Dangerous Forms – Playing by the Visual Rules. Ecological Approach to Videogames as Activity

Meldgaard, Betty Li Malvang

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Part 1

Chapter 1

Introduction

Videogames or home entertainment systems have been household items for almost 40 years and have, to some extent, paved the way for the use of home computers [Haddon:1992], thus turning the various uses of the computer into activities of both labor and leisure. The various utilizations of the computer have been actualized by the flexible use of the screen as an interactive display making manipulation with pictorial content possible. Whether by means of manipulating advanced 3D graphics or simple iconic 2D graphical elements on the screen, videogames have created a new setting, a new activity, within which we can study ourselves, qua the appeal and ability of videogames to engage us in play with technology. Videogames provide possibilities of engagement not seen in previous visual forms of entertainment and it is easy to imagine that it must have been a marvel to sit in one's own living room, with the first home entertainment system and control moving objects on the TV - screen. Over time we have become accustomed to the activity of playing videogames, and it has become a natural part of everyday life.

If we step back in time for a moment, and take into account the advertisement that followed the first home entertainment system, Odyssey[1972], it becomes apparent that it anticipated future theoretical and developmental approaches to videogames most prominently visible in the following catchphrase; *with Odyssey you participate in television…you're not just a spectator*[1]. The catchphrase is not unlike the one used in the presentation of one of

the latest inventions within videogame technology, the Nintendo Wii game console that proclaims; *you just don't play Wii, you experience it* [2].
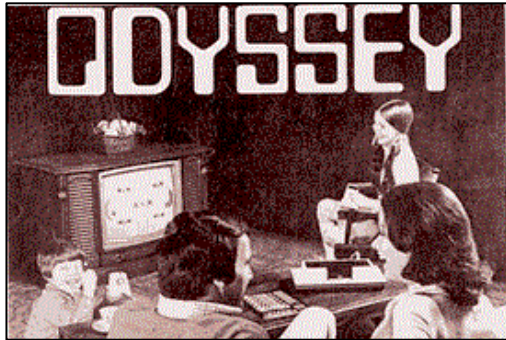
Odyssey [1]

Nintendo Wii [2]

On the Odyssey game console it was possible to play TV – tennis in a *ball and paddle* style [Wolf:2008], allowing the player to control simple graphical elements on an input device with knobs wired to the TV. On the Wii game console it is also possible to play tennis, but now it is done by wireless motion tracking technology allowing the player to move more freely in front of the screen and do it in a physical manner that resembles real tennis play.

The inventive steps that have been taken since the first videogame console to the latest are apparent consequences of the overall advances within technology. Whereas most game consoles still rely on a joystick or keyboard based operation, other types of operational modes are coming into view, again prominently visible in the Wii console, which are now being followed by similar consoles such as Kinect to the XBox console from Microsoft [3].

As another example, the handheld console Nintendo DS uses touch – screen technology, allowing the user to manipulate on-screen content directly by touch of fingers or a stylus. These game consoles push the boundaries of computing in general by affording new ways of

manipulation. They are in line with other types of computer systems emerging that enhance a more direct manipulation with screen content by removing keyboard, mouse and traditional control pads otherwise utilized to gain access to and manipulate the content.

The interaction process in these systems is referred to as "surface computing" [4]. The notion of surface computing implies an enhanced use of the body when manipulating on-screen content. The manipulation can take several forms, either as direct on-screen touch functions or as motion tracking using cameras or infrared tracking.

The tendency to experiment with new interactive technology is prominent in Sony's game concept, EyeToy, where the player is able to interact directly with the on-screen content via camera and motion tracking software, allowing new types of play with the technology. Sony's EyeToy enables its player to interact with graphical structures just for the sake of toggling screen content or it integrates the motion based interactivity into more traditional games allowing the player a variety of interaction forms within the same game concept, i.e. Harry Potter for Sony's Playstation 2. Another example is Star Wars Force Unleashed for Nintendo's Wii.

In a broader perspective, the technology invites its user to cross the boundaries of interfacing by removing the control device as a necessary means of accessing on-screen content, thus providing an intuitive direct manipulation that resembles that of everyday interaction with natural objects and surfaces.

Though the videogame concept have come a long way, most prominently manifested with the new generation of game consoles that offers alternative ways of manipulation, all videogames have in common the particular relation that emerges between the visual content and the possibilities to manipulate it. Whether the player sits

relatively still when playing games using traditional input devices or he/she engages in alternative ways of creating input data, it will be assumed here that the player utilizes his or hers visual perceptual abilities in a functional way in order for the game system to become operational and playable. As of the present, where videogames can no longer be ignored as a new type of activity, it has now unsurprisingly developed into a phenomenon worth studying within academia and a rapidly growing amount of texts that relates to videogames are surfacing.

Videogame Research

In light of the fact that video game research is in a developmental phase and has entered the scene of video games fairly late, a synchronicity between video game development and video game research is a new phenomenon, with a few exceptions [Crawford:1982]. There were no academics in the early years, which counts the 1960's and 1970's to keep track of the development of game content, influence it or even be critical about it. Some of the earliest texts on videogames appeared in the 1980's and the more academic approaches had a concern for player's/children's well-being as an outset and sprung from areas of psychology investigating whether playing games had damaging impact on players due to its often violent content [Patricia Greenfield:2010/1984].

Already attempts at creating paradigms are appearing and what could be conceived of as theoretical approaches and tendencies, more than scientific traditions, are intermingling in a broader attempt to formulate a common framework for studying videogames. The field identifies itself as being interdisciplinary or cross disciplinary, most significantly apparent in the utilization of theories and methods brought into the field from other scientific domains.

Research programs, with very different approaches to videogames, have found its way into academia and it is now possible to do research under a variety of themes and follow what could be said to be already established hypotheses or schools. This means that there are research programs that can be followed more directly as well as there is an open situation where new thoughts can be investigated freely and experimentally. The current state in relation to videogame research can be said to be a conundrum of intersecting motives and means by which videogame research is carried out, and to enter the field as a new researcher demands of the novice researcher a strict ability to create an overview of the many approaches, to navigate through a variety of textual styles and to employ a certain amount of introspection in order to stay on the path. Researchers are often gamers or previous gamers themselves, as is the case with this author, who attempt to elevate own experiences to a theoretical platform in order to both gain insight into one's own fascination, but also to disseminate insight in to the appeal of videogames as activities and media.

As a consequence of the rapid flourishing of videogame studies most aspects have been covered in width though not necessarily in depth. Every facet of videogames have, to a greater or lesser extent, been brought into perspective in order to draw out the essential and characteristic qualities that separate them from other types of entertainment and media formats. As will be visible in the chapter, which treats the various thematic and theoretical approaches to videogame research, the tone in certain approaches nears that of a declaration of war on other approaches. Interestingly so, the first attempt by Jesper Juul to do games research as a master student, already hinted at the looming problems within videogame research, visible in the title; A clash between Game and Narrative [5], which

also points to some of the initial problems of characterizing videogames. Some early questions concerning videogames centered themselves on the ability of the games to be carriers of stories….or not. Were games a new and smart form of storytelling or were they something completely different? Though these basic questions were raised in the dawn of videogame research, the themes and methods of problematizing are still present in contemporary approaches [Wolf&Perron2003/2009][Tavinor:2009].

In relation to the a-synchronicity between videogame development and videogame theorizing, the theoretical approaches are bound to retrospection and are, not surprisingly, filling in the missing historical pieces by utilizing the theories in a backward fashion. There are no problems as such with this strategy, but self evidently there might have been a more diverse palette of tested methods in conjunction with a broader perspective of what games are and why we play them, had they been taken into theoretical examination from the outset.

The strategy in this dissertation will be to take an imaginative step back in time and look forward from the point of origin of video games and investigate the fundamental premises of the on-screen content and the relation that emerges between video game player and video game interface. That the input technology has advanced over time will only be seen as a natural consequence of the technological development, thus implying that what is at the core of videogames, is the relation between on-screen content and the interactive possibilities. If videogames had been investigated from the outset in a theoretical manner, what would then have been the interesting features about the system as a visually driven new type of technologically enhanced activity? In other words, by looking forward from the point of origin it may be possible to not only look at videogames in a refreshed perspective, but also to point to some of

the gaps that still exists within videogames research. What has been overlooked, so to speak and how can, at least the gap that will be outlined in this dissertation be addressed, if I as a researcher grant myself the freedom of not being too tightly obligated by the contemporary tendencies, quandaries and other seemingly battles for theoretical domination.

It must be pointed out that the strategy of returning to the point of origin is not an attempt to do videogame archeology, but to pose questions to the most deep-seated aspects of videogames as visual interactive media and suggest that playing videogames engages the player on a visual perceptual level in a very fundamental way.

As pointed out the field as a whole is a patchwork of approaches bound to the fact that a videogame in itself is a multifaceted phenomenon and the merging of theoretical and practical approaches therefore is inevitable.

The assumption is that videogames have to be studied on other premises than those of the more traditional approaches to media use or consumption. In order to encircle the role of perception the relevant parts for perception must be extracted from the larger system of videogames. Though the term, videogame, has been specifically and consciously chosen as will be explicated further ahead, the term is a common denominator for this latest addition in category with art, books and film. The format is restrained by the denominating word "game", which may not be the proper outset for a study of the functional and perceptual means which this format is driven as an activity.

Approach

A tendency within videogame studies is to examine videogames in relation to their formal and aesthetic structures in relation to the

process of play experience. This strategy has as its outcome an apparent challenge in respect to the tendency to compare videogames to the media formats from which theory is brought into play. In relation to the visual content most often the field of film theory is applied and a cinematographical discourse is employed that spring from this field [King&Krzywinska:2002]. The just mentioned strategy, again, makes comparative studies in relation to how visual content in games can be comprehended in relation to what has been experienced and articulated within film studies. However the visual content from a more psychologically based perceptual standpoint on the premises of videogames without a comparison to other media has to some degree been left untouched. This point does not imply that the interface, which is regarded as the carrier of visual content, has not been studied, but suggests that the perceptual relation based purely on the premises of the distinctiveness of videogames, have largely been ignored. With this statement it is implied that theories of perception have mainly been left out, a condition that may have several explanations. There may be problems in relation to an understanding of what perception is and there may be problems relating to the employment of perceptual theories as this approach, obviously, have to ignore other aspects of gaming than those directly linked to perception. Or at least set them aside momentarily. Whatever is the case, it is believed that research into the role of perception while playing games will add a meaningful layer to the overall attempts to understand and address fundamental aspects of videogaming.

If perception is the key issue, videogames can be approached from two fundamentally different aspects. Videogames can either be viewed as cultural and aesthetic artifacts that integrate aspects of other known media such as film and literature in the sense that

videogames incorporate both moving images and narratives, or it can be viewed with respect to a more general use of computers and the activities a computer – screen system affords. The first approach may be more tightly linked to theories of reception, where reception and perception becomes intermingled terms. The latter approach is more closely tied to the field of Human – Computer – Interaction (HCI) research, where the means of "manipulation" of on-screen content have been studied in more task oriented ways [Kuuti:1997] and seems to be a more suitable out set for perceptual theories. If videogames are considered to be an activity that involves direct or indirect manipulation of on-screen content and the direct/indirect manipulation is made possible by a range of input technologies there are basic HCI elements present. Some concepts from the field of HCI have been employed within game development in relation to game testing [Jørgensen:2004], but a basic understanding of videogames from a HCI perspective and a basic understanding of HCI from a videogame perspective have not been developed. Jørgensen points out that; *a generic feature of the two fields is the dedication to providing the user with what they want, but nevertheless there has been little interaction between them* [Jørgensen:2004:393].

In relation to these two ways of approaching videogames, it can be argued that the approaches are separated by their respective interest in, on the one hand, the aesthetic experience derived from playing videogames and on the other hand, the functional relation between user and computer system.

The reasons for playing videogames may be uncountable, but at the center of the activity is the relation between the underlying computer system's ability to generate on-screen interactive content, which suggests that no matter the reason for playing and no matter the

experiences derived, visual perception of the content, must play a prominent role in the realization and the functioning of the videogame – player system as a whole.

A study carried out by Barr et al. that will be brought into perspective later in the dissertation; suggests that gameplay can be viewed from an HCI perspective as an activity of "playing the interface". Barr et al. in thread with Jørgensen imply that videogames are not well investigated from an HCI perspective [Barr et al.:2006:317]. They suggest a shift from the traditional task oriented approach within HCI to a play oriented approach, stating that a motivation for playing games does not necessarily derive from the participation in and a negotiation with the game rule structures which is at the core of some main tendencies within videogame research, but derives from a curiosity to see everything the game has to offer. They conclude that videogame players may devote a considerable amount of time "playing the interface". In their final remark, they state that more research has to be carried out in order to understand this relationship.

The relation that emerges between videogame on – screen content and the manipulation of the visual content will be investigated in this dissertation from a perceptual theoretical framework.

The dissertation is therefore an attempt to add a new layer to the overall field of videogame research by leaning towards the functional aspects of on-screen content manipulation as seen in HCI – research and combining this functional stance with an approach to perception that regards perception as being a functional mode of awareness. The dissertation is not a genuine HCI project, as well as it is not a genuine psychological project, but a project that eventually will stand as a fusion between articulations from several fields, and in this

respect be a genuine videogame research project with an interdisciplinary design.

The purpose is therefore to create a framework that addresses core perceptual implications and construct a ground for future research within videogames that has perception as the foundation for investigation. Though this dissertation will employ the ecological approach to perception, there will be questions put forth that, on a general level, attempts to outline how and where the aspects of videogames and videogame play becomes of interest for any researcher who is keen to take up and further the investigation of the role of perception while playing games.

Interdisciplinarity

In the field of Human Computer Interaction (HCI) the areas under scrutiny are often related to the use of computer interfaces in work related settings, where problem solving and task orientation are at the center of the activities. The field of psychology, and here more specifically, psychological theories dealing with perception, has human behavior in relation to its environment as a key focus. Due to the fact that this dissertation places itself within the overall videogame research field and therefore is not an actual HCI study as it is not an actual psychological study, the theoretical foundations in each field intersect to create a new articulate foundation for videogame studies in particular and interactive media in general. The approaches from each field form a joint foundation for articulations relating to videogames and play and make it possible to look at the gaming situation as an activity that consists of interrelated operational systemic and perceptual elements.

In videogames research as it has evolved, there is a tendency to relate to games in a rationalized fashion, in afterthought, looking

back at the games once played. When perception becomes the main area of interest, the attention is directed towards a *now* of the gaming activity. In that *now* there is a meeting with the technology and the content qua its operational functionality much like what can be seen in the field of HCI and in that meeting, the *now* is based on the player's ability, on the one hand to operate the system and on the other hand to make appropriate advancements within the game in order to reach the end, via inherent conditions within specific game types.

The research approach is at its most fundamentally interdisciplinary, bringing the ecological approach to perception into the investigation of "videogame interface – player" as a systemic based activity. In the field of HCI, activity theory has been employed as a means of both viewing activity on the level of the individual as well as viewing the level of activity in a broader societal perspective[Kuuti:1996/97:27-28]. Although the activity theory as a whole will not be unfolded, it will serve as the extraction derived from the field of HCI, which allows videogames to be viewed as an activity on the individual level. The activity approach make available the levels or units of analysis required for the ecological approach to be applied.

In previous work [Meldgaard:2008] I have demonstrated that an ecological approach to perception is a promising outset for the study of the videogame interface – player relation, mainly based on the condition that the ecological approach to perception takes into account that everyday activities and more context determined actions within activities are perception dependent. Videogame play creates a situation in which the player is engaged in an activity that affords action – taking. Whether by means of a more direct and wireless form of interaction or by means of a control device mediating the manipulation, the player needs to relate to the on-screen content in a

functional and informative way in order for the manipulation to have an effect within the videogame system. Between videogame and player there is an intermediate level of reciprocality which is constituted by the visual information available in the videogame and the player's ability to utilize the information. The intermediacy and the reciprocal relation between technology, visual content and player will be the combined subject matter brought into investigation. The three constituents; technology – videogame interface and player, needs to be addressed on different levels and from different theoretical positions, but eventually a synthesis will emerge that is derived by the joint articulation of each area brought into perspective.

Structure

Before the approach is fully formulated, the integrated elements need to be structured. Within the field of humanities, and media theory in particular, an interdisciplinary approach often points to a thinking together of already existing fields with the purpose of creating a new level of articulation and understanding. Doing interdisciplinary research involves a variety of approaches and practices and the following will briefly touch upon some implications.

In "Practicing Interdisciplinarity", Klein lists five characteristic patterns in interdisciplinary research [Weingart &Steht (ed.):2000:6]

- Developing conceptual links using a perspective in one discipline to modify a perspective in another discipline

- Recognizing a new level of organization with its own processes in order to solve unsolved problems in existing fields

- Using research techniques developed in one discipline to elaborate a theoretical model in another

- Modifying and extending a theoretical framework from one domain to apply in another.

- Developing a new theoretical framework that may reconceptualize research in separate domains as it attempts to integrate them

The list is shown in full as it will serve as an outset for the formulation of the structure of the dissertation, as a generic frame within which it is possible to formulate the context specific areas of interest and as an overview of approaches to and purposes of doing interdisciplinary studies. Though the field of videogame studies is by nature defined as interdisciplinary, it is uncommon to see explications of the exact disciplines involved.

To give content and context to the generic description above, the main goal of this dissertation will be to apply the ecological approach to visual perception to videogame studies in order to make it operational in relation to an understanding and further analysis of the videogame – player system. The overall formulation for the project is as follows;

- By modifying the ecological approach to visual perception as it is explicated in its original form and extending the use of the approach in correlation with an activity approach to the videogame – player relation, it is believed that a method of describing the relation in terms of its reciprocality will be derived.

- By applying the modified ecological approach to visual perception in correlation with an activity approach to the videogame interface – player situation it is believed that a

method of analysis of the system and its integrated parts can be derived. It is further believed that a new level of articulation will be derived in the form of a discourse that addresses the fundamental role of perception for playing videogames and the function hereof.

Each part involved in the videogame – player system will be investigated and the dissertation falls in three major parts. The approach herein is theoretical, descriptive and hypothesis developing. The purpose is to formulate a framework that can serve as a foundation for further studies of videogames in particular and interactable visual media in general.

Part 1:

Part 1 of the dissertation will center itself around the subject of study. In this part, issues will be addressed that relates to what videogames are, how they can be studied and eventually, it will be synthesized how they will be studied here. It is important for an application of extra disciplinary integration to mark out the system as a whole under investigation and further address the possible levels of analysis.

Part 2:

Part 2 will be centered solely on theories of perception in general and outline the ecological approach in particular. Where the first part can be said to be the establishing part of what needs to be studied, the second part provides the framework for understanding the role of perception in relation to videogames. This part will both contain overviews of how to theorize about perception as well as it will provide a profile of an attempt to utilize and make the ecological

approach operational. As some critique will be put forth that approaches to videogames that attempt to relate to perceptual issues, do not search out theories of perception, it has been important to show that the field of perceptual theories at large include a variety of viewpoints. It is important in the attempt to apply the ecological approach, to outline the main concepts of the general theory and position the approach in relation to more accepted viewpoints. It is believed that the understanding of the approach in this dissertation will not be comprehensible without an insight into the most basic aspects of the ecological approach and the inherent line of conception.

Part 3:

In part 3 the preliminary identifications established in part 1 will be revisited and looked at anew with the ecological approach as an added theoretical layer. Typical ways of denoting the various components involved in videogame play will be exchanged with an ecologically based discourse that specifically can address, not only the visuality of videogames as a medium, but also be articulate about the functional relation between player and system. The concepts put forth will be integrated in an activity model that addresses both the constituents and the flow of actions. It is important to address the various levels involved and within the strategy of identifying the coherent elements, the possibility emerge that characteristics are discovered which have slipped by unnoticed in other research approaches. A new concept will finally emerge and a new foundation will be brought into perspective.

Chapter 2

Technology as Entertainment

Computer and screen

The computer was not invented as or intended to be a visual medium as we now understand and use it, and the idea of an interactive interface driven by images emerged almost as an entropic phenomenon. It was not until the 1950's that a computer became equipped with a monitor. The monitor enabled programmers to observe the intricate processes of the computer in order to detect errors and correct them more efficiently [Finnemann:1991]. The monitor served, as Finnemann points out, as a mimetic mirror that showed the inner processes of the computer, as an instrument for surveillance and control. Obviously to monitor the inner processes of the computer, a connection had to be made, on a symbolic level, between the visual output and the invisible processes, the graphical interface and the algorithms. Finnemann refers to the 1970's as the decade where the monitor obtained a new meaning for non-specialized users by iconographical means of operation. Iconic symbols were developed to ease the use of computers, which put the interface and its layout into the midst of computing. In the beginning, the monitor served as an instrument for specialists and served as an access point to the symbolic layer of computation. The monitor became a new type of imagery material which was supported by computational processes.

The 1970's may have been the decade where the monitor obtained new meaning specifically manifested through the desktop metaphor

but in the early 1960's SketchPad was created by Sutherland [Sutherland:1963] [Negroponte:1995], which was a program that allowed a user to draw on the monitor and thereby laid the foundation for the future field and activity image processing.

> Sketchpad introduced many new concepts: dynamic graphics, visual simulation, constraint resolution, pen tracking, and a virtually infinite coordinate system, just to name a few. Sketchpad was the big bang of computer graphics. [Negroponte:1995:103]

Where the 1960's may have been the area of experimentation, the 1970's became the area of distribution of the new monitor based technology. The leap from using the monitor as a means of surveillance to the constructive use as a tool for creation and expression opened up a field both practically and theoretically where the functional displacement of the monitor, transformed it from a tool that could mimic the process of the computer to a technology that could mimic the processes of its user. The monitor became a *screen* and yet again a *window* [Manovich:1995][Johnson:1997] with additional *windows* opening up multiple viewpoints. Eventually, following the view of the computer as an image medium, the notion of *frame* emerged and an arch to pictorial theories seemed just at hand and the new medium, confined as it was to its frame, was aligned/incorporated with the tradition of at least 500 yrs of depiction. In "The Virtual Window" [2006], Friedberg opens the introduction by stating;

> "WE KNOW the world by what we see: through a window, in a frame, on a screen. As we spend more of our time staring into the frames of movies, television, computers,

hand-held displays – "windows" full of moving images, text, icons, and 3-D graphics – how the world is framed may be as important as what is contained within the frame." [Friedberg:2006:1]

She points back to Alberti, who in his 1435 treatise related to the frame of a painting as an open window [Friedberg:2006:1]. Though it is not the time and place yet to unfold the theoretical implications of screen technology and image creation techniques, it will be pointed out that the strategy of linking computational means of image creation and display with century long traditions is also traceable within videogames research[Poole:2000]. The various approaches to the origin and techniques for creating space on flat surfaces do not hold the same problems as the means of interaction where the operator gains operational access to the image content, which brings into sight the concept of the interface. *Interface* is the dominant term within most approaches to the on-screen content and specifically within videogame terminology. As stated earlier, the representational or symbolic screen content intersects with operational possibilities and creates a meeting point between process and means. The dynamic screen content as *framed* or *windowed* implies the static feature of the technology in relation to the more dynamic features of the *interface*.

Before delving into the notion of *interface*, a walkthrough of the utilization and origin of moving objects on a screen in relation to on-screen manipulation and videogames will be given.

From computation to home entertainment systems

Though Steve Russell is often cited as the inventor of the videogame *Spacewar!* in 1962, already in 1958 there was an experiment regarding the control of virtual objects on a screen. William

Higinbotham created *Tennis for Two*, which was a simple interactive tennis game. For various reasons, this experiment is not regarded as being a real videogame, which grants Russell the title of being the father of modern videogames. It is worth noting, that Higinbotham experimented with a type of activity that was neither related to work processes nor related to an otherwise efficient use of a computer. Using an oscilloscope and a computer, Higinbotham created *Tennis for Two* as a means of entertaining guests at the Brookhaven National Laboratory on visitor days [6]. In an interview, Higinbotham recalls;

> "I knew from past visitors days that people were not much interested in static exhibits," said Higinbotham, "so for that year. I came up with an idea for a hands-on display – a video tennis game."[7]

His sole purpose was to entertain guests by showing, what the laboratory was capable of designing and it may not be a genuine videogame in contemporary terms, but the experiment showed that it was possible to design systems that allowed a user to control interactive elements on a screen for the exclusive purpose of entertainment.

The story of Russell's attempt at creating an interactive game is more in the thread of a contemporary narrative of a geek shoved away in a basement at MIT surrounded by computers the size of refrigerators, though, as it turns out, he by no means were the sole originator. The enthusiasm that surrounded the inventive processes is comparable to explorers entering unknown territory; in a playful manner, the developers were tinkering with new technology in order to test the boundaries for performance. J.M. Graetz, one of the students involved in the creation of *Spacewar!*, describes the time as a period were

computers were "marvels", attracting people to look at them, whenever the chance presented itself, usually with a disappointing outcome regarding the expectations of what computers could do[Van Burnham:2001/2003:44]. A group of students involved in the development of *Spacewar!,* was intrigued by the possibility of creating controllable elements and several programs; four to be exact, were forerunners of the initial space game. As Graetz describes it:

> These four programs pointed the way towards interactive entertainment. Bouncing Ball was a pure demonstration – you pushed the button, and it did the rest. Mouse in the Maze was a little more interesting, because you could make it different every time. HAX was a real toy – you could play with it while it was running and change it on the fly. And Tic-Tac-Toe was an actual game, however simpleminded. So all the ingredients were there – now we just needed an idea. [Van Burnham:2001/2003:45]

Being enthusiastic readers of science fiction, the inventors felt that a game situated in outer space, could not be more cutting-edge. Challenged by his fellow students Russell eventually took up the endeavor of creating the first object-in-motion program, which was a dot on the screen controlled by switches. As Graetz puts it; *from dot to rocket ship was a surprisingly easy step.* [Van Burnham:2001/2003:45]

Though never launched as a commercial game, *Spacewar!* is regarded to be the first game known to people outside a laboratory. Russell's game *Spacewar!* later inspired Nolan Bushnell to design *Computer Space* in 1971. Though Russell and other students at MIT worked with the development of interactive games, they were

experiments with no public interference or showing. It was Bushnell that launched videogames as a commercial artifact adding a coin-slot to the game [Wolf:2008:29]. Game arcades were already established at the time, in the early 1970's, with i.e. pin-ball machines, so the already exiting physical setting for coin-operated games, provided a commercial entrance into the market of arcade computer gaming, where *Computer Space*(1971) along with PONG(1972), a newer version of the interactive tennis game, became the first popular arcade game [Wolf:2008:29].

Ralph Baer creates the first home entertainment system, Odyssey, in 1972, although he already had ideas about interactive games played on a TV-set back in 1966 [9]. 1973 is cited as being the year where game development companies shot up from the ground and in the wake brought a battle into the world that spawned an immense amount of interactive home entertainment systems based on the latest technological advances such as the development of the microchip.

The first home entertainment system created a connection to electronic technology in the domestic field of everyday life which required no expert knowledge of operation. The ability to turn the knobs attached to the physical system was sufficient. In the previously mentioned Odyssey advertisement, the console itself is described as an electronic game that could turn the living room into *a closed circuit electronic playground* and further states that; *Odyssey is Thought, Action and Reaction* [10]. Though it is questionable if Baer's system can be called a computer game, it was undeniably an electronic videogame. The goal of the creators was to engage people in activities involving the already available TV – screen. Within the arcade game machines, the screen and the control device was mounted into one large unit, whereas the home entertainment

system utilized the possibility for remote control of the screen content. The remote control, though by wires, situated the videogame player more freely in front of the screen.

[11]

[12]

The Odyssey system could furthermore be played independently of coins, which in the arcades put a natural limit to play time. With no limitation of play time built into the system, opportunities emerged in the design of the interactive content. The home consoles could also facilitate games for learning purposes. It could be fun and serious at the same time and leave more choice with the participants. During the 1970's, an assortment of home entertainment systems appeared that improved both the on-screen content and the means of manipulation. Input devices such as steering wheels, light guns, and multiplayer knob hubs enhanced the means of interaction [13].

The point here is not to create an overview of the entire evolution of videogame consoles and their various means of input, but to point to two basic elements of interest for the further investigation, namely the evolution of on-screen content and the function of the control device in relation to the on-screen content. In the two following

passages, I will take a brief look at the joystick and the graphics of videogames. The purpose is to look at the basic systemic elements in order to establish the videogame - player situation in relation to the elements involved.

Control Devices - Activity

Control devices or joysticks, as they are referred to in a popular way, have not been given much attention within videogame studies. This may be due to the fact that the joystick in itself plays a subservient role and is an operative necessity that gives access to the screen content. It has been an odd enterprise to find information about or theoretical interest in the control device and the functional relation that exists between this type of dexterous operation and the on-screen manipulation, though Juul [2010] recently have treated it to some degree. Curiously, in the few sources on videogame related interest in joysticks the common complaint is that it has not been given much attention. In an article on the subject of the 2009 E3 Gaming Expo the joystick is explicitly treated and regarded as; *one of the most overlooked achievements of the last 100 years* [14]*.* Though the article is not a theoretical text, it presents some viewpoints that eventually came to serve as a motivation for included a passage on control devices herein and take the joystick into consideration as part of the identification of videogames. To follow the thread from the mentioned article, joysticks are, on a general level, used for diverse activities as flying a plane, steering a wheelchair, operating a crane and playing videogames. What the article puts forward is that the joystick; *translates human will into a single device* [15]. That it translates will into a single device is one level of approach. Another approach is that of Bærentsen, who argues that control devices or other types of mechanistic devices translate bodily operations into the

development or evolution of artifacts. New modes of control and thereby, praxis emerge as a consequence of this "translation".

In Bærentsen [1989], an account is given of how tools evolved into machines with a specific focus on the evolution of automatic firearms. A useful point made by Bærentsen is that the evolution can be seen as a process of integrating otherwise complex and physically strenuous actions into a single device. He describes it as an *objectification* of senso-motoric actions that would otherwise be realized in a more physical and bodily fashion; the more complex elements to control the more diverse the focus will be on the part of the operator. His example shows that the automation of processes involved in loading and igniting firearms allowed the operator to change his attention from the operation of the device to the aim. The notion of objectification is relevant in relation to an identification of the processes objectified in the videogame joystick that will take place elsewhere in this dissertation. Now it serves as a useful pointer to how the joystick can be attended to and to the part it plays in the game system as a whole. As stated earlier, an activity approach to operational settings within HCI may imply a double focus on the individual activity and the activity in a larger societal or cultural context. We will briefly take a look at the general concept of an individual activity.

Figure 2.1
Mediated relationship at the individual level.
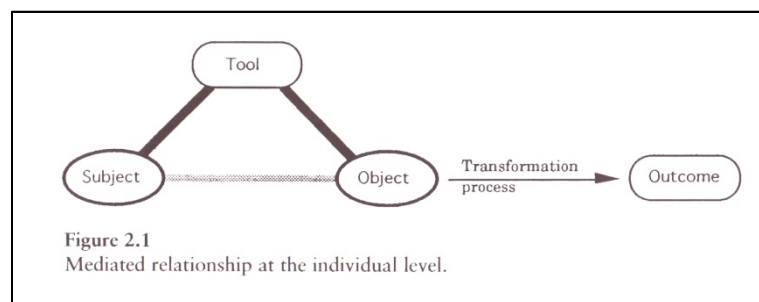
Fig. 1

The model shows the individual activity as consisting of subject – tool – object. On a basic explanatory level, the subject engages in an activity where the tool facilitates a variety of performatory executions leading to a transformation process in relation to the object. The model is static in the sense that it displays the components involved, but not the intermingled process that emerges as the operational part of the activity. For the utilization of an analysis strategy later on, it will give an insight into the complexity of processes involved in just any activity to take into view the more process-oriented layout of this model in Bærentsen and Trettvik's [2004] version of the model, here shown in a replica.
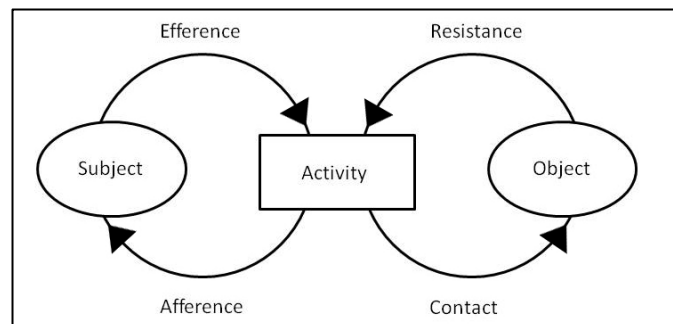
Fig. 2

In this version of the model, tool has been exchanged with activity, but it is implied that activity involves a tool, an artifact or some other physical instrumentation that eventually creates transformation or altercation to the object, which again can be informative in the further process in relation to the subject. Bærentsen and Trettvik couples the activity theory as described by Leont'ev with the concept of affordances formulated by J. J. Gibson. In a description of the model they state that;

Concrete activities are always motivated, goal directed and adapted to the conditions of the action. The three constituents of the activity are not separate entities, but rather systematic relationships, relating it to needs, intentions and conditions. [Trettvik:2004:68]

A preliminary simplified adaptation of the model contextualizes the elements present in relation to videogame play. This model will appear again in the part 3 in an extended version showing the processes involved in playing videogames. The specific case is that the object may not be conceived necessarily as a physical object and the processes involved in joystick and screen based manipulation have other processesual mechanisms as the "feedback" from the object are primarily visual.

