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PREFACE

The following Master thesis has been written in partial fulfillment of the requirements for the 10th semester at Medialogy, Aalborg University Copenhagen. The thesis is the result of the collaboration between four master students, attending this education each adding their own unique focus to the execution of the project.

The thesis builds on the foundation of a previous Medialogy project entitled *The WobbleActive*, which converted a regular wobble board into an innovative game controller. The basic notion was that this prototype would facilitate an increase in motivation through the application of computer games; a motivation otherwise lacking with a regular wobble board. The ambition of the group was to rethink and rework the existing prototype and create a more compelling and engaging experience through an understanding of the elements influencing said experience.

In line with tradition we would like to thank our supervisor, Stefania Serafin, and the remaining members of the faculty at, Medialogy, Aalborg University Copenhagen, who helped by answering questions arising throughout the course of the project. We would furthermore like to thank Mark Tofte Stæhr for providing the Phidgets plug-in to enable Unity support; Anders Laun for assisting with valuable feedback based on his physiotherapeutic expertise; the test participants involved in the iterative tests performed throughout the different phases of the development, as well as the test participants involved in the final evaluation of the prototype. Finally, each one of us would like to thank our family and friends for support and for enduring our absence during the many periods where long working hours were required.

Stefan Erik Asp

Michael Labovic Møller

Niels Christian Nilsson

David Skaarup

READER'S GUIDE

The thesis detailed throughout the following is divided in five main parts. After a brief introduction, describing the motivational underpinnings of the project, the first part *Preliminary Analysis* details the research conducted on the topics of gameplay, immersion, flow, and engagement. This research was conducted with the intention of understanding of how games may provide individuals in need of motivation with an incentive to perform ankle exercises. The part is concluded with the claim that engaging gameplay should be the concept subjected to further scrutiny.

Subsequently the part *Analysis* presents an investigation of Schønau-Fog and Bjørner's framework for classifying and describing player engagement with games. Moreover this part includes a discussion of the concept engagement from the perspective of game design and player psychology. These discussions amount to the creation of the so-called Gameplay Model, which describe gameplay as a cyclic exchange of information between player and game and try to explain what one should be aware of when aspiring to design engaging gameplay. Finally the concept of user-centered design is introduced and discussed since this design philosophy were believed to be of great relevance when one is aspiring to create game facilitating engaging gameplay.

The third part of the thesis *Design and Implementation* details the how the prototype and the accompanying game was designed and implemented, which was done in accordance with the theories described throughout the analysis.

Following this the part *Testing* describes the methodological underpinnings, practical execution, and results of the tests performed in order to evaluate the design and implementation of the prototype.

Finally the part *Discussion and Conclusion* presents a discussion of the results obtained from the test, presents more general reflections on the project as a whole before concluding upon said results and reflections.

Please note that since a large amount of terminology is introduced throughout the thesis a glossary can be found on page 288.

INTRODUCTION

On a previous semester members of the group, collaborating on the current thesis, partook in the development of an innovative game controller and accompanying games, aimed at motivating individuals in need of ankle training and rehabilitation. The prototype, which was dubbed the WobbleActive, can in general terms be described as a digital version of a conventional wobble board since it allowed its users to control a video game by means of said board (Asp, et al., 2007a p. 18).

The WobbleActive was thought to be a relative success as it was accepted for the 2007 LEDA conference (Asp, et al., 2007b) and subsequently were received with enthusiasm by attendants at the NEXT no. 5 conference, where it was presented in 2008 (Innovationlab, 2008). Nevertheless, it is possible to raise a general point of criticism against the original prototype and its theoretical underpinnings as the design first and foremost was informed by the requirements dictated by the exercises associated with proprioceptive ankle training (Asp, et al., 2007a pp. 73-82). These requirements were necessarily essential, as a prototype which did not ensure appropriate ankle training would defeat its own purpose. However, in retrospect, it would seem that important topics such as game design and player experiences largely remained an afterthought during the design process. That is, one major question was left unanswered: what is it about the act of playing games which compels players to do so for no other reason than the act itself? In other words, why is it that games may serve as a source of motivation in and by themselves?

Figure 1 – WobbleActive logo which was used in connection with the documentation of the project (Asp, et al., 2007a)

With this being said it should be emphasized that we by no means view this past project as a failure in any sense of the word since it did meet the requirements laid out for 4th semester Medialogy projects. These imperfections should in other words not be regarded as the result of err on part of the involved students, but rather as the natural consequence of the need to comply with the semester theme and the limited scope of the project. Even though these imperfections may have been admissible when the first prototype of the WobbleActive was created we feel that the need for an understanding of games inherent potential as a source of motivation does warrant our future work with the project.

Moreover it is worth noting that the qualitative assessment of the WobbleActive prototype did yield some positive results, which arguably serves as a testament to potential of a digital version of the wobble board as a means of motivating individuals involved in an ankle training or rehabilitation process (Asp, et al., 2007a p. 18). This seeming potential along with an aspiration to improve the early prototype, based on a better understanding of players' experiences with games, inspired the phrasing of the following motivating problem statement:

Box 1 – Initiating problem statement

How can we through a better understanding of players' experiences with games perform the next iteration in the design of the WobbleActive so that the final prototype helps users to become motivated to successfully complete their ankle rehabilitation process while simultaneously ensuring correct proprioceptive ankle training?

PART I - PRELIMINARY ANALYSIS

This first part of the thesis details the research which was conducted in order to rephrase the initiating problem statement, presented in Box 1, into a more well-defined, addressable and testable final problem statement. Part I consequently opens with a chapter introducing the reader to the project which lead to the creation of the original WobbleActive. This chapter has been included since the current project by and large has been spurred by the same aspiration of making individuals, in need of ankle training or rehabilitation, motivated to perform the necessary exercises by allowing them to combine the act of exercising with playing games. Additionally the chapter details a number of the premises forming the basis for the design of the original prototype as these remain pertinent to the current project. Subsequently the chapter *Gameplay* presents a discussion of this ambiguous concept, as the design of gameplay according to many scholars and game developers is the most important aspect of any game design. This discussion culminates with the proposition that gameplay seemingly amounts to everything emerging from the meeting between player and game and that the study of the two consequently should constitute our point of departure when trying to determine how to make a game which can motivate its potential users. The third chapter *Symptoms Of Good Gameplay* details a discussion of the concepts *immersion*, *flow*, and *engagement* as these terms frequently are used by scholars and developers alike, when they describe why their game facilitates good gameplay or why their theory captures the essence of why players play games. The conclusion of this discussion is that whereas all four concepts are of interest, engagement seemingly offers the most promise. The final chapter of this part presents the delimitation performed in order to determine topics that should be considered further and in what manner this should be done. This chapter concluded with the phrasing of the final problem statement.

CHAPTER 1 - A WOBBLING START

Seeing as the aspiration for the current project is to perform the next iteration in the design of the WobbleActive a number of the premises forming the basis for the design of the original prototype remain pertinent to the current project. This first chapter of the preliminary analysis does consequently provide a brief introduction to the WobbleActive, the research which informed its design and a description of related prototypes and consumer products. More specifically the chapter opens with the section, *Motivated by a Need for Motivation*, outlining the initial aspirations which spurred the creation of the WobbleActive prototype and subsequently an account of the prototype's intended users and the exercises which it was designed to accommodate is provided. The following section, *The WobbleActive,* introduces the prototype itself and its constituents, that is, the input device and the two accompanying games. Finally the section, *Games as a Source of Intrinsic Motivation* provides an account of a selection of relatable projects and describes the distinction between intrinsic and extrinsic motivation as games in many instances may serve as a source of the intrinsic motivation, and thus help individuals become motivated to perform otherwise extrinsically motivated activities such as physical training or rehabilitation.

1.1 Motivated by a Need for Motivation

What initially motivated the former group to create the WobbleActive was, as previously suggested, the assumption that individuals using a conventional wobble board to train or rehabilitate their ankle proprioceptors oftentimes found this activity relatively tedious. That is, they lacked the motivation necessary in order to successfully complete their ankle training or rehabilitation process. Readers who wish to know more about the function of proprioceptors, ankle injuries and the wobble board are asked to refer to Box 2 on the following page.

This assumption, that limited or no motivation oftentimes poses a problem, was verified through consultation with Anders Heckmann who is a physiotherapist based in Denmark. Heckmann more specifically described people, engaged in training or rehabilitation processes involving wobble boards, oftentimes stopped performing the necessary exercises after a relatively short period of time as they simply found the activity to boring. To this he added that one of the main reasons why people grow tired of exercising their ankles probably is that the improvements resulting from proprioceptive training cannot be perceived visually. So even though the therapist may be able to assert whether improvements have been made the individual has a hard time following his or her own progress outside consultations and may consequently loose his or her motivation (Asp, et al., 2007a p. 28).

Moreover, the reason why correct ankle exercises should be performed regularly for the duration of the training or rehabilitation period is that the failure to do so will increase the likelihood of injury in the first place or reoccurring injuries after the damage has been done (Asp, et al., 2007a pp. 18, 21). Finally Heckmann also provided valuable knowledge about who might benefit from using a wobble board as well as information about the exercises commonly performed when training by means of said board. The following two sections briefly outline a description of the intended users of the WobbleActive and the exercises which were viewed as pertinent prior to the production of the early prototype.

Box 2 – Ankles, injuries and wobble boards

The ankle: Mundane activities such as walking or running, which are performed without much appreciation by able-bodied individuals, are dependent upon well-functioning ankle joints. Within these joints, and the rest of our bodies, are countless so-called proprioceptors, which in broad strokes serve the purpose of relaying information about the movement of our body parts as well as their positions relative to each other. This information can then in return be used to help perform desired movements and to compensate for undesired ones. A process which for the most part is entirely automated and never enter the conscious mind. So the proprioceptors located in the ankle joint may inform the brain that a potentially damaging movement is being performed and allow it to take precautionary action by ordering the muscles surrounding the ankle to prevent said movement (Asp, et al., 2007a p. 20).

The injury: A sprained ankle will oftentimes entail stretched or torn ligaments and damage to the proprioceptive system located within the injured ankle. Damage to the proprioceptors will cause these to relay information at a slower pace which in turn makes the process of preventing undesired movement slower. That is, when the foot is dangerously close to an extreme position, no proper compensation will be performed by the surrounding muscles, leading to repeated sprains or worse (Asp, et al., 2007a p. 20). The two illustrations above have been adapted from (footankleinstitute.com, 2009).

The wobble board: The wobble board is a popular and relatively inexpensive piece of equipment for training ones ankles preemptively or as part of rehabilitation once the damage has been done. It does in all simplicity consist of a circular disk which is place upon a half a sphere (see the illustration on the left, which have been adapted from (kinesiologists.ca, 2010)). The user then stands on the disk while performing a series of specific movements. Regular usage of the board will help train or rehabilitate the proprioceptors and thereby leaving the user with better coordination, balance and stability (Asp, et al., 2007a pp. 20-21).

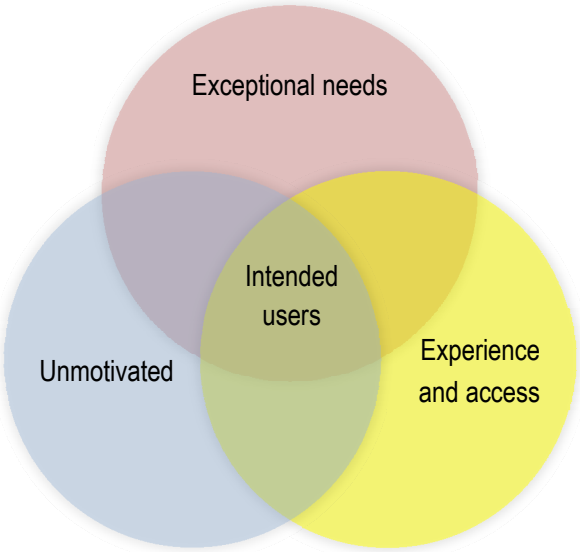
1.2 The Intended Users

According to Heckmann, the potential users of wobble boards include people of all ages and professions seeing as anybody may suffer ankle-injuries. This does, however, not mean that everybody is equally susceptible or likely to sustain ankle injuries. Based on Heckmann's accounts, three groups of people who are most likely to benefit from using the board were identified, namely professional athletes, elderly people and people who had suffered from ankle-injury in the past. With this being said, it is worth noting that it is not only people who has suffered or are in risk of suffering from ankle-injuries who may prosper from using a wobble board, since it can also be used by knee or back patients. Moreover it is possible to identify an additional group based on the documentation of the interview with Heckmann conducted at the time. He more specifically described that individuals, who perform little or no physical activity because they are slothful or otherwise unable for an extended period of time also are very susceptible to ankle-injuries as the proprioceptive system will become weakened if not stimulated regularly (Asp, et al., 2007a p. 26). This does in turn imply that wobble boards may be beneficial to an excessively large group of individuals, which suggested that the WobbleActive did have commercial potential. However, it was assumed that not all would benefit equally from using the WobbleActive input device and game, and it was consequently decided to narrow down the group of potential users a bit further. More specifically it was believed that the individuals who would prosper the most from using the application would conform to the three criteria illustrated and summarized in Box 3 on the following page.

Figure 2 – The four main groups of people who might prosper from using the wobble board: Athletes, elderly people, people with prior ankle injuries and individuals who perform little or no physical activity because they are slothful or otherwise unable (All images are adopted from (flickr.com))

Box 3 – Intended users of the WobbleActive

The WobbleActive was intended to meet the needs of individuals who conformed to the following criteria and was consequently also believed to be of most use to said individuals (Asp, et al., 2007a p. 26).



1) Exceptional needs: Individuals who are in need of ankle training or rehabilitation, that is, people belonging to one of the four groups described in Figure 2.
2) Unmotivated: Individuals who are not already motivated to perform the necessary exercise on a regular basis and thus in need of an incentive to train.
3) Experience and access: Seeing as the WobbleActive includes an input device and a software application it requires that the users have access to a computer and are experienced enough to operate said computer.

1.3 The Relevant Exercises

In addition to supplying the group with information about the groups of people who might need ankle training, Heckmann also provided a description of the exercises commonly performed when training by means of a wobble board. It was necessarily pivotal that the prototype ensured that these exercises were performed correctly and for a proper duration as proprioceptors, ligaments and muscles do not get strengthened by motivation alone, no matter how strong it might be. All of these exercises are relatively uncomplicated as they simply require the user to stand on the wobble board while remaining steady or performing a series of predefined

movements (Asp, et al., 2007a p. 22). Here it is worth mentioning that Heckmann described that these simple exercises may benefit members of all user groups regardless of what type of injury they may have experienced or are trying to prevent. The exercises proposed by Heckmann have been summarized in Box 4 below.

Box 4 – Common wobble board exercises (Asp, et al., 2007a p. 22)

Balance while keeping as steady as possible

Move the board steadily back and forth

Move the board steadily from side to side

Circular movement clockwise and counterclockwise

The illustrations have been adapted from (Ideal Fitness Inc, 2010)

Heckmann added that if the user in time experiences that any of the four exercises have become too easy he or she may choose to perform it with eyes closed, while standing on just one leg or both simultaneously. Moreover he stressed that one generally should strive to perform the exercises in a moderate tempo as slow movements require a higher level of concentration and control compared to rapid ones. Finally one should strive to avoid that the edges of the board come into contact with the floor while training since this serves as an aid and thus reduces the efficacy of the exercises (Asp, et al., 2007a p. 22).

The duration of a training or rehabilitation process may necessarily vary depending on its purpose, the physical fitness of the individual, and his or her age. However, Heckmann described that one isolated training session usually lasts somewhere between 10 and 30 minutes depending on the same factors just described (Asp, et al., 2007a p. 23).

1.4 The WobbleActive

The prototype of the WobbleActive did as previously suggested enable the user to control games, displayed on a monitor, by means of a wobble board. The user's movements on the board were registered by means of four bending sensors attached within hinges, distributed evenly underneath the disk upon the user was standing. The data gathered from these sensors were then used to control the user's avatar – a flying saucer – during play and used to navigate a menu system, which enable said user to chose between two games and adjust the level of difficulty (Asp, et al., 2007b pp. 4-6).

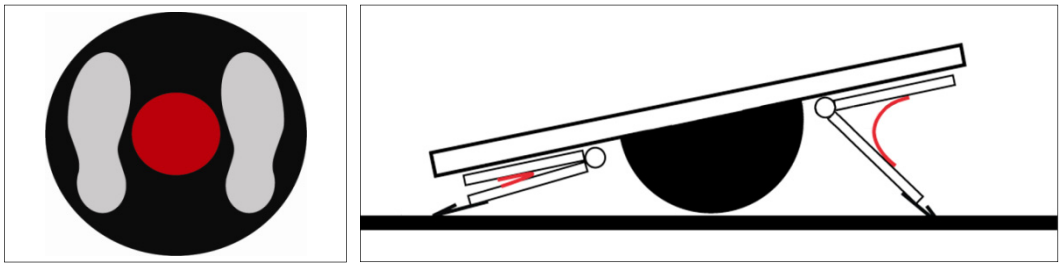


Figure 3 – Left: Top-down view of the physical interface. The added footprints indicated where the user should stand thus clarifying the board's affordance (Asp, et al., 2007a p. 55). Right: Schematic drawing of WobbleActive's physical interface illustrating how the bending sensors (red lines) were placed under the board (Asp, et al., 2007a pp. 55, 75).

The designs of the two games were primarily informed by the need to ensure that the user performed the previously described exercises while playing (Asp, et al., 2007b pp. 6-7). It is, however, worth mentioning that even though the exercises were the primary concern other relevant theories pertaining to motivation were taken into consideration, namely *goal setting* and *flow* theory. Goal setting theory does essentially stress the importance of challenging, achievable and lucid goals, while flow theory in broad strokes describes the need for maintenance of a suitable balance between the challenges and skills (Asp, et al., 2007b p. 3). In one game the users were faced with the challenge of keeping the flying saucer within an area at the center of the screen, thus forcing them to balance on the board, and in the second, the challenge was to navigate through a maze, as this ensured both movement from side to side and back and forth. Both games were designed to provide the player with feedback pertaining to his or her level of proficiency. The decision of making this feedback central was largely based on Heckmann's description that the inability to follow one's own progress, when using a traditional wobble board, probably was a main reason why people lost the motivation to exercise.

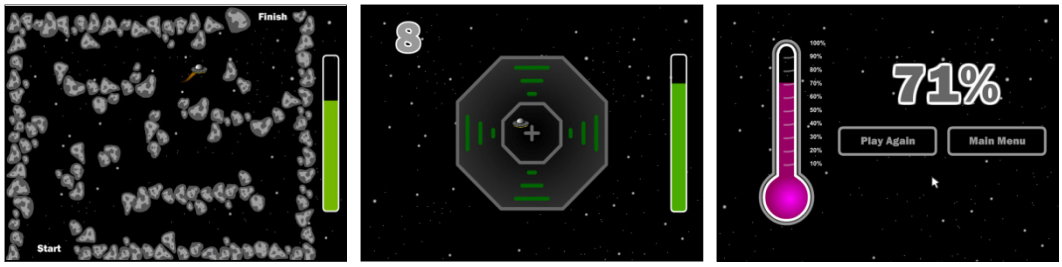


Figure 4 – Left: Screenshot of the maze game (Asp, et al., 2007a p. 84). Middle: Screenshot of the balancing game (Asp, et al., 2007a p. 81). Right: Screenshot of the score system used to indicate how successful the user had been when playing the balancing game (Asp, et al., 2007a p. 87).

The qualitative test conducted in order to assert whether the WobbleActive had any potential as a source of motivation did, as mentioned in the introduction, yield relatively positive results. That is, all six participants partaking in the test preferred using the WobbleActive prototype as opposed to performing exercises on a conventional wobble board. It should, however, be noted that none of the participants were involved in an ankle training or rehabilitation process and consequently had little or no incentive to perform the exercises other than being asked to do so (Asp, et al., 2007a pp. 128-129). In addition to scoring well with the test participants, Heckmann confirmed that the designed games did afford the correct exercises and generally displayed enthusiasm for the concept (Asp, et al., 2007a p. 123). Even though the results obtained from the qualitative test did not make it possible to determine whether WobbleActive would suffice in terms of motivating individuals for an extended period of time, it did lend credence to the general concept underpinning the prototype. That is, it indicated that games may serve as a source of motivation for individuals performing proprioceptive ankle training while simultaneously facilitating the necessary exercises.

1.5 Games as a Source of Intrinsic Motivation

The insight that games may serve as a source of motivation is by no means a novel one as apparent from the deluge of terms used to describe systems capitalizing on games' ability provide an incentive where none was otherwise to be found. Examples of such terms include *exertainment* (Zabulis, et al., 2009), *exergaming* (Bogost, 2005), or *edutainment* (Okan, 2003), to mention but a few. Yet it is even more interesting that this insight, and the associated terminology for that matter, by no means is confined

within the hallways of academic institutions and have been embraced by the industry and the popular media alike (Rowan, 2005).

Within the context of the 4th semester project, which amounted to the creation of the WobbleActive prototype, and throughout the preceding sections, the term motivation has been used repeatedly, albeit with little clarification. Readers will hopefully agree that this has posed a little problem as the common understanding of the word motivation – *"the reason or reasons behind one's actions or behaviour"* (Oxford Dictionaries, 2009) – by and large has sufficed. The aspiration forming the basis for the production of the original WobbleActive was indeed also to provide its users with a reason to perform the proprioceptive ankle exercises.

However, with this being said it does seem prudent to introduce the distinction between extrinsic and intrinsic motivation as the latter seemingly correspond to the type of motivation which games are likely to entail. Denis and Jouvelot (2005) more specifically describe that extrinsic motivation refers to motivation that *"[…] pulls us to act due to factors that are external to the activity itself, like reward or threat"* (Denis, et al., 2005 p. 1). This implies that the extrinsic motivation associated with ankle training and rehabilitation might be constituted by the individual's personal need to perform the exercises as well the possible feeling of obligation towards the physiotherapist involved in the process. In this scenario the rewards would be regained or increased strength or the praise offered by the therapist upon successful completion of the process, and the threats might be yet another ankle injury or the fear of disappointing the therapist. Denis and Jouvelot describe that intrinsic motivation, quite contrarily, *"[…] pushes us to act freely, on our own, for the sake of it"* (Denis, et al., 2005 p. 1). Something, which games arguably have the capacity to make us do as we arguably play games for no other reason than the act of playing itself. It would in other words seem that games more often than not can be viewed as intrinsically motivated.

In continuation hereof, it is worth recalling Heckmann's description of how individuals oftentimes stop performing the prescribed wobble board exercises because they grow tired of performing the activity. This can presumably be ascribed to the insufficient or complete absence of extrinsic motivation on behalf of the individuals involved in the ankle training or rehabilitation process. It was exactly this problem, which the original WobbleActive prototype was intended to solve. However

even though the interaction with the two games presumable may have given rise to intrinsic motivation it is notable that little explicit effort was made to foster this form of motivation since the game design first and foremost was based on the exercises. So, as it was suggested in the introduction, one important question remained unattended during the design of the original prototype: What is it about the act of playing games which compels players to do so for no other reason than the act itself? In other words what is it about the experience of playing games which make the act of playing qualify as an intrinsically motivated activity?

In order to determine how we might get closer to an answer to such curious questions, and perform the next iteration in the design of the WobbleActive, the following chapter will present a discussion of the ambiguous concept gameplay, as the design of gameplay seemingly is the most important aspect of any game design.

CHAPTER 2 - GAMEPLAY

Creating a game that is intrinsically motivating might sound like an obvious goal for any game designer. Nevertheless, to create something that in itself is a motivational factor requires a certain understanding of the medium that you intent to utilize. It is then evident that a certain degree of knowhow should be acquired in order to understand what game design is. However, here we encounter the first obstacle in our way towards motivational gaming. Though game designers can list a myriad of components that fall within the sphere of game design, the term entitled *gameplay* has arisen as a pivotal element within the industry. This term is often used as a universal idiom for why a game has achieved success or total failure. Something that can be so vital an instrument for games cannot be overlooked. However, many may feel that they can explain the term or try to define its parameters, but a as the following chapter will show; there is a schism within the game design community on what is entailed when designing for gameplay.

2.1 The Goal of an Industry

This headline entails a study of game designer arguments of how to design 'good' games, which is outlined in the subsequent section. However, here we encounter a problem, which will have to be addressed. The world of game design does not constitute a unanimous body of knowledge and no standard language of science can be said to exist in its logical positivistic sense. Meaning, one has to be critical of terminology usage within game design, since it often is in the eyes of the beholder. Chris Crawford, author of several books on game design aspects, summarizes this by explaining that "*the world of game design has been swamped in a madcap array of terminology*" (Crawford, 2005 p. 5). With this caution in mind one can then open any book on game design and start to read. When doing so, one quickly comes across a wide variety of terms that seem to be thrown about with as many different definitions as one can think of, most pivotal and important of those is: *gameplay*. Richard Rouse III, game designer and author of the book 'Game Design – Theory & Practice', writes that "*all someone needs to do in order to justifiably be called the game's designer is to establish the form of the game's gameplay. Indeed, many game designers perform a wide variety of tasks on a project, but their central concern should always be the game design and the gameplay*" (Rouse III, 2005 p. XXI). In prolongation hereof, his colleague Roger E. Pedersen goes a step further by stating that "*there is nothing more important than gameplay*" (Pedersen, 2003). Furthermore, the highly publicized authors on game design books, Andrew Rollings and Ernest Adams, simply state that "*gameplay is the core of the game*" (Rollings, et al., 2003) and it should be universally accepted by game designers.

Since all of these eminent figureheads within the area of game design can agree on the importance of gameplay, it is not too forward to suggest that the goal of the industry is to design and implement gameplay successfully. Thus, it is the key to ensure that the game designed for the current project achieves the indented motivational factor.

Figure 5 - According to game design sources the key to good game design is gameplay, which in turn implies that gameplay may be key to motivation the users of the WobbleActive.

