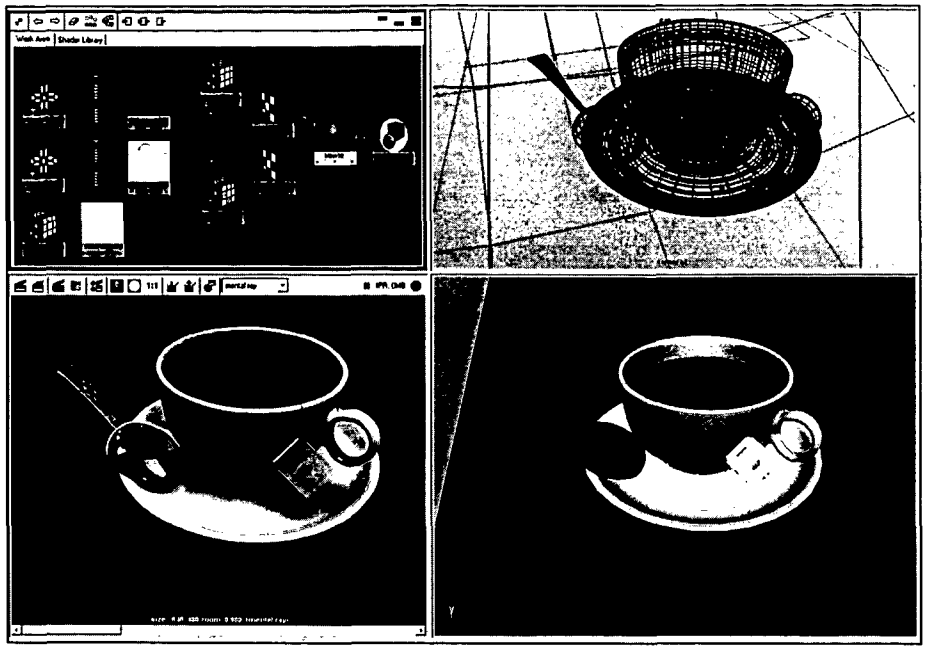
interface components. Customisation is a prime requisite for *personalisation* - a broader conception of the process of adapting a tool so that it is considered as personal. Yet skinning is always only decoration. The way we lay out folders on the desktop (if our operating system lets us do so) is another, rather primitive, example of personalisation. Even in this case, personalisation is limited to visual appearance - but since the desktop is a visual interface to an underlying structure, the layout affects this structure (i.e. the file system) too. On the other hand, some productivity software applications even allow editing components of the product itself within the product.

Programming for Non-Programmers

Alias|Wavefront's *Maya* is to a vast degree scriptable and extremely extendible. The scripts may be written within the software and affect even user interface behaviour and thus program logic. Maya is one of the prime tools for 3d modelling, used in projects like Hollywood movie productions.

In the screenshot on the next page, we see an example of how a person not capable of using a programming language can program in Maya. For applying filters etc. on textures, Maya uses a so-called *patcher*. A patcher is a visual programming environment based on objects that are linked together with *patch cords*. These cords determine the program flow.

This model resembles more or less the analogue synthesizer, and it is no wonder that it is widely used in music software, too: Max/MSP, jMax and other music applications offer patcher environments. Another example of this class of software is *Pure Data* (short *PD* for convenience), an open source real-time multimedia authoring environment that can be described in terms of a visual program-



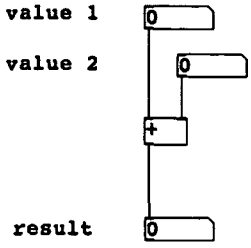
in alias|wavefront`s maya, a dependency graph is used to manage textures (upper left corner). the tea stain on the table is combined with the wood material and then linked to the object through outlining it graphically. the top right image showes a wireframe model of the scene. the lower right image is software-rendered. the lower left image shows the final rendered scene.

source: thanks, juergen

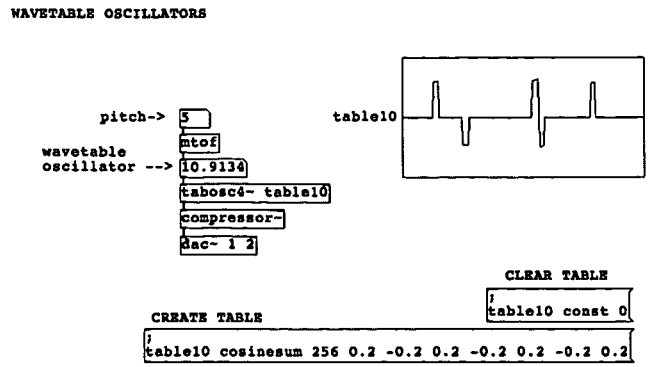
ming suite. In PD, every user is a programmer, and due to the origin of the software as open source software, every programmer is a user.