Fig. 3

| Subject | Activity/Tool | Object |
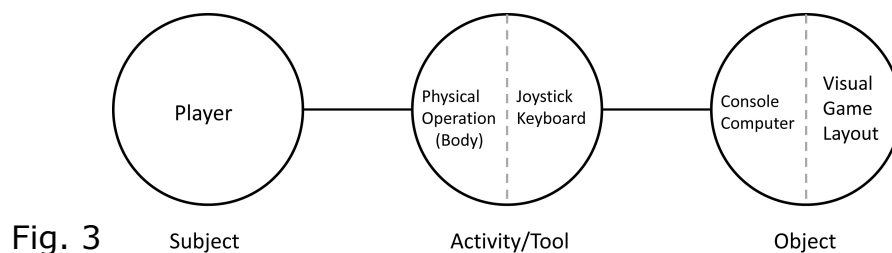
Here, the model serves the purpose of showing the constituent elements in videogame play and point to the systemic relation between the constituents as the whole system under investigation herein.

In an HCI perspective, input devices are tools for operative control and manipulation with on-screen content. Hinckley [2008] gives an overview of a range of input devices used in more task oriented settings. The relation between the input device and the on-screen

content may be addressed on a functional level in relation to both how the device is handled and what manipulative possibilities the device utilizes. Amongst the numerous distinctions, that Hinckley makes, in relation to input devices, some are interesting for videogame joysticks, i. e. the difference between direct and indirect manipulation. A device that has a pointer or another type of representation on the screen is regarded as an indirect control mechanism whereas touch screens and the stylus represent a direct input mechanism as there is a direct relation between the operation and the outcome.

By coupling Bærentsen's notion of objectification and Hinckley's notion of direct and indirect control, types of input mechanisms used when playing videogames can be identified in the sense that an indirect mechanism constitutes the objectification of operative processes whereas the direct manipulation overcomes this objectification by allowing the direct control.
 In relation to videogame consoles, the typical use of joysticks is an indirect form of manipulation where the objectified processes can be addressed in relation to which processes are being substituted and thus allows a focus on the aspect whereas the more direct manipulation as seen in the Wii allows a direct focus on the bodily action involved.

The timeline of joysticks illustrate that a diverse set of input devices has been developed, which on different levels create the relation between input and on-screen layout.
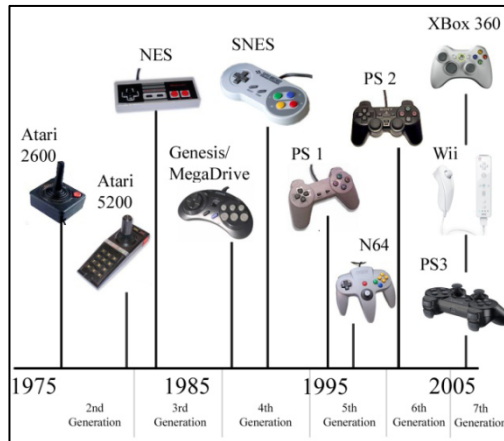
[16]
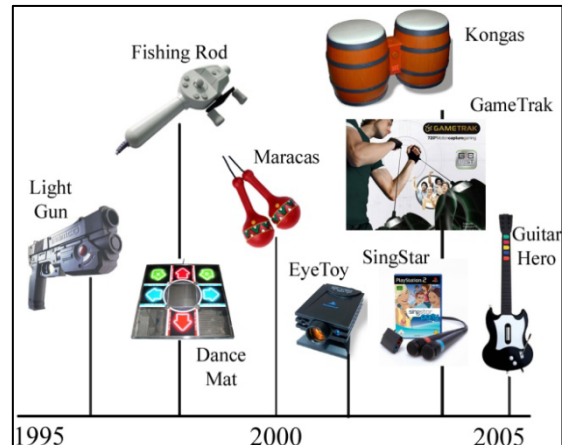
[17]

In the above images, there is on the one side a timeline of the traditional stick and button operated controllers and on the other side a range of controllers that, on various levels, activate a life like mode of operation. In this respect, it is possible to point to two different motoric levels of operation.

It is interesting to note that it is possible to translate otherwise physical, motoric and bodily functions into simple mechanistic processes, but there must also be integrated into the thought to which degree the operations are assigned to other body parts and if new motoric processes emerge and to which degree they become adaptable processes. The images are organized in a timeline, but an alternative layout of the control devices presented, would be to view the distinction between the types as a distinction between indirect and direct control devices. The image on the right contains control devices that resemble the otherwise physical processes involved in the given activity.

As was put forth earlier in relation to the screen denoted as an interface, the joystick or other means of control is often within both videogames research and HCI regarded as an interface. The various interfaces that emerge in relation to the access and control of screen

content will be treated in a preliminary manner with the purpose of revisiting and expanding the notion of the operational level that can be assigned to each present type of interface. Linking this conception to the activity models above, it is possible to point to two basic interfaces, namely the subject – tool interface and the subject – object interface, whereof the latter is a dependant extension of the former. There are several ways of describing and even pointing out different types of interfaces. In HCI, a separation of the involved interfaces is often employed and Kaptelinin [1996/97:111], who denotes the HCI related use of activity theory as a shift from an information processing approach to a tool mediated perspective, makes a distinction between two basic interfaces as being; *the human – computer interface and the computer – environment interface* [Ibid:111]. For the purpose of this inquiry and with a focus narrowly on the individual activity, the notion of interfaces will be extended with inspiration from Andy Clark.

Two basic interfaces

Clark [2007] addresses the notion of interfaces in relation to the ability of humans to be in contact with and act upon their environment. He makes the remark that;

> It is a commonplace observation, however, that the use of simple tools can lead to alterations in that local sense of embodiment. Picking up and using a stick, we feel as if we are touching the world at the end of the stick, not (usually) as if we are touching the stick with our hand. [Andy Clark:2007:264]

What is implied in Clark's notion is that when we use tools, they tend to become transparent in the process and the attention is directed

away from the mere grip of a stick to that which is at the end of the stick. In other words, this suggests a direction of attention from one interface to another interface. In line with Bærentsen, the objectification of a process into a tool or an artifact allows a shift of focus in the given activity. Winograd and Florens [1986/1990] treat this artifactual transparency in relation to flow in processes and make, from a notion from Heidegger, a point in relation to when a tool either disappears or (re)appears in a process. In relation to the act of hammering, they give an example derived from Heidegger.

> To the person doing the hammering, the hammer as such does not exist. It is part of the background of *readiness-to-hand* that is taken for granted without explicit recognition or identification as an object. [Winograd&Florens:1986/1990:36]

In this respect and with a further deepening of Clarks approach, the first basic interface in any form of computing is a meeting with the physical mean for control. Clark is in line with theories of tools as extensions akin to Winograd and Florens and with the ecological approach as it will be explicated later.

Basically, we have the physical interface or the interfacing of different materialities, the human and artifact. Clark refers to this encounter, with a furthering of the example in the quote, as the first basic interface where the hand meets the stick. The second interface emerges; *as a place where the extended system "biological agent + stick" meets the rest of the world,* and goes further to state that; *What makes such interfaces* **appropriate** *as mechanisms for human enhancement is, it seems, precisely their potential role in creating* **whole new agent – world circuits** [Clark:2007:265].

In relation to the traditional joystick it is possible to transfer Clark's notion to that of the operational mode of joysticks. There is a meeting point of hands and joystick, where the shape and placement of the operational sticks and buttons in correlation with the anatomy of the hands make certain operations possible and more convenient than others. It is not the point here to integrate ergonomics, but to describe the first level of encounter. As the operation of the joystick is learnt and utilized, it becomes more and more transparent in the process of playing games and questions emerge in relation to both the role of dexterity in relation to joystick control and the displacement of attention. The aspect is important in relation to the basic operational levels with respect to the types of functions objectified in the joystick and displacement of physical functions. In relation to the activity model, the first basic interface is where the subject utilizes a tool or in this context, the joystick. The objectification of otherwise physical functions in the joystick creates new operations now assigned to i.e. the hands.

On a simple level, it is possible to point to the joystick's controllability of an on-screen viewpoint in relation to physical transport, due to the specific objectified processes. If the viewpoint is moved as if physical transportation takes place, then the physical operation of i.e. walking is now assigned to the hands and the hands' ability to operate the joystick, which points further to the second interface where agent/player + joystick meet the graphical interface or as videogame researchers most often label it, the game world.

It is the graphical interface that most videogame researchers are preoccupied with and the joystick operation, as transparent as it can become, seems to have slipped by relatively unnoticed. Videogame player's supreme demonstration of *readiness-to-hand* in relation to

the physical control has not been of major interest within videogame research, which could be an effect of the researchers' exploration for meaning on an entirely different level of gaming. It is mentioned in places that the joystick is considered as part of a general notion of videogame interfaces, but no larger unfolding of the role have been located. As an example Wolf and Perron [2003] remarks that an interface is not necessarily the graphics involved and understands the notion of interface on a very large scale with underlying assumptions of the experience of playing games. The state that;

> The interface occurs at the boundary between the player and the videogame itself, and can include such things as the screen, speakers (and microphones), input devices (such as a keyboard, mouse, joystick, trak-ball, paddles, steering wheels, light guns ect.) as well as onscreen graphical elements such as buttons, sliders, scroll bars, cursors, and so forth, which invite player activity and allow it to occur. The interface, then, is really a junction point between input and output, hardware and software, and the player and the material game itself, and the portal through which the player activity occurs. [Wolf&Perron:2003:15]

Here the interface is understood as a passage way "into" a game world. They state that player activity is at the heart of videogame experience and further notes that a separation can be made between activities on the diegetic level and the extradiegetic level. The approach has been included to demonstrate that videogaming as an activity has very different connotations in relation to the theoretical foundation. Clearly, the authors relate to the videogame context as a

narrative realm that can be entered through the interface that separates the gamers' (real) world and the (fanciful/virtual) world of the game. The metaphor of a portal that is passed through as the entrance point is not operational within the understanding of activity implied in this dissertation.

The dexterous skills must play a role on the larger scale of videogaming, especially as the means of operation and the combined set of operations on joysticks challenge the ability to make use of all objectified processes. As an example, in games like D.O.A. and Tekken, which are third-person-perspective fighting games, a series of combinations of button pushing creates more precise and detailed moves of the in-game characters possible. No doubt, there are uninvestigated territories of game operation, as the combination of objectified processes has to become adaptable processes on other levels of the videogame – player activity, i.e. the dexterous level. This level of operation will not be treated in depth, as it is an entirely different kind of study. Here it stands to suggest that the processes involved on the level of physical operations of joysticks are complex mechanisms as the objectified processes are primarily hand operated and this level of learning may not be as easy to adapt as it appear.

Screen Content

In this section the rudimentary description of videogames is continued and the screen content will be treated in relation to the development of manipulative possibilities. Jakobson and Pargman [2007] point out that several books on the history of videogames have been produced that deploy a chronological organizational principle, which is one strategy. Counter to the chronological approach they suggest an approach that takes into account the

expansion of the videogame space, which they believe can be observed along five parallel dimensionalities;

- In-game space is expanded

- The interface between the virtual and real world is extended

- The physical gamespace is expanded

- When and where games are played is extended

- Games transcend play

Each point can be explicated under a variety of theoretical frameworks but to outline the theoretical positions that can be utilized anticipates the further progression of the text and therefore the preliminary focus will be on the expansion of what they refer to as the in-game space.

The in-game space or the on-screen content underwent an evolution from being a layout fitted to the screen to being fully explorable 3D layouts as in contemporary games. In games as the earlier mentioned TV – tennis and PONG [18], and in later games such as Space Invaders [19] and Pacman [20], there was a fixed layout within which one could manipulate the content. In relation to the joystick an operation that permitted movement along the x or y axis or both was sufficient.
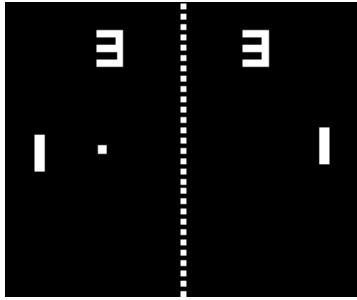
[18]

[19]

[20]

Later, the scrolling games arrived that allowed the player to move, first in one direction, and later, in two directions and later again in all directions. In relation to games played on the Wii console, it will conclusively be remarked that games such as bowling are still a layout fitted to the screen though the means of operation has changed, which in the presented theoretical perspective suggests that it can be analyzed under more than one heading, as it also expands player space. Though Jakobson and Pargman take games into account that can be played on mobile devices and online multiplayer games, a strict focus here will be on the relation between on-screen videogame content, the means of manipulation and the player.

The concept of interfaces needs to be deepened. In the term is implied that the basic interface of visual media and videogames is the on- screen content. But as noted earlier the first basic interface is the physical interface. As this first part of the dissertation will end with a preliminary concept of videogame play as an activity, it is pivotal to seek out exactly which types of interfaces are present and on which levels they are operational. A closer inspection of game world layouts, in this respect, will be given.

On the screen, in the game world or just there

We need a closer inspection of types of games and game systems. This will not involve an interminable listing of games, but will be examplificatory in relation to some common and shared features in relation to what kinds of manipulations are possible and how the games are operated on the visual level. From a visual outset videogames can be defined on a number of levels relative to the actions possible. They can be defined from the first and third person-point of view, which implies that there is an extended viewpoint from that of the player. They can be defined as being either two-dimensional (2D] or three-dimensional (3D), relating to the degrees of explorative possibilities. Often the characteristics of 2D games lie within the limits of explorability, whereas 3D games are often characterized by their freedom of exploration. In addition 2D and 3D refers to styles and techniques of construction.

A selection of games will presented from the viewpoint such as first or third person perspective, as platform and scrolling games and as games with a layout fitted to the screen. This presentation will show some common features in order to get an idea of how a game layout may be arranged.

In the above passage it was suggested that game worlds could be viewed from their development in relation to expansion of the game space. The examples shown [18-20] are game worlds fitted to the screen which means that all the action takes place within the frame, so to speak. These early games allow very little manipulation and the directional movements are often confined to movements along the one or the other axis, that is, the player can control the objects by moving either up or down as in the tennis game or from side to side as in Space Invaders. In Pacman [20], the player can move the

object more freely, but is still constraint within the "fit – to - frame" game world.

The next evolutionary step in this respect can be said to be the scrolling games that allowed the player to move in one direction thus offering the possibility to move the point of view. An example of this game type is Super Mario Bros. [1985]. Here the player can move Mario to the right as seen below, thus expanding the view of the game layout.

Super Mario Bros. Screen shot 1
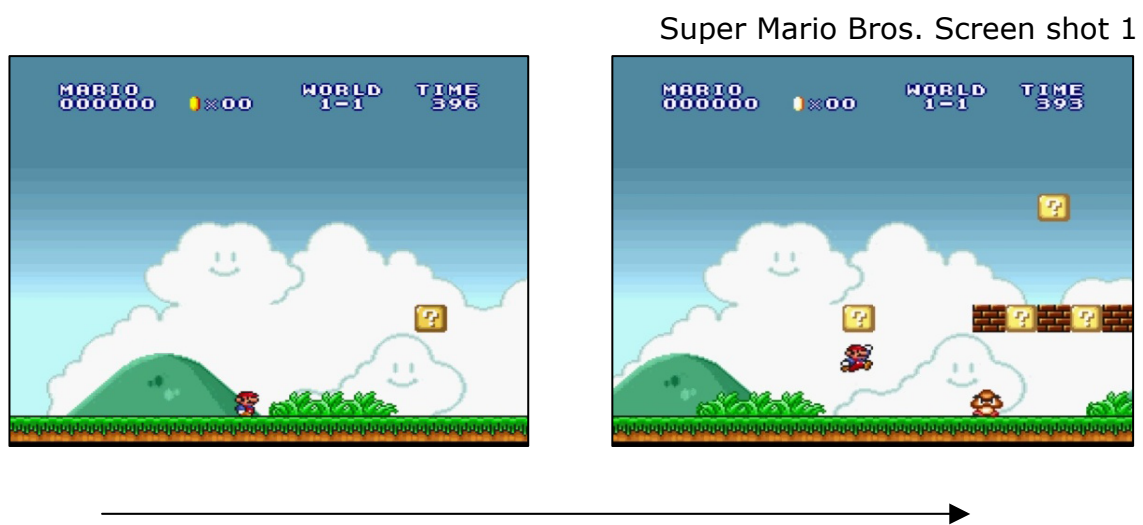
This type of game, which in some respect is canonical, requires few operations on the joystick; a directional operation and 2 buttons for jumping and firing light balls. The Super Mario Bros. later developed to a two-way scrolling game, thus enhancing the freedom of exploration, though to a limited degree. Until the beginning of the 1990's, scrolling games or platform games was a typical type of game, with some moderation taking place within the same basic framework. A change in perspective can be seen in the game DOOM (1993). A first person perspective not only gives the player a sense of looking into the world, but may also have an arm in the field of view that is operational, i.e. loading the gun. DOOM is a maze-like game

where the player moves the viewpoint along hallways and shoots enemies as they appear.

Here the view point is moving along the z – axis, extending the operational abilities. A contemporary game that has expanded this concept is Bioshock (2007). Along the lines of expansion Bioshock is constituent of games that are more freely explorable with the option of turning the view in almost all directions and also has a hand or two in the layout. In Bioshock a left arm is the basic property, though it may not be used. Occasionally both hands are visible in relation to the use of weapons and other things possible.

Bioshock 2007 – Screen shot 3

Though the graphical resolution has changed from the days of DOOM to Bioshock some features are the same.

In some respects Super Mario Bros. can be said to be a third person perspective game, since the player controls a figure in the layout, but this definition is not used in this respect. Third person perspective games are games like the Tomb Raider series, where the player controls a figure in a relatively freely explorable layout exemplified in the images from Tomb Raider- Angel of Darkness.

Tomb Raider Screen shot 4

The game examples shown here are played with traditional controllers, that is, joysticks that have directional buttons or sticks, action buttons and in some examples buttons for control of viewpoint. The games are also constituent of games where the player is situated in front of the screen, most often, sitting down.

The EyeToy concept, developed for Sony's Playstation 2 and the Nintendo Wii game system provide the player with new means of interaction. The EyeToy concept uses camera and motion tracking software, as described earlier, which allows the player to manipulate the graphical layout with an enhanced use of body and hands. It also mirrors the player in the game world by integrating his/her image into the layout, as shown below.

[21]

This game in correlation with Wii expands the physical game space if understood along the five expansion dimensionalities.

[22]

[23]

In relation to the Wii system, the player still has to use a controller, but the system is reactively tracking the player's movements. In Wii, if playing a game of bowling, the player can move the body naturally as they would, where they playing real bowling. Here it must be stated that the Wii system actually do not require for the player to use the body as the EyeToy system does. The player can actually sit down and only move the wrist. The movement of the body within the Wii game system is a choice.

Two tables were shown earlier that displayed the evolution of the traditional joystick and the evolution of alternative input devices. The former could be said to be the indirect way in which the player gains access to the content, whereas the latter types can be said to a more direct type of operation.

Juul makes an interesting distinction between, not only the types of input devices used in various games, but also the appeal of the input technology on players. It is has become common to distinguish *hardcore gamers* from *casual gamers* and the brief definition of the respective types is that a hardcore gamer enjoys difficult games, whereas the casual gamer dislikes difficult games [Juul:2010:8-10]. Though it is not the point of this dissertation to address videogame players in this fashion, the distinction is, as it turns out, relatable to both the type of graphic a game displays and the means of operation. Many casual games uses a more simple type of graphics and with the arrival of the new types of game consoles that enhances the direct form of operation, the input devices are easier to use in opposition to the, by now, advanced modes of control on the traditional joysticks. In this respect Juul points out that the interfaces of the new types of consoles are mimetic and defines it as follows, as one of two characteristics of casual games ;

> The first trend is games with *mimetic interfaces.* In such games the physical activity that the player performs mimics the game activity on the screen. [Juul:2010:5]

He also states that the revolution of casual games is a rediscovering of the mechanisms of early videogames with its simplicity and the appeal that lies on the mimetic level [Juul:2010:2]. It is easier to pick up the guitar in Guitar Hero and play for a short time, than to pick up the advanced joysticks used to play time-consuming and complex 3D games. Here the notion put forward in relation to indirect and direct control shown in the images displaying timeline of control devices resurface, as another layout could be to follow Juul's line of thought where the mimetic interfaces are often controlled directly by the body or devices that resemble objects from activities the games mimic.

A preliminary conclusion here will be that the more complex a game world is constructed the more complex types of operation is involved, which again points to a more complex objectification of processes into the joystick. The new types of games, on the contrary, have lesser complex levels of operation, as they mimic the physical processes that a given game simulates and therefore do not require of the player the learning process of complex joystick operations.

This chapter has served the purpose of introducing the components present in videogames, the input devices and the screen content. A connection has been made with an HCI approach in an attempt to view videogames as an activity, as well as a connection between different types of graphics and the means for control has been established. The model presented, which display the videogame – player activity system's constituents will resurface in part 3, where it will be explicated in detail and serve as the analytical instrument, when videogames are being reviewed in light of an activity that relies on players perceptual accommodations.

To complete the investigation of videogames it will be necessary on the premises of the format to look at the most dominant theoretical approaches brought forward by a research field under development.

Chapter 3

Videogame research

The theoretical interest in videogames has intensified within the last decade, bringing the study of the phenomenon into established academic circles. A research field focusing on a variety of aspects of video gaming is emerging and because of video games' multifaceted properties, an interdisciplinary approach is characteristic of the field, which stems from a realization that the peculiarity of videogames cannot be investigated from a single theoretical outset. In an essay by F. Mäyrä, the focus is placed on interdisciplinarity and multi-methodology, which he states is "…an inherent characteristic of game studies" [Mäyrä:2006:313]. He argues that the interdisciplinary approach in video game studies is born out of necessity, due to the fact that videogame studies is a relatively new field that has not yet a formulated framework for doing research and therefore must draw on other established scientific fields. He adds more interestingly so that "…games are best conceived as multiple layered systems and processes of signification that mix representational and performative, rule – based and improvisational modes in their cultural character" [Mäyrä: 2006:314]. He determines some minimum requirements that must be present when doing game research. First, a game should not be viewed in abstract terms detached from the player and the gaming situation. Further, the player cannot be studied without an integrated focus on the system with which the game is carried out and in conjunction with this; his belief is that the ludic aspects must be taking into consideration in relation to gameplay. What he points to is the complexity involved in carrying out game studies, since all aspects of videogames can be taken into consideration from a variety of theoretical platforms. In the appendix of "Video Game Theory

Reader 2" [2009], an overview of relevant independent possible approaches is listed with a note stating that the list is; *neither comprehensive nor inexhaustive* [Wolf&Perron:2009:331]. To give an idea of just how diversely the field of videogame studies has evolved, the list will be included here. Besides the establishing of the complexity, the purpose of replicating the list is that it will serve as a pool, containing areas of interest, from which it will be possible to pick a few for further description. In alphabetical order the areas listed are; Anthropology, Art and Aesthetics, Artificial Intelligence, Business/Industry (includes Marketing), Communication Theory, Computer Graphics, Computer Programming, Cultural Studies, Design, Economics, Education, Ethnography, Film Studies, Game Theory, Gender Studies (includes Feminism), Genre Studies, History, Human – Computer Interaction, Interdisciplinary Studies, Law, Literary theory, Ludology, Media Ecology, Medicine, Methodology, Narratology, New Media (includes Interactivity), Phenomenology, Philosophy (includes Morality and Ethics), Politics, Psychoanalysis, Psychology (includes Cognition, Emotion and Pleasure), Reception Theory, Semiotics, Sociology, Sub-creation Studies, Television Studies, and Theater and Performance Studies.

A brief scan over the list is enough to conclude that studying games is as broad a discipline as studying the world about which everything is of interest. Several headings in the list can be unfolded further and combined in infinite ways and though the inexhaustibility seems almost dizzying, this can also be said to be the liberating force surrounding videogame studies. Anything is yet possible and no one direction is the right one, which points to an almost anarchic atmosphere in which game studies is carried out. There are however, as will be visible later in the passage describing videogame research more detailed, tendencies to claim a right to a definition of what

constitutes a video game. In the following passage the difficulty of defining the subject at hand, *videogames,* and agreeing on a name for it, will be treated.

"What is a video game?" and why is a definition needed?

What videogames are, in its basic phenomenological sense, is still debated and no single definition has been reached. What can be concluded, at least at a preliminary stage is that various levels of the phenomenon have been granted more attention than others and the field is, interestingly; open for new articulations and approaches and even new suggestions to what videogames are. Curiously, a seemingly simple task, such as naming the phenomenon has its problems and no common term has been agreed upon. Terms like interactive digital entertainment, video games, computer games, and digital games, just to name some, are flourishing within the field.

The difficulty of defining what a game is could derive from the interdisciplinarity itself, since established fields of research outside videogame studies have own methods of defining its subject of study in conjunction with a specific field's ability to articulate something significant about videogames. In the introduction to "The Video Game Theory Reader 2", the editors state, in thread with the above statement, that;

> The fact that the field is so multidisciplinary may also slow down the codification of terminology, as the variety of approaches slowly converges on definitions and terms. [Wolf&Perron:2009:7]

As for the name of games, the editors point to a search carried out on March 4, 2008, where a search criteria was "video game" in

opposition to "videogame" with the result that "video game" in two words had a massive amount of hits in relation to the one-word term. I.e. on the search engine, Yahoo, "video game" gave 207 million hits, whereas "videogame" turned up 36.1 million hits [Ibid:8]. The point is not to suggest that a simple search on the internet should influence the label, but it says something about the usage of the terms. In "The Art of Videogames", Tavinor [2009] settles with the one-word label, videogame, which has also become the choice in this dissertation. Tavinor takes on the task of looking at definitions or the lack of such, as he calls attention to. He even states that game researchers in general are not concerned with a definition and that the most prominent directions within videogame research such as the *narratological, ludological* and *interactive fiction* approaches do not; *come in the form of definitions* [Tavinor:2009:15]. Tavinor further refers to James Newman, as an example of a researcher that confirms the exception, and has granted attention to the problem of defining games. As pointed out earlier, videogames are called by a number of names and since there are no formal agreements, a decision in relation to the preferred term within this dissertation had to be reached. Prior to my choice of *videogames* as one noun, the preferred label was *computer games*, but inspired by Tavinor's attempt at a definition the term *computer game* was replaced with *videogame*.

Tavinor argues that the visual aspect of the medium must be a part of the definition, though once settled with the term, this still provides definition problems, if videogames should be a label that encompasses all types of games carried out on a computer or game console, since some early games were text based. Still, for a contemporary approach to videogames, the visual aspect is maybe one of the most important ways in which the medium separates itself

from other pictorial media. This statement anticipates what is to come, so, for now, a closer inspection of Tavinor's suggestion is needed. He states that a set of conditions must be implied in the definition which does not mean that all conditions are necessarily present individually, but must be present in various combinations for an artifact to be a videogame. His more formal definition is as follows;

> X is a videogame if it is an artifact in a visual digital medium, is intended as an object of entertainment, and is intended to provide such entertainment through the employment of one or both of the following modes of engagement: rule and objective gameplay or interactive fiction. [Tavinor:2009:26]

Incorporated in the definition is the visual aspect in correlation with the ludic and narrative aspects. According to the Online Etymology Dictionary[], the word *video* means "I see". In other words, the definition can be translated into "I see"-game or "seeing"-game, which point to the visual perceptual aspect of the gaming process.

The use of Tavinor's definition is based on a preliminary need for a common denominator and a definition that takes into account the visual aspect which may not necessarily be implied in other terms, like interactive fiction or digital games. It will be conclusively remarked that videogame research as a field is a multi ingredient melting pot with no clear definition of its subject.

There are, evidently, what could be considered as, predispositions, movements, waves and turns within videogame research and a deepening of both the theoretical implications as well as implications

relating to the problem of an ill defined subject of study, a look into the various transitions within videogame research is unavoidable.

Prominent Tendencies within Videogame Studies

In the following, the prominent approaches within videogame research will be outlined with the purpose of presenting a layout of the field. The attention given to videogames points in all directions and the guiding factor for doing research, seems to originate from personal levels of interest. What will become apparent is that research strategies and articulations regarding the graphical layout prove to be difficult to muster in relation to the strategy and appropriate level of analysis sought after in this dissertation.

The walkthrough of different approaches has been organized due to both the historical outset, the thematic theoretical content and to conceptions of what videogames simulate and represent.

Narratological Approach

In 1997, Espen Aarseth published the book; "Cybertext – Perspectives on Ergodic Literature", where he places videogames in the literary tradition, as a specific type of text; an ergodic text. He borrows the term *ergodic* from the Greek words *ergon* and *hodos* which means *work* and *path* [Aarseth:1997:1]. Ergodic texts in this appropriation refer to literature that by nontrivial effort, as Aarseth puts it, allow the reader to work out a path through the text that in its nature is non-linear and thereby requires an active operation from the reader other than starting from the beginning and proceeding to the end. An example is that of the Chinese "I Ching", where the reader gains access to pieces of text by throwing coins that by a predetermined set of rules open up pieces of the text. In his book, Aarseth claims that videogames can be viewed as traversal pieces of

text, where the player gains access to the text or pieces of the text via rules or conditionalities, and that the flux of emotions that moves between frustration when access is not possible or the epiphany when you succeed, is the dynamic of playing/reading. If the player does not succeed he is excluded from the world of the text. Aarseth labels the computer's literary significance as a cyborg-relation, where the text is created or emerges in a correlation between operator, sign and medium. This triadic relation establishes what he calls *the textual machine.* Aarseth's approach to videogames as "text" is described in "Understanding Digital Games" [Rutter&Bryce:2006] as a *poetics* that investigates conventions and rules within the "text".

Aarseth's book was an attempt to legitimize videogame studies as an academic discipline, where his own approach bears traces from modern literary theory evolving around the active participation of the reader with references to Eco, Iser and others. Retrospectively, Aarseth's strategy can be seen as an intuitive notion about the interaction process and the dynamic relation between medium and user, which he attempts to explain with an extension of the notion of "text". At that point in the history of videogame research, an alternative idea about "text" seemed to be a promising approach, which could be seen as a strategy that; "…*ask which of the previous non-gaming forms of culture videogaming most resembles*" [Tavinor:2009:15]. If the extended notion of "text" could be understood in a broader and more dynamic way, then it seemed plausible that the theories could be tweaked to fit the involvement that videogames required from its player. It could say something about the process of getting access to the content and thereby to its meaning.

At the same time as Aarseth publishes his book, another researcher in the field of interactive digital media, Janet Murray, published

"Hamlet on the Holodeck: The future of Narrative in Cyberspace" [1997]. She also proposes a literary and narratological approach to the medium, including videogames as a new way of telling stories, of bringing about stories and creating narratives through interaction, and thereby questions the idea of authorship among other things.

The examples of the literary/narratological approach to computer games are numerous, and the above mentioned books are in some quarters viewed as milestones. Common amongst researchers who chooses this approach is to view videogames as texts, thus providing the framework for the use of narrative theories with regards to games. Symptomatic for this approach is that an already established research field, the literary theory, is sought to be broadened so videogames can be encompassed or embedded within a broader paradigm of "texts". As Tavinor points out; *"Problematically, narrative does not seem to be a sufficient or even necessary condition of videogames."* [Tavinor:2009:20], is due to the fact that some games cannot even meet the most basic requirements that constitute narratives, such as plot, characters or a predefined ending.

Ludological Approach

The term *ludology* was coined by Gonzalo Frasca and was thought of as a term that would bridge all videogame research. The creation of the term would incorporate aspects and theories of *game* and *play* and could be seen as a movement away from the literary approaches, though the term builds heavily on a specific narratological standpoint. On his webpage Frasca states;

> We will propose the term *ludology* (from ludus, the Latin word for "game") to refer to the yet non-existent "discipline that studies game and play activities". Just like narratology,

> *ludology* should also be independent from the medium that supports the activity. [24]

Ludology, as an arch term, is independent of the medium just like Aarseth's use of the term ergodic literature, which means that it can include activities not carried out on a computer. The term refers to game and play activities in general, the videogame being one activity amongst many. The defining explanation of the term is inspired by narratology. The videogame has a beginning, a development (middle) and a result (ending) that is either a success or a failure. The model is very similar to that of Bremond's model of possible narratives, which operates from the level of basic narrative functions [Bremond:1980], where an agent is given a task that can either be carried out or rejected. If he takes on the task, he can succeed or fail.

> In Bremond's words, an adventure videogame could be described as follows: the player's performance would determine a particular set of functions, from the point of view of the character he is controlling. One particular combination of functions (plot) is the winning one; all the rest will lead to the players defeat. [25]

Since Bremond's narrative model suggests that choices are being made within a diegetic world, i.e.; the hero of the story can take on a task and influence the development of the narrative, which implies that had other choices been made other narrative structures would have unfolded. It seems applicable to the interaction process, due to the earlier mentioned conditionality as viewed from within the frame of the ergodic text, since choices made by the player, can influence the game later on in the gaming process. A choice on one level can make game objects and passages available in another level. Even

though ludology is not a direct application of narratological principles, the idea of a text is flowing within the terminology, since the game have hypertextual traits that branch out and leads to different ways in which a game can be unfolded. The hyperstructure of a game may resemble a narrative structure in light of Bremond's approach.