Nonetheless, as explained in the previous section, there is a general lack of clear terminology within this area, and as a result of this it often becomes confusing to understand what to do in order to create something successful. This becomes especially evident when discussing the ramifications of *gameplay* in terms of successful design. Where other aspects of game design might be accepted as being vaguely formulated, gameplay should be expected to be defined clear as day, since it is indeed the goal of every single game development to achieve it successfully. However, this is not the case. The explanations for this is wide and many e.g. Rouse argues that *"[…] getting your gameplay working is one of the most essential parts of game design, yet it is also one of the most difficult to try to explain or teach"* (Rouse III, 2005 p. 293) and others simply put it down to a lack of academic focus (Ermi, 2005 p. 1). This has lead game designers Rollings and Adams to conclude that *"[…] there is no definition of gameplay*" (Rollings, et al., 2003) that is universally accepted. Following this train of thought one can then be lead to believe that the industry as a whole lacks a clearly defined objective.

Nevertheless, this has not discouraged several authorities from making the attempt. These should not be overlooked since they are made by individuals with years of experience within the industry and they might facilitate an understanding of where focus shall be placed in the game design of this project.

Firstly, the perhaps most universally accepted definition of gameplay originates from the creator of the Civilization-series Sid Meier, which defined gameplay as "*a series of interesting choices*" (Rollings, et al., 2003). What should be extracted from Meier's definition is that gameplay has something to do with 'choice', which entails that the player is given an opportunity to choose between at least two options.

Figure 6 – Sid Meier's definition of gameplay relies on choice as the primary component.

Nonetheless, one can see that this definition suffers from a broad generalization that serves little or no practical application. Ernest Adams concurs with this in his book 'Fundamentals of Game Design' by stating that Meier's definition, along with others, are not necessarily wrong, but "*too general for practical use and not much help as you learn how to design a game*" (Adams, 2010 pp. 9-10). Similarly, Rouse follows much the same line

of thought and states that gameplay is constituted by an aspect of computer/video games that is unique to the genre: interactivity. He writes; "*the gameplay is the component of computer games that is found in no other art form: interactivity. A game's gameplay is the degree and nature of the interactivity that the game includes*" (Rouse III, 2005 p. XX). Though Rouse neglects to mention e.g. interactive art installations is a similar medium that relies heavily on interactivity, the sentence exemplifies Rouse's focus on interactivity as the key component of gameplay.

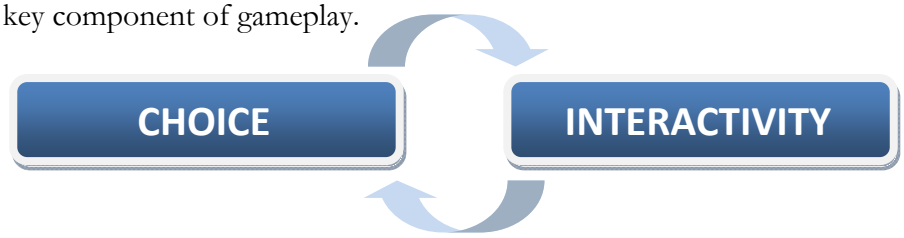


Figure 7 - Interactivity facilitates choice in computer/video games and Rouse argues that this is the key component in gameplay.

Interactivity is what allows the player to make choice and not just sit idle by and let other choose for him. Rouse's attempt at defining a vague framework for gameplay cannot be said to be much more useful than Meier's. However, it points towards what makes computer/video games unique and that is worth remembering. It seems that computer/video game designers sometimes forget the aspect of interactivity when creating games. This is especially evident when it comes to storylines in games. Though there is much hype around storytelling within games these days, and Chris Crawford is one of the big names that advocate for the extended use of storylines in computer/video games, there are continuously developed examples that show that this focus can steal from the interactive aspect of the game.

Figure 8 - Screenshot from Gearbox Software's Brothers in Arms: Hell's Highway from 2008

Just to mention a prime example one can play through 'Brother is Arms: Hell's Highway', developed in 2008 by Gearbox Software. Here cinematic cut-scenes take over every other second and deprive the player of both interactive abilities and the freedom of choice. In this relation, Rollings and Adams state that "*the goal is to make the player feel as if he is in a story of his own telling. When you as the designer take over too much of the telling, the player feels as he's being led by the nose*" (Rollings, et al., 2003 p. 114). The point of this example is to exemplify that interactivity is of extreme importance for gameplay, but when combined with such an element as storytelling it has to be executed in a way that creates at least the illusion of interesting choices. So it seems justifiable that Rouse outlines interactivity as a dominant factor in defining gameplay. Even though one can argue that interactivity is what facilitates the option of choice there is a clausal that the game developer Dino Dini have attached when he defined gameplay as "*interaction that entertains*" (Adams, 2010 p. 9).

Figure 9 – Dini's definition of gameplay builds on interactivity, but it also emphasizes that the goal is to create something entertaining.

However, with Dini's definition there arises a problem that collides with previous definitions (and the following). Since gameplay now has to be entertaining, then it must logically have to be enjoyable and thus a good experience. Jesse Schell writes in his paper on entertainment in games, that "*persons who are well and truly entertained are focused, alert, alive and are enjoying themselves. To entertain someone is to fulfill, at least partially, the needs and desires of another person*"(Schell, 2005 p. 2). Nonetheless, this is a sort of schism within the definition of gameplay, since it argues that gameplay must be enjoyable. But as one can see from both the previously mentioned and following definitions, not all include this level of "goodness" to gameplay. The question is then if gameplay must be good in order to become *gameplay*, and if it is not good, then what should it then be called? Since Adams uses much the same formula as Dini, by stating that gameplay is constituted by *challenges* and *actions* that are entertaining (Adams, 2010 pp. 9-10, 251), it seems there is a portion of the game design community that ascribes to this aspect of gameplay. In the beginning of this section it was stated that gameplay can lead to motivation and this makes sense if viewed in terms of Adams and Dini's inclusion of entertainment.

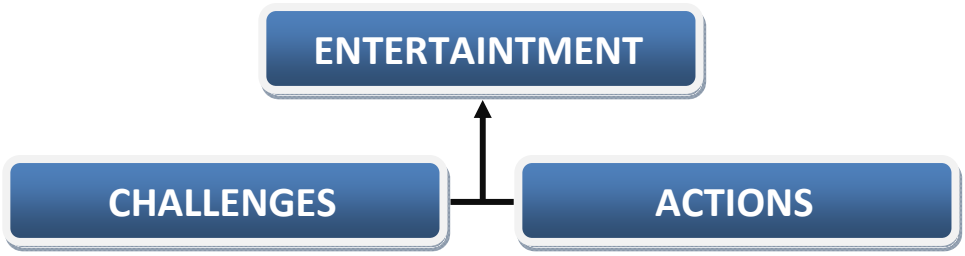


Figure 10 - Ernest and Adams definition of gameplay relies on an undefined mix of challenges and actions that facilitate entertainment.

When coupling entertainment with the definition of gameplay Dini seems to be making the argument that gameplay is per default a positive entity. This might not be a feasible argument, since game critics often talk of *bad* gameplay. Nevertheless, Dini's inclusion of entertainment should rather be viewed as a positive outcome of successfully designed gameplay, but not part of the term definition in itself.

Besides the discussion of gameplay entertainment as part of the definition, Adams' explanation divides interactivity into two components, being *challenge* and *action*, which he defines as:

1. "*The Challenges that a player must face to arrive at the object of the game*" (Adams, 2010 p. 11)

2. "*The actions that the player is permitted to take to address those challenges*" (Adams, 2010 p. 11).

It is indeed an interesting notion that Adams creates this dualism instead of just referring to interactivity. One reason can be found in the ways game designers talk of their craft as being focused on presenting the player with challenges. As Crawford writes "*there are myriads of ways to play a game, but good game design ensures that only the challenging ways are possible*" (Crawford, 2005). It can then be established that challenges are dominant in game design, thus also in gameplay, still according to Adams, then gameplay includes not only the design of a challenges in the game, but also a reaction on the part of the player.

To add some more aspects to Adam's definition, which also outlines the ever-changing nature of gameplay in the minds of the game designers, then one can look at a statement from Adams and Rollings made in 2003, that outlines gameplay as being:

"*one or more causally linked series of challenges in a simulated environment*" (Rollings, et al., 2003). Again, the focus is on the challenges of the game, but what is interesting is that it outlines that these actions have to take place within a simulated (read: game) environment in order to be viewed as gameplay.

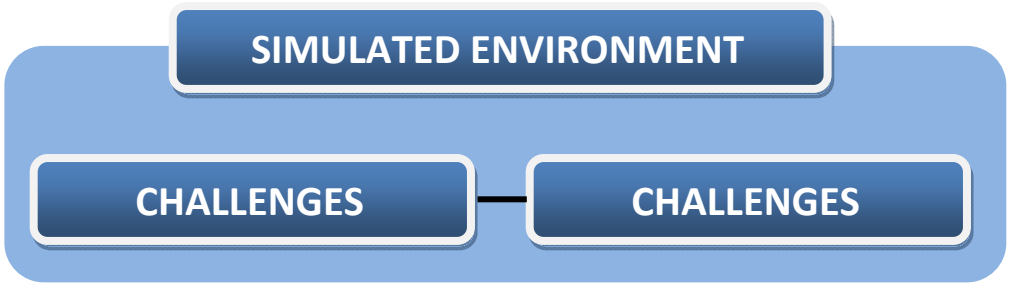


Figure 11 - Adams & Rollings defined gameplay the result of linked challenges within a simulated environment.

Thinking of gameplay as being within a confined environment is not something unique to Adams and Rollings. An interesting parallel can be draw to Chris Crawford's definition of play, which he defines as "*A voluntary activity or occupation executed within certain fixed limits of time and place, according to rules freely accepted but absolutely binding, having its aim in itself and accompanied by a feeling of tension, joy, and the consciousness that it is 'different' from 'ordinary life*" (Crawford, 2005).

Crawford writes of fixed limits of time and space, which can be transferred as being a simulated environment in relations to play within computer games. But one can also notice the parallels to both Dini and Adams' focus on entertainment from the accompanied feelings that play affords. A rather obvious hint is also the use of 'play' in gameplay, so it plainly suggests that it is play within the boundaries of a game. This entails a new question, since these boundaries are not clear. This is especially, since Crawford writes that "*you can't design games if you don't understand play - and play is a complex and tricky human behavior*" (Crawford, 2005 p. chapter 3). This again suggests a dualism within gameplay where an active player has to exist within an environment that is able to present challenges. This can then lead to certain psychological perceptions and feelings on the part of the player.

2.2 A Component Shop

As the previous section illustrates, gameplay is not an easy term to grasp and the continuous attempts to redefine it does not seem to bring forward any single-line-statement that accommodates the many aspects that gameplay seems to involve. Each definition presented here contains important components in terms of good game design, so they should not be neglected. However, gameplay can also facilitate an academic discussion that might very well not end with a productive outcome, so a more fruitful approach has to be sought. Even Adams and Rollings admit that "*gameplay is so difficult to define because there is no single entity that we can point to and say, "There! That's the gameplay. Gameplay is the result of a large number of contributing elements*" (Rollings, et al., 2003). Additionally, according to Rouse, when trying to innovate on gameplay "*even if it is only a variation on a proven theme, all hope of predictability in its development is thrown to the four winds*" (Rouse III, 2005 p. 249), which suggests that more elements are at play than outlined previously. Where Rouse would like to constraint gameplay to the field of interaction, it seems that a broader scope will have to be taken in order to understand what it takes to create good gameplay, and thus a motivating experience. Rollings and Adams tried to examine and explain gameplay as invariant with the player, but as the explanation below will illustrate, this might not be possible, or feasible.

In their paper on gameplay Laura Ermi and Frans Mäyrä builds on the dualism presented at the end of the previous section. They state that gameplay cannot be ready-made, but must be a result of an active process between a player and a game (Ermi, 2005 p. 2). Alternatively, to accommodate Rouse's focus on interactivity, they also write that "*gameplay is represented as interaction between a particular kind of game and a particular kind of player*" (Ermi, 2005 p. 7).

Figure 12 - Ermi and Mäyrä states that gameplay is an active process between player and game.

Ermi and Mäyrä brings focus to the player as an element which is central to determining gameplay, but points towards the player's "*sensations, thoughts, feelings, actions and meaning-making*" as the determining factors (Ermi, 2005 p. 2). Chris Crawford's reference to a *cognitive* process (Crawford, 1984) can be borrowed for easier reference, which Ermi and Mäyrä adapts by stating that *"[…] the challenges of gameplay seemed to be related to two different domains: to sensomotor abilities such as using the controls and reacting fast, and secondly to the cognitive challenges*" (Ermi, 2005 p. 7). The cognitive aspect of gameplay seems to be relatively uncharted territory in regards to gameplay, but some studies have been conducted that suggest that "*[…] in general, studying gameplay involved trying to extract different aspects of meaning in the experienced and observable behavior of gameplay*" (Lindley, 2008 p. 1). The suggestion of viewing the player as a product of cognitive based actions is also supported by Crawford, who writes that "*there really isn't any such thing as a pure sensorimotor challenge; a certain amount of spatial reasoning is necessarily involved. In other words, when the player sees a bad guy pop up, the player must perform a certain amount of spatial reasoning to estimate the amount of danger posed by the bad guy, the likelihood of successfully shooting him, and so forth*"(Crawford, 2005).

What we can infer from these quotes are that when speaking of a cognitive process in terms of gameplay, then it becomes a question of perception, on the player's part, of the game. On the basis of this foundation, Ermi and Mäyrä outline a gameplay experience model that focuses on a player's immersive capabilities when gaming.

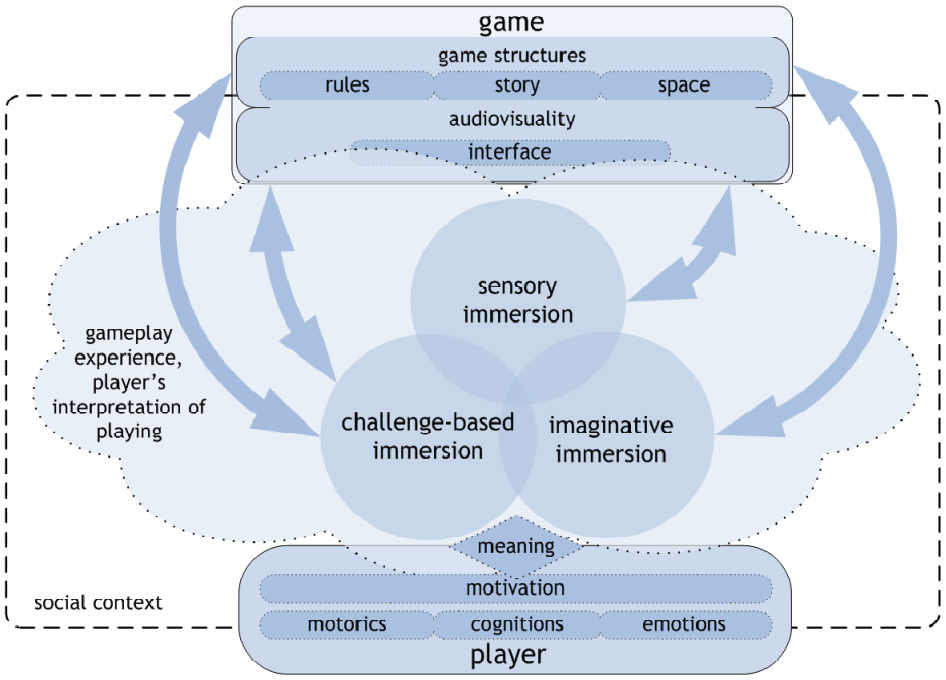


Figure 13 – Ermi and Mäyrä's gameplay experience model (abbreviated as SCI-model at times), which outlines gameplay as an experience based on an interaction between player and game. (Ermi, 2005 p. 8)

As can be seen from the above model, gameplay is outlined as the player's interpretation of playing, which suggests a complex system with many influential factors. Among these factors we should notice that Ermi and Mäyrä have included 'motivation' as part of the player's abilities. This coincides with the findings in the section *Games as a Source of Intrinsic Motivation* in the previous chapter of this report. The gameplay experience model is interesting because it tries to outline the relationship between the game and the player himself. Meaning that it outlines those elements of both that each component (e.i. the player and the game) brings to the table. As explained, Ermi and Mäyrä focus on immersion as being the key ingredient to a gameplay experience, but the real question then becomes whether or not immersion really is a profitable focus area for game designers and especially in relation to creating motivational games for the wobble board? Even though, this model presents an interesting and perhaps the most valued outline on the term gameplay, it is sadly no more practically applicable than Sid Meyer's original statement on gameplay. Additionally, as outlined in relation to some of the definitions of gameplay, the term does not necessarily have to go hand in hand with a good experience of gaming. There is also talk of bad gameplay as the result of poor game

mechanics, storyline etc. One can embrace the concept of a wide gameplay definition that is able to include the multiple aspects that various game designers have tried to couple with gameplay over the years. If nothing else, then it can be said that across the wide variety of definitions and authorities on game design gameplay is something that that can be agreed upon is imperative for the field. Thus, one could choose to focus on a single definition and use that as a goal for successful game design, whether it is to entertain or offer interactivity options. However, this does not seem fruitful; since each authority has valid points to make and each definition presented in this chapter is build on the solid experience within the field. Only in regards to the definition of gameplay as being solely a positive experience should objections be raised, since bad gameplay experiences are clearly possible. The question of positive experiences should rather be the goal of the gameplay, but as it will be discussed in the following section, the idea of a positive experience may have many ramifications and not always entail laughter and fun. In this regard one can refer to the previously mentioned game designer, Chris Crawford, who explains that the term 'fun' is a relative substance for which interpretation should not influences the game designer too much. Indeed he argues that it is an approbatory term in the same line as groovy or cool (Crawford, 2005).

If one goes away from trying to formulate a single line explanation of gameplay, one can then focus on the experience of gaming. Here it important to remember that the player is central to the whole system, since he not only formulates the experience, but also defines how the design is made and manifested in the game engine. Building on this, one can easily make the claim that the player, or user of the game, is central to the game's design. Thus gameplay must be a formula or system based on the player's intentions, needs, motivation and everything that he brings to the table when he interacts with a game. Therefore it is extremely important to remember the player in any system on gameplay. If one looks at Ermi and Mäyrä's model that outlines gameplay as being a production of the interaction between player and game, one has to remember that gameplay might be the meeting between the two components of the system, but only one component, the player, can experience the game, the other is simply built on the assumptions of the other's wishes. What then becomes interesting for a game's design is what equals a motivating gameplay experience in terms of player cognition? In other words, since gameplay is so important for the game design, then what constitutes 'good gameplay'?

CHAPTER 3 - SYMPTOMS OF GOOD GAMEPLAY

Throughout the previous chapter it was established that while many game developers and academics view gameplay as the fundamental source of good experiences the term remains loosely defined at best. Following this seeming ambiguity a variety of different definitions of the term gameplay were discussed. A discussion that culminated with the proposition that gameplay ultimately amounts to everything emerging from the meeting between player and game.

Even though this blanket description does provide us with two important points of departure it does still invite the question of whether there exists some defining feature of the player's experiences that is symptomatic of good gameplay. In other words what is it about gameplay which makes the act of playing qualify as an intrinsically motivated activity? Questions which necessarily are of great relevance when one is striving to use a game as a means of making people, in need of ankle training, perform the necessary exercises for the duration of the training process.

Both developers and scholars frequently resort to terms such as immersion, or presence when describing why their game facilitates good gameplay or why their theory captures the essence of why players play games. It would, however seem such terminology is anything but self explanatory as these concepts arguably are shrouded in much ambiguity and contradiction as the phenomenon gameplay itself.

The following chapter consequently details a discussion on the concepts immersion, flow and engagement and attempts to clarify whether these are adequate in terms of describing what may constitute good gameplay.

3.1 Immersion and the Other Realities

It seems reasonable to assume that few people would find themselves baffled if they were asked to explain what the experience of immersion means to the scuba diver who just plunged over the bulwarks of his boat. So why is it that this term oftentimes causes bafflement when used in connection to situations that do not involve the submersion into some form of liquid? In her frequently cited book *Hamlet on the Holodeck* Murray provides the following description of the term, which both explains its origins and implicitly directs our attention to what may be the reason for the term's ambiguous usage.

> *Immersion is a metaphorical term derived from the physical experience of being submerged in water […] the sensation of being surrounded by a completely other reality, as different as water is from air, that takes over all of our attention, our whole perceptual apparatus" (Murray, 1998 p. 98)*

The general consensus seems to be that immersion does refer to this experience of being surrounded by some other reality, but there appears to be number of alternate propositions as to what this other reality may be comprised of and why it may be experienced as immersive. Based on the definition of immersion presented above Arsenault has phrased the following redefinition, which rids the original of both the water metaphor as well as the reference to some 'other reality':

> *"[W]e can define immersion as a phenomenon that occurs when a layer of mediated data is pasted upon the layer of unmediated data with such vividness and extensiveness that it blocks the perception of the latter." (Arsenault, 2005)*

Despite the substitution of the words 'other reality' with the expression 'a layer of mediated data' this definition still allows for multiple interpretations and consequently fails in terms of providing the needed clarity. In continuation hereof it is worth referring to McMahan who argues that *"[…] immersion has become an excessively vague, all-inclusive concept*" (McMahan, 2003 p. 67). The term has come to stand for a multitude of different types of experiences and a lucid terminology is consequently needed in order to separate the different ones from one another.

Figure 14 – Right: The experience of being immersed in water (Laverty). Middle: The experience of immersive technology (Adapted from (vrealities.com)). The experience of being immersed in another mediated reality (Adapted from (WomanAroundTown.com)).

We propose that that these different types of experiences can be ordered into a simple hierarchy of distinct, albeit not mutually exclusive, forms of immersion. This hierarchy does in other words comprise. The hierarchy does in other words describe how different definitions of immersion may relate to one another. So rather than regarding the multitude of different meanings of the term as a source of bafflement we consider these as a means of gaining a more complete view of the experiences which gameplay may amount to. Figure 15 illustrates this hierarchy of the different forms of immersion which will be subjected to more scrutiny throughout the following subsections.

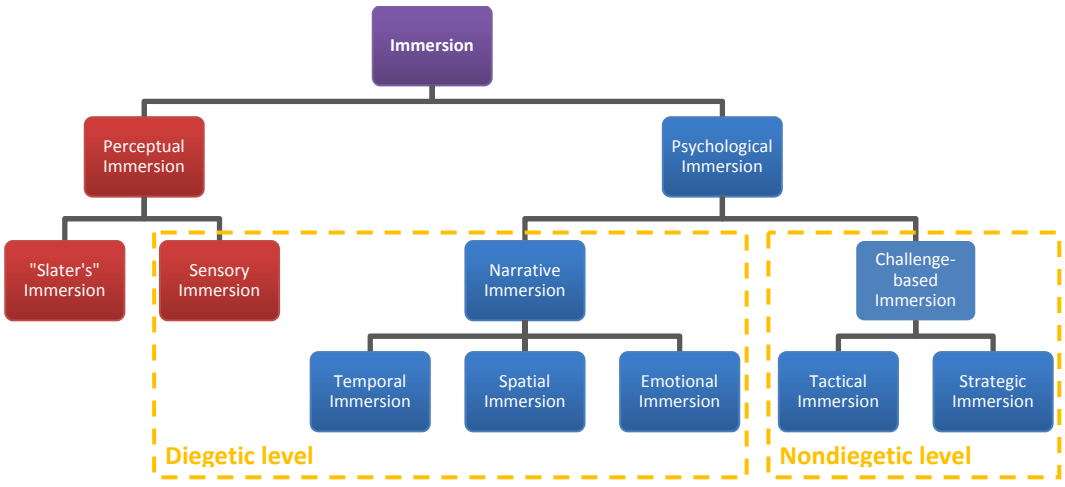


Figure 15 – The established hierarchy of different forms of immersion and how these relate to the players' involvement with the game on either a diegetic or non-diegetic level.

On the most general level of the hierarchy we find what McMahan refers to as *Perceptual* and *Psychological Immersion*. The former refers to immersion as a property of the system delivering the stimuli – immersive technology – and the latter refers to immersion as the result of experiencing the content mediated by the technology – immersive content.

According to McMahan Perceptual Immersion *"[…] is accomplished by blocking as many of the senses as possible to the outside world and making it possible for the user to perceive only the artificial world, by the use of goggles, headphones, gloves, and so on"* (McMahan, 2003 p. 77). This definition of Perceptual Immersion seems virtually identical to Slater's general, and far more restrictive, use of the term immersion. Slater is more specifically of the belief that we should reserve the term *"[…] to stand simply for what the technology delivers from an objective point of view. The more that a system delivers displays (in all sensory modalities) and tracking that preserves fidelity in relation to their equivalent real-world sensory modalities, the more that it is 'immersive'"* (Slater, 2003 p. 1) This necessarily implies that we by no means should view immersion as a phenomena pertaining to how the player experiences the content mediated by means of the technology. The 'other reality' which surrounds the experiencer is in other words constituted by something very real and unmediated, namely the technology facilitating the experience. Here it is important to note that Slater does not disregard the mediated content altogether, he simply does regard it as a factor influencing immersion (Slater, 2003 p. 2). Here it is worth referring to Ermi and Mäyrä who have proposed a relatable definition of immersion which describes how the fidelity of the content itself may give rise to immersion. The two authors have dubbed this particular form of immersion Sensory Immersion and describe it as follows:

> *"[Sensory Immersion is] related to the audiovisual execution of games. […] Digital games have evolved into audiovisually impressive, three-dimensional and stereophonic worlds that surround their players in a very comprehensive manner. Large screens close to the player's face and powerful sounds easily overpower the sensory information coming from the real world, and the player becomes entirely focused on the game world and its stimuli." (Ermi, et al., 2005 p. 7)*

Slater would in all probability also refer to this system described as immersive – although at a lower technological level than e.g. head-mounted displays and data-

gloves – just as he describes that a *"[…] a book is at a certain low level of immersive 'technology'"* (Slater, 2003 p. 2). We shall see later that Ermi and Mäyrä's description of the immersive potential of three-dimensional and stereophonic worlds to some extent also has its place amongst the subsets of what we shall refer to as Narrative Immersion. Whereas it is hard to dispute the general validity of Slater's definition of immersion one may argue that a more blanket usage of the term poses little problem as long as the distinction between the different forms of immersion is clear. It does, however, seem sensible to distinguish between the form of immersion used to describe the technology providing the experience (Perceptual Immersion) and the types of immersion brought about by the players' experience of the content mediated by this technology (Psychological Immersion).