Pure Data is features a kernel - the application itself - and a constantly growing amount of plug ins (so-called *externals*) and plug in collections (termed *libraries*). I have used Pure Data in several projects and even contributed some functionality. There are libraries for 3d graphic programming (GEM), video processing (PDP, framestein, GEM), physical modelling (pmpd), network communication (via OSC or audio streaming), audio filters (iemlib), programming language support (pyext, kcext), non-realtime audio handling (vasp) as well as a c++ front-end (flext) and many others.

The crucial point is that software like PD allows non-programmers to do tasks that require programming. This is achieved through an interface that lets users become programmers. In this regard, Pure Data is more influenced by the com-



a simple *patch* in *pure data* for adding two numbers. the flatter boxes are editable number boxes and the box with the text ‹+› inside is an object that performs the corresponding calculation. the result will flow into the bottom box labelled ‹result›.

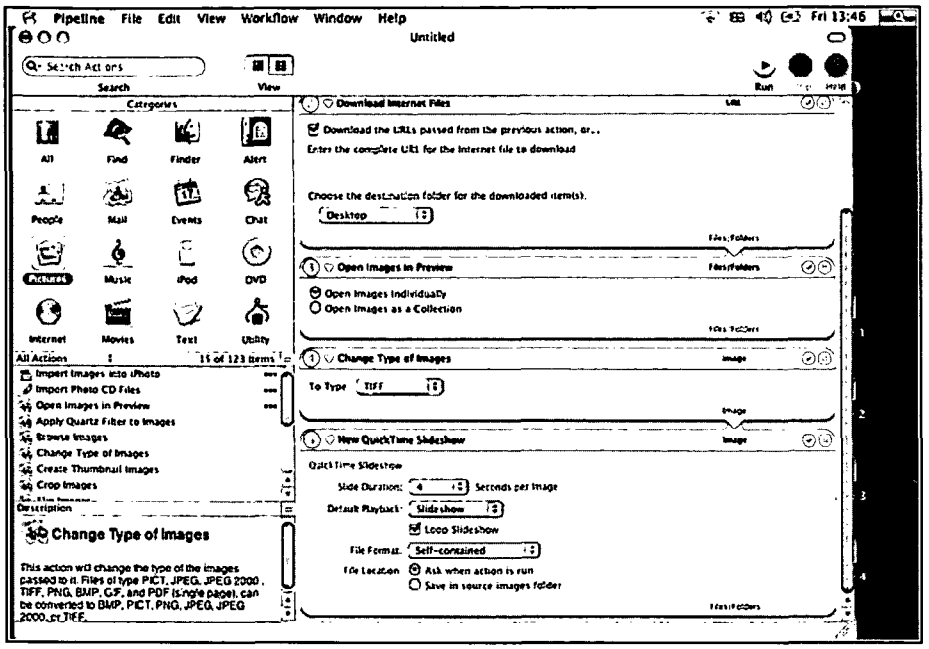


a *patch* in *pure data*: on the left side, data flow is indicated through the vertical lines connecting the boxes. the waveform on the right is a visualisation of a table, initialised and cleared through the buttons on the lower side.

mand line - the traditional mean of end-user programming - than by classical direct manipulation applications (Pflüger (2004) summarises the development of user interfaces in that regard). Another important fact about such software is that it changes the process of creating a product: Due to the fast and convenient work-style one can use it for interactive design purposes - working with it has the characteristics of an inquiry. It also allows for the creation of very detailed prototypes - too detailed for early design stages, yet perfectly fitting for the final phase, before implementation starts. I used exactly this software to build a working prototype for a wearable art piece that preceded the seven mile boots (see the appendix for details about this project) within only two weeks. The working process in this two weeks was inherently dialogue-based, as we were developing in a group of three people. We brought the base systems with us for building the prototype: A PDA running PD, a micro controller with attached sensors and a jacket that would be fitted out with the equipment. Sadly, we did not have time to document our progress.

Developments in other areas show that the interface of the patcher is gaining more attention recently, OSX version 10.4 labelled *Tiger*, scheduled for release in the first half of 2005, will feature an interesting application called *Automator*.