Eskelinen [2001] favors the ludological approach and attempts to give the deathblow to all theoretical influences from literature, drama and film as he determines the approaches to be *ill – grounded*. He acknowledges that the structuralist ludological approach bears resemblance to certain narratological positions, but that is, as pointed to above, based in the underlying structure from which events unfold. And in relation to certain theorist's position that the videogame is a new form of storytelling, he states that;

> Outside academic theory people are usually excellent at making distinctions between narrative, drama and games. If I throw a ball at you I don't expect you to drop it and wait until it starts telling stories. [Eskelinen:2001]

The narratological and ludological approaches have in common a concern with in-game structures from which meaning can be derived. They are more traditionally object-oriented in relation to an unveiling of the underlying structure and the means of uncovering and utilizing these structural elements. These approaches largely ignore the perceptual and visual aspects in the sense that in-game characters, rules or withheld narrative information serves as structural elements that fill out parts in the larger interpretative process of gaining access to the meaning within the game.

Cognitive Approach

The strategy to use narratologically inspired ideas, can be said to hold an implicit conception of narratives' functional relation to human understanding and experience of themselves and the environment. Torben Grodal approaches narratives as functional entities closely related to the evolution of man. Narratives can be a way to organize and structure information. He criticizes the literate approach to computer games by stating, in opposition to what the narratological exponents themselves claim, that this approach only says something about a medium through which *some storytelling* is taking place.

> Some researchers, for example, define narratives by referring to literary works, others like Brenda Laurel, describe video games and other computer applications by reference to the theatre and theatrical structures. Such descriptions have some advantages, but also problematic consequences, because phenomena such as "story" or "narrative" are then only defined in relation to their media realizations, not by their relation to unmediated real-life experiences and those mental structures that support such experiences.[Grodal:2003:129]

The distinction Grodal points to is that narratological approaches can be useful for the analysis of the artifact, but can say nothing about the function of narratives in humans' experience of being in the world. Where the narratological position rests on a media reception and consumption foundation, Grodal takes the larger perspective of everyday life and asserts that media formats play a role in how we make sense of our existence and holds that interactive formats, rather than mirroring or imitating other media, imitate every day processes with which we as humans encounter the world. What Grodal further points to, is that the above mentioned strategies are

problematic when used to describe phenomena such as videogames and virtual reality, since the interaction process on various levels are more like simulations of everyday experiences. The article, where the quotation stems from, is entitled; "*Stories for eyes, ears and muscles – Video Games, Media and Embodied Experience*" [Grodal:2003], which indicates a coupling of a functional narratological approach with an embodied cognitive psychological approach. If there is a story, it is unfolded in a holistic process that involves and situates the body in a specific encounter with the game world. As an example, he describes the gaming process as a learning process, an iterate process of acquiring skills, where the emotions invested not only relate to a possible narrative content, but to the joy of making progress on the basis of repetition. The literate approach is object oriented and centers itself around the content of the artifact, whereas Grodal's approach relates to human processes and the embodied or wired in mechanisms that the user brings to the situation. By improving your skills, you enhance and support the flow of the gaming process, something that exists independently of the narrative. In this respect, the learning process is taken to be part of the overall gaming experience, since a novice player may be engaged in the gaming process with a different attitude than a player with master skills. With respect to this aspect, it is interesting to note that Grodal identifies three phases of play experience; *unfamiliarity and challenge, mastery* and *automation.* This is a point that will be used later, when the full identification of the various interfaces involved in playing videogames is carried through. The process is in its own right considered to be aesthetic. That is, aesthetics in this sense is not necessarily bound to the object or the subject, but arises in the process or is the process [Grodal:2000].

While the narratological approach narrows down the process as an experience of narrative structures or as a gain of access to narrative components through negotiation with i.e. the ludic elements, Grodal broadens the perspective to include the body in a more holistic understanding of the game process. The interesting part about Grodal's approach is that he attempts to explain the essential and embodied relation between a person and his/her relation to the surrounding world in general and applies this notion as a means of describing the game process. Very much in thread with the approach sought in this dissertation from a general viewpoint, though divergent on the level of detailed description, he states that;"…*most of the game activity consist in seeing, hearing and doing in a simulation of real − world interaction*" [Grodal:2003:130].

Grodal explains the gaming process in a structural bottom up −top down cognitive model which narrows down the functional parts that relates to basic modes of experience in general and in the game flow in particular. He calls the model, PECMA, where every letter in the abbreviation represents a part of the process flow. P(perception), E(emotion), C(cognition) and M(motor)A(action). **P**erception gives rise to **E**motions that again gives rise to **C**ognition or the creation of schemata upon which **M**otor − **A**ction can be based. In Grodal's example, the situation could be as follows; Hans sees (P) a dragon, he gets scared (E), he rationalizes that he must do something (C) and he then kills the dragon (MA). There are some obvious problems with this model due to its mechanistic layout. Though models present matters in a simplified manner, the model can mistakenly be understood as a chain of conditions where one follows the other. Perception never ceases, the priority in relation to emotions giving rise to cognition can be questioned and the use of schemata would in some psychological circles be deemed as outdated. In remark to this

statement, Neisser who named a direction within psychology as *Cognitive Psychology* in 1967, which presents an approach to cognition based on information-processing and heavily made use of the notion of schemata, states in 1994 that no single principle will be able to explain cognition and concludes that;"… *schemata won't do it"* [Neisser:1994:227]. The use of the terms schema and schemata is seen flourishing the field of media theory, which may represent a symptomatic condition in relation to application of theories from other well defined fields of research. This discussion will be brought up in part 3, after the introduction and description of approaches to perception. The reason why it is mentioned here, is that the explanatory level Grodal utilizes seems to have colonized almost all attempts within interactive media and videogames research when an explanation is needed of how human perception functions. The underlying theoretical approach which Grodal and others rest upon is a constructionist cognitive approach that in general terms have its own intrinsic paradigm with which it explains perception and the role cognition plays for perception. It will, in short, be pointed out here that an application of cognitive psychological assumptions within media theory rarely contains a critical view of the theories and their premises, but is almost always used in an axiomatic fashion, presuming that the by now well described mechanisms of cognition and perception have reached the level of grand theory or have laid bare the processes and acts by which they co-jointly function.

Chapter 4

Visuality of Videogames

Though some of the positions listed below reside within the overall field of videogame research, the choice here has been to extract the more visual oriented approaches and describe them under the heading of visuality.

In relation to the first presented approaches, it must be stated that no matter how computer game research is approached, no matter the theoretical positions, interests or beliefs, the game is played due to the actualization of a graphical interface. The interface represents or presents how a given game world looks, how the game world can be explored and which elements in the layout can be manipulated. The term interface here refers to the visual interface or what was preliminarily defined as the second interface in a previous chapter. Still the discourse employed here is based on the common jargon within game research. The introductions to approaches with interest in the visual aspect will be subordinated, as sub-areas of interest appear within the broader concept of the visual interface.

Researchers who have an interest in the visual aspects often come to a final acknowledgement that the traditional and textual inspired approaches in combination with the applied theories from other visual fields do not do the job, when used as an explanation for the visual mechanisms. James Newman [2002] claims that it matters not what a game looks like, in the sense that no particular artistic style secures the success of a game. It is not a question, from his viewpoint, to focus on the visual art involved, but on the kinaesthetics, which suggests, without Newman being explicit that it is not just the mere

look of the layout as images in an artistic and aesthetic sense, but the kinetic structures that are of interest. What he suggests is that a player can be just as engaged in an old school game as he would be in a new 3D game with enhanced graphics, which points to something within the layout that is independent from its aesthetic artistry. A simple game as PONG, which basically consists of 4 white elements on a black background may engage the player just as much as a game like Tomb Raider, which is a "realistic" adventure game, with enhanced control possibilities when compared to PONG. Stockburger [2006] has suggested that the visual aspect can be understood as a modality, a kinaesthetic modality that serves a specific purpose in the overall gaming process. He realizes that an attempt to grasp videogaming under one heading or one definition reduces the possibilities of addressing all aspects and suggests an organizational principle under which the variety of modalities are treated separately although they function interdependently, such as the kinaesthetic, the auditive and the narrative modality and treats them as experiential 'spaces'.

One of the typical undertakings when relating to game world graphics is the use of terms deriving from the field of cinematography. Technical terms from the world of film, such as zoom, panning, and other terms based on the camera angle is often seen as an explanatory strategy when describing what takes place in the graphical layout[Poole:2000][King&Krzywinska:2002]. When a player approaches an object in a game world, this can be described as a zoom or dolly, relating to whether the phenomenon is a simulation of changes in the lens or changes in the position of the camera. It is a method that attempts to place the player in a field of view, to address issues relating to a first – or third person perspective, and to describe which movements it is possible to simulate within the layout. In

relation to the construction of layouts, both Poole [2000] and Bolter and Grusin [1999/2000], refer to the tradition of perspective painting. This approach points to the constructional aspect of the game world more than it relates to experience.

In relation to the experience of the visual aspects of videogames there seems to be a tendency to confuse the experience of the layout with the means for constructing the layout, that is, the visual techniques employed in the creation. An example of the mix up of explanatory levels is seen in "Understanding Video Games" [Nielsen, Smith&Tosca:2008], under the chapter heading, *Video Game Aesthetic.* Besides an approach also relying on the notion of perspective to explain the modes of first – and third person perspective the authors eventually counter-conclude that;

> "As we follow the historical evolution of video game design, we should increasingly not cling to a strict division between first – and third – person perspective; rather, we should discuss a game's *point of perception*, the point from which the player perceives the gamespace." [Nielsen, Smith&Tosca:2008:110]

The notion held in this quotation suggests a turn from the use of pictorial terms to a use of perceptual terms, but no theories of perception are introduced. What is introduced is a level of description that has to do with the construction of space using techniques derived from mathematics and geometry and to some extent terms derived from cinematography, in line with Bolter & Grusin [1999/2000], and Poole [2000]. The construction and simulation of space on flat surfaces has been known since the discovery or invention, one might say, of the central perspective. The construction of space where space does not exist has been investigated in the

visual arts since the 15th century. With the computer as a visual medium for space construction, the use of the Cartesian coordinate system using x, y and z axes have been applied as a tool and we now readily refer to spatially explorable constructions as 3D images in opposition to 2D images[Wade&Swanston:1991]. Again it will be pointed out that an explanation of the experience of game space by describing how game space is constructed is a mix up of different levels of description.

Following the comment made in relation to Grodal's perspective, the use of the Cartesian notion of space as being in three dimensions and unfolding along the three axes, falls under a scientific paradigm within which the cognitive constructionist approach ascribes itself. That the above mentioned authors turn to this strategy in relation to a description of the game space may be sought within the conundrum of approaches to perception.

More interestingly so, for this dissertation, is the notion of videogames as a play with the interface, which was brought forward in the introduction of this dissertation, namely in the presentation of the study carried out by Barr et al. The study presents; *an analysis of this form of playing with the control system and interactive possibilities as an example of how an HCI approach to videogames might be conducted* [Barr et al.:2006:317].

The paper has played an inspirational role in the establishment of a framework for studying the relation between player and interface. Now it has been mentioned as a reminder that there are, though very few, approaches to this specific relation between player and videogame.

Simulation

In the above passages, the most rudimentary aspects of videogame research have been posted. But significant for the field is a revision of earlier posed stances and positions, as is the case with Aarseth who eventually revised his own initial approaches.

The interdisciplinary rummage of the field is often defended with the argument that the field is new, growing and in search of identity. In "Understanding Digital games" [2006], Aarseth is reviewed. The authors refer to the term *ergodic literature,* from the 1997 "Cybertext", as a new term for adventure games in particular. Because of the short period of time in which videogames have been studied, it is possible to track the movements and repositioning of the researchers within the field, since they are themselves under flux. In "Understanding Digital Games"[2006] it becomes evident that by the year 2004, he shifts position, and claims that the central aspects of games is *simulation,* and that simulation is what separates computer games from other media. The interesting point to be made is that not only does Aarseth change his focus and make a turn away from the literate, he also makes a more profound scientific approach in the sense that he is no longer concerned with what Tavinor referred to as a resemblance strategy, he is now concerned with the differentiable aspect, that is, how games separate themselves from previous known cultural formats.

> Simulation is the hermeneutic Other of narratives; the alternate mode of discourse, bottom – up and emergent where stories are top-down and preplanned. In simulations, knowledge and experience is created by the players actions and strategies, rather than recreated by a writer or a moviemaker (Aarseth 2004: 52][Understanding Digital Games:2006:110]

The authors of "Understanding…" comment Aarseth's statement as follows;

> If we accept Aarseth's claim, then it is clear that we will need to find new tools for understanding the relationship between the player and simulation, as well as new tools for analyzing the complex composition of the simulation itself. [Understanding Digital Games:2006:11]

What they move on to suggest, as an approach to the shift of focus they believe Aarseth is representative of, is an understanding of simulation as a mimetic representation with roots in the Middle Ages and the mechanistic view of the 19th century together with a semiotic interpretation of the mimetic representation. The representation can be seen as a system of *signifiers* and *signified*, or as they state, *a chain of significations.* Collectively, the referenced examples show the need for new approaches, without offering any.

Similar to Aarseth, Andrew Darley [2002] argues that the central point in understanding videogames is not the story of the game, but the interaction.

> Here, the term "interactive" refers, as we have already begun to see, to a distinctive mode of *relating* to audiovisual representations or fictions. The player is provided with a way of directly taking a leading role in what occurs, given the means of control – at least in part – what will unfold within the scene on the screen.[Darley:2002:156]

Darley describes how it is possible, within the computer game world, to simulate hopping, running and shooting and compare it to activities known from everyday life, like driving a car, which is an activity that demands a similar, operative control. The simulative

aspect coupled with the interaction points to everyday-like scenarios which is a significance of Grodal's approach as pointed out previously.

Spatial Turn

As of 2008, Stephan Güntzel, not only points out in his paper; "The Space – Image", that a paradigmatic shift has taken place, stating that; *while computer games were primarily conceived of as interactive fiction or texts in the 1990s, starting around the turn of the millennium computer game research took a turn, trying to define games in opposition to texts and other media like film* [Güntzel:2008:170]. Following this thread, Lev Manovich claims that the key feature of computer space is navigation. Manovich states that; "What has received little attention, however, in both cultural studies and in new media theory, is the particular category of *navigation through space.* And yet, this category characterizes new media as it actually exists; in other words, new media spaces are always spaces of navigation" [Manovich:2002:252]. Though Manovich claims that little attention has been given to *navigation through space*, researchers within videogame studies have been articulate about various aspects relating to the space of the game world and various means of navigation, in the view of the concept that navigation can be seen as part of gameplay. It is worth noting that Manovich by relating to navigation in new media spaces reaches back to the very beginning of *Spacewars!*, which specifically had navigation in a mediated space as it main goal. But often, as commented below, the notion of space can be seen in relation to the game world's layout.

> Typically, videogames create 'worlds', 'lands' or 'environments' for players to explore, traverse, conquer, and even dramatically manipulate and transform in some

cases (the *Sim City* series is notable though by no means unique). [Newman:2004:108]

Newman expresses how the concept of space is a typically applied term to describe explorable digital worlds and refers to a dialogue between Henry Jenkins and Mary Fuller, in which Fuller points out that the spatial elements of video games resemble travel-novels from the 16th and 17th century.

For Fuller and Jenkins, the player is not engaged in a struggle to rescue the captive princess so much as they are engaged in a battle against the terrain of the landscape of the game world they have to traverse. [Newman:2004:113]

In a conclusive fashion, Newman states that for Fuller and Jenkins a part of the pleasure of playing games is to transform "place" to "space". That is, the pleasure is derived from a kind of geographical control.

Another approach to space in games can be seen in the writings of M.J.P.Wolf [1997], who deconstructs the many spatial representations of video games and relate to spatial structures from a more formalistic approach. He separates the various spaces of games into 12 spatial structural elements, which by closer inspection, do not relate to spatiality and space as such, but to an assorted mix of spatially manipulative possibilities. As Güntzel [2008] points out, Wolf operates with two basic conditions as differentiated approaches to game space, *off-screen space* and *onscreen space* under which games by nature can be categorized*.* These two basic demarcations also function as a historical approach to the development of space representation in videogames in the sense that early videogames where confined *onscreen spaces* with no possibility of the player to move beyond the frame, whereas *off-screen space* is characteristic of

contemporary videogames allowing the player to explore the game space that exist beyond the frame. I.e. on-screen spaces are equivalent to PONG and Space Invaders, shown earlier [18-20].

In "Videogame Forms and Contexts"[King&Krzwinska:2006], the authors examine the tighter link between game space and the explorative possibilities, introducing the concepts of "hard" and "soft" boundaries, where hard boundaries are perceived as limitations to exploration and soft boundaries as temporary barriers that can be overcome under specific conditions allowing the player degrees of traversability. Intriguingly, as highlighted earlier, Espen Aarseth as a researcher seems to continuously re-negotiate his own earlier approaches and is, in the above mentioned text, referenced as follows;

> The 'defining element' of videogames is spatiality, according to Espen Aarseth, who argues that games are 'essentially concerned with spatial representation and negotiation', issues that have often been neglected in debates between those styled as ludologists and narratologists.[King&Krzywinska:2006:77]

It is worth noting that a definition of "space" is rarely seen in texts making use of the concept. Space is, generally speaking, something that has to do with geography, manipulative exploration, representation of three-dimensionality that is, with reference to geometry, something that can be simulated and thus virtually traversed and used in characterizing games in the sense that it is used as a parameter for separating 2D games from 3D games.

Approaches most prominently present in videogame research center themselves around the narrative, ludic, simulative, spatial,

experiential and visual aesthetic aspects. As for the center of attention in this dissertation it turned out to be a difficult task to find an approach that could serve as an established platform or a framework within which a study from the perceptual perspective could be carried out. There are useful pointers and suggestions that will be taken into consideration.

To cover the whole field is an impossible task and the strategy employed has been to give a historical account of the most well-known approaches and the turn of focus that has taken place from the text based to the spatial based perspective. In the process of researching material in relation to videogame theory, one criterion has been to search exclusively for text where perception served as the frame for an investigation. No larger works have been found that exclusively treats the perceptual relation between videogame and player. It was suggested in the passage describing the difficulties in deriving at a common term for videogame, that videogames can be understood with an emphasis on the prefix, video, "I see". What the above described approaches may be said to emphasize in the term is "game".

In the following passage, I will look at a concept that elaborate the preliminary notion of videogames as games of "seeing".

Videogames – space and simulation

One of the main positions in this dissertation is that the graphical layout of videogames should not be studied in a traditional pictorial way by means of theories that relate to visual arts or the construction of images. The graphical layout is dynamic in a way that not even films can deploy. In Güntzel's layout, interactive computer images have to be reviewed employing other strategies than that of the

approach to static images, as they are constituted by; reception and interaction [Güntzel:2008:171]. Though techniques from classical static image creation are seen in videogames, Güntzel states, with reference to film as moving images, that:

> In contrast with the image of film, which presents a determinate movement that is passively received by the viewer, the movement in an interactive image must be induced by the viewer. [Güntzel:2008:172]

The approach presented here has philosophical undertones, in the sense that Guntzel's project is to illustrate a turn in the reception of images as a movement from the pictorial space as an "image-space" to navigable and interactive images as a "space – image". [Güntzel:2008:171]

If videogame layouts are not images in a traditional sense, the question that follows is what they are? Already, it is possible to point to a double problem of the game layout. They are images and they are not images, which suggest that they are created as images, but experienced as something else, thus pointing further to images that simulates to be spaces, to follow the discourse applied by Güntzel.

It has been difficult, yet again, to find concepts that inherently attempt to address the issue of how to understand and eventually analyze interactive images, if they, on a preliminary level, are understood as such. Some of the concepts brought up in the previous passage related to the spatiality, the simulation or the navigability. These properties can be addressed on different levels in relation to the construction or the conception of images. In relation to the aspect of simulation, both Aarseth and Grodal referred to the simulation of, on the one hand space and on the other hand real – life. In relation to the perceptual interest herein, the most promising attempt at

identifying the peculiarity of interactive media as navigable space or simulation of everyday life, is given by Peter Weibel, who resides within the world of film and electronic art. In order to get a tighter grip on the visuality of videogames, we will look at how the media as a host of visual content can be related to former traditional forms of representation.

Convergence of moving image and moving observer

In the article "The world as Interface" (1996), Weibel describes, how *the image,* with the invention of the photography; *escaped into other host media.* [Weibel:1996:340]

> Visual culture was no longer limited to the study of paintings, but extended to the study of photography, film and so on. Image and vision dichotomized. The result of this encounter between image and technical media was the birth of the Visual. [Weibel:1996:340]

Something happens to our reception of images, caused by new ways, or techniques, to capture and depict the environment. The photography as the birth of visual realism leads to moving images, film, and the depiction of realistic motions. Moving images, it should be noted, was not invented with the purpose of entertainment, but served as a new scientific method to study motion, since the frame-based technique gave access to visible stages of motion and movement that had otherwise been invisible to the human eye. The frame-based technique of films created the possibility of capturing motion and projecting it in real time, but also provided the opportunity to reverse the process. In order to study motion, motion had to be stopped, in a manner that allowed images to be studied sequentially. Most notably can be mentioned the works of Muybridge

and Marey [Shaw&Weibel (Ed.):2003], who considered themselves as scientists or at least investigators of the new medium of moving images and not as artists. Weibel suggests that the first experimentation with the film media relates to perception. An aspect which he claims the use of film for entertainment purposes undermines. That it is about perception can be seen through the media's extensive possibility to give access to information about motion and movement that is otherwise concealed due to limitations in our perceptual apparatus, is his argument.

The genealogy or evolution of images as Weibel suggests, starts with the still image of painting, moves on to photography and the moving images and further on to the generating of code based interactive images. His claim is that still images study *vision*, film is capable of projecting and synthesizing motion, *vision of motion* and the computer is capable of simulating vision, *vision of vision*, which he labels opseography, *the writing of seeing.* In relation to the endeavors of Marey and Muybridge, Weibel characterizes their techniques as; *the technique of seeing the seeing.* [Weibel:1996:340].

> The possibility of imitating movement through pictures was a decisive step towards improving the representation of reality, and was the basis of the transformation of painting and photography into cinema, as a *trompe d'oeil* technology simulating motion. Image technology and its late-twentieth-century tendency to imitate life moved on from the simulation of movement (the motion picture) to the simulation of interaction: a responding and reacting image, the image as living system, the viable computer. [Weibel: 2003:594]

The genealogical account of the transformation of images per se, is unique to Weibel. He not only focuses on the depicted, as would be the case in more traditional approaches to images. He focuses on the material involved in the realization of images or image techniques. Computer generated interactive images are code based. They are not fixed to a material in the conventional sense and this fact influences the reception and perception on all fundamental levels.

> The picture became an image system that reacted to the observer's movement. The observer became part of the system he observed. He became an internal observer – for the first time in history. In the real world, the observer is always part of the world he observes, always an internal observer. The external observer exists only in an idealized, non-existent world. [Weibel:2003:594]

I will replicate the illustration he displays in the article where the above quotation stems from [Weibel:2003:595]. The illustration is articulate in respect to the shift in situated reception that he believes takes place with interactive images.
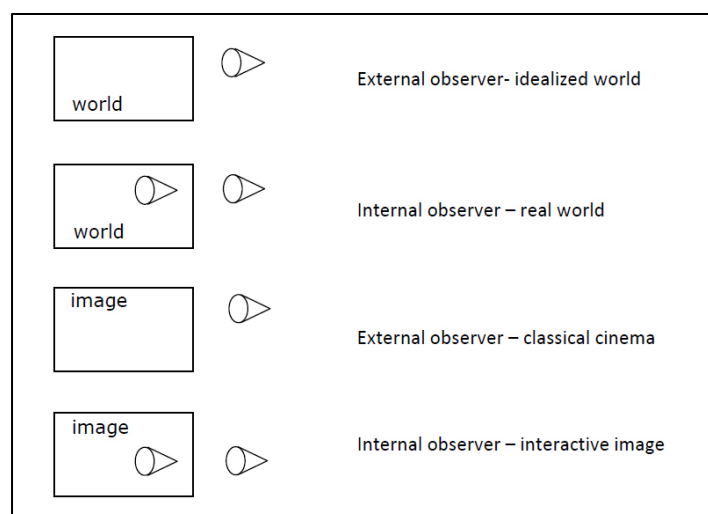
Fig. 4

In classical cinema, the observer is excluded from the material in the sense that he cannot alter it. The code based material of the computer allows the observer to manipulate the code, though in an indirect manner. On the most essential level, interactive images can be said to be a tinkering with the underlying algorithms. Most notably and useful for this dissertation, is Weibel's notion that within the interactive image system, moving image and moving observer converge, thus simulating an aspect of reality. This conception fits well with the earlier notion that "videogame" could be understood as "I see" – games or seeing - games. Accepting Weibel's notion of the interactive image system, as a convergence of moving image and moving observer coupled with Barr et al.'s [2006] notion of "playing the interface", the activity of playing videogames can be understood in more holistic terms as a videogame – player system where the alteration of the code based material is part of the process.

Though Weibel's project is to formulate a frame for electronic and interactive art, his position in relation to concepts about the role of the participants in artistic interactive environments serves as a useful foundation for the introduction of perceptual theory into the world of videogames in particular and interactive image media in general. It serves as a media theoretical frame within which a dynamic approach to perception can be thought.

Doing things with images

The title of this final section is inspired by a book entitled, "Doing things with things" [Costall and Dreier:2006]. Central for theories based on activity theory is the role of the tool or artifact [Trettvik:2004]. In this respect, if we accept some of the main assumptions put forth in relation to both the objectification of the joystick operation and the notion of interface – play, the overall activity of playing videogames can be understood as an activity

where the player is "doing things with images". Taking the point into consideration that there appears to be a mix up of explanatory levels in relation to the means for constructing images with the level at which experience of interaction on the visual level can be understood, there may be more inspiration to seek from the process of image creation, especially with computerized means of doing so. As mentioned previously, Sutherland founded the basis for modern image manipulation software and the processes that emerge using image processing programs are more in thread with the process of manipulating videogame images. The point here is not to give an extensive insight into image processing, but to state that on the most fundamental level of videogaming is a tinkering with interchangeable image components. The manipulation can be seen as a process of rearranging the given visual elements within determined confinements with the purpose of obtaining an ideal position of the elements within a game layout. In digital image creation processes emerge where a variety of possibilities are sought out by rearranging, re-coloring, adding new components and removing old one. There is an a-chronology built into the process and a reversibility allowing the creator to return to previous states of the process and reevaluate the outcome. The process is tool based and may employ tools that are similar to those used in videogame operations, like the stylus.

In relation to the activity model modified by Bærentsen, the general process of image manipulation and the process of videogaming may bear a resemblance as a visual process and therefore as a perceptual activity. Weibel stresses the permeability of interactive images, that is, the user's possibility to alter the material. Though videogames have confined graphical layouts, the alterfication process can to some degree be compared to the trial and error situation of an image creator toggling a confined set of image components in order to

arrange them in a purposeful way. This comparison points to a level of visual awareness that is brought to the gaming situation. That there is meaning to be derived from the gaming process beyond the perceptual engagement is visible in the diverse approaches to videogame research but the general methods and theorems under which videogame studies is traditionally carried out will not be employed here. In order to address the perceptual level and figure out which elements are relevant for the position here, the next part will be an investigation into perceptual paradigms and eventually the ecological approach will be described and related to concepts of activity within the ecological realm.

Chapter 5

Introduction to Visual Perception

An investigator trained outside the field of psychology, who decides to venture into the field of perceptual studies, may find him/herself, lost in a theoretical maze. The various approaches, applied methods and presented results within perception research, paint a multicoloured picture with no apparent beginning, direction of attention or fixed frame. (A picture of a field that grows organically with no obvious perspective demands from its observer a choice of viewpoint and the means to create an own frame within which to find a starting point. In a Heideggerian phenomenological sense the observer must be aware of not only what is being observed, but of the point of observation [Heidegger:1977]. The collective fields of perception studies have historical pillars to rest on, but as the interest in the significance of perception and its role in maintaining existence spreads into new scientific domains, the concepts of perception equally broadens and changes. Visual perception in particular is one of the most studied areas of the human bodily system and more questions than answers emerge in a forward accumulating fashion.

As the statement below emphasizes, the perceptual processes with which we as humans are in contact with the surrounding world, can be so autonomous that we are hardly aware of how perceptually aware we actually are.

> "Perceiving is our means of keeping in touch with the world, of obtaining information about the world and where

we are in it. The process of obtaining this information is so natural that it can be hard to explain that there are problems in understanding it. It [perception] is an ongoing activity, [...] and it provides us with fundamental knowledge that we take for granted."

[Gibson&Pick: 2000:3]

Every little effort we put into getting around and about require that we are turned on, so to speak, in order for us to carry out the tasks we take on in our everyday life. As is implied in the citation, the naturalness with which we develop and utilize our perceptual skills on the other hand creates problems when we start to question what is going on, how it is happening and for which purposes, that is, when we turn the scientific eye to the matter. An overview of perceptual theories can be given many layouts and typically the investigator will meet charts or headlines that encircle the main directions within both the natural sciences and the humanities.

Specific levels of interest

In "Theories of Visual Perception (1.ed)", Ian Gordon outlines six areas of interest, whereof some have overlaps. In any model or chart, there will be a simplification of the matter at hand, which is also reflected in his overview. It is here considered to be a useful tool for navigation among different approaches to perception. In addition to the above mentioned reasons for implementing the overview, another reason is that it can give an idea of the confusion that can arise when visual perception is brought into perspective as a means of explaining modes of experience in relation to human reception of cultural artifacts such as films and videogames. If perception is sought to be integrated into fields where reception of image media is

considered to be of importance, the right level of description will influence what can be articulated. It is therefore important to demonstrate that a variety of approaches can be employed, which poses different questions to the act of perception, per se.

The figure is a stylized replica of the one Gordon presents. And the descriptions are distilled from those presented by him.
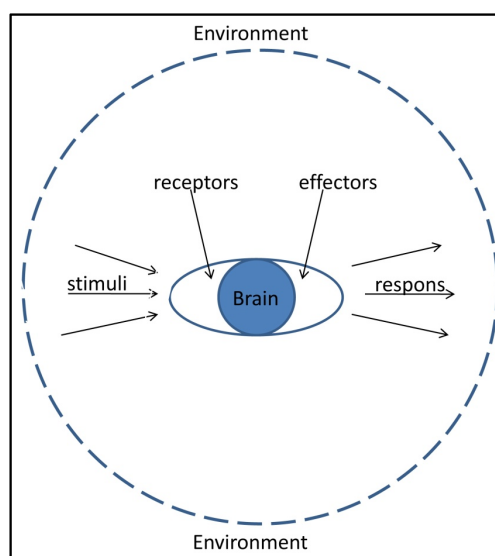
1. Environment
2. Incoming stimuli
3. Receptor surfaces and the peripheral sensory system
4. The Brain
5. Peripheral effector systems
6. Motor responses by the perceiver

Fig. 5

Each areas and overlapping areas can be tied to different paradigms and methodologies. Some belong to the humanistic traditions and some are practiced within natural sciences and again the borders may be fuzzy.

The Environment

This is the physical world of surfaces and objects, which is assumed to exist independently of a perceiver. When this area is studied, it often refers to the ecology of the organism. Ecological studies are mainly carried out within the fields of geology, geography and

biology. The ecological approach to perception has gained ground within psychology.

Incoming stimuli

Objects in the world are a part of everyday experiences and events. Some properties are directly detectable and some are not. Knowledge about important aspects of stimuli/the perceived derives from physics and chemistry and revolves around light, sound, heat, pressure, and so on.

Receptor surfaces and the peripheral sensory system

Within this area of interest, it is presumed that in order for the percipient to respond to stimuli, a process of converting the incoming stimuli to neural code is taking place. This presumed mechanism is called transduction which means that one kind of energy is transformed into another kind of energy. Questions of concern here will i.e. be; how is light absorbed by the eye, how does changes in frequencies affect the ear and how are chemical substances absorbed by the nasal membranes. The interest centers itself around pathways of neural messages; on the codes that are used to represent changes in quality and intensity together with interaction on the level of neurons.

The Brain

When it comes to the brain, things get complicated and some problems are more obvious than others. Within psychology, the connection between the processes of the brain and behavior is being studied under various sub fields. Areas such as neuropsychology and neurocognitivism are fields that work with the correlation between behavior and brain processes. The problems of studying brain processes within purely mental areas are that, often, cognitive

processes cannot be studied directly, which means that conclusions may be based on interpretation.

Peripheral effector systems

Within this area of interest, the external responses are studied. Stimuli cause the body to react in specific ways, i.e. when the pupil contracts when exposed to light. Careful studies of this aspect have given an insight into the relation between the composition of an eye, for instance the eye of a lizard, and how different types of eyes respond to different waves of light. Examples of external responses could be sweaty palms, blushing of the cheeks and rapid heartbeats.

Motor responses by the perceiver

Percipients are not passive receivers, but move around in the world and are to some extent conscious about or aware of stimuli. The quickest movement any animal is able to create is the movement of the eyes. The questions here concern the relationship between eye movements and external stimuli, what triggers and guide these movements and what role do they play in perception? Eye movements can be abrupt, ballistic, soft, and rapid and the connection between incoming stimuli and eye movements are of interest. This field has been dominated by psychology and physiology. On a simple level, the study of motor – response is a study of what the body is actually doing and how it is responding to various circumstances.