3.1.1 Psychological Immersion

As suggested in the previous paragraph McMahan defines Psychological Immersion as the form of immersion that *"[…] results from the user's mental absorption in the world of the game's story"* (McMahan, 2003 p. 77) which in turn implies that it is this world that makes up the 'other reality' surrounding the player. Without contesting the general validity of this claim one may argue that the player's mental absorption does not always result from his or her preoccupation with the world in which the events of the games story unfold - the games diegesis. More specifically it seems reasonable to assume that the mental absorption equally well may be the product of the player's obsession with performing the actions necessary in order to progress in one way or the other. The events which cause the need for action on behalf of the player may very well be part of the games diegesis, but this does not necessarily imply that the player is immersed on a diegetic level. This line of reasoning is by no means foreign to McMahan and she is in fact a proponent of the view that one should distinguish between immersion on a diegetic and a non-diegetic level (McMahan, 2003 p. 68). By this she means that there is a difference between the feeling of immersion resulting from being "[…] *caught up in the world of the game's story (the diegetic level)"* and the immersion brought about by "*the player's love of the game and the strategy that goes into it (the nondiegetic level)"* (McMahan, 2003 p. 68). However, by comparing McMahan's general definition of Psychological Immersion and this description of immersion on a diegetic level it would appear that the two describe one and the same thing. The argument here is that that *"the player's love for the game and the strategy that goes into it"* in

some instances also may be the result of his or her mental absorption with the game. This does in turn entail that the provided definition of Psychological Immersion is to narrow in scope as it also needs to encompass these non-diegetic features of the gameplay, which may give rise to mental absorption on behalf of the player. The following addition to the definition does arguably suffice in terms of doing just that: Psychological Immersion results from the player's mental absorption in the virtual environment of the game and the possibilities for interaction afforded by said game. With this moderate redefinition of the term in place it seems prudent turn our attention to the possible subsets of Psychological Immersion – Narrative and Challenge-Based Immersion – which will be describe in turn throughout the following paragraphs.

Narrative Immersion

Narrative Immersion does, as the name implies, refer to the form of immersion which may result from experiences of narrative works such as novels, films, photographs, representational paintings or digital games where the player assumes control of the protagonist or antagonist in the game's story (Ryan, 2003 p. 15). It does in other words largely correspond with McMahan definition of immersion on a diegetic level. This form of immersion have been dubbed Narrative Immersion by Adams and Rollings who describes it as the "[…] *the feeling of being inside a story, completely involved and accepting the world and events of the story as real"* (Adams, et al., 2006 p. 30). Here it is worth noting that there exist a number of alternate definitions of similar forms of immersion, which are virtually identical to the one proposed by Adams and Rolling, albeit under different names (e.g. Imaginative Immersion (Ermi, et al., 2005 p. 8)). Adams and Rollings more specially describe that, exhilarating plots, interesting characters, and dramatic situations are prerequisites for the experience of narrative immersion (Adams, et al., 2006 p. 30). In continuation hereof it is worth referring to Ryan who has identified three distinct forms of involvement with narratives, which may be constituent to general experience of narrative immersion, namely Spatial, Temporal and Emotional Immersion. Even though her descriptions of the three does not particularly pertain to gameplay immersion they still seem to be of great relevance within this context and have consequently been included as subsets of Narrative Immersion in the hierarchy presented in Figure 15 (page 27).

Spatial immersion does in general terms refer to the form of immersion brought about by the reader, spectator or player response to the depicted location or scenery. In order for a narrative to be experienced as spatially immersive it needs to *"[…] promote a haunting sense of the presence of a spatial setting and a clear vision of topography"* (Ryan, 2003 p. 121). Moreover Ryan provides the following description of how spatial immersion in its truest form may influence the reader of a textual narrative:

> *"In the most complete forms of spatial immersion, the reader's private landscapes blend with the textual geography. In those moments of sheer delight, the reader develops an intimate relation to the setting as well as a sense of being present on the scene of the represented events."*(Ryan, 2003 p. 122)

Recall that Ermi and Mäyrä argued that the Sensory Immersion may result from experience of impressive three-dimensional and stereophonic worlds presented by means of high-fidelity hardware, which arguably makes Spatial Immersion the textual counterpart to this form of immersion. It should, however, be noted that Spatial Immersion by no means solely is dependent upon the fidelity of the stimuli as it primarily arises as a consequence of subjective experience of the depicted setting on a diegetic level.

Just as Adams and Rollings describe that exhilarating plots are constituent to the experience of Narrative Immersion so does Ryan. She more specifically refers to this form of immersion as Temporal Immersion and describes that it is brought about by the experiencer's *"[…] desire for the knowledge that awaits her at the end of narrative time."* (Ryan, 2003 p. 140). Temporal immersion may in other words be defined as the "*[…] the reader's involvement in the process by which the progression of narrative time distils the field of potential, selecting one branch as the actual, confining the others to the realm of forever virtual […]"* (Ryan, 2003 p. 141). This evidently implies that Temporal Immersion is closely tied to feelings of suspense and surprise as they result from the player's uncertainty of the future events of the narrative (Ryan, 2003 p. 146).

The player's desire to know what happens at the end of narrative time does necessarily also related to an interest in the fate of the narrative's characters, which leads us to the final of the three forms of involvement with narratives proposed by Ryan, namely Emotional Immersion. Emotional Immersion does in broad strokes refer to the experience of immersion resulting from the player's emotional investment

in the fate of the protagonists or antagonists of the narrative (Ryan, 2003 p. 148). Ryan more specifically argues that this form of immersion is achievable because of the mind's capacity for simulating incredibly vivid emotions even when their causes are not real (Ryan, 2003 p. 154). Consequently, it is makes sense to distinguish between emotions associated with real life experiences and the ones induced by fiction, that is, *"[…] in real life we have beliefs and desires leading to emotions; in fiction we have make-beliefs and make-desires leading to "quasi-emotions"* (Ryan, 2003 p. 154). Whereas this distinction does seem meaningful one may argue that the experience of playing games may give rise to both quasi-emotions and "real" emotions. The quasi-emotions may, as described above, result from the player's involvement with the characters of the game's narrative. They are in other words the product of events pertaining to the game's diegesis. The "real" emotions, on the other hand, are brought about by the player's investment with the game on a non-diegetic level. Imagine that a player assumes the role of some game's protagonist. At some point throughout the course of this game the player may finds him or herself in a confrontation with one of the game's antagonists. This encounter may produce a series of emotions as a consequence of the player's attitude towards this adversary and the character he or she is controlling. If this antagonist has behaved maliciously towards the character controlled by player, such emotions could be anxiety or anger. Ryan would refer to these emotions as quasi-emotions as they are spurred by fictional events.

Now imagine that this encounter may lead to the death of the character controlled by the player. If the encounter has this dire outcome the player is finds him or herself prevented from progressing and may be forced to replay a large segment of the game in order to do so. It is not hard to imagine that the player's knowledge of this possible outcome may result in the experience of real, albeit probably less intense, feelings of anxiety or anger. Moreover the antagonist could be controlled by another human player, which in turn would entail that these feelings would be directed at a real person as opposed to a fictional character. In both of the last two examples the feelings were resulting from the player's involvement with the game on a non-diegetic level. On this note it is worth proceeding to the description of Challenge-based Immersion, which constitutes the second subset of Psychological Immersion and relates to immersion with the game on a non-diegetic level.

Challenge-based Immersion

The term Challenge-based Immersion has been coined by Ermi and Mäyrä who describes it as *"[…] the feeling of immersion that is at its most powerful when one is able to achieve a satisfying balance of challenges and abilities"* (Ermi, et al., 2005 p. 8). Moreover Ermi and Mäyrä describe that Challenge-based Immersion may be brought about by challenges to motor and mental skills alike. The two authors are however of the belief that the challenges more often than not will pertain to both in some capacity (Ermi, et al., 2005 p. 8).

Whereas the simultaneous occurrence of both types of challenges does seem plausible one may argue that, in order for these challenges to be experienced as immersive one of two conditions have to be meet. Either the simultaneous occurrence of these challenges has to be brief enough so as to avoid attentional overload; or else the player has to be so apt at tackling one of the two types of challenges that he or she has the attentional surplus necessary in order to face the second one. This argument is based on the writings of Saariluoma (2005) who describes that our limited attentional capacity normally is restricted to one item at a time. We do, however, possess mechanisms such as task switching and automatisation which enable us to circumvent these limitations to our attentional capacity (Saariluoma, 2005 p. 72). Task switching essentially refers to the mechanism allowing us to *"[...] switch attention from one target to another relatively swiftly and thus follow two or more competing messages at a time"* (Saariluoma, 2005 p. 72). This mechanism would however only allow players to tackle both types of challenges simultaneously for limited periods of time as it is a relatively demanding process (Saariluoma, 2005 p. 72). The second mechanism, automatisation, refers to how repeated execution of a particular task under similar conditions may result in increased speed and efficiency. Saariluoma describes that once a task becomes fully automated its demands on cognition become diminished and performance become effortless and possibly even unconscious, thus enabling it to be performed alongside a more controlled main task (Saariluoma, 2005 p. 72). With these arguments in mind it seems reasonable to distinguish between the immersion engendered by challenges to the players motor and mental skills.

In their book *'Fundamentals of Game Design',* Adams and Rollings – who previously was credited for coining the term Narrative Immersion – make exactly this distinction.

They do more specifically distinguish between Strategic Immersion and Tactical Immersion. The former refers to the experience you have when you are *"[…] deeply involved in trying to win a game, you are strategically immersed. You don't think about a story, characters, or the game but focus strictly on optimizing your choices"* (Adams, et al., 2006 p. 30). The two authors more specifically describe that Strategic Immersion results from player's intense preoccupation with observation, calculation and planning (Adams, et al., 2006 p. 30). Tactical immersion does, quite oppositely, refer to the form of immersion experienced when playing hectic action games where continuous demands for reactions to occurring obstacles give rise to an experience of complete engrossment. This repeated confrontation with relatively small and similar challenges may in turn cause you to experience that *"[…] the action is so fast that your brain has no time for anything else. You don't have time to think about strategy or storyline; the game is mostly about survival"* (Adams, et al., 2006 p. 30).

3.1.2 An aside on presence terminology

The term presence has, like immersion, come to stand for a multitude of different types of experiences and to make matters worse some scholars and game developers use the two terms interchangeably (McMahan, 2003 p. 68). In order to rid the current discussion of this added confusion the following paragraphs will briefly introduce Lombard and Ditton's taxonomy of different conceptualizations of presence and describe which one we adhere to within the context of the current project.. The two authors do in general terms define presence as *"[…] the perceptual illusion of nonmediation"* (Lombard, et al., 1997), and add the following explanation for their particular choice of words.

> *The term "perceptual" indicates that this phenomenon involves continuous (real time) responses of the human sensory, cognitive, and affective processing systems to objects and entities in a person's environment. An "illusion of nonmediation" occurs when a person fails to perceive or acknowledge the existence of a medium in his/her communication environment and responds as he/she would if the medium were not there. […]It should be noted that this illusion does not represent a perceptual or psychological malfunction or psychosis, in which the mediated experience is consciously confused with what is nonmediated or "real"." (Lombard, et al., 1997)*

This definition is according to Lombard and Ditton broad enough to encompass the six different conceptualizations of the term, which they have identified from the writings of a wide variety of fellow scholars (Lombard, et al., 1997). For brevity's sake these six distinct, albeit interrelated, forms presence have been summarized in Box 5 below.

Box 5 – Lombard and Ditton's six conceptualizations of presence

1) Presence as social richness: According to Lombard and Ditton this conceptualization of presence is defined by the extent to which individuals engaged in some form of mutual interaction, find the medium facilitating the interaction sociable, warm, sensitive, personal or intimate (Lombard, et al., 1997).

2) Presence as realism: The second conceptualization of presence does, as the name imply, hinge upon the *"[…] the degree to which a medium can produce seemingly accurate representations of objects, events, and people – representations that look, sound, and/or feel like the "real" thing."* (Lombard, et al., 1997). Moreover Lombard and Ditton describe that it is possible to distinguish between two forms of realism which may contribute to the experience of presence, when perceived in isolation or in concert, namely social and perceptual realism. Social realism refer to *"[…] the extent to which a media portrayal is plausible or "true to life" in that it reflects events that do or could occur in the nonmediated world"* (Lombard, et al., 1997) while perceptual realism refer to the extent to which mediated characters, environments and artifacts are mistakable for their real world correlates (Lombard, et al., 1997).

3) Presence as transportation: When describing presence as transportation Lombard and Ditton distinguish between three different types of transportation, namely *"[…] "You are there," in which the user is transported to another place; "It is here," in which another place and the objects within it are transported to the user; and "We are together," in which two (or more) communicators are transported together to a place that they share"* (Lombard, et al., 1997). Notably, both McMahan and Slater are proponents of the view that the first of the three, "You are there", is tantamount to presence altogether (McMahan, 2003 p. 77), (Slater, 2003 p. 2).

Continued on the following page

4) Presence as Immersion: This meaning of the term presence does essentially refer to how an individual may experience both perceptual and psychological immersion (Lombard, et al., 1997). Recall that perceptual immersion refers to how the perceptual apparatus of the experiencer may blocked from the surrounding nonmediated world by means of visual, auditory and haptic displays; and psychological immersion refers to how the experiencer may surrender all of his or her attention to the particular medium because of the mediated content.

5) Presence as social actor within medium: According to Lombard and Ditton this form of presence relates to how the experience of mediated characters may entail that individuals *"[…]overlook the mediated or even artificial nature of an entity within a medium and attempt to interact with it"* (Lombard, et al., 1997).

6) Presence as medium as social actor: This sixth and final conceptualization relates to how individuals may treat the medium itself as a social actor. Lombard and Ditton do more specifically describe that *"[…] because computers use natural language, interact in real time, and fill traditionally social roles (e.g., bank teller and teacher), even experienced computer users tend to respond to them as social entities"* (Lombard, et al., 1997).

The fourth of the conceptualizations featured in Lombard and Ditton does needless to say imply that immersion and presence are indistinguishable from one another. However if one pauses and considers the general definitions of the two terms it seems possible to point to a minor difference that arguably makes the two concepts differ. Recall that following Arsenault's definition, immersion is *"[…] a phenomenon that occurs when a layer of mediated data is pasted upon the layer of unmediated data with such vividness and extensiveness that it blocks the perception of the latter"* (Arsenault, 2005) and presence was defined as *"[…] the perceptual illusion of nonmediation"* (Lombard, et al., 1997). So it would appear that immersion is the result of the experiencer assigning a great deal of attention to the medium while presence seemingly is the result of the voluntary, albeit subconscious, delusion that whatever is being mediated is real. It seems plausible that the confusion of the terms in large parts can be ascribed to the fact that the two oftentimes are experienced conjointly and one may even go as far as claiming that immersion to a large extent is a prerequisite for presence. That is, in order for the experiencer to perceive and respond to mediated locations, artifacts and characters as if these were nonmediated he or she will have to be so focused on the events unfolding that the mediated or artificial nature of these items remains

unattended. Even if there is a difference between these two general definitions of the risk of ambiguity remains imminent, given the numerous meanings ascribed to each of the two. So in order to avoid future confusion we shall reserve the term presence to stand solely for the experience of being transported to some other place, unless otherwise specified.

3.1.3 Immersion and good gameplay

When the curious phenomena immersion was first introduced it was argued that the general consensus seemingly were that the term generally is used to describe the experience of being surrounded by some 'other reality'. The term does in other words describe the experience of more or less complete attentional surrender on behalf of the experiencer. Moreover it was proposed that the there exist alternate propositions as to what this other reality may be comprised of and why it may be experienced as immersive. The review of the different forms of immersion presented throughout the previous pages arguably lends some credence to this claim. The 'other reality' surrounding the experiencer may either be comprised by the technology facilitating the experience or the content mediated by said technology. In the latter of the two cases there may be a number of reasons why the player experiences the surrounding reality as immersive. Whereas the unification of these different views of immersion within the context of the hierarchy presented in Figure 15 (page 27) arguably helps provide a more complete view of the experiences which gameplay may amount to one question is still left unanswered: Is immersion tantamount to good gameplay?

In her previously cited book *Hamlet on the Holodeck* Murray describes that *"[t]he experience of being transported to an elaborately simulated place is pleasurable in itself, regardless of the fantasy content. We refer to this experience as immersion."* (Murray, 1998 p. 98) It would in other words appear that she believes immersive experiences to be pleasurable by definition. Even though this claim probably is true for many immersive experiences it is by no means impossible to imagine instances where such experiences are unpleasant in one way or the other. Simply imagine playing a horror game. You might experience the narrative and the virtual environment, in which it unfolds as very immersive, but ultimately the game is too scary and you may consequently find the gameplay unpleasant.

Similar arguments seemingly apply to immersion on a non-diegetic level. Picture yourself playing the horror game once again. You find that the challenge of killing the zombies, vampires and werewolves to be suitable given you level of proficiency. This implies that you should be experiencing challenge-based immersion as these reoccurring challenges do not allow you to attend to anything other than the events of the game. However, since you prefer puzzle solving over the mindless slaying of the monster stereotypes you do not find these challenges interesting and consequently do not wish to continue playing the game or return to it in the future (If the game involved puzzles and you preferred high paced action the reasoning is evidently reversed). It would in other words seem that even though challenge-based immersion for the most part is experienced as a positive feature of gameplay this does not always have to be the case. Moreover it seems possible to imagine scenarios where challenge-based immersion is experienced as unpleasant even though the challenges lie within the range of the player's abilities and the task of tackling them are of interest to said player. This is perhaps best illustrated with a real life example.

Readers who have a driver's license will have little difficulty imagining the experience of being a novice driver in the midst of rush hour traffic. It seems reasonable to assume that many novice drivers do take an interest in the act of driving and since these have been granted license to drive it is hopefully also safe to presume that the challenges do not exceed their abilities. If we labor under the assumption that these conditions are true it seems likely that such drivers are in fact experiencing challenge-based immersion, albeit it is far less likely that they wish to prolong the experience or find themselves in a similar situation in the future. The possible discomfort can arguable be ascribed to the magnitude of the involved risk. The risks involved in playing games do generally seem far less daunting – perhaps with the exception of games involving financial stakes and some branches of sports. Nonetheless it seems plausible that immersive gameplay also may be experienced as unpleasant if the risks involved exceed some internal threshold particular to the individual player.

The arguments presented throughout the previous paragraphs do needless to say rely on a certain level of interpretation of the various definitions presented throughout this section. This interpretation notwithstanding, the arguments do serve the purpose of illustrating that neither attentive surrender nor the experience of presence need be sources of intrinsic motivation. It would in other words appear that, just because an

experience *"[…] takes over all of our attention, our whole perceptual apparatus […]"* (Murray, 1998 p. 98) or provides *"[…] the perceptual illusion of nonmediation"* (Lombard, et al., 1997), this need not be an experience we wish to continue presently, and let alone, one we wish to revisit in the future. Even though it would seem as if immersion more often than not is constituent to good gameplay, it is not tantamount to this form of experience. The concept immersion does in other words not suffice in terms of describing why games may be experienced as intrinsically motivating.

3.2 The Flow Experience

What could Michelangelo's experience of painting the Creation of Adam on ceiling of the Sistine Chapel possibly have in common with Maradona's experience of playing, and scoring, in the quarter-finals of the 1986 World Cup? Moreover, what could these experiences possibly have in common with the experience of good gameplay?

Figure 16 – Left: A segment of Michelangelo's famous painting on the ceiling of the God giving on the the Sistine Chapel (Michelangelo, 1511). Middle: Maradona scoring his famous first goal (The Hand of God) against England in the quarter finals of the 1986 World Cup (Adapted from (Marcotti, 2007)). Right: A gamer (Adapted from (VGS.com, 2009)).

According to Csikszentmihalyi, and his followers, the common trait of these otherwise dissimilar types of experiences is that they constitute potential flow experiences. Flow theory and research, which as implied were pioneered by Csikszentmihalyi, has and still do strive to gain an understanding of optimal experiences. Such optimal experiences are according to Nakamura and Csikszentmihalyi(2005) brought about by intrinsically motivated, or autotelic, activities, as opposed to activities motivated by the outcome which they are supposed to amount to (Nakamura, et al., 2005 p. 89).

Both the activity performed by Michelangelo and Maradona were in some capacity extrinsically motivated as one reluctantly were commissioned by the Pope while the other probably was motivated by his desire to win the World Cup. This does, however, not change the fact that the acts of artistic expression as well as the act of playing soccer may be regarded as autotelic activities under many circumstances. As it happens, it was the willful and sometimes irrational perseverance displayed by some artists that first inspired Csikszentmihalyi to gain an interest in optimal experiences. Moreover both play and games were some of the first activities which Csikszentmihalyi and his followers subjected to study. The principal reason for choosing such activities was that intrinsic rewards are a salient feature of both play and games (Nakamura, et al., 2005 p. 89). So it would appear that the theory of optimal experience, and by implication the concept flow, is of great relevance when one is trying to understand why the act of playing a game may be enjoyable in and by itself.

3.2.1 Flow as activity and subjective state

A flow experience can in broad strokes be described in terms of the conditions necessary for it to arise – we shall refer to activities meeting these conditions as flow activities – and the concomitant subjective state of the experiencer – the flow state (Nakamura, et al., 2005 p. 89). It is notable that a flow activity by no means need to be an activity of leisure and as long as it meets the conditions described by Nakamura and Csikszentmihalyi it just as well may occur within a work setting. Box 6, below outline these conditions.

Box 6 – Conditions for flow

- "Perceived challenges, or opportunities for action, that stretch (neither overmatching nor underutilizing) existing skill; a sense that one is engaging challenges at a level appropriate to one's capacities"
- "Clear proximal goals and immediate feedback about the progress that is being made."

(Nakamura, et al., 2005 p. 90)

So in order for an activity to qualify as a flow activity it needs to include challenges, or opportunities for action matching the experiencer's level of proficiency, that is, the challenges are neither to difficult nor to easy. The actions of the experiencer have to be informed by unambiguous goals in order to ensure that they are experienced as purposeful, and finally immediate feedback has to guarantee that the experiencer is aware of his or her progression. Notably, these conditions are virtually identical to the ones defining Challenge-based Immersion, which in general terms was described as the experience of attentional surrender caused by the challenges inherent to the game. However there exists a third condition, which arguably makes flow experiences distinguishable from experiences of challenge-based immersion. The particular precondition in question is that the experiencer takes an interest in the activity being performed (Nakamura, et al., 2005 p. 92). Nakamura and Csikszentmihalyi describe that fulfillment of these conditions, entail that the experiencer enters a subjective state of flow which is characterized the features presented in Box 7.

Box 7 – Characteristics of the flow state

- "Intense and focused concentration on what one is doing in the present moment"
- "Merging of action and awareness"
- "Loss of reflective self-consciousness (i.e. loss of awareness of oneself as a social actor)"
- "A sense that one can control one's actions, that is, a sense that one can in principle deal with the situation because one knows how to respond to whatever happens next"
- "Distortion of temporal experience (typically, a sense that time has passed faster than normal)"
- "Experience of the activity as intrinsically rewarding, such that often the end goal is just an excuse for the process."

(Nakamura, et al., 2005 p. 91)

Interestingly this subjective state of flow greatly resembles the state of attentional surrender associated with the different forms of psychological immersion described earlier in this chapter. As a matter of fact Nakamura and Csikszentmihalyi describe that *"[i]ntense concentration, perhaps the defining quality of flow, is just another way of saying that attention is wholly invested in the present exchange"* (Nakamura, et al., 2005 p. 92). More

specifically they describe the general role of attention and its relation to the precondition for flow as follows:

> *"Entering flow is largely a function of how attention has been focused in the past and how it is focused in the present by the activity's structural conditions. Interest developed in the past will direct attention to specific challenges. Clear proximal goals, immediate feedback, and just manageable levels of challenge orient the organism, in a unified and coordinated way, so that attention becomes completely absorbed into the stimulus field defined by the activity" (Nakamura, et al., 2005 p. 92).*

Moreover it is notable that the other characteristics of the flow state, merging of action and awareness, loss of reflective self-consciousness, and distortion of temporal experience ultimately are the product of this experiencer's intense focus. To be more exact Nakamura and Csikszentmihalyi argue that once the experiencer is completely focused on the activity being performed his or her limited attentional capacity prohibits any objects external to the immediate interaction from entering awareness. The attentional burden does in other words entail that all reflections pertinent to the self or the elapsed time remain unattended (Nakamura, et al., 2005 p. 92).

On a more peculiar note it would seem that the experience of flow in some respects are analogous to the mental state "myopia for the future", which according to Damasio, may be experienced by individuals under the influence of alcohol or other intoxicating substances (Damasio, 2006 p. 218). Damasio more specifically describes that *"[i]nebriation does narrow the panorama of the future, so much so that almost nothing but the present is processed with clarity"* (Damasio, 2006 p. 218). This analogy is necessarily crude in nature and the intention is by no means to insinuate that there exists a relation between the experience of flow and the consumption of mind-numbing substances. There is, however, an additional parallel to be drawn. Just as alcohol and other drugs may give rise to an urge for more so may flow. To be exact, Nakamura and Csikszentmihalyi describe that *"[…] flow encourages a person to persist and return to an activity because of the experiential rewards it promises, and thereby fosters the growth of the skills over time"* (Nakamura, et al., 2005 pp. 95-96). So whereas the experience of flow may be attractive due to the escapism made possible by the loss reflective self-consciousness – something which arguably also is an addictive feature of inebriation – it is first and foremost the intrinsic rewards which incites the urge for more.