Automator allows the user to design a patch - a graphical outline of program code (see above) - that does arbitrary tasks such as generating a slide show out of a set of images that are first to be converted to gray-scale colours using an image processing filter. To generate such a patch, the user does not have to type a single line of code, yet she gets access to a fair amount of the capabilities that a software offers without using the software's user interface. Every application exporting its functionality to Automator widens the space of possibilities for the end user.



***automator*, a new application that will be part of the upcoming macintosh os x release features a patcher interface. the data flows from top to bottom. the connections are visible near the scrollbar.**

source: www.apple.com

As mentioned before, the user becomes the designer of her own software products, and software merely forms a base of constraints for the user. This situation is usually referred to as *End-User Programming*. According to Myers & Burnett (2004, based on Boehm & Abts 2000), »the number of end-user programmers in the United States is expected to reach 55 million by 2005, as compared to only 2.75 million professional programmers«, thus more research into this topic is to be expected in the next years.

All of the above examples share the spirit of handing over more control to the user. They acknowledge the principles of adaptable interfaces. This adaptation realises more interactivity between the user and the material and therefore fosters immersion necessary to get into an emotionally pleasant state of mind. Once the technological character of the interface vanishes (Streitz 2001), the user stops thinking in terms of working *with a tool on* material but in terms of working *on* material: The tool feels like a part of the user. Strategies to achieve this vary, depending on the material and the tool - and thus the process of working. It is important to note that the tool itself is still present and the joy of working comes to a vast degree from the ability of being able to learn to work with the tool.

Participative Design

There are more approaches to including people into the design process. These efforts stem from the observation that users often have difficulties in explaining their needs. Even interviews and other accepted techniques of acquiring user requirements often fail to uncover fundamental needs:

> »This information is often difficult to obtain from just talking to people or observing their behavior, and these difficulties have led to the misconception that people do not know what they want or cannot tell you what they want. We believe, though, that people have a latent sense of what they want, which may not be easily expressed through conversations or interviews.« (Gage & Kolari 2002)

In order to uncover this latent knowledge of the peer group, design has to explore different modularities of the interaction between people and the object in question:

> »When all three perspectives (what people do, what they say, and what they make) are explored simultaneously, one can more readily understand and establish empathy with the people who use products and information systems.« (Sanders 1999)

Tools have to be invented for this purpose, so that they allow the potential user of a future system to enter a state of mind allowing her to express her needs. E.g. Svanæs & Seland (2004) propose the »Workshop as a Design Method«, thereby working with low-fi prototypes and role-playing elements, and:

> » ... have found role playing and low-fi prototyping to be of particular value ... Our workshop format allows for the simultaneous exploration of future use and future technology. That is of great value in the design ... where we simultaneously need to design their use.« (Svanæs & Seland 2004)

The underlying assumptions leading to the thought that a major part of the design can be handed over to the user, are:

> »All people are creative. All people have dreams. People project their needs onto ambiguous stimuli. People are driven to make meaning and will fill in what is unsaid or unseen.« (Gage & Kolari 2002)

All these facts were discussed in this dissertation to varying degrees. The crucial point is to develop tools that allow people to participate in design. These tools have to be constrained (as described in the chapter ➢ *The Interactive Design Process*) as the user has to express herself as clear as possible. Thus they consist of items that »resemble items in an elementary school classroom« (Gage & Kolari 2002). The difference between traditional design and this new approach is summarised in the following statement:

> »Traditional design research methods were focused primarily on observational research (i.e., looking at what people do and use). Traditional market research methods, on the other hand, have been focused more on what people say and think (through focus groups, interviews, and questionnaires). The new tools are focused on what people make, i.e., what they create from the toolkits we provide for them to use in expressing their thoughts, feelings and dreams.« (Sanders 2004).

The characteristics of design tasks were explained sufficiently out in this dissertation. It is important to notice that the tools described above are only useful in early stages of design. Tools for the later stages of design were described in the beginning of this chapter. We arrive a situation that is to be considered as new: The user participates in the creative process of design in all stages of the development of a product. The product is not as much the good handed over as the goal the user sets. The designer in a mediated environment only provides instruments that foster the abilities of the user. Emotions come into play as the user has the opportunity of establishing an emotive connection to the object(ive):

> »By identifying the key moments in their desired experiences, emotions associated with those moments, and the specific components that can

provide these feelings, a foundation for applying the processes of experience design is established.« (Gage & Kolari 2002)

Reality Check

There are voices in the design community that demand the same relevance to the emotional side of an experience as I do (see Forlizzi 2004 for an overview). Although they end up at different advices for the future, they agree that emotions are general and inevtitably shaping all experiences:

»... designers are becoming aware that emotions are not a luxury, but a necessity in rational decision making. ... We think the interaction with physical objects opens up other ways of detecting the emotional state of the user. Our interaction with the real world expresses our emotions.« (Djajadiningrat 2000)

The link to the expression in the real world is understood by most design theorists that talk about emotions and design. Wensven & Overbeeke (2000) read from it, that products should be capable of understanding the user's needs:

»... we argue that emotions and actions are closely intertwined. We use actions as the source of information to get to emotions. Indeed, people should be able to communicate their emotions *to* the product, not *at* it.« (Wensven & Overbeeke 2000)

Peter Desmet is researching the relation between the user and the object as product. Static objects as products bear a resemblance to interactive objects, yet some factors are different in product design than in interaction design. Interaction design can and should be a part of product design. In his model, Desmet focuses on emotions and appraisal:

»... emotional responses are regarded as the outcome of an appraisal process in which the product is linked to underlying human concerns. If a product is appraised to collide with a concern it will evoke an

> unpleasant emotion, whereas it will evoke a pleasant emotion when appraised to correspond with the concern.« (Desmet 2004)

As an outlook for further investigation he highlights the research done by Gutman (1991), who found that general values and their classification can not provide an understanding of the link between the consumer's aspiration and concrete aspects of the product. On the other hand, Desmet notes:

> »... stronger relationships may be found between human concerns and emotional responses when the focus is on instrumental rather then general values. In our future research we will aim to find methods and instruments that can be used to understand the relationship between emotional responses to products and the full repertoire of underlying concerns.« (Desmet 2004)

Everybody is a Designer

In the beginning of this chapter techniques that currently govern the modalities for establishing an emotional link between the user and an interactive product were discussed. Starting off from primitive ways of *personalisation*, as *skinning* and *level editors* for computer games that mostly aim at changing static factors or the decoration of the working environment, ways of personalising the dynamic behaviour of software were approached. The focus thereby was on mechanisms that do not require text-based programming but still manage to empower the user through visual programming. Currently, *patcher* environments form one of the most common visual programming interfaces. The second part of this chapter was about ways of embedding the end-user in even earlier design stages. Recently, a lot of research was done in that area, yet the proposed techniques have not left the experimental state. Further research is necessary in order to develop work-styles for designers that build more strongly on user participation than it was usual in the past. The title of this chapter is a close relative to Don Norman's Epilogue ‹We are all Designers› (Norman 2004).

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DESIGNING FOR EMOTIONS

»It wasn't that the designs themselves were emotional, or elicited strong emotions beyond curiosity. Instead, they served well to create a space in which emotions could occur, but not be directed, a space in which communications created by the elders elicited intrigue and curiosity in viewers.«
Gaver, 1999

This book is dedicated to exploring a design process that fosters the consideration of emotions in interactive systems. This last chapter summarises the findings of this dissertation and presents them in a structured and organised way. Still, many aspects will be left open since the topic itself demands openness: Emotions cannot be summarised in a table and can neither be described using the traditional means of analysis and synthesis. This dissertation merely proposes relations and makes connections between several areas of research that contribute to the ongoing discussion about emotions. It was my aim to outline how complicated the matter of emotions is rather than to simplify it - and thus to propose strategies to deal with emotions rather than providing solutions. I hope I was able to shed light on fundamental aspects of design and emotions in interactivity.

Making Sense

We already encountered astounding discrepancies between design theory and practice. While most design theories, as other scientific theories, strive for keeping emotions out of scope, design practice is embracing them. When you ask a designer how she defines her work, you will likely hear something along the lines of *design is about emotions* as an answer. Design practice acknowledges the fundamental role of emotions in everyday life. Design theories do not assign a marginal role to emotions or deliberately exclude them; emotions are simply not part of most design theories. Old school theories achieve this through formalisation of the design task on the basis of rational models. These rational models build on a formalisable view of cognition. But even enlightened *open process* models do not touch emotionality.