As mentioned before these different entries to study perception have shared and overlapping levels of explanation and methodologies for testing. As an example, psychophysical methods often involve techniques to measure i.e. a given threshold for perception. On an everyday basis we are preoccupied with adjustments of stimuli. We turn the volume button on the radio to find the right level of sound;

we add sugar to the coffee and taste it to find out if it needs more. If it needs more we adjust by adding a small amount, taste again and add a small amount again if necessary until we reach the satisfying level of sweetness. When thresholds are measured the extreme positions will be that which is detectable and that which is not detectable, and if detectable fine tuning can be the desirable action to carry out [Matlin&Foley:2009].

Other methods of separating the various approaches to perception exist. Though the most superordinate paradigms will be explicated later, a division of interest in perception could fall under psychological denominators or directions. Matlin and Foley [2009] outline the main areas of research into the following; the empiricist, the Gestaltist, the behaviorist, the Gibsonian, the information-processing and the computational approaches. The mentioned approaches, loosely, follow a historical order, but also follow basic assumptions on the paradigmatic level.

In the subsequent passage a brief historical overview will be given followed by suggestions of how, on a very simplistic level, to navigate and form a path through the thicket by viewing the various approaches under two main assumptions or world views.

Historical tracks

In retrospection, there are specific periods in history in which groundbreaking steps have been taken to understand the nature of human perception, and specifically visual perception. In Wade and Swanston's introductory book on visual perception, the authors have devoted a chapter to "The Heritage", as they call it. Here, they state that the history of perception is somewhat overlooked or neglected in books on perception, which they regard a pity given that the history

of ideas play a role in the positions of contemporary theories. When uncovered, contemporary ideas of perception may not be all that modern and some of the theories are based on centuries old paradigms, which are brought into perspective by Wade & Swanston, who concludes that in ignoring the history of perception it may be implied that our present ideas are superior to those of the past and therefore, past ideas need no further investigation.

> "In fact, the same theoretical issues often recur, disguised by the new jargon to appear different. Seeing through the shroud of the present can facilitate our understanding of such issues, and remaining ignorant of past attempts to grapple with them can inhibit progress." [Wade&Swanston:1991:16]

One of the main questions, in relation to visual perception that have occupied scientists and philosophers is how images or reflections of the outer world become "inner" properties. This question is as old as the interest in perception itself. How does the outer world meet the eye, and, once the projection "is in the eye", what happens to it? These questions are, on a very basic level, what both Johannes Kepler and René Descartes were interested in answering centuries ago. At the time of Kepler, which roughly counts the 16th and 17th century, a human eye was dissected for the first time [Wade&Swanston:1991:21] [Trettvik:2004]. The dissection gave anatomical knowledge of the construction of the eye and its mechanisms. Up until the period of Kepler, it was largely believed that light was emitted from the eyes and not transmitted to the eyes. Kepler described how light actually did pass through the eye forming an image on the retina, which had become visible due to the dissection. This led to the general scientific assumption that the image on the retina corresponded with the real world scene.
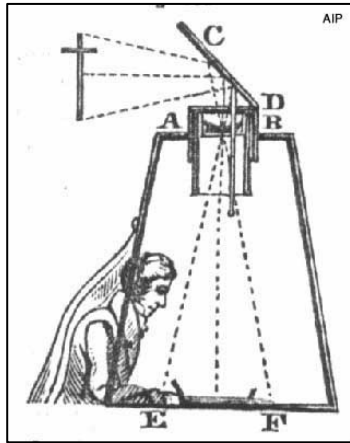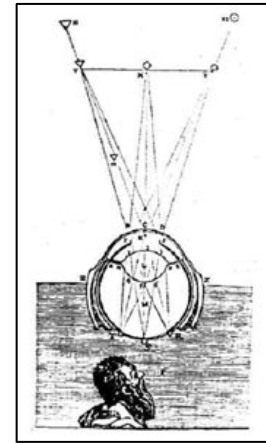
[26]   [27]

It resembled the technique used in "camera obscura" [26], a technique that by casting light through a pinhole could project a real – world scene, though upside-down, and an analogy using the apparatus to describe vision was formed.

As W&S put it, "…the emission theory of vision was replaced by a reception theory." [Wade&Swanston:1991:19]

In support of this emerging theory on perception and on interpretation of vision in general, discoveries within representational art played an important role at the time of Kepler, since the linear, or artificial perspective as it was called at that time in opposition to a natural perspective[Gibson:1979/86][Aumont:1997:25], was a household technique among artists.

> "The rules of perspective were formalized in the intellectual cauldron of early fifteenth century Florence; linear perspective was demonstrated by architect and painter Brunelleschi and formalized by a contemporary mathematician called Alberti." [Wade&Swanston:1991:19]

The analogy between the retinal image and camera obscura seemed an obvious one, but created new problems of how to understand the

relation between the eyes and the brain. In Kepler's time, it summed up to problems of the relation between the world as it exists on its own, the light that projects images into the eyes and the subjective or personal experience of such.

> Following Kepler's description of the ways light is refracted or bent when passing through the eye, students of vision in the seventieth century tended to reduce the analysis of vision to an analysis of the image formed in the eye That is, vision became a problem for geometrical optics. [Wade&Swanston:1991:21]

The basis for understanding and investigating vision that arose with the discovery of the retinal image and its apparent analogy with pictorial techniques and means of representation, created a foundation for Descartes, who continued Kepler's study of geometrical optics. Descartes became increasingly interested in finding out what further happened to the image once it entered the eye. Descartes [27] suggested that the two optic nerves from each eye had to be combined in the brain thus creating one unified image. Though he rejected the idea of an internal observer, a homunculus in the brain, he upheld the notion that the perceiver and the world were separate [Lombardo:1987]. Though the mind was considered, by Descartes, to be seated in the brain, brain and mind were conceived as being ontologically distinct. The body and brain were a machine and the mind of another substance, but still the relation between rational thought arising in the mind and the mechanistic body was difficult to account for. Finneman [1991], explains that Descartes, who also developed the analytical geometry, and as stated, was fundamentally preoccupied with a theory or model for vision, was puzzled by the seemingly illusional content of vision and the mind's power to work rationally and eventually held that analytical geometry

and thus mathematics was the tool by which the mind/brain was able to make sense of the perceived. This conception was based on the idea that the world was created in the language of mathematics [Finnemann:1991:140]. Whether perception is inborn or acquired was not of interest to Descartes. What concerned him was that a trustworthy description of perception had to be based on the language of mathematics, to rid the mind of its illusions. The problem whether perception is inborn or acquired is among the contemporary recurring questions, as is the object – subject dichotomy that Descartes is largely held responsible for creating. Finnemann claims that the divided subject – object notion of Descartes had forward reaching implications and it spawned a new field of study, the psychology of perception. He writes;

> The distinction between a mental, non-spatial and non – physical internal conscious state in opposition to external phenomenon, turns the connection – and thereby perception – into a particular problem. This gradually led to the establishing of a new field (subject of study), perception psychology, which as its unsolved and defining question, has the relation between perception as a physical –physiological process and perception as a mental process[Finnemann:1991:141] [own translation]

The historical outset for modern perception psychology is thus, in Finnemann's view, to be found in the basic problems that emerged as the consequence of the distinction between subject and object, meaning that Descartes not only served as an originator of modern perceptual psychology, but also of the way questions are being asked within the field. Fundamental issues stem directly from the division of the subject – object which is reflected in the basic questions concerning either the object or the subject or both co-joined.

Therefore, Descartes has had an enormous impact on later approaches to epistemology and laid the ground for future disputes, discussions and controversies.

Though the history of perceptual theories by no means can be considered as a linear chain of events, the account presented here will serve as an informative basis for the recognition of apparent reoccurring questions concerning perception, when contemporary ideas are being described.

Images in vision or vision of images

The concept that perception could be understood in terms of an image or images is an essential problem within almost all approaches to vision.

> The perception of the world as being pictorial, or rather that the experience of the world equals an image, is based on the conception of the division between subject – object. [Trettvik:2004:86][own translation]

In a chapter in his dissertation, Trettvik investigates the relation between images and mental representation in light of the ecological approach to perception, and points to the notion that within the ecological theorem, mental representation is regarded as having no influence on perception. The idea of the world as an image brings up the recurring problem of an internal observer and seems just as relevant as it did centuries ago.

The problem of basing theories of visual perception on pictorial theories holds some implications in relation to specific levels of description and hypothesizing.

In the study of perception, within natural sciences, it is often implied that there is a common understanding of vision as analogous to image perception and the employment of pictorial cues can be observed as methodological foundations for testing. Sciences that work with the creation of Virtual Reality(VR) are, due to their task of creating perceivable spatial environments preoccupied with means to extract from vision some operational principles that can be applied on the image constructing level [Sherman&Craig:2003].

A strategy is to divide vision into monocular and binocular vision as a means of extrapolating which pictorial cues are necessary for the perception of i.e. depth [Matlin&Foley:1997:194]. There are systems of cue descriptions that are more or less based on purely pictorial means of perspective creation and the general jargon is a pictorial based language. As was hinted earlier, a pitfall that may emerge when attempting to apply a perceptual theory to a dynamic image medium is that an obvious confusion of the level of analysis springs out as a natural consequence of the perceptual fields utilization of a pictorial discourse basically derived from a static medium, namely the painting and its representation of perspective. We can look at the early attempts to explain vision as the origin of confusion. The pictorial techniques were adopted as the way the world had to be seen. But instead of discovering the underlying structures or mechanisms of perception, techniques were developed that refined our possibilities of depicting the world around us.

The ecological approach to visual perception is held to be one of the most recent realistic attempts to describe the basis for perception; realistic in the sense that both the discourse and the properties taking into consideration are stripped of their possible narrative and semiotic values. That a cup, can be a particular cup, with an

inscription, given as a gift and holding some symbolic value is of no immediate interest in an ecological framing. What is interesting is what can be done with the cup. In this respect it becomes extremely problematic to explain function and activity from a visual perceptual standpoint by deploying a picture based discourse. This is believed to be a relevant point due to the fact that dynamic and interactive media are on the one hand constructed from the very same pictorial techniques that are used to describe vision, but on the other hand more experienced as if it is "world" and not image.

Perception Theory –   paradigmatic overview

One of the fundamental questions within theories of perception is whether we are capable of perceiving the world directly or if the perceptual process is an indirect process which involves cognitive operations or inference, which in return adds meaning and content to the perceived[E.J. Gibson&Pick:2000].

On each end of the scale are the opposing views that perception cannot be direct and perception can be direct. Those who support the first notion that perception cannot be direct, claim that since what we perceive is light waves the brain must be involved in a process of making sense of the incoming stimuli. Researchers within this theoretical tradition hold that there is not enough information in light or that the information in light is arbitrary, so we have to add meaning and content by an interpretation process that is carried out more or less unconsciously. Those who approve of the latter notion that perception can be direct claims that there is more than enough information in light and the process of perceiving is a process of differentiating, which means that perception holds meaning in itself, since if this was not the case, how could a cognitive inference occur.

There seems to be a gap between these two extreme positions with a variety of sub positions in between. E. J. Gibson and A. Pick have created an overview of the most general and distinct directions within psychology that have an interest in or are based directly on a certain perceptual paradigm. There are basically two overall paradigms, the collective theories based on enrichment and the collective theories based on differentiation. About the enrichment theories they state that;

> These theories have in common the notion that originally barren reception of stimuli is supplemented by some form of accrual or interpretation. [E.J. Gibson&Pick:2000:7]

As can been seen in the chart below, two branches of the enrichment theories were operative in the 1950's; the cognitive and the response oriented, whereof the cognitive theory with its development of the idea of a cognitive schema is the most popularized and wide spread.
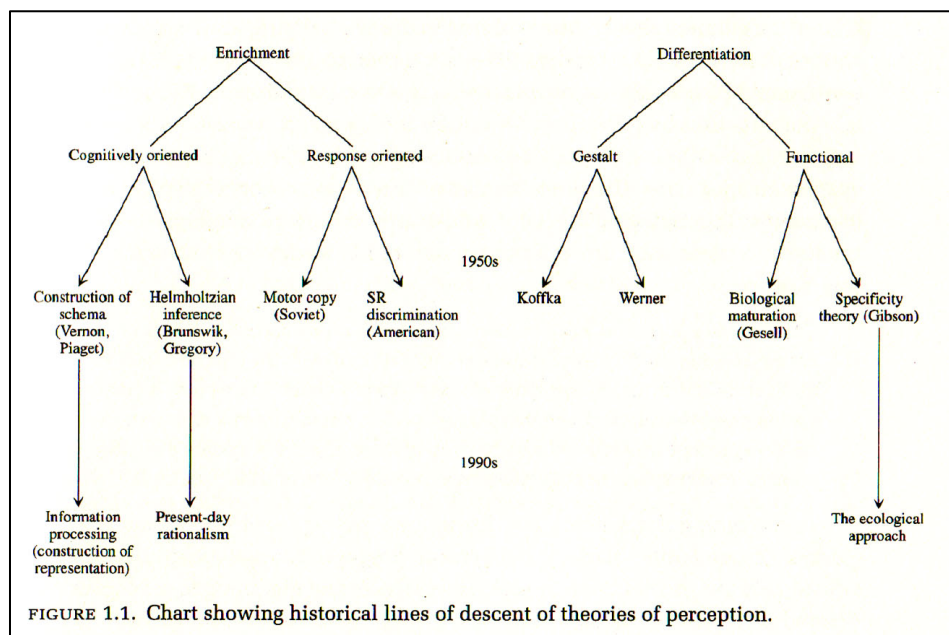
FIGURE 1.1. Chart showing historical lines of descent of theories of perception.

Fig. 6

95

The idea of a schema was coupled with perception by Vernon, who claimed that perception involve the construction of a schema in the brain. The perceptual learning process was therefore a continuous construction of schemas, where new percepts were adjusted, fitted in and classified.

Another concept of enrichment is that of inference that suggests that prior to perception a rational and logic process must take place, a kind of logical interference that is based on previous experience about properties in the world and thus springs out of perception as something retrospective. One of the theorists that hold this notion is R. Gregory, with whom James J. Gibson had several discussions. Gregory calls his theory an active theory because he believes that the process involved can be seen as an active interference. His notion of perception indicates that we are prefigured to perceive and the active part is our interpretation of the perceived. The reason why Gregory's idea of active perception is emphasized is that the ecological theory is an action based theory of perception, but the different notions of being active should not get mixed up. The active theory of Gregory and the active theory of Gibson are not to be confused since they are in direct opposition to one another. How these views contrast can be seen in a newspaper article written by J. J. Gibson and E. J. Gibson. The Gibsons were invited by a newspaper to write one of two articles, the other written by R. Gregory, in order to put up a confrontation between these opposing viewpoints. They outline the main difference by stating;

> Professor Gregory believes that there is "a cognitive element in perception." He is saying that one has to *know* something about the environment in advance before he can *perceive* it properly. But there is a dilemma here. Surely one cannot know anything

the environment *except* as he perceives it, or has perceived it. [E.J. Gibson:1991:505]

When Gregory refers to his theory as being one of action or activity his understanding is purely mentalistic and is understood as internal active processes involving the brain. J. J. Gibson's active approach to perception on the other hand is based on a holistic and bodily active process of perception. The direction which Gregory represents is seen as a genealogical forerunner for a modern rationalism, while the direction that Vernon represents is viewed as the antecedent of the computational cognitivism, listed in the chart as information processing (construction of representation). Put in a popular way, this direction compares the brain to a computer and its computational operations [Neisser:1967] [Marr:1986]. One of the exponents for this direction was David Marr who is known for his concept of 2½D vision [Marr:1986]. His idea of perception is like most of the perceptual theories based on the concept of the retinal image; if perception is light falling on the retina and an image is created that is interpreted by the brain, then something must be lost in the process. The retina, being a flat surface in the eye, is not capable then of capturing the third dimension and he draws the conclusion that since we see the world in 3D and not in 2D, the brain adds what is lost in the process. It adds the third dimension or fills out the missing information for the z-axis. Descartes' invention of the three-coordinate system plays a large role in Marr's conceptualization.

The other main paradigm shown on the chart is that of differentiation. In this overview, the Gestalt theory is placed under the differentiation paradigm, which is a position that can be discussed. Differentiation is the core concept here, since it is believed that perception is rich in itself, in opposition to the enrichment paradigm, and that perception is an active process of differentiating between various kinds of

information we pick up from our environment which in itself carries meaning.

> "Perceptual differentiation can be characterized as a narrowing down from a vast manifold of information to the minimal, optimal information that specifies the affordance of an event, object, or layout." [E.J. GibsonPick:2000:149]

In the chart, J. J. Gibson has his own branch that leads from the theory of specificity to the ecological approach. If we look at the time periods on the chart it can be concluded, at least on a preliminary level, that the contemporary opposing directions even more crystallized now apparently, than ever, rest on pillars of these two main paradigms. Wade & Swanston describes J. J. Gibson's and Marr's approaches as having a common goal with opposing and contrasting means to reach it. So, as shown in the chart, J. J. Gibson and Marr represent the absolute extremes. To sum up the polarity between information processing on the one hand, with Marr as its main spokesman and the ecological approach on the other hand, with Gibson as its originator, the dichotomy revolves around the concepts of indirect perception vs. direct perception. The indirect approach uses the computer as a metaphor for the cognitive processes involved in perception and claims that without mental operations no perception can occur. The direct approach to perception rejects the indirect approach by posing questions concerning evolution in the sense that it would seem absurd for humans and animals not to be able to perceive the world directly and thus make use of the information. Common for most of the theories presented in the chart, except the ecological approach, is that they are not concerned with the role of perception in relation to action or they understand action as being based on something other than perception.

Having as his key subject of study the development of human action and perception, Goldfield distinguishes the opposing standpoints as a motor –system approach vs. an action – system approach.

> A fundamental distinction between these two views is in the way they treat the relation between dynamics and information. In the motor view, the role of information is to adjust or correct movement relative to some internalized standard. [Goldfield:1995:9]

The distinction between the two systems relate to problems concerning the relation between perceiver and environment. As an example, Grodal's model of the PECMA – flow, resides within the paradigm of the motor-system.

E. J. Gibson and Pick's chart was chosen to illustrate the various theoretical positions because it makes explicit the framing of the fundamental assumptions involved on each end of the scale. Theories under the heading of enrichment are focused on the arbitrary data of light and to some extent the problems of making sense of the retinal image, that is, provide a framework for the interpretation and computation of data.

The theories under the heading of differentiation may have various attitudes towards the retinal image, but as an example the Gestalt theory employ an extensive use of images in its investigation of visual perception, and thereby stresses the importance that, in some areas, are put on images. On the far end of the chart is the ecological approach that, at its core, rejects the most traditional assumptions regarding perception in general and visual perception specifically. Christine Skarda [1995] goes as far as relating to the two main paradigms as the Old and the New Model.

Opposing paradigms or different world hypotheses

Nothing is ever all black or white and the above effort to outline or at least draw a very rough map of the theoretical landscape serves the purpose of pointing to the two most distinct paradigms, the two pillars that divide and demarcate fundamental assumptions about the world and the beings in it.

Flowing through the description of theoretical viewpoints has been the use of the term paradigm. The term paradigm is most commonly associated with Thomas Kuhn [Cutting:1982]. Cutting refers to Kuhn's concept of paradigms as, first, being intended for the natural sciences. Secondly, some basic criteria must be fulfilled within the concept of a paradigm. A paradigm is the result of a single innovator and paradigms are followed by members of a group. Information-processing has no clear *single* innovator and though J. J. Gibson is the innovator of the ecological formulation, he never founded a *group* or belonged to one. Cutting questions if the notion of paradigm is the right distinction and notes that Kuhn reframes his approach to a disciplinary matrix. Cutting turns to Popper and his idea of *world hypotheses,* stating they are…*beliefs about how the world is structured and how it should be dealt with* [Cutting:1982:202]. This notion softens the boundaries between the theories given that, as world hypotheses, they cannot in principle reject each other, is his claim. Cutting states that all animal-environment conditions must be addressed by both and that the information processing approach has a narrower focus, and the ecological approach a broader. What follows from this is that the choice of the ecological approach as a foundation for this dissertation not only stems from a pragmatic approach to the usability of the applicable possibilities but also relates to the hypothesis as a belief system. It is not the project of this dissertation to show no less prove that one direction is the better, but

to show that affiliation with the one or the other, shapes and influences the articulations that can be derived from the usage when applied to other research fields. It has been the purpose here to bring to light the various and fundamental problems that exist in relation to conceptions of visual perception. Gordon concludes in "Theories of Visual Perception" that;

> "[…] it can be asserted that there is as yet no satisfactory general theory of visual perception. For example, no theory has adequately united a full analysis of the environment *and* the cognitive aspects of seeing. No general theory has thoroughly incorporated and explained the motor aspects of seeing. The extent to which perception is determined by stimulation (involving bottom –up processes) or knowledge (top-down processes) has not been agreed upon. [Gordon:2004:217]

On this note, the introduction to and discussion of approaches to visual perception comes to an end. In the name of interdisciplinarity in relation to application or integration of theories from one domain to another, the enterprise may not be as straight forward as seems to be the general case, especially within videogame research. As was pointed out in chapter 3, there are obvious problems in relation to what the researchers pointed out as the *point of perception*, from which videogame layouts, in their claim, should be studied.

Chapter 6

Ecological Approach to Perception

The ecological theory of perception was originally formulated by James J. Gibson, as pointed to in the prior chapter. Though several directions have branched out from the original notion, the ecological approach is often distinguished by the *formulation* and the *re-formulation*, the latter with prominent figures as Turvey, Shaw and Mace [Chemero:2006]. Gibson, himself, changed position a number of times, reformulating his own original concepts, which were first put forth and detailed in his 1950 book, "The Perception of the Visual World", then reformulated and elaborated in his 1966 book, "The Senses Considered as Perceptual Systems" and finally adjusted and commented in his last testimony, the 1979 book, "An Ecological Approach to Visual Perception", which can be said to be both repetitive, evaluating and reinforcing in relation to earlier statements. In his final book, he states that the ecological approach is just that; an approach and he directly urges other scientists to continue to investigate the ecological approach and develop it, as he believed, he was only, after more than 50 years in the field, still at the beginning.

Costall [1995] even refers to an "early" and "late" Gibson, pointing to Gibson eventually turning point.

> His early theory had been a frank attempt to repair the mechanistic framework of the stimulus – response psychology by treating both the stimulus and response in terms of higher-order, relational structure. Gibson's later theory marks a radical shift from his own position but also from any other standard approach within psychology. [Costall:1995:470]

J. J. Gibson's later shift can be seen as a turn to the animate, that is, to the relation of human's and animal's active relation to the environment. His claim was that meaning could be obtained directly from the environment and that perception does not depend on enrichment or inference. On this notion, Gibson, as Costall implies, created a new position from which he reexamined both the concepts and activities of perception. The activity of obtaining meaning is a relation between animal and environment, he claims, and to study perception is to study both the animal/human and its environment. In order to bridge the subject – object gap, he coined the term *affordances.* Affordances relate to both animals/humans and the environment, and serves as a two-way pointer, where environment always implies a perceiver/actor and vice versa.

Gibson's approach is characterized as a meta theory in the sense that he did not propose solutions to old problems but suggested new ways of thinking about them [Cutting:1993]. In particular two problems sprung to his attention, in the beginning of his quest for a new theoretical foundation for, especially, visual perception, namely the problems of space and depth perception. The explanations for space perception and depth perception were related to the old world views described, in the former chapter, and revolved around the problematic condition in relation to the attempts to clarify how a 2D image on the retina was transformed into the experience of a 3-dimensional world [Cutting:1993][Gibson:1979/86]. Gibson eventually came to realize that the Cartesian coordinate system with its three axis, x, y, z, was of great convenience to mathematics and a technique for constructing images to represent a perspective on a flat surface, but it was inconvenient for an explanation of visual perception[Gibson:1979/86].

On the basis of a realization of the inadequacy of the traditional geometrical optics [Gibson:1979/86:47] as an explanation of environmental properties on the perceptual experiential level, Gibson eventually develops the concept of *ecological optics.* With reference to the meaning of the word, *optics*, as a science of light, Gibson explains that the term is riddled with confusion, because the science of vision is also called *optics*. The study of light or *optics* is carried out under different scientific disciplines, such as the science of radiant energy in physics and the science of optical instruments as founded by Helmholtz [Gibson:1979/86:48]. Gibson realized that he had to invent a concept that would describe the appropriate level of perception within the ecological approach and thus coined the term *ecological optics.* Collectively all concepts within the ecological approach to visual perception can be understood under this concept.

> "What I call *ecological optics* is concerned with the available information for perception and differs from physical optics, geometrical optics, and also from physiological optics. Ecological optics cuts across the boundaries of these existing disciplines, borrowing from all but going beyond them". [Gibson:1979/86:47]

As pointed out, Gibson reacted to a set of theoretical assumptions. The stimulus – response approach treated the senses as channels where stimulus when meeting the receptors caused a response. There were problems with the notion of inference from some mental activity in relation to action and the whole notion of the retinal image caused problems when applied to real – life situations. To give an account of the 50+ years in which Gibson was preoccupied with perception will take up to much place in this dissertation, but Lombardo[1987] and Reed[1988] give extensive insights into the theoretical movements of Gibson's struggle with older paradigms. His accidental occupation

within aviation made him realize that a whole new foundation for visual perception was needed, since the old theories that were used to develop training programs to enhance visual flying skills of pilots were inadequate and had little impact when applied in praxis[Reed:1988:95]. The foundation for perception had to be questioned, yet again, and as noted above, Gibson ultimately ventured into a reformulation of the basic unit of perceptual research, specifically re-investigating the very notion of senses.

The senses as Perceptual Systems

In "The senses considered as Perceptual Systems" [1966], Gibson formulates the forward reaching foundation of the ecological approach to perception as he proposes a new theory of the senses. In the preface, Gibson states that he wrote the book twice, indicating that he underwent a process of maturation.

> We shall have to conceive the external senses in a new way, as active rather than passive, as systems rather than channels and as interrelated rather than mutually exclusive. If they function to pick up information, not simply to arouse sensations, this function should be denoted by a different term. They will here be called *perceptual systems.* [Gibson:1966:47]

The concept of the "senses" as perceptual systems creates the possibility of organizing, the ordinarily understood categorization with five distinct senses or sense modalities, according to the activity involved and not just as *modes of conscious quality* [Gibson:1966:49]. Another important notion is that perceptual systems are mutually inclusive in the sense that they are co-operative systems with subsystems. The audio-visual system is noteworthy, since interactive digital media, are often characterized as

being audio-visual. As Gibson emphasizes elsewhere, the function of the senses cannot be reduced to a conception of i.e. the ability to the mere acts of seeing and hearing, but involves an active perceiver that is moving around, looking and listening [Gibson:1963]. Gibson explicates his change of concept from senses as they are traditionally understood to the concept of perceptual systems by emphasizing that the act of perceiving is an achievement of the perceiver, not something that happens upon him and that the concept of senses can be understood in a passive sense whereas perceptual systems are active and involve perceptual awareness.

> It is a keeping-in-touch with the world, an experiencing of things rather than a having of experiences. It involves awareness-of instead of just awareness. It may be awareness of something in the environment or something in the observer or both at once, but there is no content of awareness independent of that of which one is aware. [Gibson:1979/86:239]

That the concept of perceptual systems points to both the environment and the perceiver implies that both have to be described. It is not sufficient to describe the perceptual apparatus of animals/humans alone. That which surrounds us and that about which we can be aware in correlation with how we can be aware on the perceptual level is the main concern for Gibson. The radical position Gibson takes in his insistence of detailing the surrounding surfaces and composition hereof within which we act, means that a new understanding of the role of the perceiver has emerged in correlation with an appropriate level of description. Perception cannot be understood as something distinctly belonging to the perceiver. The perceptual systems are functional relative to what there is to be perceived. The notion of the perceptual system should then be

regarded as the environment – perceiver or an environment-organism [Turvey:2009] system as a whole, where the perceiver is equipped with perceptual accommodations that allow him to obtain information from the environment.

Information and how to pick it up

Information is an imperative to Gibson's approach. On a simple level, it can be stated that information creates the tight link between a perceiver and the environment. A cornerstone within the notion of perceptual systems is that they are active information seeking systems [Gibson:1966]. Due to the wide use of the term information within Gibson's approach, it is worth taking a brief look on the concept.

Information is widely used within a range of sciences and the term corresponds to a variety of meanings and usages.

There is the notion from Gregory Bateson[2000:381] that information 'is a difference which makes a difference', which has become textbook knowledge for any student of communication [Bateson:1979]. Another approach to information is the quantifiable approach from mathematics, most notably derived from Shannon and Weaver [1948] who related information to the decoding of messages. Information in its quantifiable form led to the use of the term, bits. Bits could be measured and large streams of information could be subordinated within the bit system.

In the ecological approach information has a different meaning from that of the quantifiable or the communicated information. The commonality of the concept, information, whether used to organize data or as means of communication, almost always implies that the information is transmitted.

> Information as here conceived is not transmitted or conveyed, does not consist of signals or messages, and does not entail a sender and a receiver. [Gibson:1979/86:57]

In the Gibsonian notion, information is available to be picked up and the main activity of the perceptual systems is to pick up information. Gibson states that;

> We cannot explain perception in terms of communication; it is quite the other way around. We cannot convey information about the world to others unless we have perceived the world. And the available information for our perception is radically different from the information we convey. [Gibson:1979/86:63]

Entailed in the quote is that there is a difference in the way we pick up information and the way we express or communicate the information. The last sentence can be interpreted to suggest that the means of communicating about perception should not be confused with the actual act of perceiving.

Concepts of information within different scientific fields have been investigated by Cutting [1998]. The general scientific view, even within opposing theories of perception, is that what we perceive as human beings is information. What information then refers to is where gaps between opposing viewpoints emerge. Though the term may have been made popular by Shannon and Weaver, as there is no evidence that the term was used within psychology before the second half of the twentieth century[Cutting:1998], the term has been absorbed and is widely used to address any arbitrary relation a subject may have to an objective world. The fact that information could be quantifiable in *bits,* made the notion operational and thus, applicable and measureable within a variety of settings and as

Cutting exemplifies; *the information-processing approach to cognitive psychology was born…"* [Cutting:1998:70]. Alhough the use of the concept of *information* within psychology has its problems, there seems to be one common purpose, as Cutting points out;

> "…we [psychologists] use the term information to help solve one aspect of the Cartesian problem of two worlds, the physical and the mental. If the concept of information is to do any theoretical work it must help us bridge this gap: Information presents to the perceiver a "digestible" form of the object or the event that it presents. How do we suppose it does that? [Cutting:1998:86]

In the ecological view, several suggestions can be put forward. Information is always available though it may not be picked up by any perceptual systems. Information must be *informative of* or *about* something [Cutting:1998]. Information is specific to modes of perception and can be understood as a structure, and not a single attachment or property. Information is related to action and guides behavior and activities.

Central to the theory of information pickup is the aforementioned concept of *affordances*. Perceivers do not roam the environment purposelessly. Perceivers use information from the environment in purposeful and functional ways. Properties in the environment can be informative on a number of levels, ranging from information for passage between two large objects to information for shelter and food. The process of picking up information involves the perception of affordances that is, the perception of what things can be used for and how one can navigate amongst them. Affordances are specific in relation to the animal that perceives them. Affordances are not measurable in a traditional physical sense. A chair may be

measurable according to its proportions on the metric scale, but in relation to affordances it is more important that the information for the sit-on ability of chairs can be perceived. In this respect a number of things can afford sitting-on, but may not be chairs in the classical understanding. We will return to the complexity of affordances further ahead.

In relation to the example of the sit-on-ability of an object, a perceiver not only picks up information about an object's affordances, but also of the surface texture, the substantiality and its relation to the surroundings. Gibson's notion of information is complex and better understood if the environmental source of information is described.

Environment – what is there to be perceived?

The environment is our surrounding circumstantial condition in which all activities are carried out. Gibson has more than one way of addressing the properties of the environment. First and foremost he uses the biological term, *niche,* which defines the narrower aspect of the environment within which humans and animals adapt. Relating to the environment in general terms there are different levels of specificity involved. A customary way of addressing the proportion of the environment is in relation to the microscopic and the macroscopic scale. Gibson refers to these concepts as having no or little significance in experiencing a given niche. The concept of a niche can be understood from various scientific fields, but within the ecological approach, Gibson defines a niche as a set of affordances. A niche will always be constituted by the proportions relative to those, humans and animals, which inhabit it, even though these proportions can be altered to some extent. In relation to the environment the niche is where the perceptual system is in function. Gibson does not suggest

a manner in which a niche can be termed within the micro-macro scale, but the term mesocosmos will be suggested here. Mesocosmos, a term borrowed from geography, constitutes the part of the environment that is within immediate reach. Meso refers to that which is in the middle, from Greek; mesos – middle [15]. Interestingly, Grodal attempts to address the proportional relation between human and environment and relate to "human-sized" or "mid-sized" world [Grodal:1997].

That microscopic or macroscopic features can be brought into sight by microscopes or telescopes is not relevant here since the concern is about the level of natural human perceptual experience on the everyday level and, thus, on the mesoscopic level. The properties described are therefore mesoscopic in relation to a living observer and the observer's ability to pick up information from the niche. The forthcoming section will describe the basis of the perceptual system, namely the environment followed by a description of the percipient/obs

Media and Substances

In "The Ecologiocal Approach…"[1979/86] Gibson starts by describing what is present in the environment to be perceived. The appearance of the environment can be addressed on various levels, as stated above, but in the ecological perspective, the functional relation between the percipient and the environment is always at the center.