Furthermore it is worth noticing that Nakamura and Csikszentmihalyi in the previous citation highlighted growth of skills over time as this directs attention to another common feature of flow activities. That is, a *"[…] flow activity not only provides a set of challenges or opportunities for action but it typically also provides a system of graded challenges, able to accommodate a person's continued and deepening enjoyment as skills grow"* (Nakamura, et al., 2005 p. 92).

So the growth of skills may in itself be considered to be a reason why people derive pleasure from performing flow activities. Moreover the possibility for growth Even though this feature perhaps should not be viewed as a precondition for flow on par with the ones highlighted in Box 6 it would appear that it is vital to the continued experience of flow since it relates to the preservation of the balance between challenges and skills over time.

3.2.2 A fragile equilibrium

Nakamura and Csikszentmihalyi describe this balance between the skills of the experiencer and the challenges inherent to the activity as a dynamic equilibrium. The experiencer's perceived capacity for action continuously grows as a consequence of the challenges being encountered and the perceived difficulty level of future challenges consequently needs to increase in proportion to this increase in proficiency (Nakamura, et al., 2005 p. 92).

The flow state is, however, intrinsically fragile as an offset in the balance may entail that flow becomes replaced by aversive states such as anxiety or boredom. That is, if the challenges exceed the experiencer's capacity for action he or she experience a state of anxiety and conversely if his or her capacity for action exceeds the challenges faced then a state of boredom may arise. This first mapping of the relationship between the three states flow, anxiety and boredom; and the perceived challenges and skills formed the basis for the graphical representation of the flow experience illustrated on the left graph in Figure 17.

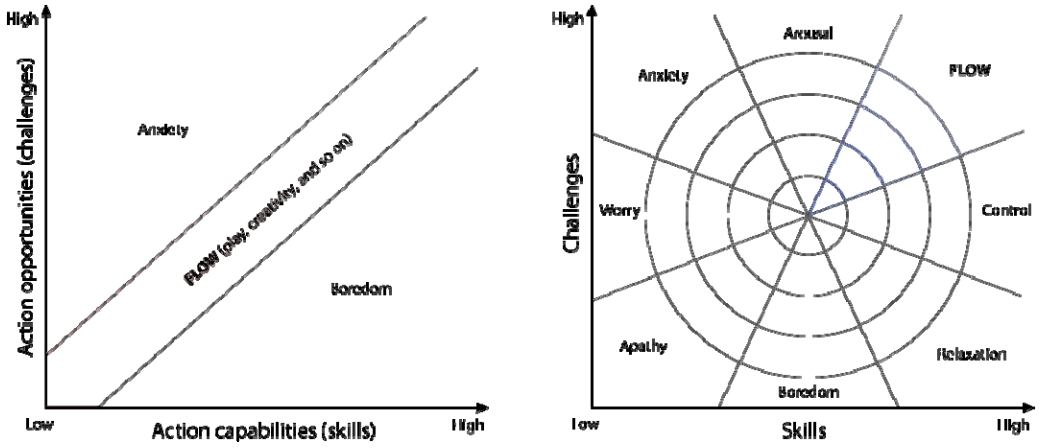


Figure 17 - Left: The original graphical mapping of the relationship between flow, anxiety and boredom, and perceived challenges and skills (Adapted from (Nakamura, et al., 2005 p. 94)). Right: The latest graphical mapping of the relationship between flow and other less desirable subjective states, and perceived challenges and skills. The circles denote the intensity of the experience and the intersection of the lines (the centre of the circles) signifies the experiencer's average levels (Adapted from (Nakamura, et al., 2005 p. 95)).

However, it has been discovered that this mapping does not correspond with how individuals actually experience the relationship as it takes more than an equilibrated relationship between challenges and skills to achieve flow. (Nakamura, et al., 2005 p. 95). More specifically, Nakamura and Csikszentmihalyi describe that *"[a]ctivities providing minimal opportunities for action do not lead to flow, regardless of whether the actor experiences a balance between perceived challenge and skill"* (Nakamura, et al., 2005 p. 94). Flow is in other words not possible when both perceived challenges and skills are minimal. Moreover this entails that flow is more likely to arise as part of the experience of participatory media, e.g. sports or video games, as opposed to their non-participatory counterparts, e.g. books or movies (Nakamura, et al., 2005 p. 94). In response to this inconsistency it has been proposed, that the flow state instead arises when the state of equilibrium is preserved and the average level of skills and challenges exceed the average level of the experiencer (Nakamura, et al., 2005 p. 95). This does more specifically imply that *"[…] flow is expected to occur when individuals perceive greater opportunities for action than they encounter on average in their daily lives, and have skills adequate to engage them"* (Nakamura, et al., 2005 p. 95). This recasting of the concept have yielded an alternative, and arguably more accurate, mapping of the how perceived challenges and skills may lead to flow and other less desirable subjective states. The right graph in Figure 17 illustrates the graphical representation of this mapping. This recasting notwithstanding, attention still plays a pivotal role for the

experience of flow. Moreover Nakamura and Csikszentmihalyi provide the following description of how the remaining, less desirable, subjective states similarly are closely tied to the attentional "preferences" of the experiencer:

> *"Apathy, boredom, and anxiety, like flow, are largely functions of how attention is being structured at a given time. In boredom, and even more so apathy, the low level of challenge relative to skills allows attention to drift. In anxiety, perceived challenges exceed capacities. Particularly in contexts of extrinsic motivation, attention shifts to the self and its shortcomings, creating a self-consciousness that impedes engagement of the challenges."(Nakamura, et al., 2005 p. 92).*

So it would appear that it primarily is while being in flow that the experiencer finds him or herself incapable of attending to anything other than the activity itself and consequently experiences the merging of action and awareness, loss of reflective self-consciousness and distortion of temporal experience.

3.2.3 Flow in games (and everywhere else)

So far flow has been described in more or less generic terms with little regard to the specific activity facilitating it. The theory of flow has, however, been applied with a variety of domains including, but not limited to, elite and non-elite sports, literary writing, aesthetic experiences, and software design (Nakamura, et al., 2005 p. 95). One proponent of the application of flow within the context of game design is Chen, who in the journal article Flow *in Games (and Everywhere Else)* describes that flow theory may hold the key to maintaining and extending players' and other technology users' interactive experiences (Chen, 2007 p. 33). Chen bases his descriptions of how to apply flow theory within the context of game design on the first mapping of the flow experience and is of the conviction that designers should strive to design their applications so that they ensure that the dynamic equilibrium between challenges and skills are preserved at all times. That is, the user experiences being in a state of flow – stays in the flow zone – for the entire duration of the experience (Chen, 2007 p. 33). Chen does, however, believe this preservation to be somewhat problematic in relation to the design of video games as players differ greatly in terms proficiency and preferences. The challenges that make one player enter a state of flow, may give rise to boredom or anxiety for the next, and the individual player has unique expectations to these challenges prior to and while facing them (Chen, 2007 p. 33). The left graph

on Figure 18 illustrates the different flow zones of novice, average and expert players, and the red line indicates the uniform experience oftentimes afforded by games, which need not be sufficient in terms of providing novice and expert players with a flow experience (Chen, 2007 p. 33).

Chen argues that in order to circumvent this problem one needs to design games that accommodate these varying levels of proficiency and allow all players to enter the flow zone. Games do in other words need to be adaptive and provide the player with the option of facing appropriate challenges given his or her current capacity for action as illustrated on the right graph in Figure 18. Moreover Chen argues that these choices should be seamlessly integrated into the core interaction of the experience so as to avoid that the player becomes overwhelmed by this range of choices and the experience of flow interrupted (Chen, 2007 pp. 33-34).

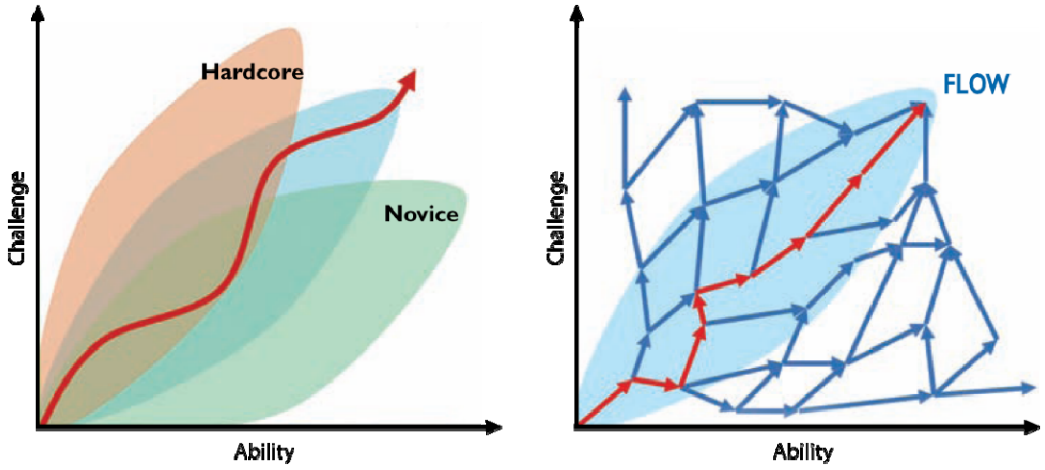


Figure 18 - Left: Flow zones of hardcore, average and novice players (the red line indicates the experience afforded by many game, which need not give rise to flow for hardcore or novice players). Right: Chen's illustration of how a game may accommodate players with varying skill levels by providing various choices (the red arrows indicate one possible series of choices). All three figures have been adapted from (Chen, 2007 p. 32).

Without disputing the validity or applicability of Chen's description of flow within the context of video games one may argue that the graphical representations used to illustrate the flow experiences of novice and expert players is confusing at best and deceptive at worst. His juxtaposition of the flow zones of these three types of players within one graph seemingly suggests that challenges and abilities are somehow objective properties of the flow experience. Nakamura and Csikszentmihalyi do, however, quite contrarily argue that it is *"[…] the subjective challenges and subjective skills,*

not objective ones, that influence the quality of a person's experience" (Nakamura, et al., 2005 p. 91). The perceived action capabilities (skills) and the perceived action opportunities (challenges) are in other words relative to the previous experiences of the individual performing the activity. Multiplication and division may seem horribly trivial to a young man in high school, but constitute a daunting, and potentially flow inducing, challenge to a small boy as they force him to operate at full capacity even though he is an apt mathematician compared to his classmates. Conversely the challenges necessary in order for the high school student to experience flow needs to be appropriate given his level of proficiency. Chen presents a similar description of the conditions under which novice and expert players experience flow (Chen, 2007 p. 33); however his figure paints a very different picture as it indicates that a very proficient player does not operate at full capacity when experiencing flow.

3.2.4 Flow and Good Gameplay

Throughout the preceding pages flow has been described as the subjective state arising when an individual performs an activity of interest where the perceived challenges correspond to the perceived skills of said individual. The subjective state itself is characterized by intense and focused attention, merging of action and awareness, the loss of self-consciousness, a sense of control, distortion of temporal experience, and finally the experience of the activity as being intrinsically rewarding. This does by implication make the experience of flow enjoyable and gameplay involving flow may consequently be considered as good gameplay. However, does this mean that we should regard flow as prerequisite for good gameplay and it is necessary for the player to be in a state of flow for the entire duration of experience?

As it happens we do not simply have to resort to speculations when attempting to answer this question as Nakamura and Csikszentmihalyi provide evidence suggesting that flow is not the only subjective state, which may be experienced as enjoyable. To be more exact, the two authors describe a study in which it was investigated how the balance between challenges and skills of various performed activities relate to the experience of concentration, importance of future goals, self-esteem, enjoyment, and the wish to be doing the activity. All five variables were in average above the personal mean when the participants experienced high level challenges and skills (the flow quadrant of the right graph in Figure 17). However, in relation to low challenge high

skill scenarios (the relaxation quadrant) the average ratings of both enjoyment and wish to be doing the activity were even higher (Nakamura, et al., 2005 p. 97). Interestingly this suggests that for some individuals flow need not be a prerequisite for a positive experience and one may similarly interpret it as an indication that gameplay devoid of flow need not be necessarily bad gameplay. Moreover it does seem possible to imagine instances where a player may wish to continue playing even if his or her skills greatly exceed the ones necessary in order to tackle the challenges at hand. One such instance could be a scenario where the player experiences a strong sense of narrative immersion, which is neither too scary nor trivial. The study described by Nakamura and Csikszentmihalyi did, however, yield quite different results in relation to activities where the participants were facing difficult challenges without the sufficient level of skill (the anxiety quadrant). That is, enjoyment and wish to be doing the activity were on the low, while concentration and importance for future goals were high (Nakamura, et al., 2005 p. 97). However, one may argue that this does not necessarily mean that moments, or even prolonged periods, of anxiety, entail bad gameplay as long as the reward makes the frustration worth the while.

Moreover it would seem that Chen's claim that one should strive to design games so that the player experiences being in a state of flow for the entire duration of the experience is somewhat erroneous. It is in all probability desirable that the player to some extent experiences flow, but it seems less likely that he or she needs to be in a state of constant flow in order for the gameplay experience to qualify as good. Being in the state of relaxation could as argued in itself be enjoyable and anxiety need not ruin the experience as long as some progression is made and the ensuing payoff is sufficiently big.

So if we labor under the assumption that these claims are true it would seem that flow by no means is equatable with good gameplay. The experience of flow may result in good gameplay, but a good experience, which is intrinsically motivated, may just as well result from activities where the dynamic equilibrium of challenges and skills is not maintained.

3.3 The Experience of Engagement

Earlier it was described that immersion is a metaphorical term derived from the physical experience of being submerged in water and the term Flow may similarly spur images of being carried by a stream of water, neither still nor cascading, but steadily *flowing*. The term engagement, on the other hand, is likely to bring about a series of very different associations as it commonly is used to describe the *"[…] formal agreement to get married"* (Oxford Dictionaries, 2009). Even though the term probably never was intended to bring about such imagery these do seem to capture the essence of what it means to experience engagement, namely the willing and continued commitment to the act of playing the game. A commitment which reportedly can become so strong that it, like some marriages, is till death does them apart as was the case in 2005 where ten South Korean gamers died from blood clots caused by the absence of physical movement for an extended period of time (Brown, 2009 p. 177).

Figure 19 – Left: Couple experiencing the result of engagement (Adapted from (Bowman, 2009)). Right: Two boys experiencing engagement (Adapted from (gameinmind.com, 2009))

In continuation hereof it is worth referring to McMahan who describes that very intense engagement may cause players to become almost obsessed with the act of playing. This degree of engagement is tantamount to what Jeremy Bentham refers to as deep play which is *"[...] a state of mind in which users would enter into games almost irrationally, even though the stakes were so high it was pointless for them to engage in them at all"* (McMahan, 2003 p. 69). More generally McMahan defines engagement as the player's involvement with the game on a non-diegetic level. That is, *"[...] the level of gaining points, devising a winning (or at least a spectacular) strategy, and showing off their prowess to other*

players during the game and afterward, during replay" (McMahan, 2003 p. 69). Recall that McMahan previously was cited for claiming that one should distinguish between immersion on a diegetic and a non-diegetic level – the latter being closely tied to her definition of engagement.

Brown and Cairns similarly use the term to describe the player's involvement with the game, albeit in a somewhat different manner. The two authors view immersion as an expression of player involvement, which can be divided into the three distinct levels: engagement, engrossment and total immersion (Brown, et al., 2004 p. 1298). Within this hierarchy engagement constitutes the lowest level of involvement because it results from the initial interest and effort of the player as well as the experience of accessible controls and appropriate feedback. If these conditions are met the player will experience the desire to continue playing (Brown, et al., 2004 p. 1298).

Following engagement is the state of engrossment, which is characterized by the player finding the audiovisual stimuli, the tasks, and the plot interesting. Just as importantly engrossment is associated with the experience and investment of emotions on part of the player. The experience of engrossment will to an even higher extent incite the player to continue playing (Brown, et al., 2004 p. 1299).

Finally Brown and Cairns introduce the term total immersion which they believe to be synonymous with presence. Here the term presence covers both the experience of being somewhere else (presence as transportation) and the complete detachment from reality in the sense that the game is all that matters (presence as immersion) (Brown, et al., 2004 p. 1299). Total immersion is, according to Brown and Cairns, largely the product of emphatic identification with characters and the experience of the game's atmosphere which is defined by the graphics, sounds and plot (Brown, et al., 2004 p. 1299).

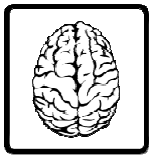
On a previous semester, one of the members of the group working on the current thesis conducted a study of a framework intended to classify and describe how the state of engagement may be brought about by the experience of playing games (Nilsson, 2009). Even though the documentation of said study will form the basis for the writings presented throughout the following the reader should be aware that framework originally was introduced by Henrik Schønau-Fog and Thomas Bjørner, who both are lecturers at Aalborg University Copenhagen.

The general view of engagement forming the basis for this framework is akin to the ones outlined throughout the preceding paragraphs as the term also is used to describe the subjective state of players who wish to continue playing and subsequently revisit the experience of playing the game (Nilsson, 2009 p. 7). It does, however, differ from McMahan's conceptualization of the term in the sense that the two authors do not believe engagement to exclusively result from players' involvement with games on a non-diegetic level. The game's diegesis is in other words also considered as a variable when one is striving to determine why players willingly commit to the act of playing a particular game (Nilsson, 2009 p. 8).

The framework also sets itself apart from the one proposed by Brown and Cairns in that engagement is not viewed as a precondition for the experience of immersion or presence. Instead Schønau-Fog and Bjørner have attempted to unite existing theories pertaining to immersion, flow and presence within one unified framework. Moreover the framework has been devised with the intention of explaining how other features of gameplay, brought about by more recent developments within the industry, may lead to engaging experiences. These features include the physicality associated with alternative input devices; the possibility for creative expression through user generated content; and the socialization accompanying the mutual player interaction occurring both on- and offline (Nilsson, 2009 p. 7). The reason why the framework seemingly is sensitive to such a diverse range of gaming experiences is that it distinguishes between six different types of engagement, namely *sensory*, *physical*, *intellectual*, *social*, *dramatic*, and *emotional engagement*. Individually each of the six corresponds to a particular dimension of gameplay which may make the player willingly commit to the act of playing (Nilsson, 2009 p. 8). Brief summaries of each of six types of engagement are presented in Box 8.

Box 8 – Schønau-Fog and Bjørner's six types of engagement

Sensory engagement: The experience of engagement resulting from the player's perception of the auditory, visual or haptic stimuli provided by the game. Oftentimes associated with the experience of curiosity, suspense or fear on behalf of the player (Nilsson, 2009 pp. 9-11).

	**Physical engagement:** This form of engagement arises as a consequence of the player's interaction with the game by means of physical input devices. Related to the acquisition of skills and the joy of mastery (Nilsson, 2009 pp. 11-12).
	**Intellectual engagement:** The type of engagement resulting from the player's experience of challenges requiring the use of his or her intellect. Like physical engagement this type is related to the acquisition of skills and the joy of mastery (Nilsson, 2009 pp. 13-14).
	**Social engagement:** Social engagement may be experienced when multiple players share the gameplay experience. Oftentimes associated with competition and cooperation, or various forms of socialization with other players (Nilsson, 2009 pp. 15-16).
	**Dramatic engagement:** The experience of engagement ensuing the player's experience of singular dramatic events or the connected series of dramatic events making up the overarching narrative of the game (Nilsson, 2009 pp. 17-18).
	**Emotional engagement:** This type of engagement results from the player's experience of emotions during play. These emotions may be brought about by human players, computer controlled characters, locations, object or the story of the game (Nilsson, 2009 pp. 18-19).

Schønau-Fog and Bjørner's original description of the framework and its six constituents was, as suggested, partly informed by existing theories of immersion, presence and flow. Considering the discussions of immersion, presence and flow presented earlier it might appear as if the framework is founded on a risky premise as none of the three in isolation sufficed in terms of describing what constitutes good gameplay.

However, seeing as engagement is believed to be a highly subjective state, dependent upon the prior experiences and presupposition of the individual player, its preconditions must also include: interest on behalf of the player; risks which do not discourage said player; and the absence of emotions which are excessively unpleasant. So even though immersion, presence and flow may contribute to making an

experience engaging, the term engagement cannot be reduced to the experience of either of the three, just as good gameplay cannot be described solely in terms of immersion, presence or flow.

3.3.1 Engagement and Good Gameplay

Throughout the preceding pages, engagement has been introduced as the willing and continued commitment to the act of playing a particular game. However, the cited authors' descriptions differed in terms of what they believe to cause engagement and in regards to the intensity of the commitment they associate with the term. These differences notwithstanding, one common denominator is present, namely the belief that the experience of engagement will make the player continue playing and subsequently return for more. This does in other words imply that engaging gameplay by and large is tantamount to good gameplay as it by definition incites the player to desire more. Particularly Schønau-Fog and Bjørner's conceptualization of the term, and the associated framework, holds some promise as it seemingly is able to describe a variety of different experiences while remaining sensitive to the subtleties of the individual experience. The framework may consequently help explain why players experience the willing and continued commitment to the act of playing. This did in turn imply that the concept engagement and the framework proposed by Schønau-Fog and Bjørner seemed to be of great relevance within the context of the current project as the goal was to create a game that would make players willingly and repeatedly commit to the act of playing, and by implication the act of training. With this being said it is should be mentioned that it primarily was five of the six types of engagement which were believed to be of relevance. Seeing as the WobbleActive from the outset was intended as a device for helping individuals in need of ankle training, social engagement was not believed to be of great significance. This limitation notwithstanding, it still seemed that the objective by and large was to create a game which facilitated engaging gameplay, as this by definition is intrinsically motivating in that it incites the player to desire more gameplay.

CHAPTER 4 - DELIMITATION

This final chapter of the preliminary analysis details the delimitation performed with the purpose of determining what topics should be considered further so as to ensure that the project would progress along an advantageous path. Moreover this narrowing of the scope of the project enabled the rephrasing of the initiating problem statement page 2, into a more well-defined, addressable and testable final problem statement, which will be presented in Box 10, on page 58.

4.1.1 After a wobbling start

Throughout the first chapter of this part, the project which spurred the creation of the first WobbleActive prototype was introduced. Seeing as the initial aspiration for the current project largely remains the same, some premises forming the basis for the design of this original prototype remain pertinent, namely the relevant exercises and intended user group. That is, the exercises outlined in Box 4 page 9 are still applicable since they have not been changed since the creation of the first prototype. The potential users of the WobbleActive should similarly be identical to the ones which the current project aspires to reach, however with the addition of the individuals who perform little or no physical activity because they are slothful or otherwise unable for an extended period of time. The intended user group is consequently still made up by individuals conforming to the three criteria outlined in Box 3 page 8, that is, they have special needs they are un-motivated to perform the prescribed exercises, and they are familiar with and have access to computers.

Based on a review of the data gathered from the interviews conducted with physiotherapist Anders Heckmann, it was argued that individuals' failure to successfully complete ankle training and rehabilitation processes presumably can be ascribed to the insufficient or complete absence of extrinsic motivation. This problem can be seemingly lessened by leveraging games' potential as a source of intrinsic motivation. Even though the first WobbleActive prototype did constitute a step in the right direction, little explicit effort was made to foster this form of motivation, leaving an important question unattended: What is it about the act of playing games, which compels players to do so for no other reason than the act itself? Attempting to answer this question and using the gained knowledge to inform the future design of the WobbleActive should consequently be the goal of the current project.

4.1.2 Engaging gameplay as a source of intrinsic motivation

The body of work detailing theories pertaining to curious phenomena like gameplay, immersion, presence, flow and engagement is immense and throughout the preceding pages we have only traversed the fringe of this semantic jungle. A jungle which is steadily growing in size and density as scholars coin new terms, redefine existing ones, and dedicate publication after publication to the description of these endeavors. This is all very well and the numerous publications on these and related topics do in all

probability lead to novel and valuable insights. However, the semantic disputes, which at times motivate these publications, do arguably provide us with little other than topics for further discussion. The discussions presented throughout chapters 2 and 3 are not explicitly intended as a contribution to this debate, but rather as an exploration of which concepts might be of relevance when striving to design an application intended to ensure that players wish to come back for more. In order to preserve coherence and clarity throughout the remainder of the current thesis the discussed terms have been summarized in Box 9 and will be used accordingly unless otherwise specified.

Box 9 – Summary of adopted and adapted terminology
Gameplay: Everything experienced and occurring during the meeting between player and game.
Immersion: The attentional surrender on part of the player brought about by his or her involvement with the game on a diegetic or non-diegetic level.
Presence: The perceptual illusion of nonmediation in sense that the player feels transported to another location.
Flow: The subjective experience of playing a game of interest where the perceived challenges correspond to the perceived skills of said player.
Engagement: The player's willing and continued commitment to the act of playing a particular game, caused by the experience of sensory stimuli; physical or intellectual challenges; socialization, competition or cooperation; or singular or causally related dramatic events (the narrative).

Throughout the discussion on gameplay it became apparent that there neither within academia nor the industry exists a commonly agreed upon definition of the term. However, instead leading to the selection of one of the described definitions this discussion culminated with the proposition that gameplay may amount to everything emerging from the meeting between player and game. Even though this definition is rather copious in nature the distinction between player and game does seem to provide two meaningful points of departure when striving to determine what it is that incites player's to play. Moreover it is worth recalling that this definition of gameplay

neither equates gameplay with positive or negative experiences. Something, which in turn gave rise to the question of whether there exists some defining feature of the player's experiences that is symptomatic of good gameplay.