There are a number of cognitive theories that try to explain how we generate meaning out of perception. The theories I explained in this dissertation were

embedded in concepts of the general task of problem solving. The epistemological frame is laid out by the Constructivists around Heinz von Foerster and Ernst von Glaserfeld (1992). They describe the world as entirely constructed personal reality. Even the human senses can be examined from different perspectives. While some researchers prefer to view them as interfaces to the environment, others insist that cognition plays a more active role. In the corresponding chapters (➢ *Perception*) I discussed the perceptive capabilities of humans and the various interrelations between the senses. Generally spoken, perception is not passive but an unconsciously active act. In addition: different senses affect each other, and the reception of a situation is thus based on complicated operations that require intramental and extramental sources of cognition. That means: When we generate meaning we rely on the mind, the world, and some negotiation between them. This negotiation is on one hand aided by internalised information about the world acting as expectation (based on knowledge) and on the other hand by externalised expectations through inquiry (a form of interactivity). This interactive cognition process is based on the ‹Theory of Inquiry› by John Dewey (1938). Recent research results in human computer interaction (as the experiments of Kirsh and Maglio, 1992) can best be understood on base of this theory. Emotions arise at discrepancies between expected and actual outcome. As explained in the chapter ➢ *Emotions*, they can range from slightly affecting the experience to fully dominating it. They are interrelated with our attitudes (Dewey 1894, 1895). Emotions are not either there or not there, but continually shape our thoughts and habits to varying degrees. Thus, emotions are a ubiquitous feature of human action.

Narrativity and Metaphors

Marie-Louise Ryan argues that all problem solving acts are narrative (Ryan 2001a). If a narrative structure needs only actors and events in order to emerge, all causal relationships can be regarded as narrative. Therefore in the mind of a person narratives emerge whenever she is exposed to anything (since the spectator is the one actor needed). While the process of generating meaning is sometimes mediated (e.g. stories, explanations, software tutorials and manuals), it happens on a subliminal level more often than not (e.g. learning by doing, watching others).

Metaphors are a basic means of narrativity. Lakoff & Johnson (1980) traced the origin of all understanding to a handful of primary metaphors; e.g. the schema of *containment* as the separation between inside and outside of our body and the pattern of the *journey* as the basic rule about causality and intention. They argue that we learn and understand by means of metaphors. Therefore metaphors shape the quality of experiences and in the case of being manufactured consciously they are the most basic way to manipulate qualitive aspects of meaning. We have seen that metaphors are based on substitution: something depicts something else. Metaphors can be located on several different levels of communication, and metaphors are the prime means of shaping the perceived - they are mere proposals for forming an inquiry.

Here, the narrative is the sole instrument of entangling a user so much that she enters an immersed state or at least a state of being emotionalised. Therefore, a narrative structure is necessary whenever immersion takes place. Like metaphors, narrative structures are generated by the user during the inquiry. Like instruments, they can be seen as structures - something that gains meaning during use and shapes the direction of an act of inquiry.

The Practice of Inquiry

Communication forms the base of every interactive inquiry. It relies on a signifier and a signified. Signs and symbols incorporate meaning - according to Julian Kücklich (2003) (following Charles S. Peirce (1935)):

> »A sign is something which can be interpreted infinitely, a process in which the sign gains complexity and meaning. This infinite semiotic process is the way in which we usually make sense of the world, without ever actually perceiving anything but signs. ... The actual construction of the narrative is always done by the player by taking the signs on the interface and interpreting them further.« (Kücklich 2003)

In this sense, the narrative itself is not part of any tool or instrument, it merely constitutes during the process of use. Thus, the user generates the narrative and is therefore the ultimate author of any experience.

Numerous attempts have been made to incorporate narrative structures (i.e. structures that allow the user to experience narration) into user interfaces, the most prominent are agents modelled as interactive actors (Bringsjord 2001, Loyall 1997, Marsella & Gratch 2002), computer games, and the translation of objects of everyday life into metaphors (i.e. desktop - see Tomitsch (2003) for a deeper discussion of the desktop). Agents use emotions primarily as content. Computer games focus on immersion through providing emotion-laden plots and settings, and adrenaline pushing interactivity. Yet emotions can also act as a direct communication channel. Examples are the trash can metaphor and warning signs in dialogue boxes. These do not tell an emotionalised story but indicate (and often also trigger) an immediate emotional response.

The primary method of constructing a narrative meaning out of the partially perceived is *closure*. Closure is the act of (inductive, not deductive) logical inference on a very low cognitive level - it is reading incomplete signs. Closure is largely based on experience, attitude and instinct - concepts that bear a tight relationship to emotions. William Gaver, known for his early project in audio enhanced

scott mccloud on user participation and closure. through not showing the crime that happens between the panels, the user has to comit the crime as an accomplice.

source: mccloud, 1994, p. 68

interfaces *Sonic Finder* (Gaver 1989) recently published a paper suggesting that HCI research should abandon the »twin goals of HCI research and development« (Gaver & Beaver 2003) - usability and usefulness - and exploit *ambiguity* instead. He argues that ambiguity can be »intriguing, mysterious, and delightful« (Gaver & Beaver 2003) - factors that clearly formulate an emotional standpoint:

> »By impelling people to interpret situations for themselves, it encourages them to start grappling conceptually with systems and their contexts, and thus to establish deeper and more personal relations with the meanings offered by those systems.« (Gaver & Beaver 2003)

Considering Kücklich's statement above, ambiguity prevents the sign from gaining a too specific meaning over time. That way it keeps the process of interpretation running.