> According to classical physics, the universe consists of bodies in space. We are tempted to assume, therefore, that we live in a physical world consisting of bodies in space and that what we *perceive* consists of objects in space. But this is very dubious. The terrestrial environment is better described in terms of *a medium, substances* and the *surfaces* that separate them. [Gibson:1979/86:16]

The Earth basically consists of three media; earth, water and air. The meeting points or the surfaces that separate these media are referred to as interfaces; the earth-water interface being one, the water-air being another and third, and most important for terrestrial living animals, the earth – air interface, since this supports our most common and everyday means of transportation. The notion of media and their interfaces is relevant for specific types of locomotion, in view of the fact that locomotion is supported by both the ground and the forces present in relation to a specific interface. Interfaces in the ecological sense can also be described as adjoined substances. In order to fully grasp both the segregation between interfaces and the relation between substances, we will take a look at Gibson's concept of substances.

A more detailed look at the environment and the substances that eventually make up the surfaces will be informative in relation to manipulative possibilities in the immediate environment. Below will be listed the most prominent features of substances in order to, on the one hand, grasp the specificity involved in Gibson's approach and on the other hand, to get an idea of objects as they are made up of substances that can be informative beyond a traditionally classification of objects. A preliminary example could be that of a cup. Traditionally, a cup will be classified as an object from which liquids can be consumed but, in regards to the substance of a cup, other functions can be perceived additionally. After the list, the example of the cup will be elaborated due to its substance or materiality. After each point, an explanation will be given to amplify the understanding in order to create a link between what appear to be abstract descriptions of everyday perceived properties.

1. All persisting substances have surfaces, and all surfaces have a layout. (This means that the appearance of a surface is relative to the

substance and its chemical composition. The surface of a specific chemical composition can be acted upon by external forces. In the case of a rock, it can be course or it can be smooth relative to its exposure to i.e. water. No matter the force acting upon it, the transformation of its surface layout will always be due to its substantiality.)

2. Any surface has resistance to deformation, depending on the *viscosity* of the substance. (In continuation of the above point, a substance may be exposed to forces that can alter its shape. Rubber can be squeezed and may temporarily appear in an altered form. Due to its viscosity, it may regain its original shape.)

3. Any surface has resistance to disintegration, depending on the *cohesion* of the substance. (A substance may be exposed to breakage or dissolute when acted upon. Salt will dissolute in water and a clay pot may break when thrown.)

4. Any surface has a characteristic texture, depending on the *composition* of the substance. It generally has both a layout texture and a pigment texture. (In the case of a rock, it may have a characteristic course surface, but also be pigmented. Here can be stated that rocks may have similarities due to the layout texture, but may diverse in regards to pigment texture.)

5. Any surface has a characteristic shape, or large – scale layout. (This point is tricky, since substances can be processed. A lump of clay may have a characteristic shape shared by other lumps of clay, but when processed, the shape may change radically.)

6. Any surface may be strongly or weakly illuminated, in light or in shade. (This point relates to the condition of perceiving a surface. In light and strongly illuminated, a surface is more detailed than when

weakly illuminated or in shade. In relation to information, the former may be more informative than the latter.)

7. An illuminated surface may absorb either much or little of the illumination falling on it. (Various surfaces are more or less absorbent. This property of a surface can relate to the substantiality, the texture layout and the texture pigment)

8. A surface has a characteristic reflectance, depending on the substance. (In continuation of the above point this characteristic may also depend on substantiality, texture layout and texture pigment. A course surface reflects light in a different way than a smooth surface. Color is also important since the pigmentation will influence reflectance.)

9. A surface has a characteristic distribution of the reflectance ratios of the different wavelengths of light, depending on the surface. This property is what I will call its color, in the sense that different distributions constitute different colors. (And again, following the above points, a surface's ability to distribute light and thus color, depends on already mentioned properties of the substance.) [Gibson:1979/86:23-24]

Returning to the example of the cup, the substance of a cup may convey information that does not relate to a classification of its most common use. The cup can be characterized in a variety of ways with regard to the listed properties of substances and surfaces. In order to contain fluid, the cup must be resistant to both deformation and disintegration in the sense that it must be produced from a material or substance that does not melt or otherwise dissolve. The substance of an object, like the cup, is informative to a set of functional relations that will be treated further under the passage describing affordances. Substances or substantial objects in the environment

can be *detached* or *attached* within the layout. A cup is a *detached* object that can be picked up whereas a mountain is *attached* to the ground. *Detached* objects are properties than can be utilized in a variety of activities.

Another important aspect of surfaces is that they relate to the idea that substances can be nested in hierarchies. Bricks can be said to be nested in a building which is nested in cities which again are nested in landscapes. The potential nesting systems can be scaled up and down and are both relative to micro proportions as well as macro proportions. Atoms are nested within molecules just as planets are nested within galaxies. The environmental niche which surrounds an individual or group holds all the possible relations that can be immediately perceived, they are nested within the mesocosmic scope.

Ambient Optic Array and Optical changes

Gibson's notion of ecological optics provides another way of describing the environment from the point of visual perception. We can relate to environment as that which surrounds us, but when we look around there is an order under which everything is structured. This should not be understood as a predetermined order or an order defined in the form of a pattern, but a natural order by which the surrounding substances and thereby surfaces are structured and how light is structured. The structure is referred to as an ambient optic array. The ambient optic array is structured due to degrees of illumination and points 6 – 9 in the overview of substances, detail possible surface reflectance.

The illustration below shows the structure of an ambient array, not occupied by a perceiver.
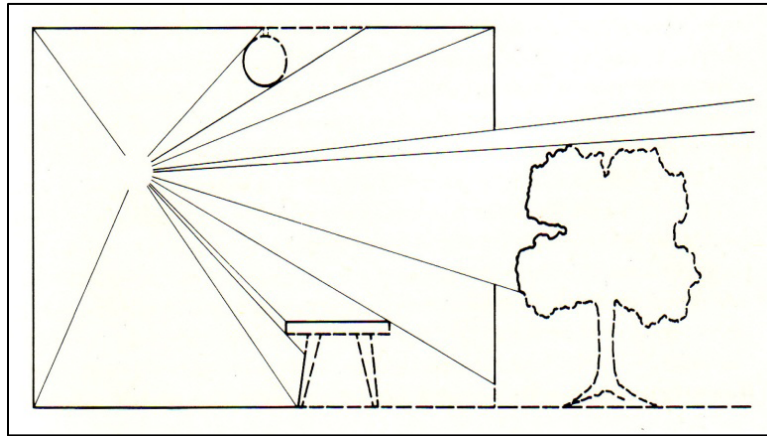
Fig. 7

It can be stated that the environment is where all things are visible to an observer, but this is too broad and generic. More precisely, an observer occupies a point of observation within the ambient optic array. Gibson would describe motion as changes in the optical structures in the ambient optic array which is a more precise approach than describing changes as occurring in the environment. There may be changes in the ambient optic array due to motion or locomotion, but that does not necessarily imply that changes also happen to the environment, though it may be the case. The information pickup process can in respect to optical changes, be understood as a process of differentiating invariants and variants in the optical structure. There will be invariants, which to some degree will be relative, that is, persist over time. This notion can also be described as a differentiation of persistence and change, which should not be confused with the figure-ground concept most notably known from the Gestalt theorists. In Gibson's conception, some properties persist while others changes, which is a more dynamic approach to active perceivers doing things within the environment. In Gibson's approach variants or changes are perceived relative to invariants or persistence in the layout. This notion implies that changes are not only spatial in nature but spatio-temporal [Warren&Shaw:1981:6].

Changes in the optic array or optical structures are *events* and *sequences of events* and will always change over time.

The description of the environment did not imply an observer and thus followed the order of presenting concepts in Gibson's 1979/86 book. In order to view the environment/organism or more accurately the ambient optic array - moving observer system which constitutes the perceptual system in function, it seemed logical to start with the environment within which the observer is contained.

Observer/Percipient

An observer can occupy a stationary or moving point of observation. When an observer occupies a given point in the environment, the perceptual system begins to function. As stated earlier, the perceptual system is constituted by the environment and the observer in tandem. The relation is reciprocal.

To comprehend the notion of ambient optic array, Gibson uses the following illustrations to place an observer within an ambient optic array.
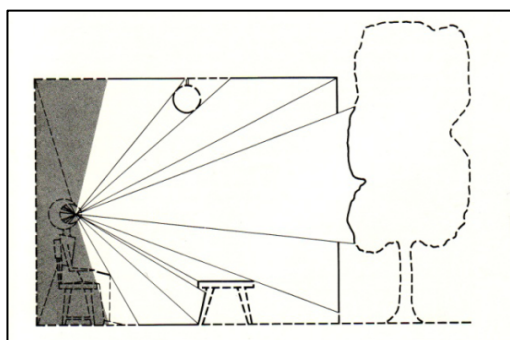

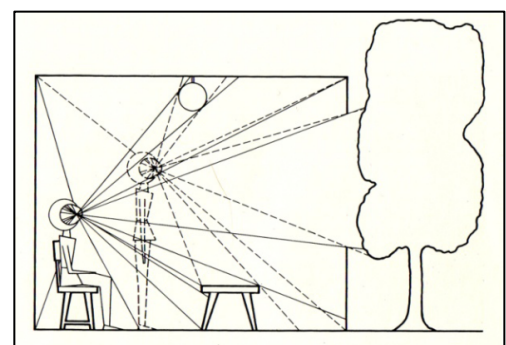
Fig. 8   Fig. 9

The illustrations show the ambient optic array at a stationary point of observation and at a moving point of observation. As Gibson states the perceptual system is in its optimal function when the observer

starts to move. A stationary point of observation is a rare case of perception, as Gibson states.

The changes that occur when an observer is moving are thus, as described before, optical changes and should not be confused with physical changes. Physical changes may occur but they are not essentially what constitute changes in the ambient optic array.

The connection between an observer and the ambient optic array will be explained in depth later, but first a closer look at the observer is needed. Though changes in the ambient optic array are vital for the process of picking up information for action the observer brings modalities to the situation based on its human conditions; eyes at a specific location in the head, ears placed on each side of the head, and so on. The observer has two basic modes of obtaining visual information from the array, *ambient* and *ambulatory* vision. Ambient vision is turning the head and looking in all directions, whereas ambulatory vision is information obtained by moving the body and turning the head. In order to gain more detailed information from properties in the layout, an observer may have to move closer to an object in order to inspect it, thus making use of ambulatory vision. A pivotal statement from Gibson's hand is that a perceiver does not see the world through his eyes, but with eyes-in-the-head-on-the-body-resting-on-the-ground [Gibson:1979/86:205]. In relation to his concept of the senses as perceptual system, this point is important on several levels. First, this implies that visual perception cannot be localized as a phenomenon only involving the eyes. The condition for visual perception involves the whole body and its postures. This notion of the body as an important and supportive property secondly implies that visual perception involves the body in specific ways. In order to obtain information from distant objects, the body moves to the location. The anatomy of the human eye does not involve a

complex zoom mechanism, so a perceiver is dependent on the mobility of the body in order to carry out explorative investigations. In the above illustrations borrowed from Gibson, the ambient optic array is seen from the side with an occupied stationary or moving point of observation. I have chosen to further illustrate the concept of the stationary point of view, without and with head turn, thus exemplifying the difference between stationary and ambient vision. The examples are photographs of an everyday situation on a street corner that demonstrate the difference between the changes in optical structures due to other things moving in the layout and changes in optical structures due to head turn/ambient vision. The first example shows a stationary point of observation with a moving car.
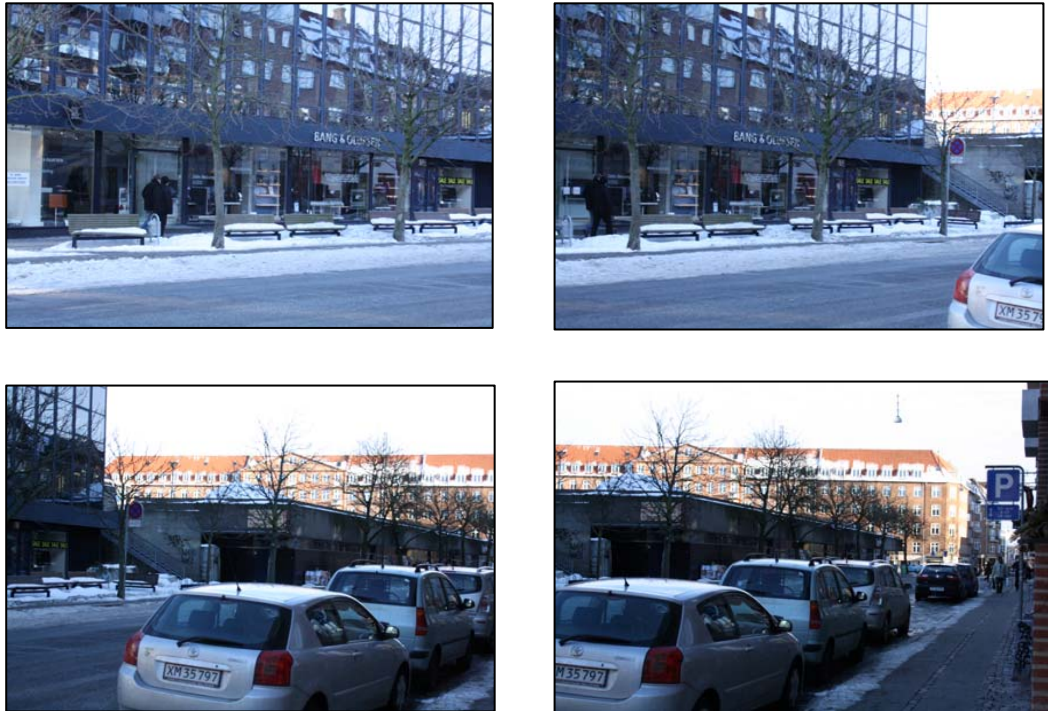

Own photos

The moving car is constituent of a type of optical changes that occurs independently of the observer. With the use of photographs it is now possible to address specific characteristics of optical changes that will become more comprehensive as they can be explained in relation to a visual example. There are important characteristics present that will be coupled later to Gibson's notion of how to differentiate between changes caused by things in the environment and changes caused by locomotion. Within the ecological discourse, changes in the layout are described as *disturbances* in the optical structure and the changing occupation can be viewed as *displacements.* In the photographs, the car is an object in motion and the changes it causes to the layout are picked up in relation to the persisting background. To use the term background is not quite within the ecological terminology but will be used for explanatory purposes. As the car moves, it causes a *deletion* of other properties. The car in the background is visible in the first picture, disappears in the second and reappears in the third. In relation to the *deletion* of the car in the background, the motion of the front car when passing causes an *accretion,* thus making the car visible. This type of deletion/accretion phenomenon is closely tied to Gibson's notion of the most extreme events that can occur in the visual field, namely things going in and out of sight. Depending on the cause of the disappearance and reappearance of properties, a moving observer can to some extent influence the matter. Going out of sight is not the same as going out of existence. Going out of sight and coming into sight are constantly reoccurring events. As the moving car passes, it will itself go out of sight and if an observer wishes to keep it in sight, head turn will be the appropriate action. In relation to the difference of changes in optical structures, the next

example will be that of a right head turn. Now that the observer is active, more things can be specified in the layout.

These photographs are instances in a right head turn. Here it becomes visible that persistence is relative in the sense that the buildings in the background are *invariants* in the layout although changing over time. The edge of the field of view to the right is the *leading edge* whereas the left edge is the *trailing edge.* Objects are coming into sight at the leading edge and objects are going out of sight at the trailing edge. By reversing the head turn, the opposite is the case, thus turning the leading edge into the trailing edge and vice versa. This example emphasizes that information pick-up is an active process involving the entire body. Implied in the photos is the support of the observer by a solid ground. If the support in itself was

not an invariant, the visual flow field would look significantly different.

In relation to manipulation of the visual field in videogames and bringing the notion of the objectification of the joystick into mind, we can now, on a preliminary level get a glimpse of the functionalities of the perceptual system objectified within the control functions of the joystick, as one type of objectification would be that of head turn. In the passage relating to locomotion, another example will be given that explains the optical changes when the observer is moving.

Visual kinesthesis and Visual control

We move around in the environment while engaged in a variety of activities. As stated before, the theory of information pick-up is a central part of the ecological approach. It has been suggested that information is never arbitrary and must be information-of something. We will now take a closer look at the types of information that are necessary for locomotion. This passage will contain a description of the specificity of information in relation to locomotion under a variety of conditions. Locomotion hardly ever takes place in an environment free of objects and navigating in, for example, a cluttered environment requires the picking up of specific information. On a simple level, visual kinesthesis is the changes in optical structures and visual control constitutes the types of changes that can be made by carrying out specific context related actions.

To state that visual kinesthesis is the changes in optical structure need an explication as it is not to be confused with visual feedback, is Gibson's claim. Within this concept is implied, in Gibson's layout that the visual perceptual system picks up movements of the body. This is a tricky demarcation since if the body falls over, there will be visible evidence in the optical structure of the body position in relation to

e.g. the ground on which the body is about to land or there may even be no information of the ground, but of the sky. The lack of information that specifies i.e. the ground may itself hold information of the location and movement of the body. If the body falls backwards outdoors then there will be a lot of sky in the visual field. In this respect, the visual system picks up information of both the body and the environment simultaneously. Further ahead in this section there will be some examples on a very basic level of how optical structures and changes in optical structures can be visualized. These visualizations serve the purpose of understanding how specific structural changes are informative about both environment and perceiver.

Visual kinesthesis is the process of picking up information from at least three distinctive types of information; *head turning relative to the body, limb movement relative to the body, and locomotion relative to the environment.* [Gibson:1979/86:126]

The information held or obtained in relation to visual kinesthesis always implies self-perception and each type mentioned conveys specific types of information. The visual kinesthesis for head turn will differ from that of locomotion.

Gibson formulates what he calls laws for visual control. These are not laws in a rigid sense, more like guidelines. In relation to locomotion, the informative changes in the ambient array can be acted upon by following the laws for visual control. Specific optical changes may correspond with options for control in a pair – like fashion. I will post examples of some of the assertions made by Gibson and provide some of them with illustrations in order to make the descriptions more comprehensible on the visual level. The list below is not

complete in relation to the one listed by Gibson, but an extraction has been made that are relevant for later purposes. The descriptions below will be accompanied with descriptions of possible actions for control. The changes can be conceived of as changes in the flow field or flow perspective. It must be stressed, in order not to induce confusion, that due to the static and 2 dimensionality, the illustrations are simplified examples of an information pick-up process that will naturally be more complex. The illustrations are not themselves what should be understood as visual kinesthesis, but informative optical structures relative to an occupied point of observation and the changes of structure relative to a simple movement.

Out-flow specifies approach and inflow specifies retreat

As seen in the illustration, approaching something or moving forward creates an outflow in the surrounding structure that appears to stem from a center point, given that the observer is looking straight ahead.

For someone driving a car, this change will be experienced as if the surrounding elements move alongside, above and under the car, like white stripes on the road seem to disappear under the car. The outflow is therefore informative in relation to heading.

In the case of retreat or of moving backwards, the surrounding structure appears as an inflow towards a center point. Moving backwards for a longer period of time is a rare kind of action. Retreat from something can be the result of collision avoidance or change of direction. None the less, retreat is an appropriate action under specific conditions and in relation to locomotion, approach often implies that retreat is possible, the one being the reversed action of the other.

These two basic cases of locomotion are informative on various levels. First, as stated, the one can imply the other, which points to the reciprocality of not only the perceiver and the environment, but also to the reciprocality of actions. It is indicative of Gibson that he stresses the relation between sets of action, like in the case of picking up an object. If an object of relative size can be picked up by the hands, then it is immediately implied that the object can be thrown. This aspect is important in navigation and visual control, since certain actions are paired with a reversed action.

To make it absolutely clear, the outflow is informative of a body moving either by own force or by some other force. The optical changes are not visual feedback from the environment, but informative structures that contains information of the body creating the optical changes in correlation with the environing circumstances.

**The focus or center of outflow specifies the direction of locomotion**

Other types of changes in optical structure that relate to the above mentioned are the changes of direction or heading.
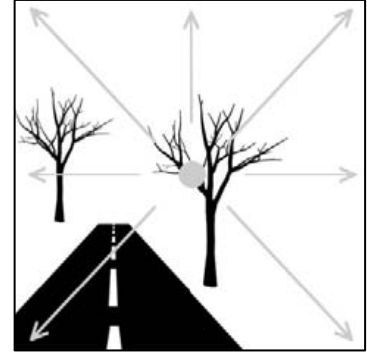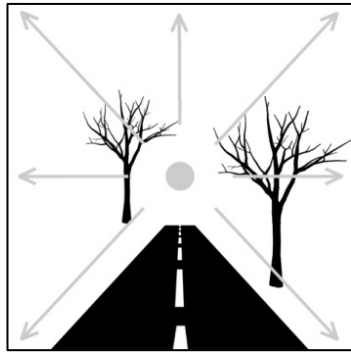
This type of information may involve visual control in relation to collision-avoidance action. If the center of outflow stays the same, we are moving straight ahead, but if the center changes we are turning and changing direction. In car driving an abrupt change of center for outflow may indicate danger, as in the above figure, where a collision with a tree seems unavoidable.

Going up or going down

Loss or gain of structure below or above the horizontal line is relevant in airborne activities as well as in terrestrial activities. Navigation and control during flight when depending on sight, loss or gain of structure is crucial.
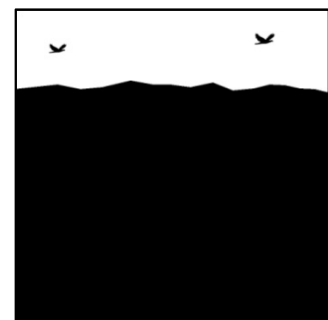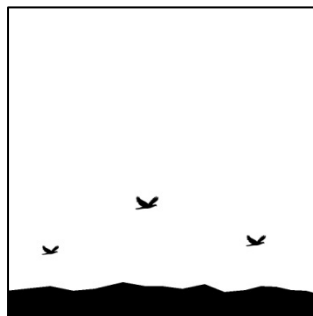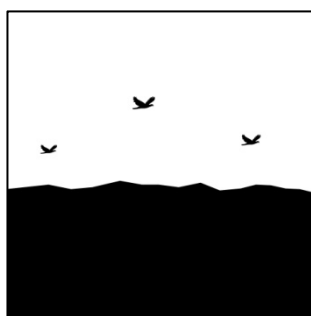
Loss of structure below the horizontal line is informative in relation to moving upwards and loss of structure above the horizontal line is informative in relation to moving downwards. When flying and even walking, the visual structure above the horizontal line is important in

relation to i.e. falling. If the structure below the horizontal line increases, ground collision is impending. To avoid ground collision, move so as to increase the structure above the horizontal line, would be the appropriate visual rule.

Going forward or being blocked

Loss and gain of structure on either side of a vertical line is important for the information for passage. As is the case with loss or gain of structure below or above the horizontal line, the loss or gain of structure in relation to a vertical line can be vital.
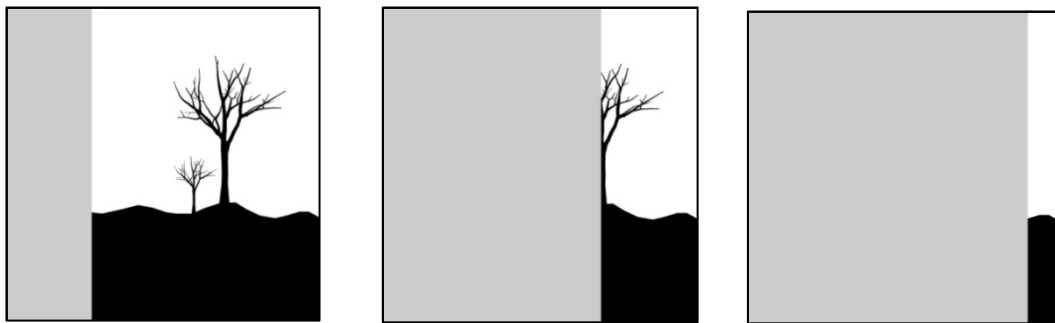
The grey area in the illustrations could be a wall. Since a wall does not move by itself, though some automated doors might, the increase and decrease of optical structure in this case, will be due to locomotion. In specific cases, a moving object could create this kind of structural change, but for now, locomotion is considered to be the case. A specific path of locomotion will cause the wall to create a deletion of the layout as pointed out above. Again, passage and collision are of interest. So in order to pass and avoid collision, move so as to maintain visual contact with the structure, in this case, on the right side, would be the appropriate action. This also holds for the reverse.

We have now looked at some ways of describing changes in the ambient optic array that are relevant in relation to locomotion. As an example of the interconnectedness of visual kinesthesis and visual control, Gibson gives the following description of possible actions in a dangerous situation.

"For moving predators and enemies, *flight* is an appropriate form of action since they can approach. The rule for flight is, *so move as to minify the dangerous form and make the surrounding optic array flow inward.* If, despite flight, the form magnifies the enemy is catching up; if it minifies, one is getting away. At the predator's point of observation, of course, the rule is opposite to that of the prey: *so move as to magnify the succulent form by making the surrounding array flow outward until it reaches the proper angular size for capturing.* [Gibson:1979/86:232]

The example demonstrates the instructive level of visual rules for control and brings us to the natural outset for perception.

Locomotion

Locomotion is considered to be the natural outset for the function of the perceptual system. Locomotion is self initiated motion on behalf of the perceiver and is intrinsically visually guided [Gibson:1950][Warren Jr.:1998]. This may involve the body or other means of transportation, such as a car. Perceivers are always in relative motion. Relative, because a fixed point of observation is seldom obtained for very long periods of time, and though the body may not move the head can move and if not the head, then the eyes. The moving eyes may be a farfetched notion in relation to locomotion, but still the turning of the eyes creates optical changes. When we move around, things start to happen and changes in the optical structures occurs in manifold ways. We can take into account

the description of the environmental media. The ground supports one kind of locomotion, whereas water supports another kind of locomotion. In relation to air, this may create inertia in relation to moving along the ground. Moving forward in strong wind is difficult and thus demands a specific type of awareness from the perceiver. This may especially be the case if the wind carries objects or there is a heavy snowfall. Locomotion creates a flow of changes in the ambient optic array called a locomotive path. The locomotive path is not to be confused with i.e. the position of objects along the path or a map of how to get from A to B. The following example shows the change in optical structures caused by locomotion in a stable setting. It can also be understood as information obtained by ambulatory vision.

Own photos

129
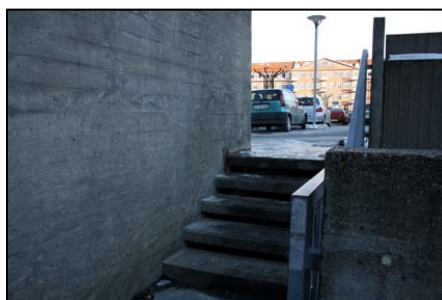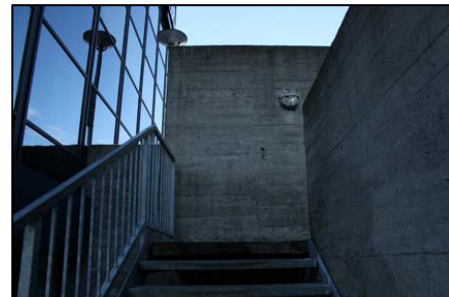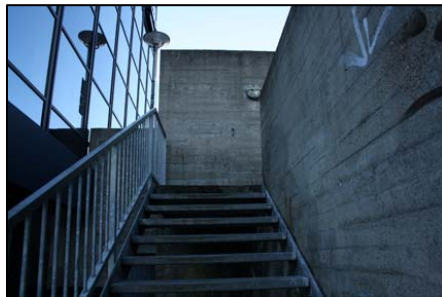
The instances show the action of walking up stairs and turning to the right, thus implying all the constituents in the example of both head turn, ambient vision and body movement plus head turn, ambulatory vision. The occluding edge, the wall, on the right side of the field of view has a surface texture different from the wall at the back thus indicating that here are two separate though adjoined surfaces. This may indicate that passage is possible further on. Information available in the optical changes along a locomotive path can be seen in relation to the concept of exterospecific and propriospecific information. As is the case here, the leading edge of the field of view brings properties into sight.

Now it has been important to show that specific optical structures relate to specific modes of perception. Though the optical changes shown in the examples are part of our everyday information pick, we may not pay direct attention to these attributes, but we are always aware of what goes on around us relative to exterospecific and propriospecific information.

If change in the optical structure is caused solely by a perceiver in a stable environment then the locomotive path can be reversed. Going forward may imply going backwards. In relation to locomotion and the previous mentioned condition that actions are visually guided, a closer inspection of optical changes in the ambient array and their relation to action will be in order.

Awareness of self, others and other things

In the above passage, the terms exterospecific and propriospecific have been mentioned in passing. It is worth taking a closer look at these concepts as an additional term will be incorporated that Gibson did not coin.

Time and again Gibson uses the term awareness. He states that;

> To perceive is to be aware of the structures of the environment and of oneself in it. [Gibson:1979/86:255]

Since awareness is a somewhat fuzzy term, the first objective here will be not to confuse it with consciousness which can be said to be even fuzzier and a slippery path to take, due to the fact that awareness and consciousness can be conceived of as being both analogous and also mean very different things within various subfields in psychology. Secondly, awareness as a concept will be unfolded to mean specific informative relations concerning the environment and the perceiver in it. The perceptual activity has previously been characterized as a reciprocality of perceiver and environment. Simultaneously as the perceiver gains information from the ambient optic array, he is gaining information about himself. Gibson uses the terms exterospecific and propriospecific information. The first relates to information specific to the environment and the latter relates to information specific to the perceiver. A third concept, *expropriospecific,* has been proposed by D. N. Lee [1980]. He suggests that the third concept is needed in order to include the control that is involved in interacting with and within the environment. The term, *expropriospecific,* he suggests fills in the gap of what he regards as a *binary conception*, obviously pointing to a duality of the terms as proposed by Gibson. Lee states that, in order to control i.e. locomotion, information is needed for the whole body and/or the body parts involved and the information must be relative to the environment. In Gibson's own layout of propriospecific information, the concept of proprioception, that is, self – perception, fulfills just that. He states that;

> Vision picks up both movements of the whole body relative to the ground and movements of a member of body relative to the whole. [Gibson:1979/86:183]

Exterospecific and propriospecific information is complementary in an essential Gibsonian understanding, in the sense that both kinds of information are obtained simultaneously, that is, awareness of the surrounding world and awareness of self, co-exist. A further investigation of the concepts including Lee's addition will prove useful as the duality surrounding Gibson's use of two concepts can be questioned in respect to their narrowness.

A case of propriospecific information would be the visual perception of one's own extremities, or *semi-objects* as Gibson calls them. We almost always have some parts of the body protruding the field of view depending on the activity we are involved in. There are, naturally, other perceptual modalities involved with regards to proprioception such as the perception of the support, i.e. the surface we rest upon. The inadequacy of the term proprioception and its following active states that relate to the propriospecific information can be elucidated if the activity of i.e. hands is taken into consideration. As noted in Pick and Saltzman[1978] Lee divides the concept of proprioception into two states; *(1)* proprioceptive *information about motion of one body part with respect to another; and (2)* exproprioceptive *information about of the body with respect to the environment.* [Pick and Saltzman, ed.:1978:159]

The term exproprioception implies the co-joint information of both self (proprio) and environment (extero), as it is comprised of both terms. A closer look at Lee's description is needed.

In "The Functions of vision" [Lee:1978:160], Lee states that; […] *the fundamental function of vision, as of any of the perceptual systems, is the obtaining of information in the service of activity. Information is needed not only for the planning of acts but also for the ongoing control of them.* Although Lee bases his own approach to the function

of visual perception on a Gibsonian foundation, he finds that Gibson's own insistence on the adequacy of only two concepts escapes the function involved in i.e. object manipulation.

In the chapter regarding game examples all three concepts will be applied. Due to the dynamic and manipulative possibilities within the game layout, there will be cases were information can be said to lie in between propriospecific and expropriospecific or be transient from the one to the other.

Affordances

The concept of affordances has not been touched upon beyond a mere introduction and definition. The concept is one of the most popular and widely applied concepts extracted from the ecological approach to perception [E. J. Gibson:2000] [Michaels:2003]. The description has been deliberately postponed until now, because an overall introduction to the ecological approach to perception had to be in place. And there are numerous reasons for that.

The concept was introduced to the world of design by Donald Norman[1986], who made a life and a career out of affordance-based design concepts. Most students of design will be familiar with his usage of the term. He introduced it in his 1986 book on design, but interestingly he killed it off in an article from 2008 where he stated that the days of affordances are over. "Forget affordances", were his new buzzwords. That is a radical statement from a theorist, who can be held responsible for the extensive misunderstanding and misuse of the concept, which he admits in his book, "The Invisible Computer", stating in relation to his own conception of *perceived* affordances in relation to *real* affordances that;

> I didn't make this point sufficiently clear in my book and I
> have spent much time trying to clarify the now widespread

misuse of the term. "I added an affordance to this icon by putting shading around the sides," says the visual designer. I shudder at the misuse of the concept, however well intentioned. Worse, I imagine J. J. Gibson sitting up in his grave starring at me once again, and then, with a rich, dramatic gesture, shutting off his hearing aid and lying back down with a look of disgust on his face. [Norman:1999:124]

That there may be some implications in relation to whether affordances are perceived or real will not be brought into discussion here. It has been the purpose to show that the concept at some point turned in to a buzzword for designers, as a promising new way of describing features of graphical objects.