This question was addressed throughout the discussion of immersion, presence, flow and engagement, which arrived at the conclusion that the experience of engagement seemingly was tantamount to good gameplay. It is, however, important to recall that this did not imply that good gameplay cannot be accompanied by the experience of immersion, presence or flow. The argument was rather that neither the experience of immersion or presence ensures good gameplay and even though gameplay involving the experience of flow by definition must be good this does not mean that concept flow suffices in terms of describing good gameplay altogether. Contrarily engagement seemed to be of great relevance within the context of the current project as the goal was to create a game that would make players willingly and repeatedly commit to the act of playing, and by implication the act of training. Here it is worth recalling that intrinsic motivation was defined as the type of motivation that *"[…] pushes us to act freely, on our own, for the sake of it"* (Denis, et al., 2005 p. 1) which implies that engaging gameplay must be intrinsically motivating. It would in other words seem that the objective of the current project by and large was to create a game that facilitated engaging gameplay, as this should incite players to desire more gameplay. However, even though Schønau-Fog and Bjørner's framework seemingly constitutes a good ground on which to build, it is by no means the Rosetta Stone which makes it possible for game designers to understand the language of good gameplay. Instead it would seem that there exists not one, but a number of stones, which need turning in order to make engaging gameplay more readily palpable to developers and academics alike. The implication for the current project was that a more detailed study of the complex relationship between player and game – gameplay – was necessary, as this might help shed some light on the processes that may make or break the experience of engagement. Considering the limited relevance of social engagement this implied that a more detailed study of how to design games facilitating the remaining five types of engagement was pertinent.

Finally the limited temporal scope of the project imposed an additional restriction. The original aspiration for the project was, as previously mentioned, to help motivate individuals to successfully complete their ankle training or rehabilitation processes

while simultaneously ensuring that they performed the correct exercises. In order to assert whether users would in fact use the prototype on a regular basis for the duration of this process, it would be necessary for the test to last for this duration as well. However, given the limited time available it was not regarded as feasible to conduct a test conforming to this requirement. Alternatively it was decided to focus solely on the evaluation of the engagement experienced during singular play sessions. Seeing as engaging gameplay by definition is intrinsically motivating and incites the player to desire more gameplay, this was believed to be an acceptable compromise. This decision, along with the various considerations described throughout the previous paragraphs, necessarily had implications for the phrasing of the final problem statement presented in Box 10 below.

Box 10 – Final problem statement

How can we, through an understanding of the complex relationship between player and game and the processes which may lead to the experience of engagement, perform the next iteration in the design of the WobbleActive so that the final prototype facilitates engaging gameplay while simultaneously ensuring correct proprioceptive ankle training?

PART II - ANALYSIS

This second part of the thesis does in general terms describe the research conducted in order to help provide an answer the question posed in the final problem statement presented in the last paragraph of the delimitation. It does in other words detail the research conducted in order to gain a better understanding of the complex relationship between player and game, and the associated processes which may lead to the experience of engagement. This understanding should in turn make it possible to perform the next iteration in the design of the WobbleActive so that the final prototype facilitates engaging gameplay while simultaneously ensuring correct proprioceptive ankle training.

The first chapter of this part does consequently detail a more elaborate, yet concise, description of Schønau-Fog and Bjørner's original framework as this should provide a more solid ground on which to base the subsequent chapters analyzing the framework's constituents in more detail. This chapter is concluded with the claim that the study of engaging gameplay will prosper from viewing this curious phenomenon from the perspective of game design and with an outset in player psychology.

In response to this claim the following chapter *Engaging by Design* presents a discussion of how the types of engagement, deemed relevant within the context of the current thesis, might be described in terms of established game design theory and principles. Moreover this chapter strives to explicate how engagement, like immersion, may be experienced both on a diegetic and a non-diegetic level.

The subsequent chapter *The Feeling of Engagement* raises an important point of criticism against the framework by claiming that it makes little or no sense to regard emotional engagement as a separate type of engagement. This critique does more specifically hinge upon the argument that emotional engagement by and large is a prerequisite for the experience of engagement altogether. With an outset in the assumption of this pervasive role of emotions the chapter subsequently strives to describe the influence of emotions on gameplay in general and engaging gameplay in particular.

Based on the writings of these three chapters the following chapter *The Cycle Of Engagement* describes an attempt at constructing a model intended to make the

concept engagement more readily palpable to game designers and academics alike. This model is more specifically founded upon the assumption that gameplay may be viewed as a cyclic exchange of information between the player and game, which under the right circumstances may be experienced as engaging.

Subsequently, the chapter *User Centered Game Design* presents a discussion of usability and playability in games leading to the conclusion that usability is a prerequisite for engaging gameplay and that engagement ultimately is an expression of a high level of playability. Moreover this chapter introduces the concept playtesting as a means of testing the game's playability, and by implication whether said game facilitates engaging gameplay. Finally, contemporary game design heuristics are investigated with the intention of aiding both the design and evaluation of the WobbleActive prototype.

Finally the short chapter *Concluding Remarks* summarizes the conclusions drawn throughout the analysis and lays the ground for the design and implementation described in the following part of the thesis.

CHAPTER 5 - THE ORIGINAL FRAMEWORK

In the light of the seeming potential of Schønau-Fog and Bjørner's framework for describing player engagement this first chapter of the analysis have been devoted to a description of said framework and its constituents, that is, sensory, physical, intellectual, social, dramatic and emotional engagement. The objective of the current chapter is more specifically to provide a more detailed, yet concise, description of each type of engagement. It is the belief that a better understanding of the six, and their interrelation, should help provide a more solid ground on which to base the subsequent chapters, subjecting the concept engagement to further scrutiny. Since the original version of Schønau-Fog and Bjørner's framework largely was informed by existing theories pertaining to immersion, flow and similar concepts the following section presents a brief description of how the concept engagement might relate to these. Finally the chapter is concluded with the claim that the study of engaging gameplay may prosper from viewing this curious phenomenon from the perspective of game design and with an outset in player psychology.

5.1 A Fabric of Intertwined Threads

Before proceeding with a description of the six types of engagement forming the basis for Schønau-Fog and Bjørner's framework for classifying and describing player engagement with games one note should be made regarding the relationship between these. The six types of engagement should more specifically by no means be seen as mutually exclusive and may coexist while individually being more or less constituent to the general experience of engagement. (Nilsson, 2009 p. 8).

So, instead of regarding the six types of engagement as separable types of engagement it seems more prudent to view them as interwoven threads, together making up the fabric of engaging gameplay and if one or more threads are missing from the fabric the remaining ones remain intertwined. So, all six types of engagement may be experienced simultaneously albeit this is not a prerequisite for an overall experience of engagement (Nilsson, 2009 p. 9). With the interdependence of the six types of engagement outlined, the following subsections detail concise descriptions of each of the six types of engagement; sensory, physical, intellectual, social, dramatic and emotional engagement. Even though social engagement as suggested on the preliminary analysis was of no immediate relevance to the current project a description of this type has been included so as to give the reader a more complete picture of the framework in its entirety.

Figure 20 – Schønau-Fog and Bjørner's six types of engagement: sensory, physical, intellectual, social, dramatic and emotional engagement (All images are adapted from (flickr.com)).

5.1.1 Sensory engagement

Readers who as children have visited an aquarium will probably have little difficulty recalling the experience of starring through the glass of a fish tank, completely mesmerized by what one was seeing. Walking along the glass exploring what was hidden behind the corals or simply standing still while watching as new fish revealed themselves. An engaging experience fuelled by the sheer fascination and joy of witnessing something unpredictable unfolding (Nilsson, 2009 p. 9).

The state of engagement, a child may enter while curiously looking through the glass of a fish tank, is in many regards analogous to sensory engagement as this form of engagement is brought about by the player's experience of the auditory, visual or haptic stimuli provided by the game. This does, however, not mean that any stimuli will give rise to sensory engagement as this would make all games sensorially engaging. Instead the experience of sensory engagement results from the player's desire to experience more and discover what stimuli will be provided next. Regardless of whether this desire manifests itself in the form of e.g. wonder, curiosity, anticipation or suspense it will incite the player to further explore and experience the virtual world and characters which inhabit it (Nilsson, 2009 p. 9). This does in turn imply that sensory engagement first and foremost is the product of the mediated content as opposed to degree of perceptual realism or the fidelity of the auditory, visual or haptic displays (Nilsson, 2009 pp. 10-11). With this being said it does seem reasonable to assume that the level of perceptual realism and the fidelity of the displays may be a factor in the experience of engagement for some players.

5.1.2 Physical engagement

The experience of physical engagement is perhaps easiest exemplified by reference to an instance of "real-life gameplay", namely that which occurs during a soccer match. Even though novice soccer players, such as children, may find it challenging to practice passes and shots – essentially perfecting their motor skills – the general experience may very well be engaging if the hard work is rewarded by an increase in proficiency. So instead of constituting negative features of the gameplay, the challenges may help making the experience engaging rather than tedious.

Physical engagement brought about by digital gameplay is similarly associated with the player's physical activity while playing a particular game, that is, his or her physical actions and reactions. The player exerts his or her influence on the game through physical actions which have correlates in the virtual world and thereby influence this world. Virtual events do then in turn cause physical responses on behalf of the player, thus creating a feedback loop between the player and the game. As was the case with sensory engagement this does not imply that all physical actions entail physical engagement (Nilsson, 2009 p. 11).

Schønau-Fog and Bjørner distinguish between two distinct, but closely related activities, which may give rise to physical engagement. Firstly, the player might find the process of perfecting his physical interaction with the game controller engaging; and secondly he or she may become engaged as consequence of the joy derived from the effortless interaction accompanying a high level of proficiency (Nilsson, 2009 p. 12). These two causes of physical engagement may arguably be experienced regardless of what type of input device the player uses to exert his or her influence on the game. It would, however, seem that there exists a third cause of physical engagement, namely the sheer physicality of the interaction associated with input devises like the Wii remote and nunchuk where there is a higher level of congruence between the player's physical actions and their virtual correlates (Nilsson, 2009 p. 12). This claim can arguably be substantiated by referring to the concept *body or movement play,* which Dr. Stuart Brown humorously defines as *"[...] the spontaneous desire to get ourselves out of gravity"* (Brown, 2008). Common to all three causes of physical engagement is that they entail a desire to continue playing either due to the aspiration to improve, the joy of mastery or simply the pleasure of going off the rails physically.

5.1.3 Intellectual engagement

Intellectual engagement does in general terms refer to the type of engagement the player may experience as a result of performing tasks involving higher levels of cognition. Schønau-Fog and Bjørner do more specifically distinguish between two different, but closely related activities, which may require mental acuity on behalf of the player. That is, solving challenges which require the use of one's intellect, and the ability to creatively express oneself throughout the gaming experience.

Intellectual challenges will oftentimes be related to strategic thinking or logical problem solving which, like physical engagement, may be experienced as engaging due to the joy of progressively improving or the feeling of being highly proficient. Two examples of games which may give rise to the experience of intellectual engagement are chess or digital real-time strategy games as players in both cases may find the strategic thinking, such as predicting the actions of one's opponent, intellectually engaging (Nilsson, 2009 p. 12).

The second feature of the gaming experience which may evoke a sense of intellectual engagement was as suggested the player's ability to creatively express him or herself through the gameplay. This form of engagement is arguably analogous to the engagement experienced by the child building a castle of sand on the beach. The child may take pleasure in the sheer process of creation as well as the subsequent praise which he or she may receive from parents and friends. Acts of creativity during digital gameplay may similarly cause the player to become engaged due to the sheer joy of the creative process, the ability to leave a unique mark on the virtual world, or the subsequent display of one's creations to "real-life" and online friends (Nilsson, 2009 pp. 13-14).

5.1.4 Social engagement

The joy derived from sharing one's contributions to virtual worlds with "real-life" and online friends does also relate to the experience of social engagement. This form of engagement is, as the name suggests, associated with the experience of playing while other players partake in the game. Here it is worth noting that social engagement equally well may result from mutual player interaction where the players are physically present at the same location or instances where the players are represented virtually via avatars and the communication occurs by means of instant messaging or voice chat (Nilsson, 2009 p. 15). Schønau-Fog and Bjørner highlight two forms of mutual player interaction which are likely to entail social engagement, namely competition and cooperation, which evidently may occur simultaneously. Competition and cooperation are, however, far from the only causes of social engagement as the desire for fame and infamy; the yearning for acceptance from one's peers; the sense of belonging to a collective or community; and the sheer joy of

sharing experiences also may incite the player to willingly commit to the act of playing (Nilsson, 2009 p. 16).

5.1.5 Dramatic engagement

Dramatic engagement relates to the experience of either singular dramatic events or the causally related string of dramatic events making up the overarching narrative of the game. Here a singular dramatic event would correspond to a situation involving a substantial risk which forces the player to operate at full capacity (Nilsson, 2009 p. 17). Such challenges may be pivotal to the unfolding narrative of the game but may lead to engagement in isolation due to the uncertainty of their outcome as well as the desire to know what successful completion might lead to.

The engagement caused by the general narrative of the game is similarly the result of the player's desire for disclosure and is consequently oftentimes associated with the experience of suspense and surprise. Seeing as the characters inhabiting the games diegesis may function as catalysts for the dramatic events making up the narrative's plot these do also contribute to the experience of dramatic engagement (Nilsson, 2009 p. 18).

5.1.6 Emotional engagement

The sixth and final type of engagement relates to how the experience of emotions during play may lead to an engaging experience. Schønau-Fog and Bjørner more specifically describe that the experienced emotions equally well may be evoked by other human players, computer controlled characters, locations, objects, singular events or the overarching narrative of the game (Nilsson, 2009 pp. 18-19). This does in turn imply that emotional engagement is irrevocably tied to the remaining types of engagement, as the experience of emotions to some extent is the defining feature of all five, without exception. Put even more bluntly, the experience of some level of emotional engagement seems to be a prerequisite for the experience of engagement altogether. So, if the remaining five types of engagement are analogous to interwoven threads, together making up the fabric of the gaming experience, emotional engagement is perhaps best described as the seam holding together this fabric (Nilsson, 2009 p. 19).

5.2 An Aside on the Theoretical Underpinnings of the Framework

The theory of the six types of engagement was, as suggested in the preliminary analysis, largely informed by existing theories pertaining to immersion, flow and similar concepts. Consequently it seems prudent to take a moment to consider how engagement might be related to the concepts discussed throughout the preliminary analysis. However, since a discussion of the interrelation between the individual types of engagement and the various different forms of immersion, presence and flow would become rather lengthy the current section solely discusses the more general relation between the concepts. An overview of how each of the six types of engagement relate to the above mentioned concepts can be found in Table 1 below.

Engagement type:	**Relatable Concepts:**
Sensory engagement	Spatial immersion, sensory immersion, presence as realism and presence as transportation ("you are there" and "it is here")
Physical engagement	Challenge-based immersion, tactical immersion and flow
Intellectual engagement	Challenge-based immersion, strategic immersion and flow
Social engagement	Presence as social richness and presence as transportation ("we are together")
Dramatic engagement	All three forms of narrative immersion, that is, spatial, temporal and emotional immersion
Emotional engagement	Emotional engagement is in some capacity relatable to all of the above

Table 1 - The six types of engagement and relatable concepts. It is important to stress that the terms are relatable and *not* interchangeable.

Recall from the delimitation of the preliminary analysis, that engagement within the context of the current thesis is defined as the player's willing and continued commitment to the act of playing a particular game, caused by his or her experience of sensory stimuli; physical or intellectual challenges; socialization, competition or cooperation; or singular or causally related dramatic events (the narrative). Immersion

was contrarily defined as the attentional surrender on part of the player brought about by his or her involvement with the game on a diegetic or non-diegetic level. Finally, flow in relation to games was defined as the subjective experience of playing a game of interest where the perceived challenges correspond to the perceived skills of said player. However, despite the fact that Schønau-Fog and Bjørner based their description of engagement on theories of immersion and flow it is important to stress that these concepts do not describe the same subjective state. Instead it is perhaps more prudent to view immersion as a sign of the willing commitment to the act of playing, which is part and parcel to the experience of engagement. Here it is worth recalling that immersion arguably also is indicative of the experience of flow, since one of the characteristics of the flow state, as previously described, is *"[i]ntense and focused concentration on what one is doing in the present moment"* (Nakamura, et al., 2005 p. 91). This does as implied by no means entail that engagement and immersion are 'two birds of a feather' since immersion solely describes the degree of attentional commitment on behalf of the player and not whether this commitment is willing or will be continued. Conversely, if an activity leads to the experience of flow it will almost certainly also be experienced as engaging since *"[…] flow encourages a person to persist and return to an activity"* (Nakamura, et al., 2005 pp. 95-96). However, this does mean that the concept flow always will be involved in engaging experiences as intrinsic motivation, and by implication engagement, just as well may arise from activities where the dynamic equilibrium of challenges and skills is disturbed. Moreover flow does not account for the pleasures derived from experiencing an engaging narrative. To summarize, it would seem that experiences qualifying as engaging form a subset of a wider range of immersive experiences, just as experiences involving flow presumably make up a subset of the ones involving engagement.

5.3 Two Perspectives on Engaging Gameplay

Even though the term engagement might not be used consistently within neither academia nor the game industry there seems to exist little doubt that members of the latter have been able to produce games facilitating such experiences since the dawn of digital games. Consequently it seems reasonable to assume that the study of engagement might benefit as much from the insights of game designers as it will from the knowledge accrued by scholars studying games and other hedonic activities. That is to say, gameplay should be studied both from the perspective of game design and

from the perspective of the player. Notably, these two perspectives on gameplay also form the basis for Hunicke, LeBlanc and Zube's formal approach to game design, dubbed the *MDA framework* (Hunicke, et al., 2004 p. 1). Here MDA is an acronym for the three components, or layers, of game consumption *Mechanics*, *Dynamics* and *Aesthetics*, which form the bearing pillars of their framework (Hunicke, et al., 2004 p. 2). Hunicke et al. provide the following description of how the three components of game consumption relate to the distinction between the perspective of the game designer and the player:

> *"Each component of the MDA framework can be thought of as a "lens" or a "view" of the game – separate, but causally linked. […] From the designer's perspective the mechanics give rise to dynamic system behavior, which in turn leads to aesthetic experience. From the player's perspective, aesthetics set the tone, which is born out in observable dynamics and eventually, operable mechanics. […] it helps us observe how even small changes in one layer cascade into others." (Hunicke, et al., 2004 pp. 2-3)*

Box 6 below, details a graphical representation of this interrelation along with the three authors' general description of the three components of game consumption, Mechanics, Dynamics and Aesthetics.

Box 11 – Hunicke, LeBlanc and Zube's MDA Framework

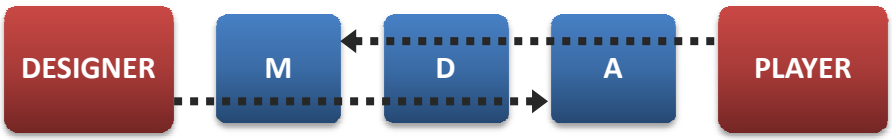


Figure 21 – Illustration of the two perspectives on gameplay (Adapted from of (Hunicke, et al., 2004 p. 2))

- **Mechanics:** "Mechanics describes the particular components of the game, at the level of data representation and algorithms."
- **Dynamics:** "Dynamics describes the run-time behavior of the mechanics acting on player inputs and each other's outputs over time."
- **Aesthetics:** "Aesthetics describes the desirable emotional responses evoked in the player, when she interacts with the game system."

(Hunicke, et al., 2004 p. 2)

It is worth noting that Hunicke et al. describe the player's experience of gameplay in terms of his or her emotional responses to the game system, as this lends some credence to the claim that engagement largely is depended on the experience of emotional engagement. Perhaps just as interestingly, the three authors use a particular taxonomy for describing game aesthetics, which bears semblance with the types of engagement used within the context of the current project. The employed terms do more specifically include, but are not limited to: Sensation (*"games as sense-pleasure"*), Narrative (*"games as drama"*), Challenge (*"games as obstacle course"*), Fellowship (*"games as social framework"*), and Discovery (*"games as uncharted territory"*) (Hunicke, et al., 2004 p. 2). In the light hereof, the following chapter ties relevant game design principles to the theory of engagement. It is, however worth noting that this chapter exclusively will discuss sensory, physical, intellectual and dramatic engagement, thus implying that neither social nor emotional engagement will be subjected to any explicit scrutiny. The former has been excluded from this discussion on grounds that social engagement, as described in delimitation, has limited relevance for the current project. The pervasive nature of emotions in gameplay will on the other hand be discussed in detail, albeit in the third chapter of this part of the thesis.

CHAPTER 6 - ENGAGING BY DESIGN

In the previous chapter the original version of Schønau-Fog and Bjørner's framework for classifying and describing engagement with games was presented and explained, along with the distinction respectively between engagement in gameplay from a game design and subsequently from a player perspective. The following chapter examines how the framework's constituents, sensory, dramatic, physical and intellectual engagement can be achieved through various game design components. This view on engagement is motivated by the need to outline the practical applications of the engagement theory, so as to create a linkage between theory and practice.

6.1 Dramatic Engagement through Game Design

Dramatic engagement can rise from a continuum of linked narrative events or from singular isolated occurrences and this leads to a possible division between dramatic engagement as both a diegetic and non-diegetic element. Firstly, we have the events that are associated with one another through a coherent narrative that forms the game's story or plot. Secondly, there is the question of independent occurrences that challenges the player through a dramatic confrontation. The reason these can be viewed as separate components of dramatic engagement lies in their nature as diegetic and non-diegetic facet, which will be explained in the following. If we focus on a game's storyline as part of several connected dramatic events that are pre-designed to ensure that a certain storyline can be told, and specifically connect dramatic events activated, we often deal with conflicts that challenges the player and forces him to overcome said conflicts. Nevertheless, the effect of success results in diegetic progression of the game's narrative. This may be as simple as slaying a malicious troll resulting in the player's avatar marrying the saved princess or getting that nifty new armor the town's people promised you for freeing them from the menace. However, it can also be more complicated and take several twists and turns that challenges the player's comprehension of the game world's diegesis e.g. as seen in 2K Games' Bioshock (2KGames, 2007) where the player suddenly becomes acutely aware that all 'good' deeds he or she has performed throughout the game, has been done on behalf of the game's villain Fontaine.

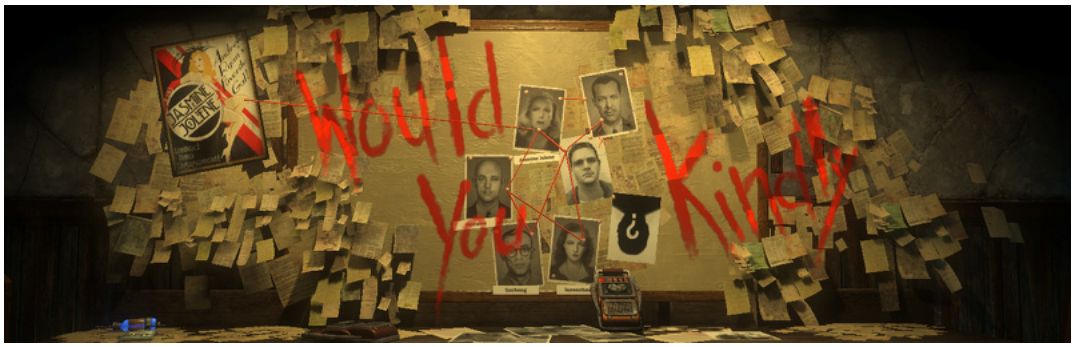


Figure 22 – Screenshot from 2K Games' Bioshock from 2007. The phrase '*would you kindly...*" was used throughout the game by the villain Fontaine, disguised as a loving family father Atlas and as a mental command that forced the player's avatar, Jack, to perform specific deeds. The player was not given a choice in the matter, but late in the game it becomes apparent that all the good intentions of the previously performed actions were but a link in Fontaine's plan to take over the underwater city of Rapture (image adapted from (Wikia Gaming)).

If we view pre-designed storylines as means of achieving dramatic engagement, there exist several methods usable to the game designers. However, it should firstly be mentioned in regards to this thesis' definition of gameplay, that storyline/plot falls within the boundaries of said term, since it is part of the gameplay experience. Conversely, this is not a common presupposition in game design terminology, where the topic seemingly forms a schism that divides the game design community. This is important to mention because in certain instances a game's narrative is viewed as an equal force to its gameplay that competes over the player's attention. Nonetheless, even authorities that present this view often agree that the narrative can be viewed as "everything" within the game experience (Lindley, 2003 p. 2). This comes tantalizing close to the view of gameplay adopted within the context of the current thesis and it does thus not seem farfetched to view it as part of the gameplay term. This is mentioned because we have tied the question of good gameplay to that of an engaging experience. When we further use Schønau-Fog and Bjørner's framework and its six constituents – the six types of engagement – it then becomes important to remember that these form a part of an integrated wholesome experience. Thus, it makes little sense to view a game's narrative as an opposing element to gameplay since it oftentimes is part and parcel to the player's experience of said game. Jesse Schell perhaps outlines this best by stating that "*story and gameplay are one*" and the question is rather that how probable it is that the player follows the intended narrative structure (Schell, 2005 p. 1). The game designer Richard Rouse III states that "*strictly speaking, computer games do not need to tell stories*" (Rouse III, 2005) and mentions a game like Tetris as a prime example of how the narrative structure can be almost non-existent. However, since we distinguish between a diegetic and non-diegetic level, it should be mentioned that Rouse's argument points at the diegesis of a game's narrative, but the player can still create narratives at a non-diegetic level though sheer imagination. Whether this is possible in a game like Tetris will remain for the reader to contemplate and we will return to the question of non-diegetic narratives as a dramatic engagement form later in this section. For now we follow Rouse's further argument that games like Command & Conquer and Thief etc. are games that make the narrative "*work as a key part of the gameplay*" (Rouse III, 2005). Additionally, the game designers Adams and Rolling argue that even though there is a wide theoretical debate on the subject of narratives in computer games the principle should be to include story only "*if you believe it will help to entertain the player*" (Adams, et al., 2006 p. 157).