Designing for Emotions

Design should be an open and holistic process. A proposal for structuring a design process that fosters the development of (pleasant) emotions was made in the last chapters. It builds on Gedenryd's (1998) tools for inquiry and Lawson's (1980) strategies and tactics in design. On top of these design techniques (I restrain from calling them methods) I introduced a factor new to the interactive design process: the end-user. By including potential users into such an open and holistic design process and establishing situations that allow them to express themselves, design gets personal. Setting up a link between the user and the product is a prime requisite for making emotions emerge. Letting the designer work with the user generally opens up a lot of possibilities.

In interactive systems, emotional responses can be incorporated by allowing the user to affect the interactive behaviour of a system. End-User Programming provides the user with facilities to alter her task environment. Upcoming developments in this area show that visual programming applications are finally to reach the everyday desktop. Then, the software is a framework of constraints that help the user to focus on solving a tasks. It has to provide an environment that enables the user to test what she is constructing in a real-time What-You-See-Is-What-You-Test situation (Myers & Burnett 2004). Such environments turn the

computer in yet another design instrument that is not bound to a specific modality or method of working, but gives freedom for expression and experimentation. This principle acknowledges a fundamental fact; the user is the last designer of a product. Design that fosters emotionality has to happen entirely in a process of inquiry.

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APPENDIX A : RELEVANT ART PROJECTS 2002-04

In this appendix I will give a short overview of my art during the time I worked on this thesis. Some of the art pieces were mentioned in the text, others not. I use texts that were in most cases written collaboratively. The purpose of this chapter is to allow the reader to understand more of the context explained by the theories in this dissertation as well as to show some practical applications.

sevenmileboots, a wearable project (2004)

with Laura Beloff/fi and Erich Berger/at
shown at *kustnernes hus*, Oslo / Norway
shown at *isea2004*, Tallinn / Estonia
shown at *ars electronica 2004*, Linz / Austria

On foot in the medium of possibilities; walking on line.

Seven mile boots, the magical footwear which is known from folk tales enables its owner to travel seven miles with one step. With little effort one can cross the countries, to be present wherever it seems suitable and to become a cosmopolitan flaneur with the world as a street.

Chatting in the net has become a phenomenon during the last decade. There is an endless communication among the online communities in the chats. Walking and wearing shoes is an everyday exercise for humans. The seven-mile-boots piece is built upon feet and shoes as an interface to move in this text-based non-space of the chat rooms.

The visible/physical part of the piece consists of a pair of boots, which are available for use. The boots have two different modes; walking through the net and standing/ listening/ observing the chat-activity.

The seven-mile-boots can be thought as a hole which is attached on the body of a user. Through the hole s/he is »seeing« behind it, at the same time s/he is aware of the hole itself in a physical environment and the hole becomes a part of the user wherever s/he goes. The piece shifts the viewpoint from the physical to the conceptual. It is focusing on the ordinary, on the everyday activities and desires of people and it offers a perspective into the processes, which are an inherent part of our current lifestyle.

Observer/Flaneur/Voyeur.

Technology enables us to observe real people communicating in real time from several remote places simultaneously. The user/observer is not in control, s/he is dependent of the existent situation and appears into it as a passive observer. S/he acts like a flaneur, who is satisfied in the midst of the crowd and waits for the next sensation to appear.

In essays written in the 1930s Benjamin was led to examine the work of Baudelaire who had earlier popularised the concept of the Flaneur, drawing attention to this figure who takes an almost voyeuristic pleasure in detachedly watching the doings of fellow city-dwellers.

The user wearing the seven-mile-boots becomes a kind of a super-voyeur, who is able to search in several places and observe various situations simultaneously in the net. When the user is wearing the seven-mile-boots and standing still s/he can listen several chat rooms simultaneously. S/he can observe the life in the net and listen to the ongoing conversations between the people in chat rooms.

The pleasure of walking.

The feet are a human device to move oneself from one location to another. While wearing the seven-mile-boots the user is walking to one or several directions in the physical world and simultaneously strolling in the net in a search for the crowds. It is a different mode of moving with diverse speeds and directions simultaneously. The piece is designed as a common apparel -shoes, which don't demand any special skills from the users. While having the boots in the feet the audible real-time/life situation becomes part of the user's intimate environment.