One reason for postponing a description of the concept is that this dissertation is not based solely on the concept, in the sense that the concept of affordances is not what this dissertation rests upon. As will be discussed later, most videogame researchers who attempt to use the theories of Gibson, are primarily preoccupied with the concept of affordances and generally set all other concepts from the ecological approach aside.

The concept will flow into the discourse as a common word covering a specific conception of the relation between perceiver and environment. Though the concept, as has been explained earlier, is the benchmark that separates the "early" Gibson from the "late" Gibson, it cannot be detached from the ecological approach as a whole. Affordances can be said to be the glue that holds all other concepts within the ecological approach together, given that the information pick-up process is the picking up of information-of something and that "something" is affordances. In an article entitled

"The World Is So Full of a Number of Things: On Specification and Perceptual Learning", E. J. Gibson poses the question;

> Does it really make us happy that the world is full of things (and people and events and places)? [E. J. Gibson:2003:283]

She follows up the question by stating;

> If it does not, at least it keeps us occupied in finding our relationship to these things, places, people and happenings, in discovering what they mean to us. [E. J. Gibson:2003:283]

On one level, affordances can, following E. J. Gibson's thread, be said to be the relation between information and what information means to us. When we move about in the world, doing whatever we do, we are constantly picking up information for affordances. The term can be said to be the operational relation between the environment and perceiver. Affordances are relative to action that may or may not be carried out. One can pick up information for affordances without acting on that information. The concept of affordances can be deployed in the description of all types of activities and functional relations between objects and people. In relation to the description of substances in an earlier passage, some examples of how the concept of affordances can be used will be given. By referring to substances, I wish to direct the attention to the environment. The use of objects or the creation of artifacts involves materials of certain substantialities. The example of the cup used earlier can be brought forward as an example of how the concept of affordances not only describes the relation between perceiver and environment, but also wrestles the understanding of forms and substances out of more classical categorizations and becomes a vital concept regarding the functional relation between people, objects and events. I will attempt to

describe the cup in as many relations as feasible based on the functionalities that can be tied to it. Some examples will be extracted from Gibson and some will be made up to state one of his points, namely that when objects are seen from a functional point and appointed to functional relations as that of affordances, possibilities not otherwise foreseen may emerge.

In the passage describing substances, the cup was characterized due to its substantiality. Elaborating on that description, more things can now be said. If we view the cup *as a graspable rigid object of moderate size and shape* [Gibson:1979/86:133] it can be picked up by hands. If it can be picked up by hands it can be thrown. Here the reciprocality of actions becomes visible again. One action often implies another action or other actions. If the cup can be thrown it is a *missile*. Since the cup is hollow it can be used as a container and since it can both contain stuff and be picked up by hands it can serve as a means of transportation. Due to its substantiality, it can contain liquids as well as solids. When it has served its purpose as a container from which one can drink, it can be used to contain the office pencils. Depending, again, on the substantiality it can be used to weight things down. Affordances are not features of an object. That the cup can be used in a number of ways specifies exactly that affordances relate to objects, people and situations. There is no clear – cut distinction between types of affordances and possible object manipulation as some functional relations described in relation to the cup may be the same for a rock. This may be one of the difficult things to understand. Gibson states that;

> If you know what can be done with a graspable detached object, what it can be used for, you can call it whatever you please. [Gibson:1979/86:134]

You do not have to classify and label things in order to perceive what they afford. [Gibson:1979/86:134]

The concept of affordances will be addressed, yet again, further on.

In the two first chapters of Part 2, theories of visual perception have been presented in an overview and the ecological approach has been outlined, with a focus on the central aspects. The next chapter will establish the framework more clearly and outline some additional concepts of importance for the understanding of the application of the presented framework.

Chapter 7

The active perceiver

J. J. Gibson laid the foundation for an approach to perception that could be integrated in the study of human development and behavior from a very specific outset. His way of questioning very foundational theoretical assumptions lead to queries in other related fields. The impact that the ecological approach has on a variety of psychological subfields, not only leads to a new hypothesis about the senses, but to alternative ways in which everything connected to perception, development and activity can be described and investigated. New concepts will be taken into perspective, especially in regards to how various operative and co-operative perceptual and body/motor systems of humans function. In the following chapter new layers will be added to, what can be considered as the foundation of the ecological approach. The prior chapter was mainly built on Gibson's original formulation, but there were aspects about which he was not explicit. Gibson mentions a variety of situations which are examplificatory in relation to a demonstration of situations in which the perceptual system functions. In Gibson's reconceptualization of the senses as functional perceptual systems, events are structured due to both constraints on behalf of the perceiver and constraints on behalf of the environment. In other words, specific actions require specific types of awareness and in a more contextualized manner, it is deducible that any activity has its own structure and involves specific functions of the perceptual systems. In the following passage, new concepts about the perceiver will be brought into perspective in order to be able to contextualize specific activities.

Activity

People engage themselves in a variety of activities that require differentiated usage of their body, the limbs and the perceptual systems. The bodily involvement in activities as diverse as walking on an everyday basis or the achievements in high performance sports has been investigated within scientific programs. Within theories of development in infancy, the growth of the body in connection with the acquisition of skills for walking and so on has been studied in order to find out how the infant obtains skilled behavior in correlation with encounters with the world around them. These types of studies are traditionally carried out under the concept of motor – system.

> In the traditional information processing perspective within cognitive science, the use of the term "motor system" refers to the brain and spinal cord as they perform computations on current and previously stored information and generate sets of instructions or commands that are translated into muscle activations and the generation of forces that lead to displacements (movements) [Goldfield:1995:7].

The theory of action systems, as formulated by E. S. Reed [1982], can be seen as an attempt to readdress questions concerning the whole perceptual system in function, including the role of perception for motor control or the coordination of the body and its parts. In relation to the traditional approach to the motor-system, Reed is in opposition to the separation of afferent and efferent activity. In simple words, this means that the motor - system approach has a strict separation between stimuli entering the body (afference) and the motor response carried out by the body (efference) [Goldfield:1995]. Within the paradigm of the motor – system, stimuli entering the body at the end of the receptors, is believed to be

transmitted to the brain that in a response sends signals to the part of the body that carries out the action. Reed suggests that activities are under a mixed control in a regulatory way and; *refers to action systems as modes, or functionally organized perception - action cycles* [Goldfield:1995:5]. Within the notion of the action system is held that activity needs to be flexible in relation to the process of picking up information. During some types of activity, an individual may be forced to alter a posture based on i.e. suddenly occurring exteroceptive conditions. Reed formulates five basic action systems; *Basic orienting*, *locomotion, appetition, performatory* and *expressive*. Locomotive and performatory action systems will be inspected deeper, as they are relevant for the focus of this dissertation. In a chart, modified from Reed, Goldfield [1995:4] gives an overview of the activity and possible achievable goals in relation to the action system. In relation to locomotion the activity could be, *approach, avoidance and steering* and the achieved goal would be *change of body position relative to surface layout.* In relation to the performatory action system the activity could be, *reach for, hold and explore objects* and the achieved goal would be, *bring objects close to body for inspection.* Goldfield's own field of research is within development in infancy, which is visible in the examples he demonstrates. Never-the-less the notion of action systems covers any type of activity possible. It is a general theory with a specific explanatory underpinning. In "Encountering the world"[1996], Reed explains his close ties to the Darwinian theory of selective pressure, which holds that evolution is a consequence of an animal's selective behavior in relation to environmental constraints. Though it is out of place here to untangle the closely knit connection between the respective theoretical approaches, the Darwinian and the Ecological, the notion of constraints play an important role, in the theory of action systems. As E. J. Gibson, who also employs the theory of

actions systems in her developmental approach argues; there is no such thing as total freedom. In a developmental context the power of selection increases followed by the increase of control, but there are always limitations due to individual and environmental factors [E. J. Gibson:1995]. In order not to confuse the use of the words power and limitation, an example would be the case of things out of reach. At a certain developmental stage in infancy, the possibilities to reach out for something are both tied to the size of the body and the placement of the object. Limitations or constraints as they will be termed are relative to a given context, but any type of activity has its built-in constraints.

Though Goldfield, as stated earlier, works within the frame of development in infancy, his effort to employ Gibson's theory of affordances in order to explain more detailed Reed's theory of action systems is informative and inspirational, for the further progress within this dissertation.

A further exemplification of the above extracted concepts, namely locomotion and the performatory action system, will be presented in order to inspect them in detail. In an overview, Goldfield [1995] lists the specific action system as defined by Reed followed by rules for control of action as described by Gibson. Within the overview, some basic examples are given.

Action system – Locomotion

Control of Action

1. To stand, keep feet in contact with a support surface; keep boundaries of the field of view oriented with the implicit horizon.

2. To steer, keep center of outflow outside patches of array that specifies barriers, obstacles, and brinks, and within a patch that specifies an opening.

3. To approach, magnify a patch in the array

Action system – performatory

Control of action

1. To lift an object, grasp it and lift the arm so that the object no longer makes contact with a support surface.

2. To drop an object, open grasped hand and release the object so that its optical specification is minified (and perhaps makes a loud noise).

3. To throw an object held in the hand, release the object while the hand is moving away from the body so that the object minifies.

The examples show how Gibson's concepts can be contextualized within the concept of action systems. Even though the examples are quite generic, a specific type of activity can now be explained on the basis of the actions involved. That activities are usually made up by a variety of actions is something that Reed also includes in his description, using Gibson's nesting concept. An example of an activity could be that of playing the piano. Although a focus may be on the hands pressing the keys, other actions are nested, such as the balancing of the body on the stool in conjunction with the use of the feet on the pedals. The purpose of playing the piano is to produce sounds and thus music, but a variety of nested actions are involved. Playing the piano can also be seen as a constrained activity that situates the body in a specific way. The posture and movements are

tied to a narrow location and within a limited, yet complicated set of nested action cycles, the human ability to produce sound is enhanced.

Exploratory and performatory activities

Following Gibson's theory of information pick-up, activities can be divided into being explorative and performative. Exploratory activity can be said to be at the core of the theory, since the perceptual systems are considered to be information – seeking. The controversy regarding information processing and the cognitivist constructivism versus the ecological approach resurfaces. Reed claims that the theory of information pick-up is fundamentally different from any previous conceptions within psychology. He states that;

> Before ecological psychology, all psychological theorists divided psychological processes into three kinds: input (sensory), output (motor), and higher (integration of both kinds). [Reed: 1996:64]

Reeds point is to emphasize the activity on behalf of the perceiver and his act of picking up information from the environment. Within the concept of sensory input and motor output, there is an implicit notion of a process of mediation between the two, which is the construction of meaning. Reed explicates this view by claiming:

> Standard theories of information processing (including connectionist theories) in both neurophysiology and psychology take for granted that there is no meaningful information available to an observer except what the observer's brain can construct out of sensory inputs. But if ecological information exists, then the observer's job is not to create it but to *find it.* [Reed:1996:65]

Finding information is thus an exploratory activity. Exploratory activity is investigative in nature and involves the perceptual systems in a variety of ways. In relation to visual perception as pointed out earlier, explorative behavior most often involves locomotion. The perceiver moves around to inspect things in order to find out what can be done. Though exploratory and performatory activities are coupled and even cyclically intermingled or nested within each other, they are types or modes of activity that have different selective contingencies[Reed:1996:80].

> *Exploratory activity,* as I call the scanning for and use of information […] typically does not require the expenditure of a significant amount of force to alter the substances or surfaces of the environment. Instead, it involves the adjustment of the head and the sensory organs to the ambient energy field.
>
> These latter *performatory activities* are precisely those cases in which the animal does use significant amounts of force to alter the substances and surfaces of the environment. [Reed:1996:80-81]

The exploratory activity is the obtaining of information and performatory activity is the acting upon the information which should not be mistaken for cause and effect, which are terms associated with the notion of input – output. Exploratory activity may be nested within performatory activity. Things may be moved around as part of the inspection as is the case when something is lost or in ecological terms, have gone out of sight.

Action systems are regulatory systems that function relative to intentionality, the information available and the constraints due to individual or environmental properties, but on the basis of the

perceptual systems. Activities are possible due to action – perception cycles with nested action – perception cycles. These cycles can be nested on larger or smaller scale, but no one activity is carried out without involving the whole perceptual system, the body and its limbs.

Agency

The perceiver is not only an observer who is stationary or moving. The perceiver is an agent who decides to learn to play the guitar, do wood carvings or go buck hunting.

The actions system as described above is presented in general terms in relation to the elements involved. A furthering of the action – system perspective will be to look at the agent involved and integrate both the concept of agent and of agency.

Eleanor J. Gibson was influenced by the ecological approach to perception but also in return influenced the approach by her implementation of central concepts into her experiments. Her primary interest was on perception and learning in infancy. Just as J. J. Gibson she produced an enormous amount of literature and carried out numerous experiments, of which a construction called *the visual cliff* is one of the more prominent [Forgus:1996:219].

Eleanor touches upon the concept of agency on several occasions. Though J.J. Gibson was not explicit about agency, it can be entailed that carrying out actions based on the pickup of information and the perception of affordances involves agency, that is, an active agent.

Action systems can be said to be both information and affordance based, due to the often implicit manipulation of objects, such as tools and instruments, which implies that the agent changes between states of performatory and exploratory behavior. Agency involves intentionality on the part of the agent. In the article," Has psychology a Future?" [1994] E.J. Gibson questions the very foundation of

modern psychology and the field's core subject of study. Clearly, she is of the conception that modern psychology has a crisis that in her layout revolves around the proper level at which to study the subject at hand, humans (animals) and their behavior. The causal relation of perceiving, acting, thinking and communicating in an environmental context should be considered and she proposes a developmental approach based on the argument that it is by studying development that the above mentioned modalities can be understood. The fundamental modalities may be present at birth in a primitive form and suggests that they are properties that undergo changes during development and are refined through progress as infants grow through the functional relation between the perceptual systems and the environment.

She lists five characteristics of agency that in Reed's view; *must be explained by any psychological theory* [Reed:1996:12].

- Agency (the self in control]
- Prospectivity (the forward-looking character of behavior)
- Flexibility (transferability of means)
- Communicative creativity (multiplication of means of communication)
- Retrospectivity (the backward-looking character of behavior)
  [E. J. Gibson:1994:71]

In relation to agency, actions have consequences in respect to the environment in an observable way, and at the same time, provide information about the agent. This account correlates with Gibson's notion of exterospecific and propriospecific information. E. J. Gibson refers to the reciprocality as a combination of *intermodal information.* Actions carried out by the agent contain a directedness that can be relative to prior actions or future actions.

I.e. prospectivity refers to *the forward-looking aspects of behavior* [E. J. Gibson: 1994:72]. Turvey pays particular attention to the matter in Turvey [1992], where he explains:

> PC [prospective control] is control concerned with future events, usually interpretable as goals to be realized. In order to perform an act as simple as walking across a room cluttered with furniture to close a door, or as complex as positioning oneself to receive a pass i.e. a football game, it is essential to see what movements are possible, what encounters are possible, and to control behavior accordingly. [Turvey:1992:174]

The notion of prospectivity is closely linked to J. J. Gibson's term affordance. To pick up information for affordances involves opportunities within the environment and an agent to utilize the affordances through providing the appropriate action – system in a future-directed fashion. Performing specialized skills within sports or non-specialized skills as in everyday activities, the prospective concept of *tau*; time-to-contact, plays an immense role in action. Abernethy refers to experiments carried out that indicates that humans, as well as animals, are attuned to *tau,* which by Abernethy is explained as; *the relative rate of dilation of an approaching object or surface within the optic flowfield* [Abernethy:1993:3]. In other words, when time-to-contact is an important part of an activity i.e. tennis, then prospective control can be understood as the coordination between the perception of the dilation of the tennis ball and the possibility of placing the racket where the ball will be in moments thus incorporating the time of the arm to move relative to the speed of the ball and if successfully attuned, the racket and ball will collide. Though *tau* is specified in the above citation as relative to the dilation of a moving object in the visual field, this is not a

necessary property since speed and distance of an object is of importance. In the case of a tennis ball it can be questioned if dilation is the main property that the player is paying attention to since it could be the trajectory, that is, the changing position of the ball in the layout. With respect to the example of a tennis game, prospective control is an intricate property in action and involves intermodal information.

The Ecological Self

Before describing what the concept of an *ecological self* holds, a view of the concept of *a self* is in place. As have been outlined prior in the passage regarding the theoretical positions within modern approaches to perception, the opposing views could be conceived of as a structural view vs. a functional view.

In E. J. Gibson's article [1995], "Are we Automata?", a title borrowed from W. James, she states that the concept of a self began its research life within the structural approach to psychology [E.J. Gibson:199:3]. She positions the two viewpoints, the structuralist and the functionalist, within questions as to whether the self should be regarded;

> As a concept based on a body image, a representation of oneself to oneself, with a face that can be presented to others? Or shall we think of ourselves as in quite another way, as agents in control of our actions, in functional terms? [E.J. Gibson:199:3]

Obviously she rejects the first notion of a self as a representational way of handling the problem. The origin of a conscious self is often described in terms of self recognition. E. J. Gibson gives an account of how the investigation into the concept of a self involved testing using mirrors in the structuralist and cognitive approached. Other

concepts of a self are seen in psychoanalytic approaches. Here, the focus will be on a concept of self following the functionalistic approaches, since perception is at the core of the study. In the ecological sense a self is an active agent. E. J. explains:

> I believe that knowledge of oneself begins with begins with perception. Furthermore, as one who embraces an ecological approach to perception, I do not believe perception begins with an image – either retinal, mirror, photographic, or any other kind. Perception is an activity, the obtaining of information from a dynamic array in the environment surrounding the perceiver. This activity begins immediately at birth (and to some extends before). The obtainable information specifies events in both the surrounding environment and in the perceiver. [E.J. Gibson:199:5]

> The concept of a self in this respect is bound to the perceiver ability to differentiate extero – and propriospecific information thus specifying a relation between the self and the environment. That is, *a self is differentiated from the external world of objects and events by detecting the difference between two kinds of events.* [E.J. Gibson:199:6]

Ulric Neisser, who forms the concept of an *ecological self*, a concept not used by either E. J. or J. J. Gibson, is broader in his approach to the concept of a self by referring to situations and paradigms within which a self can be defined as something both physical, mental, public and private amongst others. There are no doubt problems involved in the concept of a self. While individual human beings are easy to point out, selves are not. Ordinary usage suggests that selves are things people have, not things people are. [Neisser:1991:197]

Being aware of the dilemma of *self* concepts and their various meanings within different psychological approaches, Neisser refers to three types of conditions of the self; self-knowledge, self-consciousness and self-awareness [Neisser:1995:17]. He settles with the term self – knowledge and defines five kinds of self-knowledge each defined by a concept of *self.* The one being utilized here, the ecological self, is one of two fundamentally states of self-knowledge, the other being the interpersonal self. The two concepts of self are based directly on perception. He defines the ecological self as being;

> …the self as perceived with respect to the physical environment: "I" am the person here in this place, engaged in this particular activity. [Neisser:1988:36]

Whereas the ecological self is closer to the concept of J. J. Gibson's ecological approach , the interpersonal self, though founded on perception is a more speculative construct since it involves a notion of the "social situation", which Gibson himself never addressed. Neisser characterizes himself as an ecological oriented cognitive psychologist. However, his outset was within the field of information processing, most manifest in his 1967 book, "Cognitive Psychology", where he states in an almost monumental fashion that information processing is the way to understand cognition and thus perception, claiming that no perception can take place without inference. Over the years, he softened his approach orienting his attention more and more towards the ecological approach and most notably in the 1990's reviewed and criticized his own foundation as mentioned in the beginning of the dissertation in relation to Grodal's cognitive layout, stating that the old concepts of cognitive psychology, e.i. the notion of schemata, were inarticulate.

The ecological self is to be understood as a kind of self-knowledge or awareness that follows an individual from birth to death. The ecological self is a way of differentiating a type of experience bound to perception. An infant is equipped with functional perceptual systems although they develop as the infant grows and becomes more and more mobile. E. J. Gibson would explain the development of the perceptual systems as a process of perceptual learning. The more locomotive an infant becomes, the more specific information can be obtained from the environment. Infants and toddlers are, especially, characterized by their exploratory behavior. From an ecological developmental viewpoint, the senses are considered to be information-seeking systems, implying the explorative behavior. [Gibson&Gibson:1991[1972]]. Though an infant's possibility of picking up information can be said to be limited, they still perceive the world as they come equipped. Before they start to move by themselves, they experience motion by being carried by others. Prior to the act of self-movement, they have experiences of optical changes derived from what could be called second-hand locomotion.

Neisser sums up some of the characteristics of the ecological self:

- The self, like the environment, exists objectively; many of its characteristics are specified by objectively-exiting information. That information allows us to perceive not only the location of the ecological self but also the nature of its ongoing interaction with the environment.

- Much of the relevant information is kinetic, consisting of structure over time. Optical structure is particularly important, but self – specifying information is often available to several perceptual modalities at once.

- The ecological self is veridically perceived from earliest infancy; nevertheless self-perception develops and can become more adequate with increasing age and skill. [Neisser:1988:40-41]

The ecological self can, conclusively, be understood as self - knowledge and self – awareness based on extero – and proprioception.

In relation to the videogame – player system, the player can be regarded as an ecological self, utilizing a specific kind of self-knowledge. In the interaction process, the development of skills in relation to the control of on-screen elements can be viewed as a process of perceptual learning. Agency is then both the exploratory activity of getting information from the game environment and the developmental process of mastering the content in a prospective conduct.

Part 3

Playing by the Visual Rules

Introduction

The purpose of this third part of the dissertation is to discuss some of the implications of applying concepts from the ecological approach to videogames and offer proposals of how to address the basic perceptual elements present while playing videogames. This means that concepts put forth in part 1 and 2 will be revisited and eventually addressed from the ecological viewpoint. A concept will eventually be brought forward that will serve as a meta-frame in relation to an understanding of the videogame – player system from a purely perceptual viewpoint.

The ecological approach and its implications will be discussed in relation to other researcher's employment of the concept of affordances. A preliminary suggestion of how to analyze game types will be put forth and eventually the approach presented herein will be evaluated.

Throughout the process of forming this project, I have been in search of a term that could bring together the different aspects involved in relation to the role of visual perception. As will be seen in the following passage which discusses the various notions of space, world and simulation, this whole project of distinguishing virtuality from reality creates a theoretical and practical conundrum of directions in relation to separating the one from the other. The spaces are not real. We know that. And yet we readily buy into the visual and operational premises with ease. Anyone can play some type of

videogame. Anyone can learn to operate the physical objects for manipulation and anyone can utilize the body for some purpose of interaction. It could be that the visual phenomenon that defines videogames as games of seeing should not be seen as something realized through an electronic artifact we turn on, but as a technologically enhanced type of process of experience we put on. We dress ourselves perceptually, put on *vision* and delve into a visual medium which biggest asset is that it allows its "operator" to tinker with very basic visual perceptual elements. When we play games, the situation will typically arise, where we toggle and struggle with the visual elements in order for them to occupy the layout in an ideal way. The mere act of transportation takes up a large part of game playing, which is interesting since this aspect is mostly left out of films. To get from one level to the next can be a time consuming endeavor with repetition-like processes where variations of manipulation are tried out. The timing involved in getting a videogame figure land on a platform and to get a spacecraft move through asteroid fields, are activities that require perceptual learning processes and can be difficult to master. Depending on the constraints involved, both on the level of operation as well on the level of perceiving information for action, videogames can be hard to master, just as the level of theorizing can be hard to line out. There is no single way and definitely no right way as the levels of entries are numerous and the articulations in-exhaustive. There are, however, concepts that circle within the various approaches that collectively seem to compose some characteristics that the videogame medium contain in opposition to other visual media, namely the concepts of simulation, navigability and interactability.

Chapter 8

The ecological approach to videogame – player system

The employment of the ecological approach can be seen sporadically within videogames research. Most commonly is the employment of the concept of affordances, but also commonly is an abandonment of all other concepts from the ecological approach. In this respect the concept of affordances is detached from the approach altogether and the terminology which supports the conception is rarely seen.

An account of the most prominent attempts could have been carried out in the chapter relating to videogame research, but the implications involved would not have been as obvious before the ecological approach itself had been laid out.

The concept of affordances in videogame research

The major contributions to the ecological approach within videogames research take its outset in the concept of affordances. As will be remembered, affordances are relations or opportunities for action, where the picking up of information may or may not be utilized.

Within videogame research affordances have been seen as a promising way to describe the relation between game and player. I.e. Linderoth and Bennerstedt [2007] have conducted experiments regarding children's gameplay based on the ecological approach to perception and a range of videogame research papers are now surfacing taking the concept of affordances into account.

How the concept of affordances can be applied to videogame research seems to hold some problems because of the virtuality or

immateriality of the games, and the fact that not all features, objects as well as viewpoints, can be manipulated the way they would if they were physical, which is one of the conclusions Linderoth & Bennerstedt arrive at. Second, there is the double situation of the manipulation within the layout in correlation with the physical devices used for manipulation. As Rambusch & Susi state in their paper, "The challenge of managing affordances in Computer Game Play""[2008];

> "The study of the perception of affordance in computer games is, however a bit tricky, to say the least, since the game environment consists of *two worlds:* a virtual and a real one. As players are engaged in game play, they face the challenge of perceiving and acting upon affordances in both worlds, and we as researchers, subsequently face the challenge of capturing and explaining them. The challenge for players, though, is not the perception of affordances *per se,* but rather their integration, since players have to combine real world actions with actions in the virtual world". [Rambusch&Susi:2008:3]

As put forth in the above statement, affordances can be studied on at least two basic levels; the affordances of the physical equipment, the joystick, and affordances as they function in the game. In L&B's case, affordances in the game world were of interest and one of the things they pointed to was that picking up affordances in a game world does not necessarily correlate with picking up the same affordances in the real world. This means that a door is not necessarily a door, if a door is understood as something that can be walked through. In their view, a 1:1 application is therefore not possible, so a distinction between real affordances and virtual affordances is lined out. L&B suggest the term *professional vision*, to explain how we pick up affordances in games with no natural equivalents.

What is interesting to remark is that the concept of affordances seems very promising, but to make it operational also seems very challenging. R&S suggests in their paper not to overuse the concept and to do further studies. As pointed out in the description of affordances elsewhere, an assumption was put forth that in order to make the application of affordances successful, Gibson's overall approach to perception and level of description cannot be abandoned. In the following, I will make a preliminary suggestion of how the concept of affordances can become operational. In Rambusch & Susi's paper, they refer to Neisser's idea of perceptual learning. Neisser's concept is also at the core of Linderoth & Bennerstedt's study, as "responding to variables of physical stimulation not previously responded to" [LinderothBennerstedt:2007:20].

The learning process of a game and the discovery of affordances in a game are then based on the encounter with and the experience of in-game virtual properties and the possibility of manipulation. In relation to L&B's notion that doors may not be pass–through-able, how can the concept of affordances be fruitful if there is no natural relation between affordances in the videogame layout and affordances in our natural environment?

Encountering, perceiving and acting on affordances is an environmentally and bodily constrained activity. We do not learn about the world unless we act upon it and observe the consequences of our actions, and the actions possible are relative to how our bodies are situated in a confined setting. The graphical layout of the videogame may simulate properties known from our natural world in the sense that there is information for action available in the optic array. When learning about a videogame, we may find ourselves in a trial and error position, discovering which properties can be manipulated and which cannot. That the manipulative possibilities in

videogames do not correspond to real life actions, is not that important as the manipulative possibilities will be relative to the game layout under any circumstance and not necessarily to the layout of the natural environment, although principles from the natural environment may be instrumentalized as means of actions. As things can be attached or detached to the ground or other things in the natural world, so can properties in the game be detached or attached to the layout. Attached virtual objects cannot be manipulated whereas detached objects can. The knowledge of which objects are detached or attached is a part of the learning process and is discovered in attempts of manipulation. In this respect, the game layout becomes a new learning situation of game layout specificity. In older computer games, there was a high degree of object layout attachments due to limitations in computer power and technical graphical constraints, which means that only objects important to the gameplay were detached from the layout. Now, more and more objects are detached from the layout, which gives the player a higher degree of manipulative possibilities and freedom of use.

In Juul & Norton's article [2009], "Easy to use and Incredibly Difficult: On the mythical border between Interface and Gameplay", they attempt to line out the relation between the interface and the gameplay. For the purpose of their article, they state that; "…the interface is considered to be the software and the hardware tools that the player uses to understand and affect the game state. The interface can include controller buttons, mouse clicks, menus, status bars, and field of view." The gameplay is then considered;"...the core activity of the game which is accessed through the interface" [Juul&Norton:2009]. Both terms here; interface and gameplay, are fuzzy. It is important to point out that Juul & Norton are not concerned with affordances, but their approach could benefit from the

integration or at least a consideration of affordances. The statement that gameplay is accessed through the interface is a weak point. If we substitute the term interface with that of "layout", then the gameplay is something that unfolds as changes occur in the layout. That you manipulate a character, figure, etc. is not as important as how this figure occupies the layout. Again, this brings us into the ecological discourse. To be specific about affordances and their function, we need to be specific as to how all other features of a game are described. If gameplay constitutes changes occurring in the graphical layout, then the distinction between natural and virtual affordances becomes obsolete, and the concept of affordances can become operational, since affordances are based on the presence of information for action.

Furthermore, if we take into consideration the notion of the joystick as an objectification of otherwise physical processes or operations, the relation between affordances and information pick-up from the layout could be better understood if they related to the level of operation of the joystick. In this respect, there is a kind of cross over between information pick-up and joystick control in the sense that an object or other properties may not necessarily afford an action within the layout, but an action relative to the joystick that eventually causes changes to the layout. An example would be; to pick up a detached object in the game's layout, press a specific button. Sure, it is speculative to apply affordances in this way, but one way for the term to make sense is to be clear about the differentiation between information pick-up and the level of action. There are definitely complications relating to the application of the concept of affordances and the obvious typical use in relation to features in the game layout. In relation to the picking up of affordances the notion can only become operational, is the argument here, if all levels of game layout

encounters are explicated. As pointed to earlier, it may not be the most obvious strategy that eventually also may become the most articulate.

A significant attempt to apply the theories of affordances to videogame research is seen within Ulf Wilhelmsson's dissertation[2001]. Much in thread with this dissertation, though diverging in other fundamental respects, which will be explicated further ahead, Wilhelmsson relates his use of Gibson's approach to the concepts of affordances and constraints in a gameworld. He states that;

> In fact, very much of computer game environment construction relies on how the human perceptual system is able to find the affordances of the objects contained within the environment. [Wilhelmson:2001:1]

Though Wilhelmsson has many interesting points there are essential complications with his understanding of affordances. He explains affordances in the following way;

> In Gibson's ecological approach to the visual perception, affordances and constraints are thought of as being inherited within objects and materials". [Wilhelmson:2001:37]

This (mis)understanding of affordances, as inherited within objects, is a typical one, in the sense that it ascribes affordances to physical objects much in the same way as Norman does in "The psychology of everyday things"[1986]. Gibson emphasizes numerous times that affordances is a *relation* that emerges between the perceiver's ability

to pick up information and the properties in the environment and that the relation points both to the perceiver and to the environment. The understanding of affordances as something inherited in objects deflates the concept, since if affordances are properties belonging to objects and materials, then it becomes difficult to explain the relativeness of the pickup of affordances for action. An example could be that of a toddler and a grown person perceiving the same object, but perceiving different affordances. A grown person may sit on top of a chair, whereas a toddler may sit under it. Affordances are not only a property of the environment since (ex)proprioception plays a role in picking up affordances for action. Wilhelmsson otherwise points to ecological concepts that can be applied to game layouts, such as the layouts of game having textures that give them appearance of substantiality and thus become perceivable as being properties that can be stood on, picked up and so on. As put forth above, there are probabilities that layout objects can be manipulated in a natural way, but it is by no means a given that this will be the case. The experiential encounter with a game layout will be informative in relation to possibilities for manipulation.

Before the definition of the videogame – player system in this presented context, it has been important to show that Gibson's ecological approach eventually surfaces within videogame research. Another important point is that the application of his concepts may not be a straightforward enterprise. Concepts may need some modifications. This does not suggest that the concept should be wrought out of proportion or be given another meaning.

Some questions remain concerning some attempts to synthesize the ecological approach with other fields of theory. In Wilhelmsson's case, he attempts to fuse the concepts of Gibson with those of Lakoff and Johnson. Lakoff and Johnson's theoretical approach is described in

Wilhelmsson's layout as an experientialist and embodied approach to cognition. His attempt to create a synthesis between the two theoretical positions seems almost anti-Gibsonian. Here is where Wilhelmsson's enterprise, on a larger scale, diverge from the one presented in this thesis. He emphasizes Lakoff and Johnson's cognitive paradigm and adopts concepts such as image schema, which refer to the cognitive containment of image schemas on a neurological level. Even though Wilhelmsson is explicit about the complications of fusing Gibson with Lakoff and Johnson, he argues that this problem may be overcome in the interpretation of the two positions. Wilhelmsson explains the position of Lakoff and Johnson as follows:

> Cognition and conceptualization are based on image schematic preconceptual structures that organize perceptions into meaningful concepts of the mind. [Wilhelmsson:2001:85]

The combination of the two positions leads to several levels of confusion, especially for readers of Gibson, as Wilhelmsson claims that the relation to the videogame layout is a process of mapping everyday experiences onto the layout. The use of concepts such as mapping and image schemas, is a case of mixing up paradigms and paradigmatic terminology, even though Lakoff and Johnson claim that the image schema should not be taken literally as images in the mind[Wilhelmsson:2001:84-85]. Though it can be held that the attempt to rely solely on Gibson is somewhat naïve, there is a danger of distorting the original meaning of the ecological concepts - if they become instrumentalized - to describe i.e. the content of mental images or image schemas. I discovered, late in the process that

Wilhelmsson's dissertation is like an odd twin to this project. He attempts to operationalize the ecological concepts in relation to manipulation and constraints within the gaming process, but he also displays a questionable outcome in relation to the ecological approach as a visual vehicle for cognitive processes of conceptualizing about the world. If we look back at the chart created by E. J. Gibson & A. Pick, it can be concluded that Wilhelmsson attempts to merge the paradigms at each end of the scale. Put in simpler terms, he attempts to explain an indirect approach to perception by the usage of concepts from a direct approach. That Gibson himself was not explicit about cognition simply points to a claim he makes that cognition cannot be comprehended unless a proper foundation for perception is formulated. The emotional or cognitive processes of the player are not brought into perspective here, as the purpose is to make suggestions on the level of experience in relation to visual perception. That emotion, cognition and perception are inseparable in nature is another type of study.