When game designers, in their publications on game design, entitle their chapter "storyline" or "narrative" they often deal with a game's story, and the structure of same, in a diegetic sense. Adams describes that *"[…] game designers add stories to enhance a game's entertainment value, to keep the player interested in a long game, and to help sell the game to prospective customers*" (Adams, et al., 2006 p. 155). Leaving the costumer issue aside, it relates well to the core of why engagement is central to this project and consequently to how the users are motivated to perform proprioceptive training on the wobble board through continuous play.

To understand dramatic engagement on a diegetic level it is useful to make it more tangible by understanding the guiding principles and methods of game designers when it comes to interactive narratives in games.

In Ernest Adams' mind, the tension between gameplay and narrative is a balancing act that compares well with the previously mentioned view of an equal separation between the two elements. However, as we outlined, this separation does not make sense in our understanding of the term gameplay, but the schism points towards a fundamental difficulty within interactive narratives in games, which Schell as previously mentioned narrows down to a question of probability (Schell, 2005 p. 1). Since computer games are dependent on the actions of a player the question then becomes how probable it is that the player follows the designed storylines and more specifically, follows it in the intended order. In most computer games, both classics and contemporary bestsellers, this problem of free-minded players will have rather unfortunate consequences for the storylines. Here is referred to games that borrow from books and films where fixed dramatic curves are narrated through the game's design. Whether it is the Hero's Journey or the classic 3-act-structure, these elements may function well in Hollywood films, but in some cases this focus on story hampers the interactivity of the gameplay. In the already-mentioned 'Brothers in Arms – Hell's Highway' we see an example of forced gameplay as a result of a dominated storyline.

However, this kind of linear storyline is not necessarily a negative aspect of a game, though it has become more of a focus area within the later years, it can be done with success. Lately we have seen such games as 'Call of Duty – Modern Warfare 2', 'Dead Space', 'Splintered Cell – Conviction' and many more, that leave little or no choice

for the player in terms of storyline. Here the player either follows the linear pre-designed story or fails the game.

Nevertheless, all the games have received high marks by critics and player communities alike - some of them even for their storyline though it suffers from the mentioned linearity. This suggests that linear storyline games are necessarily a bad thing and even though the game design community have seen development within this aspect in the later years with e.g. 'Heavy Rain' it is somewhat of a sole flyer so far.

Figure 23 - Heavy Rain offers a unique storyline that allows the player to affect both the game's progression and the ultimate ending of it by his gameplay choices. It is however, not necessarily a must to create successful stories in games. Linear games allow for engaging story narration that can affect the player's dramatic engagement (image adapted from (Bitter Balcony.com)**).**

Adams and Rollings, sum up this dilemma by stating that *"[…] the goal is to make the player feel as if he is in a story of his own telling. When a designer takes over too much of the telling, the player feels as he's being lead by the nose"* (Rollings, et al., 2003 p. 114). When viewing both linear and interactive storylines from a dramatic engagement perspective it relates to the player's need for disclosure. As in films, if the story is dull or otherwise not interesting it is quite possibly not viewed to the end. The same is the case for games where the player can simply quit the game and put it on the shelf indefinitely. Many films shine by providing their audience with interesting stories and beautiful cinematic events, however, computer games have interactivity to consider as well. Forgetting this aspect will presumably result in a loss of dramatic engagement, since the in-game events under such circumstances do not seem influenced by the player's actions. The game designer Chris Crawford is one of the most adamant critics of the game designer community's failure to implement narratives in games. Crawford boldly claims that stories are often something that is added almost as an afterthought at the end of the design phase (Crawford, 2004 pp. 135-36). His argument warns

against the tendency to ignore storytelling in game design. However, Crawford's opinion might easily lead to the conclusion that a coherent narrative is fundamental to the development of any game, especially if one aspires to create a game that fosters a high level of dramatic engagement. This seems to be the case when viewing dramatic engagement from the point of a game's diegesis, however, as outlined in the beginning of this section there is also the possibility of achieving dramatic engagement from singular events in the game, that is, events that are not connected by a pre-defined coherent narrative.

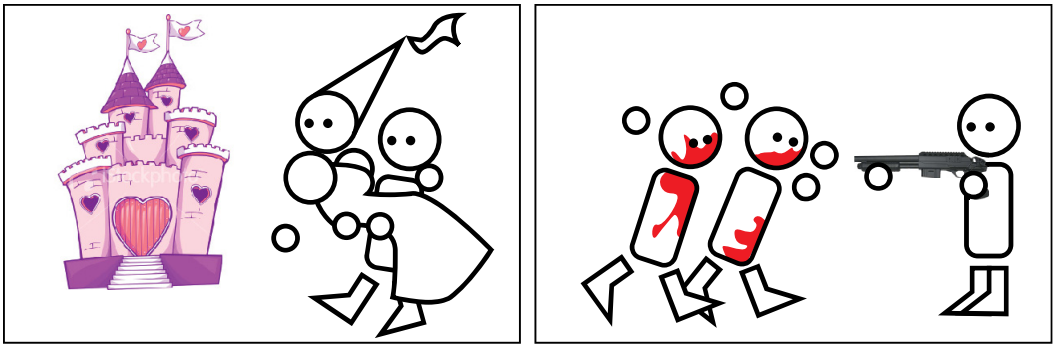


Figure 24 – Dramatic engagement can be viewed as diegetic (left frame), being a result of a coherent narrative or as non-diegetic (right frame), being a result of singular or independent in-game events that are not dominated by the game's narrative, but still creates a dramatic tension.

If we study a game such as *Left 4 Dead*, an apocalyptic zombie-survival shooter, we see an example of a highly successful game that contains a very primitive narrative: battle hordes of zombies in order to get to safety. So a storyline is present, but only in a very shallow form. Referring back to Rouse's statement that games does not really need stories, but at the same time remembering that stories are often viewed as an 'everything' component it helps to understand it from a non-diegetic point of view as well. Even if games like *Left 4 Dead* (and its sequel) contain stories and a semi-coherent narrative it does to a large extend give rise to engagement due to the player's experience of the game on a non-diegetic level.

Dramatic engagement at a non-diegetic level arises as a consequence of the player's experience of singular dramatic events that need not be explicitly connected to the overarching narrative of the game. To exemplify, *Left 4 Dead* facilitates the frequent experience of dramatic events in the form of challenges involving high risks and a substantial test of the player's skills. A concrete example could be when the players

have low health, little ammunition while the AI director simultaneously unleashes a large number of zombies on the player. This may result in a dramatic event that is experienced as engaging, mostly on a non-diegetic level, since the specific events does not rely on a continuous narrative connection.

Figure 25 – The game 'Left 4 Dead' contains almost no plot and this often allows for non-diegetic events to unfold that pushes the player's abilities to the limit, which in turn can result in dramatic engagement (image adapted from (co-optimus.com)).

Left 4 Dead might be a double-edged sword when speaking of dramatic engagement since it plays with the boundaries between diegetic and non-diegetic dramatic engagement. The reason lies in the game's weak narrative that often challenges the players between narrative progression points, for instance, the challenges faced from encountering hordes of zombies as you progress through the levels, but the story elements only come into play at specific points – often through specific challenges. It can then be argued that between narrative events in a game it is then possible to encounter challenges that function on a non-diegetic level, simply because they are so loosely associated with the game's narrative progression that the events impact the player's own ability to enjoy the challenge as a separate component from the overall plot. Other examples of dramatic engagement are perhaps better illustrated in team-death-match-shooters e.g. Quake and Unreal Tournament. Here the gameplay contains no story whatsoever, but facilitates continuous dramatic events as a result of the players' actions. However, 'Left 4 Dead' is a prime example of how a game can play with the boundaries for dramatic engagement in terms of its diegesis. What is important to remember from this discussion is that dramatic engagement is not strictly speaking dependent on an extensive coherent narrative, but can be achieved by dramatic – being challenging and skill-dependent – situations in the game.

6.2 Sensory Engagement through Game Design

As described in the previous chapter, sensory engagement relies on three different sensory inputs; being visual, auditory and haptic. Firstly, the use of haptic feedback is not something that will be utilized in this study, since haptic feedback comes from such things as force feedback in other game controllers. The interesting aspect of sensory engagement, in term of this project, lies in the visual and auditory elements that can be used in a game's design to facilitate an engaging experience. As outlined in Schønau-Fog and Bjørner's framework, sensory engagement relies on the ability of these factors to create a sense of curiosity that leads to the desire to explore the game's environment further (Nilsson, 2009), which serves to prolong the time players spend with the game. Since the ultimate goal for this project's game design is to ensure that the user's of the wobble board keep playing the game, it is an engagement type that seems prudent to take into consideration.

There are some that claim that the audiovisual stimuli presented in computer games are not strictly the most important aspect. E.g. in regards to a game's immersive qualities, the previously quoted McMahan, states that a game's visual environment contains immersive qualities, but is not a significant factor (McMahan, 2003). A game designer like Crawford is also a strong advocate for using other elements such as narratives to create a more compelling gameplay experience. Nevertheless, since it is hard to dispute that games traditionally are mediated through audiovisual stimuli it seems foolish not to think of it as a key component of game design. Ermi and Mäyrä, states outright, that the audiovisual aspects of a game are *"[…] prerequisites for gameplay immersion and experience*" and several other theorists concur on this point (Ermi, et al., 2005 p. 4). The level designer Phil Co, author of *'Level Design for Games'* further argues that the visual appeal of a game *"[…] is a huge selling point*" (Co, 2006), which suggests that it is a key component of a game's overall appeal. Moreover, McMahan describes an interesting condition in terms of achieving immersion in games that can be linked to the audiovisual representation of a game environment. She refers to the conventions that a game must match the player's expectations (McMahan, 2003). In this day and age the continual acceleration of computer power and capacity has resulted in new opportunities and complexity in audiovisual game development, which affords an expanded quest for realism. At an increasing rate we see game

developers taking these opportunities to mind when designing their games e.g. in *ARMA II* and the recently released *Battlefield – Bad Company 2*.

Figure 26 – The quest for audiovisual realism reaches its present highpoint within the game development industry in the latest edition of the Battlefield-series entitled 'Battlefield – Bad Company 2' (image adapted from (Playstation Thevolution)).

However, even though this realism is possible with today's computers, it does not entail that realistic audiovisual representations should always be used in games. Crawford puts forward the arguments that audiovisual realism should only be implemented "*to further the gameplay by making the player's situation and options as clear as possible*" (Crawford, 2005). He further points out that realistic audiovisuals can be utilized to ensure an intrinsically pleasing experience. This may be an aspect that should be added to sensory engagement, besides that of curiosity. The feeling of enjoyment from seeing something audiovisually pleasing is another element that could result in sensory engagement. An example from the abovementioned game could be how the *destruction 2.0* system allows players to demolish buildings completely if enough firepower is utilized, which seems very enjoyable when piloting a Russian T-90 tank through an urban environment in the game.

Another aspect is also what the player comes to expect from an audiovisual realistic environment. The game designer Rouse states that "*using reality as a basis for your game has its advantages [...]. First and foremost, it provides the players with a world in which they have some idea of what actions are reasonable and which are out of the question*" (Rouse III, 2005 p. 125). So, reality as a basis could be a positive outcome that helps the player to realize his options and potentials in the game environment. If the game developers have the budget and time to create this kind of realism in games, it seems a valid option in creating an intuitive link between a game's audiovisual representation and its mechanics. Oppositely, one should also consider the consequences if there is neither

time nor budget for such a production. Crawford summarizes this by stating that "*realistic graphics must be matched by realistic behaviour; if you can't achieve the latter, ditch the former*" and he further adds that "*the cosmetic features must in some way provide the player with information that is relevant to the choices that the player must make*"(Crawford, 2005). Thus it makes sense from a game designer's point of view to understand the ramifications of the development process and limit the audiovisual display accordingly. Player expectations resulting audiovisual stimuli in the game can ease the design, since it affords a certain level of interactivity. Nevertheless, if the expectation of e.g. being able to move as in real life, because of hyper realistic audiovisual stimuli, is not met, then it may easily become an experience of frustration rather than a joy.

Figure 27 – Borderland is a game that utilizes the modern capabilities of home computers. However, the game is not dominated by a quest for realism in its audiovisual representation, but rather a comic book feel. This is just one example of hyper realism not being a fundamental prerequisite for sensory engagement in games.

One might be lead to the false conclusion that a limitation of the audiovisual elements of a game is an inevitable step towards failure in terms of engagement. Especially, if viewed in relation to the previously mentioned *Battlefield – Bad Company 2* where the audiovisuals are so much emphasized. The Founder of Games2Train, Marc Prensky points out that *"[…] as good as eye candy is or may become, it is not what great games are about. [...] it is never, by itself, a sufficient condition for a great game*" (Prensky p. 9). As can be seen from many old arcade games, such as Space Invaders and Pacman, it is possible to create highly engaging gameplay experiences, but it can then be argued that the audiovisual elements are not the type of engagement that drives these games. Nevertheless, as stated earlier in this section, the audiovisual stimuli are not to be avoided when discussing a gameplay experience and indeed can be said to be prerequisites for any engaging experience (Ermi, et al., 2005 p. 4). Realism should not be considered the only option that utilizes the computational powers of the new

home computers. The above source conducted an experiment on children with results stating that the audiovisual quality and style could have a huge importance for appeal of a game, but at the same time the aesthetics of the game environment may be very different e.g. cartoony to realism. In regards to this project's focus on engagement, and indeed sensory engagement, it is worth noting that according to Schønau-Fog and Bjørner the limited audiovisuals of a mobile phone game may also lead to sensory engagement, so extremes are not necessary in this regard (Nilsson, 2009 p. 10). As with the other engagement types presented in their framework, it helps to understand them as components of a whole – that is; the gameplay experience. Sensory engagement is rather achieved when the audiovisual stimuli of a game complements the gameplay mechanics.

To sum up, in regards to sensory engagement, it is not necessary to create a game with a hyperrealism quality, but one must be aware of the pros and cons of the choices in the game design in terms of player experience and perception. Using a realistic environment may help the player understand his limitations and possibilities in the game world, but on the other hand he can get frustrated by the lack of unavailable options. Graphic appeal has a large role to play in regards to player motivation and engaging gameplay experience, but there are facets and nuances that each graphic representation offers.

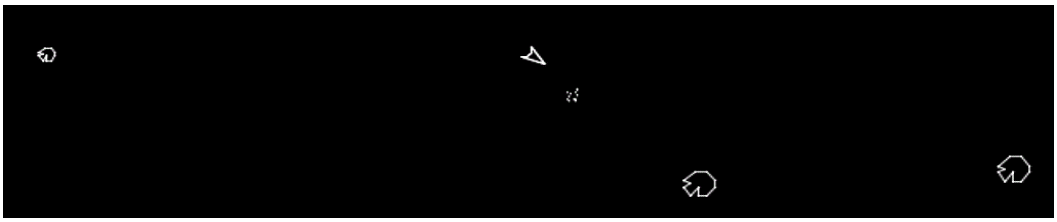


Figure 28 – abstract game environments like Asteroids can also function at a sensory engagement level through simulated emotional reality (image adapted from (thocp.net)).

Alternative, one can create what Crawford refers to as a *metaphorical* aspect of play, where both gameplay mechanics and audiovisual stimuli, thus sensory engagement, is crafted as abstract representations of emotional reality (Crawford, 2005). In plain terms this involves the design of games that mimic the challenges and experiences of real life, but is represented through an abstract game environment e.g. Pacman, Space Invaders and Asteroids etc.

6.3 Challenged-based Engagement Principles

In this section we will be looking at the correlation between physical and intellectual engagement on one side and game design on the other. As with the previous chapters on the individual engagement elements, the emphasis is on understanding the game design methodology in the scope of engagement principles. As physical and intellectual engagement has been outlined in the previous section, it is evident that both types rely on challenges of various types. Therefore, it seems prudent to deal with both engagement types in a chapter that focuses on challenge design in games. Generally, challenges are fundamental to game design and thus the gameplay experience (Crawford, 2005). However, it involves several aspects such as player, skills and last, but not least, the game environment where challenges are made manifested through props and other elements. This division is borrowed from game developer Daniel Cook's framework for skill atoms, which will be discussed later in this section. Furthermore, the player element will be discussed partially in this section of the thesis, but primarily later when discussing emotional engagement. Skills and player environment are however elements that can be tied directly to specific game mechanics and thus deserves as a more influential aspect in this section.

Figure 29 – Challenges can be divided into (from left to right) 'player', 'skill' and 'game environment' (images adapted from (flickr.com)).

There are several ways to go about creating challenges in a game, but the previously mentioned game designer Chris Crawford boils it down to a question of skill usage. He writes that *"[…] every challenge forces us to bring to bear some combination of skills"* (Crawford, 2005). He makes the argument that very few recreational challenges rely purely on physical strength, but also on mental or cognitive strength and perception, which is also the case when playing a game. He further makes an attempt at dividing the challenges that a player can be presented for in a game environment so as to help

structuralize these 'myriad of ways' challenges can be constructed. This challenge division is listed in the table below:

1. Cerebellar Challenges: High-level brain decision-making that breaks down commands into muscle reactions.
2. Sensorimotor Challenges: The ability to integrate visual information with motor responses.
3. Spatial Reasoning: Being able to visualize and manipulate 2D/3D shapes and patterns.
4. Pattern Reasoning: The ability to recognize patterns e.g. objects or enemies in a game environment.
5. Sequential Reasoning: Being able to contemplate sequences of events and actions e.g. playing chess
6. Numerical Reasoning: A special form of sequential reasoning that involves numbers at a high level
7. Resource Management: A primary function in strategy games where the player manages resources e.g. gold.
8. Social Reasoning: Need or reason to connect with other players at a social level.

Table 1 – Crawford lists the above eight challenge and reasoning types which a player can face in a game environmer (Crawford, 2005)

If we further connect Crawford's abovementioned challenge methods in games with Schønau-Fog and Bjørner's framework for engagement we start to gain an overview over the various means to affect engagement through practical design methods. It is more specifically possible to correlate Crawford's challenge and reasoning types with

physical and intellectual engagement. The correlation between the two is apparent from Box 12 below.

Box 12 – Relation between engagement types and challenge and reasoning types

Physical Engagement:	**Intellectual engagement:**
▪ Sensorimotor Challenges ▪ Spatial Reasoning	▪ Cerebellar Challenges ▪ Pattern Recognition ▪ Sequential Reasoning ▪ Numerical Reasoning ▪ Resource Management

Social reasoning has been left out from the list since it relates to social engagement, which as previously mentioned had limited relevance for the current project. However, as in the case with the engagement types it is often a question of a combined experience – meaning that it is sometimes hard to separate the various types in one experience. The same is the case with Crawford's challenge types, which can lead to a possible confusion in terms of the individual pieces' connection across to the engagement principles.

Nevertheless, if we are willing to accept this categorization we are left with a workable framework for an association between challenges and engagement. However, here we must make a caution in regards to the linkage between specific game components and human psychology i.e. the gameplay experience.

In terms of games, the normal approach has been to deal with design issues and mechanics as somewhat disconnected from the ultimate mental state of the player. This should not be understood as if there is a big gap between the game design and the eventual recipient – the player – but rather that the understanding of game design has often relied on mechanics and aesthetics (Cook, 2007 p. 3). Oppositely, new theories and models emerge that try to explain game design in terms of player enjoyment. That is, focusing on the player's mental state following a gameplay experience. We have already mentioned Ermi and Mäyrä's SCI model in the preliminary analysis, but as noted it serves little practical purpose in terms of game

design perspective. Other frameworks, such as The Experiental Framework (EMF) presented by Robert Appelman (2007) suffer from the same stigma. This problem with be discussed later in regards to player emotions as an intrinsic component of the gameplay experience. For now it is enough to understand that a player state is not viewable as a self contained logical system, but it is dominated by frail thresholds between the cognitive stages and the overall subjective perception.

Having established how challenges are connected with the two engagement types presented in this chapter, the next step is to understand how challenges function in games. This will eventually help us understand how a model for engagement design can be illustrated. As previously mentioned in regards to the components of challenges (player, skill & game environment), Daniel Cook has created a framework that outline challenges in a gameplay experience. Crook writes that *"[...] it is my belief that a highly mechanical and predictable heart, built on the foundation of basic human psychology, beats at the core of every single successful game"* (Cook, 2007 p. 1). What he refers to in this quote is that game design should be built according to the nature of the human mind. He further argues that in recent times it has started to become of interest why players react to certain stimuli. This interest can further lead to possible predictable models for pleasure and frustration on behalf of the player. Furthermore, this is a fundamental aspect of gameplay design that targets specific types of engagement. It is therefore interesting to understand how Cook himself creates a model for game interaction based on player desires. To understand the game from a player perspective, Cook constructs a 'player model' which is composed of three elements illustrated in Figure 30 below.

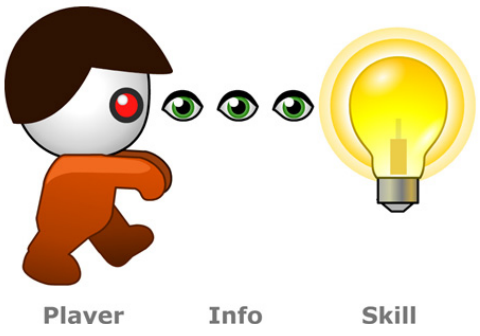


Figure 30 – Cook's player model contains three components: player, info and skill. (Cook, 2007 p. 3)

Where the player is driven by the need to learn new skills and the skill is present through the quest for or mastery by the player, the info is to be viewed as the stimuli the game presents. What Cook essentially outlines is the need for learning a skill, but it should be viewed from a challenge perspective to be fully understood. This means that though the mastery of skills can be sought by the player, it is the challenge that facilitates the need for the skill. Within the challenge lies both the player, the skill and what Cook entitles info. However, for a better understanding of what this involves, in relation to how challenges are understood throughout this thesis, 'info' is renamed 'game environment', which is a composition of the stimuli the game presents to the player.

This renaming further makes sense if we look at Cook's definition of a 'skill atom', which is a way to view the usage and mastery of skills, but at the same time focused on the understanding of said 'skill atom' from a game design perspective (Cook, 2007 p. 4). The skill atom is a gameplay fraction that functions through a skill-based feedback loop (see figure below). Here player actions result in a 'simulation', which in turn results in 'feedback' to the player. Finally the skill model (read: proficiency) is updated. The 'simulation' and 'feedback' are elements of the game environment which supports the renaming.

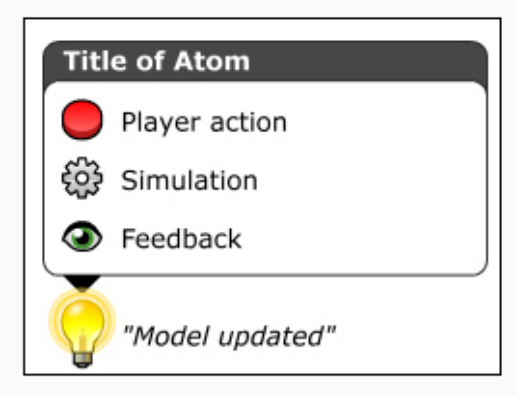


Figure 31 – Cook's skill atom. Eccentrically, he describes a game challenge, where a player performs an action, which results in a change in the game environment leading to a further proficiency in a specific skill.

In the above figure, the "Model updated" refers to five different stages of skill proficiency, which are:

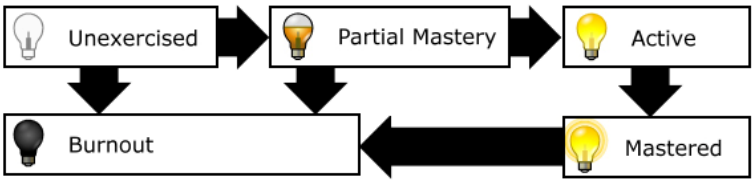


Figure 32 – Illustration of Cook's five states of skill mastery (Cook, 2007).

These five states of skill mastering illustrate the possible outcome of each skill atom according to Cook's framework.

What is interesting about this model is that Cook not only ventures to understand the player actions that are possible in the game environment, but further illustrates an updated player state. Furthermore, the atoms are possible to link in a loop-able event tree which allows the game designer to understand the player interaction with the game and follow/design his progress. If we remember that both physical and intellectual engagement can be derived from exploring and gaining proficiency in the game it seems that Cook's view correlates with Schønau-Fog and Bjørner's framework. In the chapter that follows, entitled 'The Feeling of Engagement', the joy that comes from gaining proficiency, skill mastering, is discussed in more detail. It can be remarked that in terms of intellectual engagement, there is also the joy of player expression after a skill have been mastered. This is one aspect that Cook has not dwelt upon in his design, where a skill is either active or burned out.

Where Cook can be criticised is that he narrows down the player properties to a question of learning skills. However, it may seem too much of a simplification of the player's interaction with the game environment. Not that the division of Cook's Player Model fails to include elements, but the 'player' is still somewhat of a black-box since we can only ascribe the desire to gain skill proficiency as an attribute. As with the creative expression that can lead to a sense of intellectual engagement, it seems that there is more to the player's eventual state after mastering a skill. As argued previously, it helps to understand Cook's elements from a challenge perspective and if we remember that the core essence of this project is on the motivational factor we might be able to add further to the player box. David Ghozland, game designer at Electronic Arts, argues that *"[...] if the player loses his motivation, it is because he does not have fun anymore.* –He will then *"[...] stop playing*" (Ghozland, 2007 p. 1). This has led him to the construction of a motivational loop for game design, which can be seen in Figure 33 on the following page.