Open process.

The artistic focus of the piece is in the construction of an open structure, which is filled by real people in real time; real life. A possibility space which pushes the users forward in a search for more. This deficit creates the desire for substance, a desire to consume and to experience. The piece seduces in one hand with knowing and on the other hand with not yet knowing; What will happen now? What will be the next response?

(Text by Laura Beloff, Erich Berger & Martin Pichlmair)

corrosion, a video installation (2004)

with thomas grill

shown at *freebitflows*, Künstlerhaus / Vienna / Austria

corrosion is a process of transformation. it is what happens to material exposed to other material - reacting on the surface to form something new. taken for granted that interface correlates to surface and media always features an interface, corrosion transforms cultural material to something new when exposed to new cultural influences.

> »The structure implies that the narrative/frame hierarchies must be this complex to control the proliferating narratives. At the same time, the greater complexity leads to the possibility of multiple interactions between levels, so that the space is opened to narrative proliferation

again. As chaos leads to order, and order back to chaos, the narrative comes to resemble an organism that grows by periodically dissolving and reassembling, each time at a higher level of complexity. In this sense the narrative is a cybernetic organism, manifesting within itself the same self-organizing processes that the stories take as their subject.«

Hayles, N. Katherine. "Chaos Bound: Orderly Disorder in Contemporary Literature and Science". Ithaca: Cornell UP, 1990.

the installation corrosion is based on footage and music taken from peer to peer networks. therefore it is an incredibly incomplete mirror of a cultural group. the mundane activities of peer to peer networking get externalised in this art piece. the lack of quality of the traded materials shapes the aesthetics. the installation

reflects the state of mind of people involved in file sharing networks. content shaped by communities - anonymous as the underlying principle: a panoptikon.

filesharing eludes control through technical organisation. in modern peer to peer networks, there are no dedicated servers involved. thus, the network is but a technical manifestation of the underlying principles and goals; control and responsibility are shared just as Madonna's mp3.

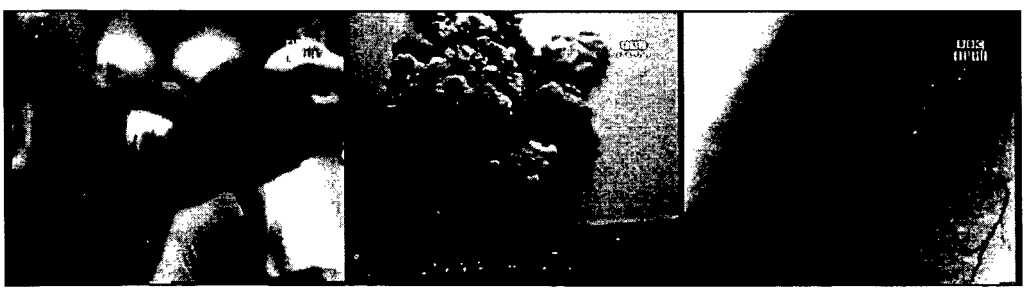
the video and audio data transformed, triggered, altered and spit out by corrosion comes entirely from peer to peer networks. it is thus more a conceptual than a technical solution to visualisation: the social dynamics is described in metaphorical rather than technical ways. yet technology plays the role of the director and narrator in the sense of structuring a subcultural narrative. responsibility is transferred to machines, mirroring the processes that take place in peer to peer networks. the machine is part of the commited copyright infringement.

inkubation - the birth machine, a video installation (2004)

with machfeld

shown at *arts birthday*, Radiokulturhaus / Vienna / Austria

the video installation inkubation is built on educational videos about birth. the process of incubation - of brooding - is fulfilled within video, the actual birth is left to the audiences imagination. a birth machine replaces the systematic nature of numbers. 9 months culminate in thousand moments. order generates time.



»Im Zentrum des Labyrinths lagert die im Dunkel liegende Geburt, der durch das Geheimnis von sich selbst losgelöste und durch die Entdeckung zu sich selbst zurückgeführte Ursprung«

»In the centre of the labyrinth hides birth lying in darkness. The origin released from itself through mystery and ascribed to itself through discovery.«

michel foucault (my translation from german)

)(PIONEER, an art project on privacy issues (2003)

shown at Freiraum / Museumsquartier / Vienna / Austria

Privacy is the prime victim of anti-terrorist measures. Biometric data in passports, Section Control Systems and other surveillance techniques have one point in common: the private person is treated as a suspect, a potential culprit.