Chapter 9

Videogame – player system as activity

Initially, it will be necessary to look at the somewhat jargon-laden discourse of videogame research in general. Terms have sporadically been brought forward to address the content of the "game world", which is a term that appear to be the preferred within videogame research. The terms applied revolve around the analogy to properties such as space, world, and simulation. More can be mentioned such as computer generated artificial environments [Morris&Hartas:2003:12] and 3D worlds. The usage of the mentioned terms often relates to the virtuality of game layouts as an implicit notion that games are not real. The question here is if the simulative or virtual aspects are of any interest in an ecological context. Sure, there are simulative aspects due to the level of construction in relation to physics, as many programs used for creating interactive graphical layouts have integrated engines that simulate i.e. gravity or weather conditions. There are features on other levels that resemble everyday activities such as cooking or nursing games, but these are activities within the larger system of the mode of realization of videogames. The games can be characterized as virtual, with respect to its lack of materiality.

Most certainly, the various terms applied to relate to videogame content, depend on how videogames are characterized, on how the player is characterized and finally on how the system as a whole is characterized. Whether videogames are virtual or not is not as important as the reality they in fact represent on its own premises From an ecological perspective, an *optical reality* exists in videogames and this level of optical reality can be understood and analyzed within the realm of the ecological approach.

World simulations or optical realities

In the following, the term simulation will be discussed in relation to the notion of an optical reality. There are numerous ways to understand what a simulation is. A textbook approach would be to look at a definition of the term, where simulation at its most basic level can be understood as; …*the representation of behavior or characteristics of one system through the use of another system, esp. a computer program designed for the purpose*[28].

On this basic level, it can be suggested that the videogame- player system simulates the perceptual system, as there are several commonalities between the two systems. From an ecological viewpoint one may go as far as to state that the purpose of the videogame-player system *is* to simulate the visual perceptual system.

J. P. Gee points out that simulators usually simulate complex systems such as the weather conditions or human cells and suggests that there must be a distinction between videogames and simulators. Gamers do not play for the sake of the simulation, is his claim [Gee:2008:31]. They play for the sake of the elements inside the simulations. But some games are like simulators [Narayanasamy et.al:2006:2], such as games that simulate flying with a view point from the cockpit and games that simulate object motion.

As described earlier, researchers such as Aarseth, Weibel and Grodal suggested that simulation could serve as a conceptual frame for videogame play as an activity that imitates actions which are not carried out in "real life", but simulate real life situations, where Weibel uses the term simulation to describe the convergence of moving image and moving observer. The game world is not "real", but a representation or imitation of life-like properties and thus virtual.

In continuation of the proposal that the visual content of videogames is an optical reality, Christian Metz [1974/91] makes an interesting notion of motion in relation to film that can be extended to fit well with the ecological approach.

He states that;

> Because motion is never material but is *always* visual, to reproduce its appearance is to duplicate its reality. [Metz:1974/91:9]

The citation should not be misconceived as an attempt to employ film theory within which Metz operated, but there is an interesting point in relation to videogames. There may not be a physical reality present in the visual content, but there is an optical reality. The changes taking place on the screen while playing games are experienced as real changes to the layout. Now, if we review the layout of videogames, it is possible to attempt a more ecological discourse to describe the possibilities of changes that a player can create while playing games.

The informative layout

Though videogame layouts do not consist of substantial materials there is a layout of the visual elements and the layout is informative. Though the employment of the concept of simulation is perplexing, it can be stated that the informative layout in games attempt to simulate that of real physical informative layouts, but the use of the term simulation may create more problems than solutions as pointed out in the prior passage. The question is however, how to handle the implications and if it is viable to dismiss the notion altogether? A dismissal will be partly attempted, though it leads to new complications in relation to a replacement of the term. If we accept

the variety of meanings of the term, the usage has to be contextually applied, in the sense that it will become a term employed when no other can be used as a substitute.

Videogames are informative about a number of things. Some game layouts may be more environing than other types in relation to the possible movement of viewpoint. It is even possible to claim that the viewpoint is a confined visual field where such features as hands in the layouts function as a protrusion of the visual field. Depending on the type of game there will be inflow and outflow in the surrounding visual field i.e. while playing a car driving game.

This type of information is vital for the sense of heading. In relation to car racing games, both with a first person perspective and a third person perspective, there is an outflow or inflow or non-flow in the layout relative to the direction of heading and a non-flow is informative of the stasis of the car. Cars can move backwards and this will create an inflow. If the flows in the layout did not resemble the flow from the natural optic array, it would be impossible to determine the way of heading. In the simplistic example below using the same static image, inflow and outflow are demonstrated. With a little imaginative power, the inflow creates the illusion of the car moving backwards and the outflow the illusion of the car moving forward.

In relation to visual kinesthetics and the laws for visual control, the operation for making a car that is driving backwards, and thus creating an inflow in the optic array, move forward, would simply be; move as to make the array flow outward. Or, as will be the case in videogames, operate the joystick accordingly. In car driving games, such as the Need for Speed or the Burn Out series, it almost appears as if the surrounding layout is moving past and under the car, if the player is capable of keeping the car arrested in one specific place in the layout. The locomotion of the car becomes more visible when there are continuous displacements of it in the layout or when there are other intrusive elements in the layout.

In the game layout, things can go in and out of sight due to either a deliberate removal of forms from the layout, or due to a turn of viewpoint. Locomotors may dilate in the visual field thus emulating approach or they may contract and emulate retreat. The occurrence of NPC's (non playable characters), can be understood as the presence of locomotors. They are elements that the player cannot control but encounter in various ways and they occupy the informative layout relative to the purpose of their presence. In the chapter that provides a deeper analysis of game types, the role of locomotors will be addressed.

Layouts may appear cluttered with objects and thus imitate obstacles that can be informative in relation to passage. There may be objects that are displaceable and objects that are not, that is, in relation to a prior statement, they may be attached or detached within the graphical layout.

To sum up this passage regarding the layout, the claim will be that to address the composition or arrangement of layouts, the ecological terminology holds some promises in opposition to a more narratively

laden type of description. The ecological terms imply action possibilities. That an object is detached and can be manipulated is more informative than to name it according to some object categorization, i.e. as a rock. If the "rock" can be manipulated, it most often implies a function relative to the larger system of actions.

A typical way of addressing elements present in the layout will be by the employment of an everyday terminology with the usage of words like, houses, cars, doors, enemies and so forth. The problem with this discourse is that it refers to the resemblance the elements of the layout bears with the objects they depict. That there is a house or a car depicted in the layout is a level of explanation that may lead to perplexity, even in its realistic attempt to describe that which is mimically depicted. To employ this discourse may lead to a mystification or befuddlement and cloud the function of objects in the layout. In the ecological terms, more can be implied in regards to the depicted objects. That a house is depicted relates to the mimicry of the object, but can say little about the functionality of that specific depicted object in the layout. To which degree is a depicted house relevant for the required types of action? Does the house fill out a specific function? Is it encounterable or changeable? What are the informative specifics of the house, etc. will be questions that are not immediately answerable by reference to its (the house) object categorization.

Player Agency

Picking up information for action is required from the player in order to make progress in the game. The player can be seen as an agent engaged in picking up information from the layout that is; as an ecological self. In relation to the concept of agency, Murray refers to; *… the second characteristic delight of electronic environments – the sense of agency. Agency is the satisfying power to take meaningful*

action and see the results of our decisions and choices [Murray:1999:126]. Later in the passage she states; *But activity is not agency alone* [Murray:1999:128]. In the ecological perspective, agency is always activity. In this respect, it is impossible to imagine activity without agency or vice versa if agency is understood in the layout of EJ Gibson. By referring to the player as an ecological self, it is not implied that the player takes on a new persona or something similar, but that in relation to the information pick-up process, the player brings a specific type of self – knowledge or perceptual awareness to the gaming situation. The notion of the ecological self is not to be confused with an identification or a new denotation of the player, as can be seen in e.g. Wilhelmson's attempt to characterize a *game ego*[Wilhelmsson:2001]*.* The use of the concept of the ecological self serves the function of crystallizing this specific area of experience already present in the player as a perceiving agent. When referring to the ecological self, other personal traits of the player are left out. The ecological self will refer to the players' experience or involvement on the perceptual level. The implications of the employment of the concept of a self have been discussed earlier, but it is necessary to stress again that it simply refers to a specific type of awareness. I will point back to Gibson's charts displaying the visual system in function on page 117 and provide an illustration of the perceiver relative to the environment from a different perspective. The first illustration is a modified version of Gibson's figure showing the perceptual system when the perceiver is stationary, whereas the second figure shows how the game becomes part of the perceptual system.
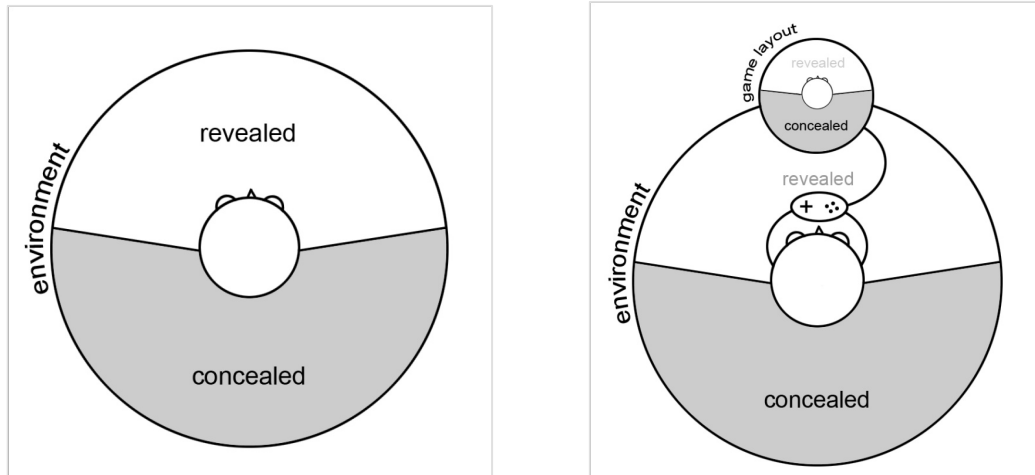
In the first figure, the player is situated relatively to the natural environment in which the gaming takes place. When we are playing videogames, a double perceptual situation emerges, which becomes visible in the second figure. Bringing into mind the concepts presented in part 1, such as on-screen and off-screen content, these terms can now be reconsidered in relation to the game layout and can be described with an outset in the model with respect to the possible revealment and concealment of layout properties.

In certain terms, the player's perceptual awareness is displaced to that of the game layout which has functional similarities on the optical level to that of the natural perceptual system. The viewpoint can be turned to various degrees which points back to the level of operation of the joystick. It would be an easy step to suggest that the viewpoint simulates ambient and ambulatory vision, but it seems more realistic to suggest that the natural means of head turn and body movement are processes objectified means on the level of operation of the joystick. The joystick is capable of objectifying the process of ambient and ambulatory vision thus providing the player with means to reveal or conceal layout properties, and if we employ

the term simulation here, the layout in turn simulates visual information related to the two basic types of informative structuring.

With respect to the player, elements in the layout – such as an arm -, are often seen as an extension of the player into the layout that enhances the sense of presence but, here, it will be a protrusion in the layout that causes a deletion. Concealment and revealment alongside deletion and accretion of the layout are often instrumental elements in games, which compel the player to operate the viewpoint in order to bring things in and out of sight.

In relation to player engagement, numerous suggestions have been made to address concepts of i.e. identification with playable figures. Jenkins points to the manifestation of player identification with game elements as prominently visible in how players refer to their achievements in games. His own account is as follows:

> When I feel the acceleration of speed, spinning real fast and clearing the screen as the Tasmanian Devil, my pleasure has less to do with my moral alignment with those characters than with my ability to control them. Even given my ample facial hair and my sometimes anarchic sense of humor, I am not, in the end, terribly much like Taz. Yet, I often speak of the game playing experience as if "I" died, "I" flew off a cliff, "I" beat my opponent, suggesting fairly direct identification with the often simplistically rendered figure on the screen.[Jenkins: 1999/2004:253]

The problem may not lie as much in the use of the "I", as much as in the interpretation of the use. There may be limitations to everyday language that make it an easy statement, as another layout simply

could be that the "I" refers to, "I the operator" and not "I" the subjective player.

Another point in relation to the player could be in relation to the level of skill. If we bring forward the notion of Grodal's division of experience in relation to *challenge*, *mastery* and *automation*, a player may find him/herself in one category or the other or transiting from one to the other. The notion can now be elevated for further use in relation the perceptual awareness. If a player is a novice in relation to the operation of the joystick, much attention may be given to this level of operation. As suggested earlier, the joystick may eventually play a subservient roll and the processes of handling it become automated, which points to more levels in the division of gaming states. The level of challenge may start at the level of the joystick and move on to the level of information pickup from the layout. Once the operations of the joystick have reached the state of automation, the level of challenge, mastery and automation are displaced to the graphical layout. The more indirect the control device is designed, the more time a player may stay in the operational phase of challenge. It is often experienced that if the control functions of the joystick are not automated processes, the player may shift his visual attention from the layout to the joystick.

With respect to the processes of player agency pointed out above, it can be concluded on a preliminary level that agency it not just relevant for the manipulative possibilities of the layout. Agency is the combined effort of joystick operation and manipulation of the graphical layout.

From an ecological viewpoint, the player can be conceived of as a perceiver, an agent and an ecological self, who brings to the gaming situation a specific and inherent level of perceptual awareness and as

an agent for whom it is possible to displace his perceptual awareness to the game layout. In a combination of joystick control and information pick-up, the player operates within both the natural perceptual system and that projected by the game.

Before the applied approach is used on the level of actual game analysis, we need to bring the concepts together in a larger understanding of the videogame – player system as an activity and repost the question, "What is a videogame?", now viewed in an ecological contextualization.

## Videogame – Player Activity Model

In part 1, a simplified model was displayed that showed the relation between player – activity/tool – object. The model will be expanded here for several purposes. The model will be a practical foundation for a delineation of the level of analysis, as more levels can be identified. The model will serve as a base for the identification of specific action – perception cycles, as well as a way to comprehend videogame – player system in its entirety, even though not all possible explanations will be laid out.

As stated, there are some implications in relation to the term simulation but, as it has also been pointed out, a replacement of the term may have its own implications. In explaining the model, the term simulation will be used to address the ability of the medium to represent optical structures, that is, to represent changes and information on the basis of the operation within the layout.

Model Explained

Though the model is represented as being flat, it must however be stressed that the process of the activity is understood as being circular, which explains the gray sections of player and visual layout

as the interface between player and visually informative layout. There is of course also the interface between player and control device, but it will be toned down due to explanations of the relation elsewhere.
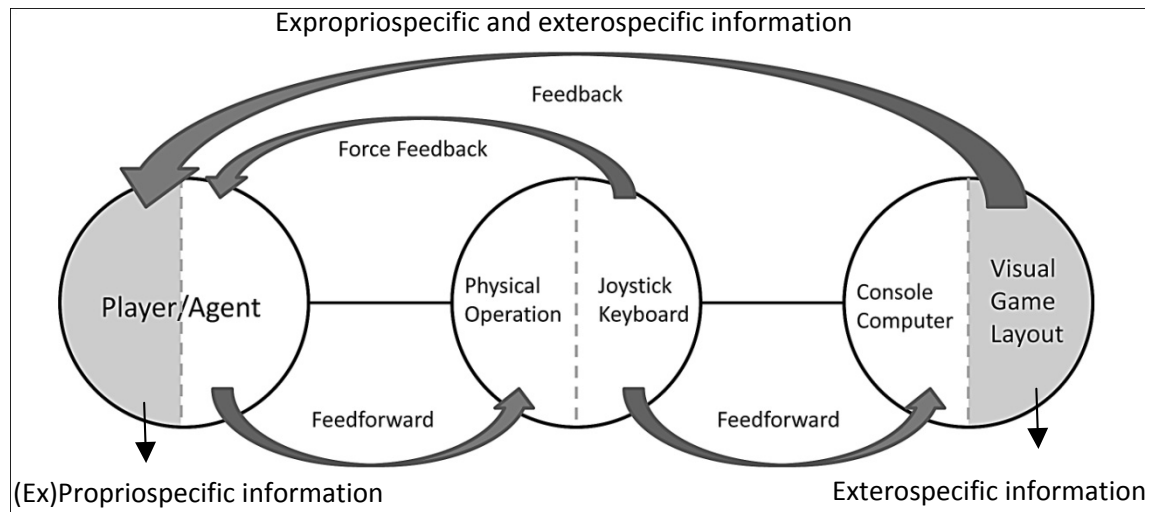
If we accept the premises of some type of simulation, the visual layout can be described more detailed in relation to the information it simulates. In ecological terms, activity contains the basic types of information; exterospecific, expropriospecific and propriospecific.

The exterospecific elements are elements present in the layout as suggested in the following overview but can also be exterospecific information as feedback from the joystick. It should be noted that the concepts presented in the model and in relation to the model are simplified with the purpose of the establishing role of the model in relation to an application of ecological terms. The simplicity of the model can be debated as it only present concepts relevant for the description of games further ahead. Some descriptions may even be questionable, but as a starting point it is an attempt to address the specific types of information involved as well as the flow of

information in relation to player manipulation and game layout, manifest in the flow of the arrows.

The exterospecific elements included will refer mainly to the game layout. It is important to differentiate the various types of information, as it is believed that much of the tension in games emerge as a correlation between information ascribed to the layout, the information ascribed to the player and the appearance of information as an emergent factor, between the specificity of information.

Exterospecific Information

Objects

- Stationary/moving
- Detached/attached

Locomotors

- Stationary/moving

Visual Kinesthetics

- Inflow, outflow, non-flow etc.

Layout/ Game Environment

- Cluttered, enclosured,
  open etc.

There will be a presence of stationary and moving figures and objects, which can or cannot be manipulated. In relation to the expropriospecific and the propriospecific elements, the divisions between these types are more shaded. In the following overview, the information will be described as (ex)propriospecific, because some types of information are both if the concept of Lee is employed. In relation to the placement of a hand in the visual layout, it can be stated that this simulates the arm of the player, and thus appears to be a type of propriospecific information. Once the hand is used for

manipulative purposes, the information becomes exterospecific as it either specifies a limb manipulating an object or becomes part of the game layout, and therefore contains both the information of a limb and the information for the limb's actions relative to objects and other game properties. Further ahead some complications in relation to propriospecific information will be treated, as this level of information pick-up, in its realistic identification may not be relevant in relation to the layout, but only in relation to joystick manipulation.

The terms employed can be seen as a modification of the ecological terms in order to place the player in relation to the informative layout, though not as a subject that identifies with a game character, but as a presence in relation to viewpoint.

Being aware of the interchangeability between these two interconnected concepts, the information relating to the player can be viewed under the following headings.

(Ex) Propriospecific information

Point of observation
- Ambient/ambulatory vision

Locomotion
- Walking, running, driving, etc.

Semi objects
- hand, hands with objects, etc.

Visual control
- Stop, start, reverse

These types of information are more directly related to both the objectification of physical processes in the joystick and to the manipulative constraints.

Even though the terms feedback and feedforward are used in the model, these are exclusively understood on the basis of the system's means of computing in the sense that a push on a button will feed information into the system, as well as the system will feed back information. The effects of feed into the system are noticeable in the layout and felt on the joystick and these effects are what the player experiences. The feedback on the level of the layout will be visual information as well as the feedback from the joystick will be tactile information.

The graphical layout is capable of representing optical changes which resemble means of transportation and object manipulation as well as information of the figures' and locomotors' placement and displacement in the layout.

The arrows in the model indicate both the flow of information and the flow of operation. The arrows applied here are different from those applied in Bærentsen and Trettvik's model where all the processes took place in relation to the activity/tool. Due to the visual interface as the place where changes are detectable the arrow that flow from the layout to player is the informative flow from which information from the optical changes are picked up. There will also be a tactile information pick-up from joysticks with force-feedback. The information from the visual layout will always be both exterospecific and exterospecific. When the player act on the visual information, the joystick or other control features will feed one type of information into the system, which is converted to the information the player can pick up. The model makes it possible to point out exactly where the

various levels of descriptions can be ascribed. On the operative level there will be different types of actions emerging depending of the types of information picked up. Some types of games require an erratic pounding on buttons, whereas other types of actions require a controlled and dexterous type of operation, where the smallest diversions can create extreme conditions on the layout. Already it is possible to consider a variety of perception – action cycles that emerge as part of the process of gaming.

Perception – Action Cycles

The concept of perception-action cycles will be viewed as more microscopic processes taking place while playing and will be present on more than one level in the process of playing. A common situation while playing games is the struggle to make the appropriate changes to the layout. This point will be clearer in the analysis of games. Here it suggests that there are various perception – action cycles emerging. Due to the relation between objectification and visual changes, the player often finds him/herself in a position where the challenge revolves around the transportation of a figure from one place to another. Often, there are obstacles to be overcome. The directional buttons or sticks on the joystick must be controlled in a very constrained manner in order for the figure to be placed exactly. Too much diversion will land the figure in the wrong place. As part of the practicing process, it has to be experienced what the exact thresholds are for the possible movements of the figure. The processes of exploratory and performatory activities are often interchangeable levels of operation where the former leads to the latter. As was pointed out earlier, the performatory activities lead to a modification and therefore to a change in circumstances, whereas the exploratory activities do not intervene with any game properties. Superordinate perception- action cycles would be that of exploring,

performing and exploring and so forth in continuous interchangeability. Within the performatory activity, action-perception cycles are nested which can be intervening functions in relation to game properties. To shoot an enemy is to remove the figure from the layout. In order to do so, there has to be a tightly knit connection between the operation and the visual information, which often involves an erratic pushing activity of the joystick in correlation with the process of picking up information for both the applied action and the actual, visual consequences of the action.

If we look at the model, certain areas can be enlarged and will contain their own nested context specific action – cycles, which in other terms can be explained as the distinction between the types of actions on the level of the interfaces involved.

Continued inspection of interfaces

If we start by separating the model into the distinct interfaces, there is the player-joystick interface and the player – visual layout interface. Here, it may be intelligible to separate the interface of the visual layout into two types, or two levels of interfacing. When the player is controlling a figure, there is a simulation of interfaces within the graphical layout in the sense that a figure may not be able to go through a wall due to the simulation of two substantial, physical interfaces; that of the figure and that of a brick wall. In this respect, the process of controlling the figure becomes a process of picking up information for the interfacing properties in the layout. I will propose the notion of a type of third interface being aware that it may be contrived. Looking at the graphical elements as interfacing properties may bridge the problems of describing the interactive process in regards to the playing "I". It is not "I" who jumps on to a platform, but a specific possibility the controllable figure possesses in relation to that which is simulated in the environment of that figure. Though

not explicitly lined out, but still present as an undertow, is the concept that the complications of addressing the specific visual means in videogames can be enhanced by the employment of a subjectified discourse. There is an "I" that manipulates the joystick or swings the arm, but there is no "I" that jumps buildings. Another argument for implying the concept of a third interface is that it makes it easier to distinguish the possible layers of explanation. Juul point to another type of distinction, similar to this one, though described differently. He suggests that traditional three-dimensional games [Juul:2010:107], and here expanded to third person perspective games, force the player to imagine a presence in the layout, whereas mimetic interfaces, which were described in part 1, allow the player to view his action in the game from a direct viewpoint. In relation to third person perspective games it makes more sense in an ecological context to describe action taking on the level of the third interface as a combined dynamic between exterospecific and expropriospecific informative changes. In this respect the figure or the avatar, is not an extension of a self, but a *displaceable expropriospecific informative element in the game*. In this respect, all controllable figures will always be expropriospecific information. To further this notion, controllable figures can be viewed as disturbances in the layout created by the player, which again may cause areas of the layout to be momentarily deleted. The displacement of the figure will create interchangeable situations of deletion and accretion, which can be understood, precisely as types of perceptual means more than pictorial means in relation to possible rearrangements of the layout.

The ideas presented here will be elaborated in the analysis of game examples, where it will be possible to point out what the perceptual means are in different game types in relation to the ones described in

the model. It will also be possible to point to specific perception – action cycles within games.

Playing by the Visual Rules - Game Examples

Though it is a typical endeavor in texts about videogames to generously provide numerous examples of games, the focus here will be on two types of games that are considered to be canonical, within each game type they represent. The examples are easy to find on the market, as well as they are widely known. Beside the argumentation that these game types are available and widely known, they are often the subject of analysis within videogame research. That these titles have been under scrutiny elsewhere is an advantage here, as it makes it possible to take other approaches into view and discuss the theoretical positions in relation to the presented theoretical framework. The presentation of game examples serves the purpose of employing an ecological discourse to games which can point to strategies of more in depth analysis.

A further argumentation for choosing games on the assessment of both their canonical characteristics and availability is that the approach presented herein, aims at being articulate on the general level of videogames, with respect to the identification of visually perceptual means and functionality, as that "something" that separates the video game media from other visual media. The approach should be general enough to encompass most available games and be specific enough to point to the inherited perception-action cycles of specific game types and large scale activities. We must keep in mind that players in their everyday activities of playing videogames are the true experts.

The exemplification of games will take its outset in extracted concepts from the ecological approach. In the explanatory listing of

the features related to the elements present in the videogame – player activity model, the focus here will be on;

The exterospecific, expropriospecific and (ex)propriospecific information

Objectification of ambient and ambulatory vision in relation to optical changes

Agency and prospective control

Exploratory and performatory activity

Perception – action cycles

Before the examination is carried out, it is important to note that the modification of the ecological terminology, in part, is to be understood on the level of discourse. Since the functionality of elements present in the graphical layout is of interest, this level needs to be addressed in relation to the functionality of the concepts in the natural perceptual system, though the natural bodily operative possibilities have been objectified in the control device. On this premise, the traditional approach with regards to a pictorial discourse will be substituted with the ecological discourse. However, troublesome it can be to maintain the consistency of terms in relation to the understanding here, for the sake of readability Mario will be called Mario, but will be understood as a functional element and not as a character. The notion of a character is relevant for a narrative investigation, but is of no interest here.

Super Mario Bros.

The Super Mario Bros., was first launched in 1985. The Mario series is one of the most played games on the market. Even though the examples brought forward here were designed to consoles that hardly exist in the modern living room anymore, namely the NES and the SNES systems, it is necessary to mention that, in 2010, Nintendo relaunched the series for the Wii console to mark the 25th anniversary. In this respect, an analysis of Super Mario Bros. is as relevant as ever. The Super Mario Bros. is a platform game, which situates the figure in world layouts where dangers and obstacles have to be overcome. It is possible to scroll sideways from left to right and, in this respect, the layout is confined within the top and the bottom of the screen. The original Nintendo game pad had four directional buttons and two action bottoms as shown in the image below. Taking the relaunch into consideration in relation to the Wii console, the Wii remote has the same types of buttons. The fact that the Wii Remote has a larger scale of objectified operations makes it more flexible in relation to the types of activities that can be integrated. In the image of the Wii Remote, the buttons are visible and when the remote is held vertical it can be operated as the old game pad.


[29]

[30]

Before the ecological approach is presented, I will include an example of how another videogame researcher has attempted to address the visual layout. Matthias Ljungström refers to the experience of games as *joy of movement,* which implies that the mere possibility of creating movements in games is a reason for playing in its own right. He has created some illustrations that show the patterns of obstacle composition often encountered in games such as the Super Mario Bros.-series. They can be understood as an attempt to create a visual grammar which displays some basic visual primitives of game layouts.
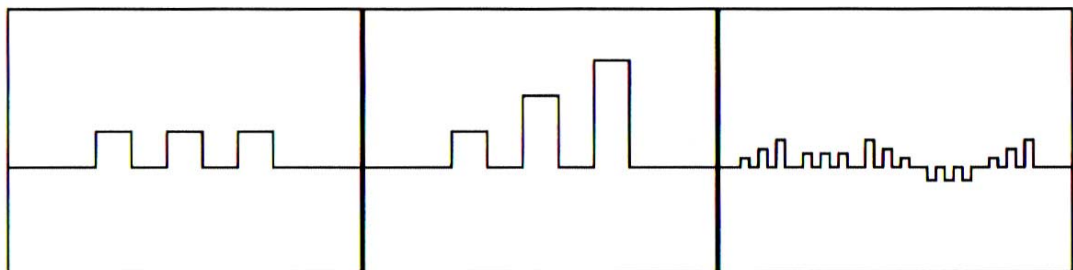
Fig. 6: Equal Spacing, Escalation, and Melody   Fig. 10

Ljungström views the compositions as flow patterns, which almost create movements that are analogue to musical compositions when encountered in games, hence his melody label of the last image in the triptychon. The approach is based on the premises of image composition and a pictorial approach to game layouts and therefore diverges from the approach in this thesis. Nevertheless, his illustrations are instructive in relation to the interfacing on the level of the notion of a third interface, namely the interfacing of graphical elements. They will be taken into account here, though used on a different explanatory level than that of Ljungström. As an example of how Ljungström uses his illustration for analysis can be seen from the example below.
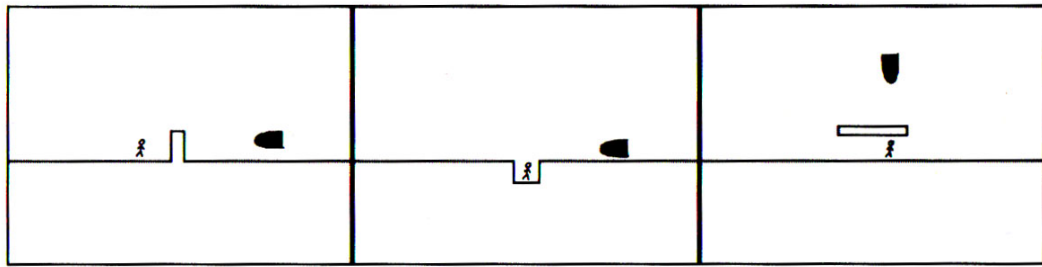
Fig. 7: The Wall, The Hole, and The Roof   Fig. 11

Ljungström refers to the above types of pattern as inherent in tactical spaces. In thread with Wolf, Ljungström separates the layout into various types of spaces, and explains the above illustration as follows;

> Figure 7 shows three basic examples relating to line of sight and cover positions. The line of sight is represented by an approaching dangerous object. The first two protect the player character against horizontal danger, whereas the last shows an example of a vertical cover. [Ljungström:2008:201]

Though the explanation may diverge from that of the ecological approach, his attempt exemplifies interfacing action possibilities. Even though he refers to player behavior, it will be more in thread with the ecological approach to suggest that the layout has interfacing constraints from which the player can create ideal displacements of the figure in the layout. There are options for a displacement, such as The Hole. It should be noted that Ljungström calls his attempt functional and that his attempt at illustrating possible encounters in the layout is unique. If we look at the first illustration shown, it resembles the below screenshot from the Super Mario Bros.

From an ecological perspective, Mario is a controllable disturbance in the layout and to control him is to constantly displace the figure in a constrained layout of interfacing elements. The layout contains exterospecific locomotors, which can be removed by performing a "jump" on them. In order to control Mario and make him jump on enemies, prospective control comes into the picture. As the enemies are locomotors, the jump has to be performed in a prospective manner taking their speed of motion into account. So in the example where the player wants Mario to jump on a moving object, the operation must include both the time of the jump and the speed of the object. This type of action thus involves a type of prospective agency because the jump has to occur before the moving object collides with Mario, and as Mario is in the air, the moving object will be positioned under him and a collision can take place. In this sense, platform games are inherently prospective activities with an employment of the tau principle. Another aspect not brought forward earlier in this chapter is that of the leading and trailing edge of the viewpoint. As Mario move to the right, the edge of the frame becomes the leading edge and the place where objects come into sight. Some games will have objects coming in at the trailing edge as well, but here this will only be the case at the leading edge. In relation to the conception of the figure as a controllable disturbance,

the figure is also always expropriospecific in nature due to the correlation between joystick control as the propriospecific element and the exterospecific displacement of the figure. Controllable figures are displaced on this basis. No functional deletions or accretions appear. The viewpoint is an objectified constraint type of ambient vision. In relation to perception – action cycles the information picked up should lead to collision avoiding prospective control of the figure, where tension emerges as the paced collision avoiding behavior of the player in relation to the non-controllable locomotors. The layout is not explorable beyond the emergence of information at the leading edge, as the unfolding of the game happens purely on the level of performatory activity.