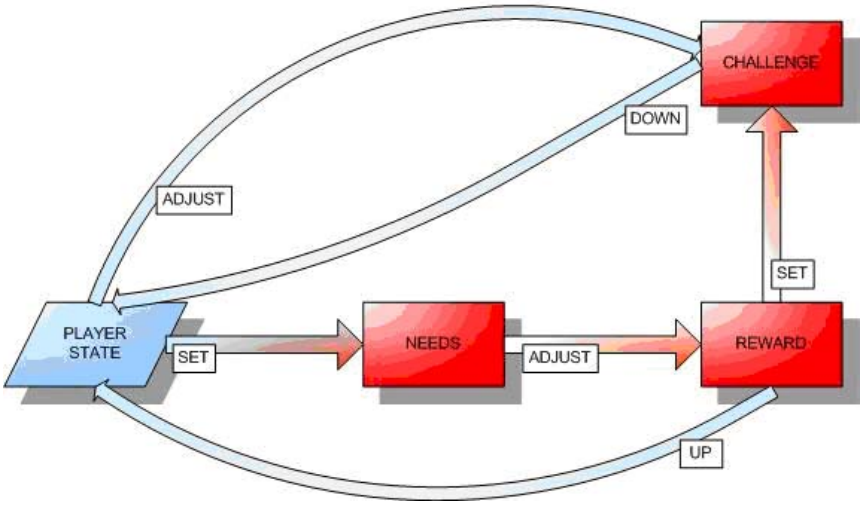


Figure 33 – The PNRC model (Player state, Needs, Reward & Challenge) as presented by David Ghozland (Ghozland, 2007 p. 2).

As with Cook's skill atom, Ghozland draws attention to possible joy and frustration states that gameplay can invoke in the player's mind, which he entitles the player state. However, this state not only signifies the state of the player, but also the state of the player's avatar in terms of diegetic elements e.g. health, weapons etc. Additionally, we see the challenge box both as an indicator of skill based player interaction, as well as related to the player's diegetic and non-diegetic needs. These needs are manifested as rewards or the expectation of same, which are claimed through the completion of a challenge. It should be cautioned that even though we see the presence of a player state, it does not infer that the red boxes in the model are solely diegetic game mechanics. Ghozland's model affords both diegetic and non-diegetic game design perspectives. In regards to dramatic engagement it was explained how that particular engagement type could be influenced on both a diegetic and non-diegetic level. In terms of challenges this becomes even more prominent as we contemplate Ghozland's model for motivation. What we need to remember is that challenges can rely on the skill of the player and be the consequence of a specific player need or expectation or reward. In doing so there is either posted a diegetic goal that involves specific needs for the player avatar, or a non-diegetic goal that might well ignore avatar needs and be the result of a the player's own needs i.e. as mentioned in the following chapter as part of *pleasures of the mind*. User researcher at Microsoft, Bruce Phillips refers to diegetic goals as *performance goals* and presents the statement that

most games are designed with these in mind (Phillip, 2009 p. 5). He infers that though many players enjoy these kinds of goals, and the challenge that goes along with them, it is necessary to understand that performance goals alone can result in a lack of motivation if the player is continually defeated in his attempt to accomplish the challenge (Phillip, 2009 p. 5). Phillips suggests the implementation of *learning goals* that award the player for simply making the effort e.g. as with the experience score system in *Battlefield – Bad Company 2* where overall playtime and hitting, not killing, other players also result in earning experience points. However, from an engagement standpoint another mean through goal-setting could be the affordance of non-diegetic goal setting, which is created by the player himself. This is of course a very subjective element, which cannot be guaranteed to work. An example of a gameplay that can lead to more frequent non-diegetic goal-setting could be the standard team-death match that is often seen in the FPS (first-person-shooter) genre in computer games. Here the game offers no other challenge and goal than to kill the opposing team, but frequent dramatic and challenging situations and intelligent opposition may lead to the player creating his own agenda e.g. killing the opposing player that just got him five times in a row.

In essence, when it comes to a question of challenged-based engagement principles it is evident that it is possible to structure challenges and player needs according with specific types of engagement. However, as presented in the body of text above, there is the ever present talk of player joy and frustration. Both of these constitute emotional outcomes of challenge types, and do consequently relate to emotional engagement, which as described in the previous chapter play a pivotal role in the experience of engagement.

CHAPTER 7 - THE FEELING OF ENGAGEMENT

The previous chapter first and foremost considered the experience of engagement from the perspective of game design. That is, how the design of visual, auditory and haptic stimuli; sensory motor and intellectual challenges; and narrative agents and plots may lead to engaging gameplay. Contrarily the current chapter focuses more explicitly on the experience of engagement from the perspective of the player.

In the introductory chapter of the analysis it was described that the six types of engagement should be seen as intrinsically connected since they individually may contribute to the general experience of engagement Moreover it was described that emotional engagement was particularly pervasive in that, the experience of some level of emotional engagement seemingly is a prerequisite for the experience of engagement altogether. Laboring under the assumption that emotions do in fact play such a pivotal role in the experience of engagement the current chapter takes emotions as its point of departure.

First the section *Emotion as a Source of Engagement* raises a single, yet important, point of criticism against Schønau-Fog and Bjørner's framework by claiming that it makes little or no sense to consider emotional engagement as a separate type of engagement and proposes that emotions instead should be considered a cause of engagement altogether. Motivated by this claim the following section provides a more general introduction to different affective phenomena and thereby lays the ground for the subsequent description of gameplay as emotional experience. This section, more specifically reviews existing theory pertaining to the role of emotions in gameplay and strives to pair said theory with the wirings of prominent emotion theorist Klaus R. Scherer. Finally the section *Engagement and the Pursuit for Pleasure* presents a discussion of how the hedonic states, brought about by the emotions experienced during gameplay, may help explain why such gameplay may be experienced as engaging in the first place.

7.1 Emotion as a Source of Engagement

One of the main insights brought about by the previously cited study of Schønau-Fog and Bjørner's framework, was that emotions seemingly play a pivotal role for the experience of each individual type of engagement (Nilsson, 2009 p. 100). Within said study this claim was substantiated by citing Dr. Stuart Brown, who describes the general importance of studying emotions in relation to all forms of play with the following humorous analogy:

> *"If we leave the emotion of play out of the science, it's like throwing a dinner party and serving pictures of food. The guest can understand all they care to about how the food looks and hear descriptions of how the food tastes, but until they put actual food in their mouths they won't really appreciate what the meal is all about."(Brown, 2009 p. 21)*

Brown's analogy was regarded as suitable since engagement, just as play may be considered to be *"[...] a state of mind, rather than an activity"* (Brown, 2009 p. 60). The perception of stunning sounds and visuals; the confrontation of physical or mental challenges; socialization, competition and cooperation; and even the perception of stimuli structured in the form of a narrative, all constitute activities. The claim was consequently that it is *not* these activities themselves, but rather the emotions they lead to, that makes the player experience engagement (Nilsson, 2009 p. 100). The argument put forth here is that this consequently implies that it makes little or no sense to talk of emotional engagement as being a distinct type of engagement. It does in other words not seem particularly fruitful to include emotional engagement in the framework as emotions seemingly are part and parcel for the individual types of engagement as well as engagement altogether. However, this exclusion of emotional engagement from the framework does not mean that the importance of emotions should be reduced in any sense of the word. Quite contrarily emotions should receive a far more critical role and be considered as a principal factor determining whether the gameplay is engaging or not.

However, before discussing emotions and their influence on gameplay in general and engaging gameplay in particular it seems prudent to pause for a moment and consider what emotions and other curious affective phenomena might comprise of.

7.2 An Aside on Affective Phenomena

Whereas words such as emotion, feeling and mood may be commonplace in colloquial English these refer to distinct affective phenomena. Here affect should be understood as an umbrella term encompassing all of the three (Fox, 2008 pp. 17-18). In her comprehensive review of recent research linking mind, brain and body, dubbed *Emotion Science*, Elaine Fox describes that emotion in broad strokes may defined as *"[a] relatively brief episode of coordinated brain, autonomic and behavioral changes that facilitate a response to an external or internal event of significance for the organism"* (Fox, 2008 p. 17). A Mood on the other hand is defined as a more *"[…] diffuse affective state that is often of lower intensity than emotion, but considerably longer in duration"* (Fox, 2008 p. 17). Moreover, Fox describes that mood, unlike emotions, may be objectless since they not necessarily are brought about by a particular external or internal event (Fox, 2008 p. 346). Finally Fox describes that feelings in general terms may be defined as the subjective experience of emotions (Fox, 2008 p. 17), that is, how it *feels* to experience the particular configuration of coordinated brain, autonomic, and behavioral changes.

With this being said it should be noted that there, according to Fox, does not exist one commonly agreed upon definition of emotion within the scientific community (Fox, 2008 p. 23). Despite this discord, it would seem that it is generally accepted that an emotion consists of at least three components, namely *bodily symptoms* (e.g. heart or respiration rate), *behavioral expression* (e.g. facial or vocal expression) and *subjective experience* (feelings).

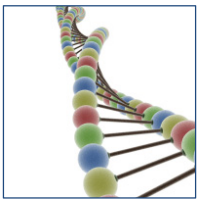
Moreover Fox describes that an additional component of emotion has gained relative acceptance, namely *action tendencies*. Action tendencies more specifically prepare and direct the actions of the individual in a manner pertinent to the event encountered. Finally some emotion theorists believe cognitive evaluation of the relationship between the environment and the self, *cognitive appraisal,* to constitute a fifth and final component (Fox, 2008 p. 23). For the sake of clarity the five components of emotion have been summarized in Table 2 below.

Emotion Component:	Emotion function:
Appraisal: (cognitive component)	Evaluation of events and object
Bodily symptoms: (neurophysiological component)	System regulation
Action tendencies: (motivational component)	Preparation and direction of action
Behavioral expression: (Motor expression component)	Communication of reaction and behavioral intention
Subjective experience: (Subjective feeling component)	Monitoring of internal state and organism-environment interaction

Table 2 – Simplified table of the components of emotion and their function (originally created by (Scherer, 2001 p. 93) and adapted from (Fox, 2008 p. 24)).

The belief that cognitive affect should be considered as a component of emotion is, however, subject to some controversy as the assumption that cognition and emotion are separate, yet interacting, systems is still held by some scholars (Fox, 2008 pp. 24-25). Even though settlement of this dispute, needless to say, is far beyond the scope of the current thesis it is worth mentioning that much contemporary research suggests that cognition and emotion are interconnected both neurologically and psychologically, and greatly influence and bias one another (Fox, 2008 pp. 10, 349). Readers who are interested in a concise overview of the four dominant approaches to emotion may refer to Box 13, on the following page. Regardless of whether one believes cognitive appraisal to be a component of emotion or not it seems reasonable to assume that this form of cognition does deserve attention when one is attempting to describe affective phenomena resulting from emotionally competent stimuli. Moreover, appraisal based views of emotions seemingly lend themselves particularly well to the study of gameplay as will become apparent from the following section on gameplay as emotional experience.

Box 13 – Approaches to emotion at a glance



Emotions are biologically given: This approach assumes that emotions are the result of biological evolution, that is, we are genetically prone to respond in a certain manner to particular eliciting events. However, this does not necessarily imply that all emotions are hard-wired into our brains. Instead the belief is that we are born with primary emotional systems, which may be altered over time as we encounter and learn from new experiences (Fox, 2008 pp. 2-4).

Emotions are socially constructed: Researchers conforming to this approach assume that emotions essentially are social and cultural constructs. So our propensity to respond to events in a certain manner is the product of a lifetime of experiences and social interactions. An important implication of this view is that some emotions may be unique to particular cultures (Fox, 2008 pp. 4-7).

Emotions result from perception of body changes: This approach implies that emotions are the result of our perception of our internal body states and changes to this state. Moreover some researchers (e.g. Damasio (2006)) believe that emotions also may occur even though no physiological change has occurred in the body. The brain is in other words able to "simulate" particular body states even though these are not actually present (Fox, 2008 pp. 7-8).

Emotions result from cognitive appraisal: Finally some researchers are proponents of an approach based on the view that cognitive appraisal is a precursor for, or constituent to, the experience of immersion. That is, emotions are associated with our evaluation of the meaning of occurring events, their relevance and our capacity for coping with them. An advantage of appraisal based views is that these help explain why different people experience different emotions when subjected to the same eliciting events (Fox, 2008 pp. 8-9).

All illustrations have been adapted from (flickr.com).

7.3 Gameplay as Emotional Experience

In his contribution to *The Video Game Theory Reader 2* (Perron, et al., 2008), Aki Järvinen describes that the act of playing games should be considered as a fundamentally human activity, which in turn puts the psychology of the player at the crux of gameplay studies (Järvinen, 2008 p. 85). This entails that both the study and design of gameplay may prosper greatly from a better understanding of the influence of emotions on the experiences of players (Järvinen, 2008 pp. 85-86). An argument which in turn lends some credence to the claim that player's emotions should be considered as being part and parcel to their experience of engagement. Central to Järvinen's description of the relationship between gameplay and emotions are the goals that games impose on players during the meeting between the two. The reason for this focus on player goals is that it by and large is the player's aspiration to achieve these goals that makes it possible for the game to elicit emotional responses (Järvinen, 2008 p. 86). Recall from the previous chapter that these goals both may pertain to the game's diegesis or be motivated by the player's non-diegetic aspirations. At first glance this claim may seem to diminish the importance of designing the various game components described throughout the previous chapter. However, it should be emphasized that it is not the goals themselves that elicit the emotions, but rather the game components encountered while striving to achieve said goals; or as Järvinen so felicitously puts it:

> *"[T]he road that players take in trying to attain those goals is beset by emotions, that is, by valenced reactions towards events, agents, or objects in the game. Depending on the game, such appraisals may range from judging one's own or fellow players' performances, outcomes of goals, rule procedures, narrative sequences, and so on." (Järvinen, 2008 pp. 86-87)*

As it happens, this brief citation does not only serve as an example of the relation between emotions and player goals. It does also direct our attention to the primary theoretical underpinnings of Järvinen's theory of video games as emotional experience. That is, he draws upon the writings of various scholars of psychology and cognitive science in favor of appraisal based approaches to emotion. Throughout the following subsections a brief discussion of Järvinen's theory will be presented along with a description of some possible ways in which said theory could be made more exhaustive.

7.3.1 The phasic processes of gameplay emotions

Based on the writings of Frijda (1986), Järvinen describes that the emotions may be viewed as a phasic process, composed of the four consecutive phases: Appraisal (*"the recognition of an event as significant"*); context evaluation (*"thoughts or plans as to how to cope with the event that caused the emotion"*); action readiness *("one's willingness to respond with another action"*); and finally physiological change (*"the bodily and expressive effects of emotion"*) (Järvinen, 2008 p. 87). The third of the four processes, action readiness, is closely related to the previously described concept action tendencies (Järvinen, 2008 p. 87). It is in fact notable that these four processes largely correspond with the five components of emotion summarized in Table 2, page93.

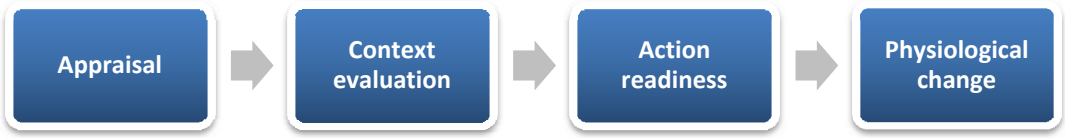


Figure 34 – Graphical representation of Järvinen's description of the phasic process of emotion.

Even though Järvinen does not explicitly describe the individual's subjective experience of the emotion, the feeling, as part of this process, he does base his descriptions on the assumption that emotions do give rise to such a subjective state on behalf of said individual (Järvinen, 2008 p. 87). In line with his view that the psychology of the player should be assigned a central role within gameplay studies Järvinen proves the following description of how he believes Frijda's theory translates to the experience of gameplay:

> *"I propose that gameplay consists of phases that are analogous to those of the emotional process; there is recognition of something significant in the game in its present state, followed by the player's appraisal of the situation and what to do. After that, the player proceeds to take action within the rules [of the game], as action readiness transforms into concrete action." (Järvinen, 2008 pp. 87-88).*

Without disputing neither, Järvinen's application of Frijda's theory, nor his description of the theory itself, one may argue that there exists at least one alternate appraisal based theory emotion, which provides us with a better understanding of the psychological process involved in gameplay. Prominent emotion theorist Klaus R.

Scherer has described exactly such theory in one of his contributions to the book *Appraisal Processes in Emotion: Theory, Methods, Research* (Scherer, 2001). The reason why this particular theory seemingly is of great relevance to the current project is that it involves a more elaborate description of the appraisal process and thus have the potential to provide a better understanding of the process inherent to the player during gameplay.

Scherer's theoretical model of emotions, *the component process model*, assumes that emotion comprises all five components outlined in Table 2, page 93. An emotion is in other words defined as *"[...] an episode of interrelated, synchronized changes in the states of all or most of the five organismic subsystems in response to the evaluation of an external or internal stimulus event as relevant to major concerns of the organism"* (Scherer, 2001 p. 93). As apparent from the central position of *the evaluation* in his definition of emotion, Scherer also conforms to an appraisal based view of emotion. Based on the findings of various existing research on emotion Scherer has identified a set of criteria underlying the appraisal processes, performed in order to assess the significance of a stimulus for the individual (Scherer, 2001 p. 93).

Scherer has, more specifically, dubbed the criteria *stimulus evaluation checks* and groups these in accordance with what he believes to be the four main appraisal objectives: Relevance detection (*"how relevant is this event for me?"*); implication assessment (*"what are the implications or consequences of this event and how do these affect my well-being and my short and long-term goals?"*), coping potential determination (*"how well can I cope or adjust to these consequences?"*), and normative significance evaluation (*"what is the significance of this event with respect to my self-concept and to social norms and values?"*). Readers who are interested in a more detailed description of the four appraisal objectives, the associated stimulus evaluation checks, and their relation to the experience of gameplay may refer to Box 14, spanning the following two pages.

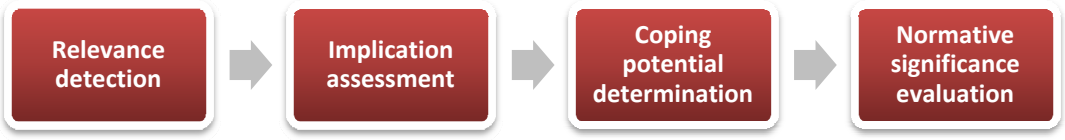


Figure 35 – Graphical representation of Scherer's sequential check theory (Adapted from (Fox, 2008 p. 114)).

Box 14 – Scherer's four appraisal objectives

Relevance detection: Individuals, including the ones playing games, continuously need to monitor both internal and external stimulus in order to assert whether the onset or absence of stimuli demands their attention (Scherer, 2001 p. 95).

- *Novelty check:* At the level of sensory motor processing, the sudden onset of stimuli is likely to be deemed as being relevant by the player. On a higher processing level the detection of relevance is also influenced by the degree of familiarity and the expectations and current mood of the player (Scherer, 2001 p. 95).
- *Intrinsic pleasantness check:* This check establishes the player's fundamental reaction to the onset of a given stimulus. Pleasurable feelings encourage approach and dislike or aversion entails withdrawal or avoidance (Scherer, 2001 p. 95).
- *Goal relevance check:* According to Scherer this check *"[…] establishes the relevance, pertinence, or importance of a stimulus or situation for the momentary hierarchy of goals/needs"* (Scherer, 2001 p. 95). Events pertinent to a high-level goal such as survival are in other words deemed more relevant than ones associated with e.g. the acquisition of some item of interest (Scherer, 2001 p. 95).

Implication assessment: This appraisal objective does as the name implies relate to the player's evaluation of whether the stimulus or situation is beneficial or harmful in relation to his or her survival or general progression (Scherer, 2001 p. 95).

- *Causal attribution check:* When performing this check the player evaluates what might have caused the particular situation. Moreover, if the event has been caused by another agent (human or computer controlled) the player will attempt to determine the motive and intentions of said agent (Scherer, 2001 p. 96).
- *Outcome probability check:* When performing this check the player evaluates *"[…] the likelihood or certainty with which certain consequences are to be expected"* (Scherer, 2001 p. 96).
- *Discrepancy from expectation check:* The player performs this check in order to determine whether the situation brought about by an event is consistent or discrepant with his or her expectations (Scherer, 2001 p. 96).
- *Goal /need conduciveness check:* According to Scherer this check is performed in order to assert whether the occurring acts or events will lead to *"[…] attainment of goals/needs, or progress towards such attainment, or facilitation of further goal directed action"* (Scherer, 2001 p. 96). A player experiencing the obstruction of this attainment may e.g. experience frustration.
- *Urgency check:* Finally the urgency check is performed in order to determine how crucial the occurring event is for the hierarchy and needs. It should, however, be noted that even though any event deemed urgent by implication is relevant to opposite need not always be the case (Scherer, 2001 p. 97).

Coping potential determination: This appraisal objective does, as the name implies, relate to the player's assessment of his or her capacity for coping with the encountered situation. Moreover the objective is to determine the options for action available and what these might entail (Scherer, 2001 p. 97).

- *Control check:* When performing this check the player attempts to assert whether he or she is able to influence how a given situation will progress. That is, he or she evaluates whether action is at all possible (Scherer, 2001 p. 97).
- *Power check:* If the player evaluates that the particular situation can be influenced a power check is performed with the intention of determining whether the disposable resources suffices in terms of performing a change that corresponds with his or her interests. More specifically Scherer describes that *"[i]n the case of an obstructive event brought about by a conspecific aggressor or a predator, the comparison between the organism's estimate of its own power and the agent's perceived power is likely to decide between anger or fear and thus between fight or flight"* (Scherer, 2001 p. 97). A description which seemingly also applies within the context of games where the player is facing challenges made up by human or computer controlled agents.
- *Adjustment check:* Finally an adjustment check is performed so as to determine whether the outcome of the situation will necessitate adjustment on behalf of the player (Scherer, 2001 p. 97). E.g. what types of adjustments will be necessary if the player fails to cope with the particular situation.

Normative significance evaluation: The final of the four appraisal objectives relates to how the experienced situation might influence the player's self-concept and self-esteem (Scherer, 2001 p. 98).

- *Internal standards check:* This check does as the name implies relate to the evaluation of *"[…] the extent to which an action falls short or exceeds internal standards such as one's personal self-ideal (desirable attributes) or internal moral code (obligatory conduct)"* (Scherer, 2001 p. 98). This check may in other words help the player determine whether performed actions live up to his or her perceived level of proficiency (Scherer, 2001 p. 98).
- *External standards check:* When performing this check the player will evaluate how a particular action conforms to the values and rules of other players. So this check relates to how the player thinks others might view his or her performance or whether the actions he or she has performed constitute a breach with the norms inherent to the game and thus qualify as cheating (Scherer, 2001 p. 98).

Even though Scherer's sequential check theory differs from Järvinen's description of appraisal in terms of the level of detail it provides, the two theories does seem to be compatible. It would more specifically appear that the different checks performed in order to fulfill the four appraisal objectives in general terms correspond to the concepts *appraisal* and *context evaluation* featured in Järvinen's theory of gameplay as a phasic process. Consequently is seems reasonable to assume that it is possible to combine the two and thus arrive at a model which describes the player's experiences of emotions in even more detail.

Figure 36 illustrates how the two theories might be combined by replacing *appraisal* and *context evaluation* featured in Järvinen's theory with the four appraisal objectives described by Scherer. Moreover this figure includes the subjective feeling state, which according to the reviewed theory on affective phenomena would correspond to the player's subjective experience of the various components included in the model.

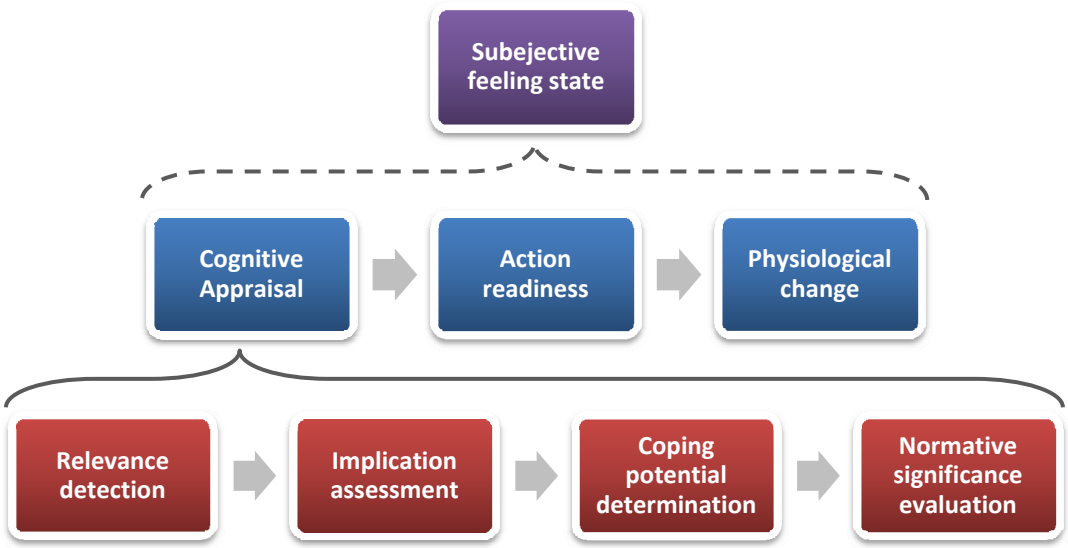


Figure 36 – Graphical representation of the combination of Järvinen's theory of gameplay as a phasic process and Scherer's sequential check theory. *Appraisal* and *context evaluation* featured in Järvinen's theory have been replaced by cognitive appraisal, which is made up of Scherer's four appraisal objectives and the box labeled *Subjective feeling state* have been added with the intention of illustrating the player's subjective experience of the emotions is brought about by his or her perception of the other included components (The dashed curly brackets are intended to illustrate that the cognitive appraisal, action readiness, and physiological change should *not* be viewed as subsets of the subjective feeling state).

7.3.2 Categories of gameplay emotions

Whereas the discussion presented throughout the preceding paragraphs first and foremost have dealt with the process leading to the player's experience of emotions, the following will present one possible way of categorizing the emotions resulting from this process.