For the project)(PIONEER we created a pleasing spying devices that was used by voluntary participants. It was a gadget that was officially made for wardriving - the scanning for open wireless networks. While they thought they were just using the device for its pretended purpose, their tracks were recorded. Thus we acquired their patterns of movement, ready for our interpretation. The)(PIONEER Exhibition connected those tracks to actual events. We worked out pseudopsychologic profiles of the suspects, linking them to actual crime and faked pieces of evidence.

UDO, emotional network sniffing (2003)

with machfeld & reMI
shown at *localtask*, Dom im Berg / Graz / Austria

the project udo is a framework project that manifested in several ways during an exhibition. the base of udo is a network sniffer - a program that is able to analyse arbitrary data in a computer network. the purpose of udo was to transform this

data into an experience - to interweave humans and technology. using real-time software and analogue counterparts to digital means we established a intuitive working environment: an art piece that can be improvised upon at set up and during the exhibition by purpose.

horizon, a video installation (2003)

shown at *esc*, Graz / Austria

horizon is a very personal work. it is a series of video projections that are based on footage shot from my flat in vienna. every sequence is a compressed scene of one whole day. at the exhibition this day was extended over the whole week so that dusk was at the start of the exhibition and sundown at the end.

abstractv, a streaming performance (2002)

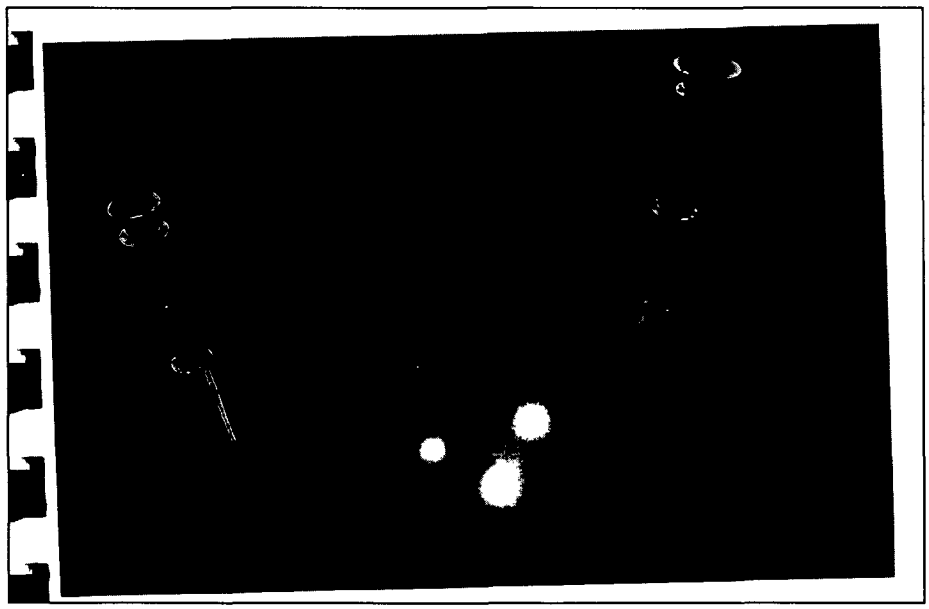
with machfeld

video stream to the event *gaisma pills* in an art gallery in riga. we used the live broadcast of a ski race as the source material for our manipulation.

ew3++, a video installation (2002)

with machfeld

shown at *fluten,* Water Tower / Vienna / Austria



an interactive video installation that used rubber balls as an interface. video image and sound resembled mechanical water - flowing like fluid.

APPENDIX B : RELEVANT WEB SITES

Computer Games

America's Army : www.americasarmy.com/

Jedi Academy : www.lucasarts.com/products/jediacademy/

Quake : www.idsoftware.com/games/quake/

Red Faction : www.redfaction.com/

Sim City : simcity.ea.com/

Applications

Maya : www.alias.com/

Pure Data : crca.ucsd.edu/~msp/software.html, puredata.info

Automator : www.apple.com/macosx/tiger/automator.html

Movies

24 (2001, created by: joel surnow et al.) : us.imdb.com/title/tt0285331/

About Sergej Eisenstein : us.imdb.com/name/nm0001178/

Hulk (2003, director: ang lee) : us.imdb.com/title/tt0286716/

Timecode (2002, director: mike figgis) : us.imdb.com/title/tt0220100/

Top Gun (1986, director: tony scott) : us.imdb.com/title/tt0092099/

Design Blogs

daring fireball : daringfireball.net/

design by fire : www.designbyfire.com

ok/cancel : www.ok-cancel.com/

ivrea : hub.interaction-ivrea.it