Bioshock 2007

Bioshock is played on PS3 and has a more advanced joystick than the former mentioned consoles. Bioshock is a first person perspective game, with an almost 360° manipulative viewpoint. There is a hand in the viewpoint as shown earlier in Part 1 and the hand can perform a variety of actions. In Bioshock there is also a wrapped-around narrative that influences the constraints in relation to the purpose of elements and action types.

In Bioshock, one of the characteristic features is the presence of semi-objects. As the viewpoint can be manipulated in both the ambient and ambulatory mode of vision, some of the concepts used in the analysis of the Mario game can be elaborated. In the case of both ambient and ambulatory vision, a constant flux can take place reversing the leading and trailing edge of the field of view, thus bringing things in and out sight. In Bioshock, this aspect play a significant role since locomotors can appear anywhere in the visual field and most often simulate approach. Below, I will show a series of instances where the point of view first moves to the right and then

shifts towards a left turn. The removal of the dangerous forms is also present in the images. I will indicate the direction of head turn with arrows.

Bioshock 2007 Screen shots
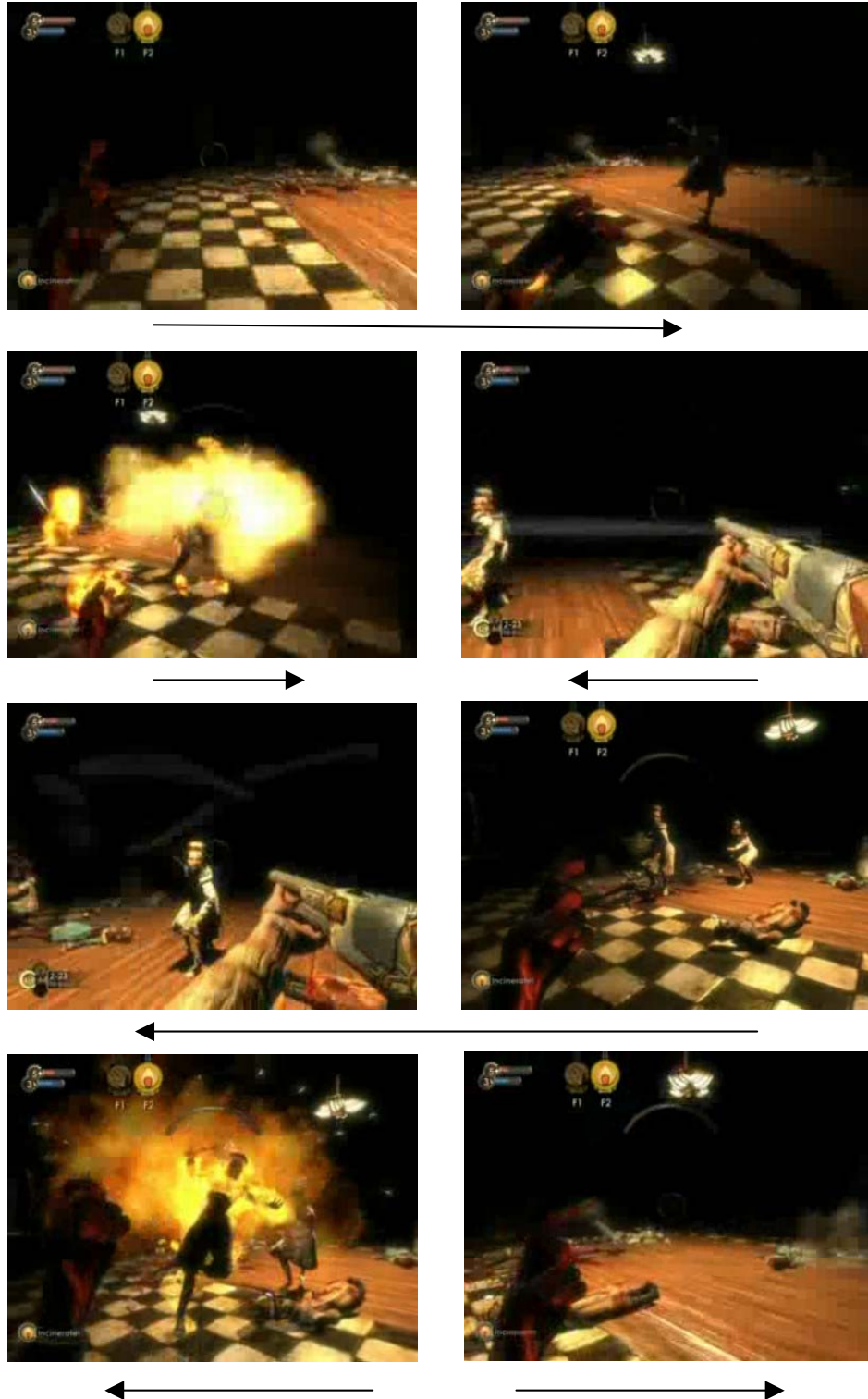
As seen in the first two instances, the simulations of a right head turn brings a figure into sight and, by immediately turning to the left, other figures are brought into sight. This shows the reversal of leading and trailing edge. Because the figures are locomotors, their occupancy in the layout is threatening due to the disturbance they cause. The instances are screen shots taken from a play duration of approximately six seconds. In instance 6 and 7, the viewpoint and the weapon are changed. This shows just how paced this type of game can be. In this example, it is clearer what can be said to be exterospecific and (ex)propriospecific information. The locomotors are exterospecific information whereas the head turn can be understood as objectified propriospecific information, though with a possible transiting between propriospecific and expropriospecific. In the case of Mario, the prospective control was more overseeable whereas here, the player sometimes just fires, due to the rapid appearance of figures. The figures also create deletions to the layout and the removal creates accretion. In Bioshock, a part of the tension emerges in relation to the objectified modes of vision, the revealment and concealment of information and the possibility to remove dangerous forms from the layout. The perception – action cycles arise as a consequence of the explorative possibilities in combination with the performatory possibilities. Here the player's possibility of free exploration is restrained by the appearance of exterospecific locomotors and there threatening occupation of the layout. In other words, the dilation of exterospecific locomotors in the layout threatens to occupy the whole visual field which points to the danger of collision and before an eventual collision occur the form has to be removed.

The above examples have served the purpose of showing how the applied approach can be used in a tighter perceptual description of

game types. At this point, the possibilities seem inexhaustible and the ecological approach seems promising for understanding aspects of gameplay that address a gaming "now". Many theories are articulate in a retrospective manner in the sense that they can be applied once a game is over. The ecological approach allows a closer inspection of the moments of action and of the experience of gameplay on the visual perceptual level.

This third part has brought the ecological approach into play and has synthesized the various concepts in a model that both attempts to describe the role of the elements present as well as the flow of processes in relation the videogame-player system. Though there are some obvious problems in relation to a direct transference of concepts from ecological domain to the domain of videogames, several implications have been brought into view. The initial illustration of the integration of the videogame – player system into the natural perceptual system has pointed to a perceptual displacement of awareness. In more a pragmatic sense the operations taking place in the natural system allows the perceptual awareness to take place. In ecological terms the concept of a perceptual displacement of awareness seems to be a more operational level of description as the concepts of player identification with characters can be avoided. That the game world is seen as an informative layout makes it possible to distinguish the types of information present and points to flow processes with larger and smaller perception – action cycles. The ecological approach also bridges the either *game-centric* or *player centric* approaches [Juul:2010] to videogame studies in its holistic attempt to maintain the reciprocal aspects of the videogame – player system, as well as the interdependent flow of actions through the system. The approach to videogames has this far been brought into play on the premise of a

perceptual approach to the videogame – player relation and the attempt has been to sustain a level of analytical approach directly relevant in a pragmatic operationalization of the concepts implied. Before this thesis comes to en end an attempt will be made to assemble all parts described in a meta-concept that, hopefully, will bring clarification to the many problematic issues that emerge when the role of perception is brought into perspective. As has been pointed out, time and again, the research field of videogames may itself not provide guidelines of how to proceed with perceptual investigations.

Chapter 10

Towards a new concept

We have now looked at the elements present in the videogame – player system on the basis of the system as an activity. Within the activity, perception – action cycles are nested and interrelating both on the level of the joystick and on the level of the visual interfaces.

The concept of a videogame- player system will be reinvestigated in this final section of the dissertation and a new concept will be proposed.

Throughout the work process of establishing the path to an articulate application of the ecological approach, it has been the assumption that traditional image theories were not capable of addressing the functionality of visual elements in the layout in correlation with the physical activity involved. Though Weibel is suggesting that we look at the interactability of the medium as a convergence between moving image and moving observer, there are still implications relative to the restraint of the system viewed as an image system. In relation to the autonomous processes eventually emerging on the level of joystick control as a consequence of practice, thus turning the operation into a subservient element, the images in the system can also in some respects be understood as a subservient function in the larger process of perceptual engagement. In other words; the operation of the joystick in correlation with the subservient role of the image points to a suggestion of how to characterize the system in a new way. The images can be perceived on the basis of their artistic aesthetic qualities, but it seems more obvious from an ecological

viewpoint that the images play an entirely different role than stimulating a pictorial aesthetic experience. This is not to say that on some level the images cannot create aesthetic experiences, but in the *now* of the gaming situation the functional level supersedes the aesthetic level. If we take the notion of Weibel in relation to his concept of *vision of vision,* the attempt here will be to propose that the videogame – player system as a subsystem of the larger interactable phenomenon of human – computer system, functions as an *exoperceptual* system. The term *exoperceptual* system does not exist and emerged in the process of creating a clarification of the conundrum that arises from attempting to look at a system that is basically constituted by some type of interactable imagery, although avoiding image theories altogether. The exoperceptual system is nested within the natural perceptual system and functions on the premises of the natural perceptual system. However, the exoperceptual system is capable of distorting, enhancing and amplifying perceptual principles as action dependent perceptual means. The term needs to be explained.

Videogame – player system as perceptual extension

There are numerous examples of how tools and media artifacts are considered to be extensions of humans and human activity. If we look back at Bærentsen's example of automation of processes in relation to firearms, it can be concluded that the sophistications of, and the means by which, the new types of firearms are operational, are extensions of human reachability. However morbid the outcome of perfecting firearms is, the example, on a general level, will be explanatory for almost all types of refinements and objectifications in relation to other artifacts.

If we follow the example of Bærentsen, the objectification of processes is an extension of picking up a rock by hand and throwing

it. This type of operation has its own constraints in relation to the rock and the muscle power of the operator. The process of throwing a rock also situates the doer in relation to the environment with an implied danger of proximity to the object to be reached. Within the ecological approach, the extension of the human bodily accommodations is touched upon by Gibson, since the utilization of objects in activities points to the larger systemic complex of affordances.

There are i.e. similarities between the Heideggerian approach to extensions put forth by Winograd and Florens and the transparency of attached objects in processes of use [Winograd&Florens:1986/90].

Gibson makes the following statement about tool use;

> When in use, a tool is a sort of extension of the hand, almost an attachment to it or part of the user's own body, and thus is no longer a part of the environment. But when not in use, the tool is simply a detached object of the environment, graspable and portable, to be sure, but nevertheless external to the observer. This *capacity to attach something to the body* suggests that the boundary between the animal and the environment is not fixed at the surface of the skin. [Gibson:1979/86:41]

The description of the conditions of the possibility to attach objects to the body correlates with Clark's notion of the two basic interfaces. When an object is attached to the body, such as a stick, which is the case in Clark's example, it points to a displacement of perceptual awareness which in return creates a porous border between subject and environment. Clark uses the conception of agent – world circuits, which, when explained, implies a specific perceptual awareness relative to the emerging interfaces of activity circuits or systems,

based on the bodily attachments. When we, as humans, attach objects to the body, the interface between agent and world changes. If we further this notion by incorporating the notion of extensions by McLuhan, we can look at the alteration of practices in thread with the notions put forth in relation to the HCI related statement presented earlier that changes of a system on one level may lead to alteration of operation and praxis on other levels. Specifically interesting for this project is the enhancements or extensions accommodated by technology.

McLuhan poetically claimed that media on different levels extend our senses and nervous systems. In relation to Bærentsen's notion of objectification of physical operations; McLuhan states that;

> What we call "mechanization" is a translation of nature, and of our own natures, into amplified and specialized forms. [McLuhan:1964/2002:62]

Even though, so far as known, McLuhan was not referring to any level of perceptual theories, but referred to the consequences of the technological invasion of the lives modern people, some of his statements can be reviewed and utilized to understand interactable visual media from the perceptual standpoint. McLuhan is preoccupied with any and all types of extensions. The "mechanical" age, which in his view presides the "electric" age, was a period of physical extensions outwardly, in opposition to the new age of sensuous and conscious extension via the possibilities of electric circuitry, which he describes as an implosion.

> In this electric age we see ourselves being translated more and more into the form of information, moving toward the technological extension of consciousness. [McLuhan:1964/2002:63]

McLuhan was touching upon and, to some extent, foreseeing the current tendencies within technological advancements. It is not the point to draw in the theoretical implications of McLuhan, but to draw in his notions of extensions as an inspirational foundation in relation to the concept of an exoperceptual system.

Another inspirational factor derives from the world of human physical enhancements as seen within technologies working on the exo-skeletal possibilities of human enhancements. A concept that has been artistically investigated by Stelarc [Clark:2007] An exo-skeleton is a wearable device that can be both mechanical and technological in nature and enhances the natural abilities of the human body. By rethinking the human ability to extend itself both physically via the means of tools and wearable artifacts and correlating the line of thought with both McLuhan thoughts of media extensions and Clark's notion of displacement of awareness in relation to emerging agent – world interfaces, the term exoperceptual system arose. The line of thought that grew out of the term will be further explicated in relation to the videogame – player system, though the scope of the operationalization may be even larger in with respect to a renewed understanding of interactable media and a furthering of the understanding of the perceptual involvement.

We can look back the facilitation of the videogame – player system in relation to the types of activities it affords. By definition, the system functions on the same principles as the natural perceptual system, though diverging on some fundamental levels. Using a joystick is an activity where objectified processes are utilized to control visual elements within a game and even though new types of consoles and tracking technology allow a freer movement of the body, the player is confined to a relatively small space in front of a screen. The medium as a medium of visuality, rather than of images, is reactive with

respect to a display of optical changes. The player can pick up information for action and may or may not utilize the information. In a direct sense, the medium does not as such simulate properties of the natural perceptual system; rather it distorts and enhances visual optical structures as a means of engaging its player/user on the perceptual level. The structuring of the informative layouts can be understood as the visual informative equivalence of optical structures if the objectified processes had been carried out in reality. Due to the algorithmic state of interchangeability, the medium is capable of rendering images at a pace that allows for the optical changes to be picked up as structures occurring due to actions taken. In some respects the videogame – player system functions exactly because of the diminutive bodily constraints in correlation with an enhanced visuality. Manovich[2002] discusses the disembodiment of interactable media as a negative consequence and McLuhan in likewise dystopian fashion states that;

> The medium gives powers through extensions but immobilizes and paralyzes what it extends. In this sense, technologies both extend and amputate. Amplification turns to amputation. [McLuhan:2003:xviii]

The point is not to make comments on social or individual effects on users of interactable technology, but to suggest that the disembodiment is inherently a natural consequence of the process of objectification of physical processes into artifacts; and although the body may be constrained from one viewpoint the constrainment is the reason for extensions on other levels, such as the level of the perceptual system.

If we return to the concept of an exoperceptual system, the concept makes it possible to imply that investigations of a videogame - player

system as an exoperceptual system always entails examination of this specific level of engagement and therefore exclude other levels of interest such as narratological or ludological studies of the medium.

In relation to the applied and synthesized approach in this thesis, the arrival of the concept brought clarification to a number of discussed complications in relation to how this media is defined.

Usually, the approaches to videogame have an outset in their entertainment value or entertainable qualities. Here, the notion of entertainment has been toned down on the account of an examination into the deeper perceptual structures of the medium. Why videogame playing is pleasurable has not been as interesting to find answers to, as it has been to find the perceptual link between the reciprocal reactive systemic components to the perceptual accommodations by which we as humans encounter the medium.

In relation to the employment of an ecological discourse, there are problematic issues at hand as the approach is based solely on the relation of humans and animals to a substantial environment. The graphical layouts of videogames may have environing features and a display of textured surfaces, but is characterized by the lack of substantiality.

Gibson did in fact address the problem of image perception, but due to the period in which he addressed the issues, his focus was primarily on still images and film. It is worth taking a look at some of his questions concerning still and moving images.

As has been noted earlier, there is a distinction between an arrested and a progressive array. The arrestment is an unnatural case of perception and progression the natural, as this is the basic mode or condition of the perceptual system. On the contrary to the claims of

Weibel in his attempt to create a genealogy of images, Gibson proposes, counter historically that;

> The retinal image is seldom an arrested image in life. Accordingly, we ought to treat the motion picture as the basic form of depiction and the painting or the photography as a special form of it. What a strange idea! It goes counter to all we have been told about optics. But it follows directly from ecological optics. Moviemakers are closer to life than picture makers.[Gibson:1979/86:293]

Now, if we follow this thread and add the interactable images, even though it may seem contrived, to the reverse account of the precedence of imagery in relation to the natural perceptual system, the interactable images from the ecological optics are even closer to the perceptual system, than any of the former mentioned image systems. This point does not suggest that we should reverse all comparative analysis of pictures and their development in the light of interactable images; it simply stands to suggest that the perceptual approach to videogame – player system and other similar media can be understood on the level of ecological optics.

In relation to both film viewing and book reading Gibson states that the reader or viewer is controlled by the creator(s). He states that;

> A very intense empathy is aroused in the film viewer, an awareness of being in the place and situation depicted. But his awareness is dual. The viewer is helpless to intervene. He can find out nothing for himself. He feels himself moving and looking around in a certain fashion, attending now to this and now to that, but at the will of the film maker. He has visual kinesthesis and visual self-

awareness,   but   is   passive,   not   active.
[Gibson:1979786:295]

Gibson also refers to this experience as a second hand mode of perception. If we follow this line of thought and look at the interactable medium in correlation with Weibel's notion of convergence of moving image and moving observer, the medium becomes a strange case of first and second hand perceptual experience. Gibson states that the seated film viewer gets optical information from the film for i.e. locomotion without moving. The field of view of the film becomes a field of view that reveals information at the leading or trailing edge of the frame. In this respect the film simulates or synthesizes (loco)motion with a passive perceiver. The videogame player in a traditional seated situation of play gets both first hand and second hand information from the layout. The second hand information is constituted in the image construction, but the first hand information is constituted by the objectification of physical processes on the level of image control. In this respect the notion of Weibel in Gibsonian terms can be understood as the convergence of first and second hand information.

In relation to the proposal of a new concept to re-frame the understanding of the videogame – player system it is possible to offer a new definition of videogames as an exoperceptual medium. The exoperceptual characteristics are constituted by the objectification of physical processes thus creating a displacement of both bodily functions as well as a displacement of the perceptual awareness. Or more accurate the displacement of visual awareness depends on the displacement of bodily processes. We do not engage in activities on the exoperceptual visual level due to the aesthetic qualities of images, but due to the functional controllability of the optical layout. The exoperceptual system is an extension of the natural perceptual

system though nested within it and due to this cohesiveness we as players get first hand information for action based on the mediums ability to produce changeable and interactable optical structures.

Interactive media are often characterized as audio/visual media with a recent addition of tactility. Interests are largely on the implications of the system, but often suffer from the traditional distinction of the senses as pointed to earlier. The concept of the medium as an exoperceptual system bridges the attempts to bring together the senses as separate entities with separate theoretical underpinnings and brings focus to the human perceptual system as a whole functional system with which we are equipped to encounter the world.

Conclusion

As it will often be the case, an ending becomes a new beginning. Looking back at the project, it turns out that the whole enterprise of reaching this point has created an urge to start over. Not at the same beginning but at a new level of realization. Questions can be asked about the goals put forth in the thesis in relation to possible answers. Did I answer anything or did I create new problems? On a positive note, the last will be regarded as the case. The eventual emergence of a new concept creates a platform to jump to, and new dangers and new challenges are appearing.

The initial outset for taking on the endeavor to address the videogame – player from a new perspective, the perceptual, served as a means to create the path towards the proposed articulations.

In the first part of the dissertation it was important to turn away from the already established theoretical approaches to videogames within the larger field of videogame research and understand videogames as an activity inspired by the field of HCI. The approach involved a refreshed perspective on the gaming situation that was not influenced by an urge to become part of already established assumptions. By placing the elements present in a model of activity, the various levels could be investigated without losing sight of the entirety. This strategy resulted in a preliminary model of the elements to be further investigated. It was from the outset assumed that an either game-centric or player-centric approach would not be the most beneficial starting point, as the knowledge of the ecological approach beforehand pointed towards a systemic approach to videogames that would allow an integrational study of the interdependency of the elements involved. The main outcome of the first part was to take the operational level into account and integrate the notion of

objectification of otherwise physical operations in the joystick and treat it as the functional relation between joystick and visual layout. It is due to the objectified processes that the visual layout becomes manipulative and informative in relation to action taking.

In the second part, different approaches to perception were treated and the ecological approach in particular was described. It has been important to make apparent the difficulties of navigating within the field of perceptual theories. There are traditions within both natural sciences and the humanities which pose very different questions to the human perceptual system and due to both theoretical assumptions and methodological approaches; the field is a conundrum of positions, though here identified within two main paradigms. It has been pertinent to demonstrate that a given perspective shapes the level of both analysis and articulation and to show that within paradigms there are basic world hypotheses about humans, their means of perceiving and their utilization of their perception. The ecological approach as formulated by J. J. Gibson was chosen from the outset on several accounts. First of all, Gibson's theory is a theory which encompasses both the perceiver end the environment to be perceived. He details the information available for the perceptual system as well as the perceptual system's means of picking up and utilizing the available information. The approach as it is laid out by Gibson was coupled with an expansion of actions as activity systems proposed by Reed. In a further development of the concept of action systems, the concept of agency and the ecological self was included.

The purpose of the synthesis of basically ecological propositions was to create a foundation for a characterization of both the activities involved in playing videogames and the perceptual accommodations brought to the gaming situation by the player. It was assumed from

the outset that the process of playing videogames had to be based on a perceptual experience stemming from the perceptual experiences in everyday activities. Concepts were extracted from the ecological terminology which served the later purpose of both assigning specific actions to the videogame system, as well as forming a foundation for a description of the system with an ecological discourse.

In part three the model put forth in part one was expanded with a proposal of how to view the processes involved in playing videogames. The model encompasses the whole videogame – player system and addresses the functionality of the elements involved. The player picks up information from the layout which in return can be responded to via the means of operation. It turned out to be an important point in relation to a discussion of affordances in relation to videogames. Most researchers incorporating the concept in their research tend to translate affordances to properties of the layout and therefore it was suggested that affordances, on the one hand, could not be detached from the ecological approach in its entirety and on the other hand, it was suggested that affordances should be understood as something that emerge in correlation with the objectified processes in the means of control and the information for action available in the game layout.

An attempt was made to view the game layout as an optical reality where changes occurring are perceived on the basis of this distinct notion of reality in contrast to the traditional notion of virtuality.

The constituents of the videogame - player system is in some respects similar to the constituents of the natural perceptual system, but also diverges due to its ability to employ perceptual principles and turn them into visual perceptual functional means by which the player can engage him/herself in the process of playing.

Part three ended with a new concept of the system as a whole. The term exoperceptual system was proposed in order to suggest a new foundation from which videogames and other types of interactable formats can be studied primarily on the basis of perception. Gibson's own inquiries into moving images were brought forward and the exoperceptual system was characterized in a synthesis of the notions from Weibel, Clark, Bærentsen and Gibson. Weibel claims that the interactable medium is a convergence of moving images and moving observer. Clark states that the extension of man leads to new agent world circuits, thus creating new interfaces which influences or redirects perceptual awareness. Bærentsen's notion of the processes of objectification makes it possible to identify the levels of operation involved and points to the possibility of displacing both otherwise physical operations and the perceptual awareness. Gibson points to the film medium as a visual medium where the seated observer has the experience of visual kinesthesis without the possibility to intervene or pick up information from the medium based on self initiated motion and refers to the experience as a second hand perceptual experience. Taking this notion into account in correlation with Weibel's main statement, the medium is proposed to be viewed as an exoperceptual system which is characterized as a medium where both first and second hand perceptual experience is possible.

The results of this dissertation are due to the theoretical approach not readily quantifiable. In this respect it is difficult to state; what is result and what is suggestion? If the term, *exoperceptual system,* had emerged from the outset of the investigation, it is likely that more philosophical aspects could have been implied and the project would have followed another trajectory. Here at the end of the process, it seems that the proposals put forth can serve as a hypothesis developing platform from which new questions can be

brought forward. Videogames are more than just games. They are a new beginning in a larger process of pushing the boundaries of our perceptual experiences with the means of technology.

Perspectives of the project

A typical approach in relation to the perspectives of the effects of a dissertation would be to explicate how and to what extent the presented ideas would influence the field of research within which they are brought into life. I have chosen another approach. There is no distinct separation of the worlds of animals and humans contained in the ecological approach. Just as often, the notation will be animals/humans as the approach relates to the adaptive and regulatory constraints, both on behalf of the perceiver and of the given niche within which the animal/human lives. As well as it is possible to use the ecological approach to the natural perceptual system as an optique through which videogames or interactable media can be understood, the idea emerged that it would be possible to use the means of the media to investigate the natural perceptual system as it functions in the world of an animal.

Along the lines of pondering about the lack of distinction between humans and animals, I decided to test whether it would be possible to apply some of the basic features of videogames to the world of animals and, in this specific experiment, to the world of my cat.

This is not an experiment that can be carried out just anywhere, as the cat is situated within the safe perimeter of a home and would react to too many disturbances, once taken out of its "habitat". Inspired by InterspeciesCollaboration.net - a collaborative research community of which I am a member - I decided to work out a set-up to see if it was possible for the cat to react to visual elements projected on a surface. The results were surprising.

Let us imagine in a reversed sense that the technology involved in videogame playing can be utilized to conduct experiments that can investigate the basic assumptions of Gibson in relation to not only the

perception of humans but also of animals. Animals can be difficult to study and follow in relation to their perceptual relation to their environment even though information can be distracted from wild life photography and film.

Based on the classic notion of the cat as a mouse hunter, I decided that it should be a cat-chasing-mouse game. Although the ideas have not yet been tested in the final technological set-up which I eventually developed with help from skilled programmers, the ground has been laid and some testing has been carried out.

First, I will describe the tested setup. Second, I will describe some of the observations made. The setup is explicitly related to visual perception and the cat's attempt to react to the visual information. In the final passage, I will describe the idea of a reactive system that will be developed further in the nearest future.

The Pet Game

The layout has a very simple design with a mouse that moves around. As of yet, it is questionable if the first setup is actually a game, if a game contains rules by which it must be played. Rules can be added depending on the reactivity of the technology. More about this later.

The test involves a projector in order to create a large visual field in order for the cat to be interested.

I first had the idea that the projector should be mounted to the ceiling thus projecting the layout on the floor. This was tested and the cat did not react at all. Then the layout was projected on a wall and now the cat showed interest. The first test was conducted with a mouse that I could control. In that scenario it became obvious that certain movements of the mouse where more interesting than others. There were clearly some kind of threshold to the velocity of the

mouse and the cat's ability to keep track of the mouse. If I moved it too fast, the cat lost interest and if I moved it too slow, the cat also lost interest. It should be noted that within the experiment, it was possible to recapture the cat's attention by moving the mouse in an appropriate manner. The cat never lost the overall interest; there were just some movements of the mouse that it did not react to.

Based on the initial experience, I created two modes of the animated mouse relative to the cat's apparent perceptual requirements, which were both a manually controlled version and a randomized animated version. As a predator, the cat naturally attempted to catch the mouse by slapping it with its paws. In relation to a possible threshold of the speed of the mouse, it became evident that the cat needed to have visual contact with the mouse over time and along a trajectory so it could "plan" an attack or rephrased in an ecological sense, so the cat could carry out prospective actions. It would lay in wait for the mouse to travel along a trajectory and slap it with both paws in an attempt to fixate it. It has been noted by E. J. Gibson that a cat does not jump where the mouse is, but where the mouse will be when the cat lands. This is an interesting notion in fact it seemed true with the cat here. In the photo below, the cat has been waiting for the mouse to arrive and it can initially be presumed that the cat has picked up information of a possible future position of the mouse. It should also be noted that the animation is the randomized version without my control.

In relation to the capture of the mouse, the next image shows how the cat attempts to grab the mouse. In relation to the terminology applied to human activity that some activities require eye-hand coordination, the cat also requires eye-paw coordination. Eye-paw coordination develops in cats when they are 7 – 8 weeks [31].
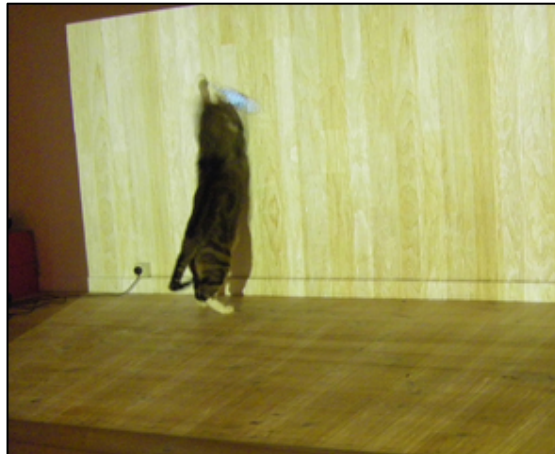
As the mouse, of course, continued to move despite the cat's apparent capture, the cat would eventually search for it. In relation to the choice of projecting the animation on to the wall, it is visible in

the photo that I split the projection so it was partly on the floor. Why the cat did not seem to be able to see the projected mouse on the floor is an interesting question. It seemed as if the cat believed the mouse had gone out of sight, if it accidentally moved on the floor section of the projection and disappeared under the skirting. The cat would look for it and scratch the skirting, where the mouse went out of sight and only react once the mouse was back on the wall.

What we (my technical assistant and myself) proved in this first set up was that the cat would react to the visual information under certain conditions. The projection had to be on the wall and not on the floor. There had to be an appropriate motion of the mouse in order for the cat to react to the mouse and, under the right circumstances, the cat would attempt to catch the mouse.

If the experiment should be further developed, some type of gameplay must be added. As we, presumably, cannot have any expectations to what the cat will do, the final concept will be with the integration of tracking technology much like the EyeToy concept, so there is a an action – reaction situation.

The idea of tracking will add some rules to the setup that will be primarily visual rules based on the initial observations. Therefore, we came up with some basic requirements for such a system. What the technology allows us to do is to track the cat via a camera and tracking software. The cat can be tracked with or without sensors attached to the body and a setup without attachments will be preferable in order not to distract the cat. In relation to gameplay, some basic visual rules can be applied. A setup would involve the relation between going out of sight and coming into sight, whereas another setup would involve some reactivity programmed into the software relative to eye-paw coordination and the attempt to capture

the mouse. It is possible to program reactivity and thus behavior into the movements of the mouse based on the behavior of the cat. This final idea is still under development in relation to the technology involved and the exact setup required. What I noticed in respect to the ordinary assumption that a cat cannot be taught tricks in opposition to dogs, was that every time I turned on the projector for other purposes, the cat would position itself in front of the projection looking for the mouse. Or so I imagine.

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Summary

Dangerous Forms – Playing by the Visual Rules

Ecological Approach to Videogames as Activity

The purpose of the dissertation is to create a framework within which it is possible to study the role of perception while playing videogames. Videogames are traditionally treated from other more media receptive perspectives and the perceptual aspects have largely been left out.

Part 1

The first part of the dissertation center itself around videogames as an activity. In this part, the videogame – player system is established as an activity based on the functional operational level of control devices in relation to screen content. Prominent theoretical approaches to videogame studies are investigated in correlation with an approach to interactable visual media which holds that the interactable system is a convergence of moving image and moving observer. In this part the constituent elements of videogame – player as an activity is established for further use in part 3. The focus is on the functional relation between the elements present in the system.

Part 2

In this part of the dissertation, theories of perception are investigated. It has been important to show that there are a variety of theoretical and methodological viewpoints and eventually a demarcation of the most prominent paradigms is outlined. A further investigation into the ecological approach, its theoretical implications and position in relation to other paradigms is put forth. The ecological approach as it is formulated by J. J. Gibson is coupled with the

concept of action systems by Reed, with the concept of agency by E. J. Gibson and finally with the concept of an ecological self by U. Neisser. The purpose of this part of the dissertation is to address the processes taking place in the videogame – player system in relation to the functionality of its constituents.

The concept of Reed is used the further the preliminary activity model put forth in part 1, as well as the concepts of J. J. Gibson is used to explicate types of information, the process of picking up information and how information can be related to the videogame – player system as an interdependent system.

<u>Part 3</u>

In part 3 the various concepts put forth in the previous parts are treated and synthesized in an extended model, in relation to both the levels of operation and the stream of information processes in the system. Game examples are brought into play in an attempt to operationalize the ecological approach in relation to the approach to videogame – play as a perceptual activity in which the constituents are functionally related.

Eventually a new concept, *the exoperceptual system,* is put forward as a conceptualization of the videogame – player system as a perceptual extension of the natural perceptual system. The exoperceptual system is a notion that attempts to address the medium solely on the grounds of perception. The exoperceptual system emerges on the basis of the mediums ability to create a situation in which both ordinary physical operations and perceptual awareness is displaced. Physical operations are objectified in the joystick which allows the displacement of the perceptual awareness to that of the visual content.