In the previously cited article, on video games as emotional experience, Järvinen presents the argument one needs to explicate the distinction between the different categories or classes of emotions arising during gameplay in order to properly differentiate between various forms of player experiences (Järvinen, 2008 p. 89). Seeing as the different types of engagement seemingly serve as catalysts for such player experiences, these categories of emotions should also be pertinent to the study of engaging gameplay presented here.

When describing the relevant categories of gameplay emotions Järvinen adopts a categorization originally proposed by Ortony, Clore, and Collins (1990) as he believes it to lend itself to easy application within the context of game studies. Järvinen more specifically describes that this categorization revolves around "*emotions in a world of events, agents and objects"*, which in turn makes it correlate well with gameplay as *"[…] an activity where players participate in events, manipulate objects, and take the role of agents and interact with other agents"* (Järvinen, 2008 p. 87). The adopted categorization comprises the five categories, *prospect-based*, *fortunes-of-others*, *attribution*, *attraction,* and *well-being emotions*, which will be summarized throughout the following paragraphs. Each summary is concluded by some cursory propositions as to how each category might be related to the four appraisal objectives inherent Scherer's sequential check theory. It is, however, important to note that even though specific appraisal objectives are highlighted in relation to each of the five categories this is not meant to imply that the remaining ones are without influence.

Prospect-based Emotions

This category does, as implied by the name, encompass emotions associated with the prospects of the player, that is, his or her *"[…] mental considerations and pictures of something to come"* (Järvinen, 2008 p. 90). Prospect-based emotions do in other words arise as a consequence of the player's inferences about the outcome of current and

future events or as Järvinen puts it: *"[…] what does the occurrence, and subsequent resolution of the event, promise for the player, and is the event worthwhile in the sense that the player invests effort into trying to make the outcome desirable for oneself or for other"* (Järvinen, 2008 p. 90). According to Järvinen this category include hope, fear, satisfaction, fears-confirmed, relief, shock, surprise, and suspense, to mention but a few. Moreover he emphasizes that the prospects of events as well as the emotions may differ substantially from game to game. To exemplify, the prospects-based emotions brought about by playing story-driven games may result from the unawareness of what is to come, while the emotions associated with competitive games might be caused the awareness that one will be either end up being victorious or defeated (Järvinen, 2008 p. 90). This seemingly implies that, in terms of Scherer's sequential check theory, prospect-based emotions by and large are the product of the player's implication assessment and coping potential determination.

Fortunes-of-Others Emotions

Emotions belonging to this category are the product of the player experiencing how a particular event influences the fate of other agents of the game, such as *"[…] being happy or feeling sorry for somebody, or on the other hand, a display of ill will in the form of resentment or gloating"* (Järvinen, 2008 p. 91). Here it is important to note that the player in this respect constitutes an agent on equal terms with other players and computer controlled characters alike. Fortunes-of-others emotions may in other words also be geared towards the player experiencing the emotion. It should, however, be stressed that this class of emotions first and foremost pertain to the events shaping the fate of the games agents as opposed to the agents themselves, or as Järvinen puts it: *"[fortunes-of others] emotions relate to the goals of others rather than to others as such"* (Järvinen, 2008 p. 91). Here it is interesting to note that Grodal has described that identification with fictional characters within film largely is depended upon our ability to adopt their goals and concerns (Grodal, 2006 p. 5). So it would seem that this category of emotions to a large extend arises as a consequence of the player's normative significance evaluation in the sense that he or she assesses the significance of the event with respect to the other agent's, or his or her, self-concept and in regards to social norms and values.

Attribution Emotions

Contrary to the class of emotions just described, attribution emotions are leveled at the agents of the game, including the player, or the game itself, if the player perceives it as an agent that is (Järvinen, 2008 p. 91). Järvinen more specifically describes that *"[t]he valance of attribution depends on the praiseworthiness or blameworthiness of [the agents'] actions, and their intensity is related to how the behavior deviates from expected behavior"* (Järvinen, 2008 p. 91). This category of emotions include, but are not limited to, pride, appreciation, shame, frustration and contempt (Järvinen, 2008 p. 91). The primary forms cognitive appraisal giving rise to this category of emotions are arguably normative significance evaluation since the player assesses past and present behavior of other agents in regards to social norms and values.

Attraction Emotions

This class of emotions is first and foremost geared towards the objects of the game such as graphics, soundtrack, level design, settings (Järvinen, 2008 p. 91). Attraction emotions do in other words *"[…] relate to particular game elements and their implementation, especially the design of characters and game spaces, and how information is distributed to players"* (Järvinen, 2008 p. 91). This category of emotions is seemingly greatly influenced by the player's relevance detection – it includes a check for the intrinsic pleasantness of the encountered stimuli – and implication assessment – this appraisal objective amongst other things evaluate the stimuli in accordance with prior expectations.

Well-being Emotions

The fifth and final category of emotions, well-being emotions, does according to Järvinen relate to whether the player finds the encountered events desirable or undesirable (Järvinen, 2008 p. 92). This class of emotions does in other words arise as a consequence of the player's positively or negatively valenced responses to particular events, that is, *"[r]eactions with positive valence give birth to joy that manifests as happiness, delight, pleasant surprise, etc."* while negatively valenced reactions *"[…] lead to distress such as depression, dissatisfaction, grief, etc*" (Järvinen, 2008 p. 92). Moreover Järvinen describes that whereas prospect based emotions by and large are brought about by the player's fears and hopes for future events, this category of emotions primarily relates to the outcome of events as opposed to their prospects (Järvinen, 2008 p. 92). So while the

player's experience of suspense or fear of losing would qualify as prospect-based emotions, the dissatisfaction experienced once the game has been lost would fall under the category of well-being emotions. The same division would necessarily also apply for the positively valenced emotions associated with the prospect of winning and the feelings accompanying the experience of victory. Seeing as this category of emotions is associated with the positively or negatively valenced responses to the outcome of events, it would seem that particularly implication assessment and normative significance evaluation may play a part in the experience of said emotions.

7.4 Engagement and the Pursuit for Pleasure

A central claim of Järvinen's theory was that *"[…] one of the key forms of enjoyment that games offer originates from how games impose goals on players"* (Järvinen, 2008 p. 86). Following the previous discussion of engagement on a diegetic and non-diegetic level it would seem that such goals may pertain to either of these two levels. The player may adopt the goals inherent to the game's diegesis – e.g. striving to save the princess – or aspire to achieve goals external to the game's diegesis – e.g. seeking to improve his or her performance. It would, however, appear that it not necessarily has to be the player's explicit aspiration to achieve such goals that causes him or her to willfully commit to the act of playing, that is, becoming engaged. Whereas these aspirations as suggested serve as a catalyst for an engaging experience, it is the emotions experienced while striving to achieve the goals that determine whether the player finds the experience pleasurable. This necessarily brings about the question of what pleasures gameplay may give rise to since player engagement seemingly hinges upon the experience of such pleasures.

7.4.1 Kubovy's five pleasures of the mind

As it happens Järvinen discusses one conceptualization of the pleasures derived from games and other forms of entertainment which might help shed some light on this matter. Järvinen, more specifically, draws upon the writings of experimental psychologist Kubovy (1999), who posits that at least five pleasures of the mind are identifiable, which correspond to *"[…] collections of emotions distributed over time, that is, sequences of emotions"* (Järvinen, 2008 p. 89). For the sake of brevity the five pleasures *curiosity*, *virtuosity*, *nurture*, *sociality*, and *suffering* have been summarized in Box 15.

Box 15 – Järvinen's description of Kubovy's five pleasures of the mind

Curiosity: Curiosity as a pleasure of the mind comprises the pleasures derived from the acquisition of knowledge pertaining to something previously unknown. The associated emotions are in other words leveled at the unknown, thus implying that this form of pleasure oftentimes is the product of prospect-based emotions (Järvinen, 2008 p. 102).

Virtuosity: Virtuosity is associated with the pleasures of being proficient, implying that it is the player's own actions and level of proficiency, which are the object of the underlying emotions. (Järvinen, 2008 p. 102). In the words of Järvinen *"[t]his pleasure anchors to the pleasure to be gained from making the prospect become reality, that is, the act of gameplay as a set of events, and one's performance as a part of it. Attribution emotions (regarding one's performance) have consequences for the pleasure of virtuosity therefore as well"* (Järvinen, 2008 p. 102).

Nurture: This category of pleasures relate to the pleasures derived from taking care of living things and the emotions giving rise to these pleasures are consequently leveled at the objects of this nurture (Järvinen, 2008 p. 102). Järvinen more specifically describes that nurture *"[…] has to do with fortunes-of-others emotions; prospects that have relevance and consequences not only to self but others. In addition, attribution and attraction emotions towards the act of nurturing, and/or the object of nurture, are bound to be elicited as well"* (Järvinen, 2008 pp. 102-103).

Sociality: Sociality is as the name implies associated with the pleasure of being a member of a social group, which in turn implies that the underlying emotions are leveled at the remaining members of the group (Järvinen, 2008 p. 103). Moreover Järvinen suggests that *"[p]leasure from sociality has to do with the attraction emotions towards agents, and attribution emotions towards their doings, as well as well-being emotions"* (Järvinen, 2008 p. 103).

Suffering: The fifth and final category of pleasures does according to Järvinen, involve *"[…] negative pleasures of the mind from "mundane" psychological pains, such as shame and guilt, or from "existential" pains, such as fears of death or related concerns, which consequently function as the object of emotions"* (Järvinen, 2008 p. 103). This does in turn imply that this form of pleasure has its roots in a wide variety of different negatively valenced emotions (Järvinen, 2008 p. 103).

All illustrations have been adapted from (flickr.com).

It is, however, important to note that even though these so-called pleasures of the mind are dependent upon the experience of emotions, the two terms are not interchangeable. Järvinen, mores specifically, provides to following description of the differences between the experience of individual emotions and Kubovy's five pleasures of the mind:

> *"[W]hereas emotions have communicative signals, such as a facial expression, pleasures of the mind do not; whereas emotions are quick and brief, and can develop rapidly, pleasures of the mind are more extended in time; whereas emotions are experienced involuntarily, pleasures of the mind are "voluntarily sought out," for example, in the form of entertainment such as games." (Järvinen, 2008 p. 89)*

Based on this description it would appear that the pleasures of the mind bear some semblance with moods which preciously were defined as an affective state similar to emotions, but oftentimes objectless, lower in intensity and considerably longer in duration. This does, however, not mean to imply that moods and pleasures of the mind are identical merely that the two share similar characteristics in that both are extended in time and may be caused by the experience of individual emotions on behalf of the player.

Even more importantly, the above citation draws our attention to the fact that pleasures of the mind are voluntarily sought out. Players do in other words strive to experience these pleasures of the mind – making the experience of said pleasures a goal in its own right – and use games as a vehicle to do so. In spite of the fact that Järvinen does not make it clear whether this pursuit of pleasure is conscious to the player it does seem reasonable to assume that it is a factor that contributes to the experience of engagement. That is to say, a player may find a game engaging because it facilitates these pleasures of the mind in spite of the fact that said player is ignorant of his or her own aspiration of experiencing these pleasures. Seeing as an engaging activity by definition also is intrinsically motivating the notion of pleasures of the mind also seems to help explain why games may serve as a source of intrinsic motivation. To elaborate it would seem that the conscious or unconscious prospect of experiencing one or more of these pleasures serves as an intrinsic goal while the actual experience of these constitutes an intrinsic reward.

7.4.2 The pleasures of engagement

In the light of this seemingly intricate relationship between the experience of engagement and the pleasures of the mind, the following subsection details a concise description of how said pleasures might relate to the different types of engagement. Since emotions seemingly influence virtually all facets of gameplay this description necessarily remains somewhat cursory in nature. It should, however, suffice in terms of exemplifying how the concepts engagement, pleasure and emotion relate to one another. Moreover, it should be mentioned that social engagement is excluded from this description on grounds that it, as described in delimitation, has limited relevance for the current project.

A sense of curiosity

In the discussion of sensory engagement commenced in the introductory chapter of the analysis it was described that sensory engagement fundamentally corresponds to the player's desire to continue playing as a result of a game's auditory, visual and haptic presentation. Moreover it was described that this desire may manifest itself through feelings of e.g. wonder, anticipation, suspense or even fear, which incites the player to further explore and experience the virtual world and characters which inhabit it. Hence, it is readily apparent that sensory engagement largely depends on the player's prospect-based emotions since these are leveled at the unknown and the player's desire to know. This implies that sensory engagement by and large is the result of the player's aspiration to experience the pleasure of the mind labeled curiosity in that the player derives pleasure from the process of ascertaining information and the subsequent experience of disclosure. The pleasure of suffering does also seem to be relatable in that it may result from the experience of negatively valenced emotions such as fear or anxiety. Furthermore the discussion in the previous chapter on how sensory stimuli breed expectations on behalf of the player suggests that attraction emotions also may play a part in the player's experience of the sensory stimuli. Recall that this class of emotions *"[…] relate to particular game elements and their implementation, especially the design of characters and game spaces, and how information is distributed to players"* (Järvinen, 2008 p. 91). If the sensory stimuli provided by the game yields expectations, this may lead to negatively valenced attraction emotions and thus hamper the experience of engagement.

Physical and intellectual virtuosity

The experience of both physical and intellectual engagement was as described previously in the analysis associated with the joy of progressively improving and the feeling of being highly proficient. This implies that this form of engagement is tied to the experience of virtuosity as this pleasure of the mind was brought about by the emotions associated with making prospects become real and attribution emotions pertaining to the player's own performance. Moreover these two types of engagement hinge upon the experience of the various well-being emotions accompanying the experience of progressing or being victorious. In light of the discussion of challenges presented throughout the preceding chapter it would appear that the pleasure of suffering also may be of relevance since encounters with such challenges also may involve negatively valenced emotions.

Drama yields suffering and curiosity

Dramatic engagement does as described throughout the preceding chapters relate to the experience of either singular dramatic events or the causally related string of dramatic events making up the overarching narrative of the game. It was described that singular dramatic events might contribute to the experience of engagement due to the uncertainty of their outcome as well as the desire to know what successful completion might lead to. This seemingly suggests that this form of dramatic engagement to a large extent is experienced as engaging due to the pleasures of curiosity and suffering.

The dramatic engagement resulting from the player's experience of the game's narrative and the agents acting as narrative catalysts, does seemingly relate to a variety of different pleasures of the mind. The player's yearning for disclosure might yield curiosity; the relation to other agents may give rise to both nurture and sociality; and the unfortunate events of the narrative might lead to suffering. Finally, the pleasure of virtuosity might also be an influential factor if the player accepts the role as an actor within the narrative and thus derives pleasure from fulfilling the goals of the fictional character which he or she controls.

7.4.3 The emotional filter

The preceding description of the interrelation between the relevant types of engagement, the five pleasures of the mind, and the associated categories of emotions could needless to say have been more comprehensive. The hope is nevertheless that this concise review will have persuaded the reader that all of the introduced types of engagement do in fact hinge upon the emotions experienced by the player during gameplay. A claim which, as suggested in the introductory paragraphs of the current chapter, entails that it makes little or no sense to talk about six types of engagement. Instead we should consider engagement as a concept dividable into five types of engagement which, despite having different eliciting conditions, remain dependent upon the experience of emotions brought about by said eliciting conditions.

To summarize, it would appear that players actively, albeit not necessarily consciously, pursue the experience pleasures of the mind and by implication the underlying emotions. This pursuit is central to engagement since the prospect of these pleasures and the associated emotions serve as a source of intrinsic motivation. Recall from the preliminary analysis that intrinsic motivation *"[…] pushes us to act freely, on our own, for the sake of it"* (Denis, et al., 2005 p. 1) as is the case when the player pursues the experience of pleasures of the mind by freely engaging with games. Notably, emotions may be negatively valenced without necessarily hampering the experience of engagement. Even though the experience of negatively valenced emotions may be pleasurable by themselves (i.e. suffering) it is important to emphasize that such emotions far from always yield a pleasurable experience. Quite contrarily it would appear that negatively valenced emotions only contribute to the experience of pleasure if they fall within a tolerable range, that is, the emotions do not exceed the player's internal threshold for negative emotions. It is necessarily difficult if not impossible to objectively define this threshold as the individual's propensity for tolerating negative affect is inherently subjective. Some players may derive pleasure from playing a game, that others find intolerably frightening, and some players love a particular theme that might lead them to accept higher levels of frustration than players who take little interest in said theme.

If we labor under the assumption that these assumptions are true it would appear that emotions in many regards are analogous to a filter, which ultimately determines

whether the player derives pleasure from playing and thus determines whether the gameplay is engaging or not. It is worth noting that this description of an emotional filtering process is consistent with the conclusions drawn in relation to the discussions of immersion and flow presented in the preliminary analysis. Here it was argued that immersion in and by itself does not suffice in terms of describing good gameplay as it does not account for how unpleasant emotions might influence an experience that otherwise entailed complete attentional surrender. Moreover it was argued that the concept flow similarly does not suffice as it implies that the experience of aversive states, such as arousal and anxiety, preclude an overall pleasurable experiences. With this being said it important to recall that it was argued that gameplay involving flow generally was described as being tantamount to good

In the final paragraphs of the preliminary analysis engagement was defined as the player's willing and continued commitment to the act of playing a particular game, caused by the experience of sensory stimuli; physical or intellectual challenges; socialization, competition or cooperation; or singular or causally related dramatic events (the narrative). The conclusions drawn from the discussion of emotion presented here does not drastically affect this definition. However, it does entail that one, when attempting to answer the question of whether the experience of the items listed above will lead to engagement, first and foremost should consider the emotions experienced by the player. In continuation hereof, it seems reasonable to assume that one, when aspiring to design games facilitating engaging gameplay, may prosper from considering how the individual game components might elicit particular emotions, which in turn may lead to particular pleasures of the mind.

CHAPTER 8 - THE CYCLE OF ENGAGEMENT

Throughout the preceding chapters Schønau-Fog and Bjørner's framework for classifying and describing player engagement has been introduced and the associated types of engagement discussed from the perspective of game design and player psychology. These discussions were essentially motivated by the aspiration of gaining a better understanding of the processes, inherent to the game and the player, which might make or break the experience of engagement on behalf of the player. This aspiration was ultimately spurred by the ambition of improving the original WobbleActive prototype so that it would provide the users with potentially engaging gameplay. Based on the conclusions drawn from these discussions the current chapter details an attempt at constructing a model intended to make the concept engagement more readily palpable to game designers and academics alike. The model is more specifically founded upon the assumption that gameplay may be viewed as a cyclic exchange of information between the player and game, which under the right circumstances may be experienced as engaging. With this being said it is important to emphasize that this model by no means should be considered as a recipe for designing engaging gameplay, but rather as conceptual model highlighting a selection of the components of gameplay – features of, and process between, player and game – which one should consider when striving to design a game facilitating sensory, physical, intellectual and dramatic engagement.

8.1 The Cyclic Process of Engaging Gameplay

Recall from the final problem statement, page 58, that the ostensible goal of the current project was to provide the WobbleActive users with an engaging experience while simultaneously ensuring correct proprioceptive ankle training. An aspiration which more specifically necessitated a better understanding of the complex relationship between player and game and the associated processes that might make or break the experience of engagement. It was in other words deemed necessary to gain a better understanding of the meeting between player and game – the gameplay – and the inherent processes that might cause or inhibit engaging gameplay.

Figure 37 – Adaption of the figure featured in the section *Gameplay*, in the preliminary analysis, illustrating the two constituents of gameplay, the player and the game.

Seeing as the four types of engagement deemed relevant within the context of the current study – sensory, physical, intellectual and dramatic engagement – by and large were defined in terms of their eliciting conditions the chapter *Engaging by Design* discussed different approaches to designing said eliciting conditions. The subsequent chapter *The Feeling of Engagement* did contrarily focus on the psychology of the player and detailed existing theories pertaining to gameplay as emotional experience and cognitive appraisal. Throughout these two chapters a number of influential features inherent to both player and game were identified and related to the experience of engagement. One may argue that both the designer aspiring to design, and the scholar aiming to study, the curious concept engaging gameplay will prosper from an easy overview of these features and their interrelation, that is, the processes which may make or break the experience of engagement. The previously cited game designer and theorist Chris Crawford provides a general definition of interaction, that seemingly captures the essence of gameplay at is most general level, thus serving as a suitable foundation based on which to describe the identified features and their interrelation. Based on what he believes to be the most general processes involved in mutual human interaction Crawford defines interaction as *"[a] cyclic process in which two active agents alternately (and metaphorically) listen, think and speak"* (Crawford, 2005 p. 76).

Figure 38 – Two instances of interaction where two active agents alternately listen, think and speak (Illustrations adapted from (flickr.com)).

Even though a game and the platform on which it is executed neither is able to think, listen or speak, in the commonsense meaning of these words, this description does provide useful perspective on the interaction inherent to gameplay. To elaborate, we may regard the player and the game as two such active agents that alternately listens, thinks and speaks. This conceptualization of gameplay as a cyclic exchange of information does in other words provide us with a description of the processes of gameplay on its most general level, which in turn may help explain when and why gameplay is engaging. The following two subsections detail explanations of how the various features inherent to games and players, discussed throughout the preceding chapters, translate into this view of gameplay as a "conversation" between two active agents.

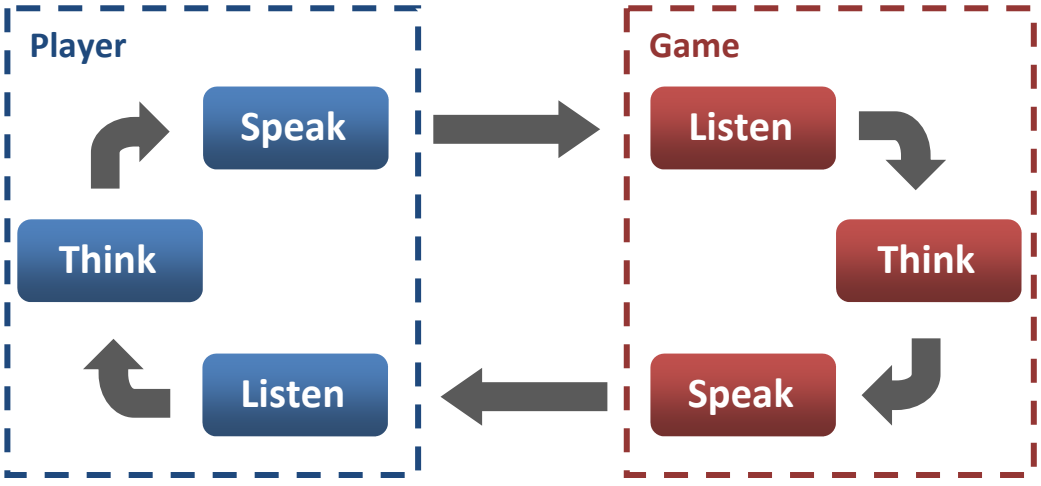


Figure 39 – Illustration of how gameplay may be described in terms of the two active agents *Game* and *Player* "who" alternately listens, thinks and speaks.

8.1.1 Games as active agents

In the light of Crawford's description of the three processes inherent to active agents partaking in an interaction, it is possible to break down a game and the platform on which it is played into three corresponding categories. The three categories pertinent to games are *input* (how the game "listens"), *rules and contents* (how the game "thinks") and finally representation (how the game "speaks"). Notably each category may be further subdivided into its respective constituents as apparent from the following description of the three processes.

Input does simply refer to the manner in which the player exerts his or her influence on the game, thus implying that this category comprises the device registering the physical actions of the player as well as the way in which said actions are transformed into their virtual correlates, that is, the actions of the player's avatar. The second category is, as implied by the name, divided into the two elements rules and contents. Here contents is used as an umbrella term for the game's fictional world, environment or level; the agents and objects occupying the game's diegesis, including the virtual representation of the player; the singular or causally related events – the narrative – propelled forward by said agents; and the different challenges and the associated risks and rewards, encountered by the player while he or she is pursuing certain goals. The rules should on the other hand be understood as the governing set of laws and commands, dictating and controlling the possible behavior of agents and objects occupying the diegetic space of the game. Finally, the category, representation, refers how the content is mediated to the player by means of auditory, visual and haptic stimuli. This category does in other words relate to the appearance, sound and feeling of the content as well as the types of displays facilitating the mediation.

Before proceeding with the description of the player as an active agent it is interesting to note that the three categories just described and their respective constituents ultimately constitutes the devices for eliciting engagement at the disposal of the game designer.

8.1.2 Players as active agents

Like the case with the game, it seems possible to dissect the player into three categories corresponding to the three processes of interaction introduced by Crawford. The three categories inherent to the player are *sensation* (how the player "listens"), *player properties and affective state* (how the player "thinks") and finally, and *action* (how the player "speaks"). It is, however, important to stress that these categories and their constituents purely are conceptual and by no means are intended to reflect the structural composition of the human mind and body. This disclaimer notwithstanding, the division is still believed to be meaningful since it helps draw attention to an important selection of the human factors which come into play during gameplay.

The first category, sensation, does simply refer to the parts of the player's sensory system, commonly employed during gameplay, that is, vision, hearing and touch. The second category does, as suggested, comprise of the two elements player properties and affective state. The former does more specifically include a wide range of subjective features of the player, i.e. the player's sensory motor and cognitive skills; the experiences accrued during gameplay and the concomitant expectation; and finally the goals and needs of the player, which may or may not be identical to the ones internal to the game. The associated element, affective state, refers to the emotions experienced by the player during gameplay, and the associated pleasures of the mind, which largely are dependent upon cognitive appraisal of the player properties and the sensed stimuli. The finally category, action, does as the name implies relate to the intentional or inadvertent actions performed by the player while attempting to exert his or her influence on the game by means of the input device. It is interesting to note that the three categories pertinent to the player as an active agent comprise the part of the gameplay which the designer strive to influence in order to induce an engaging experience on behalf of the player. The complete cyclic exchange between player and game – the gameplay – has been illustrated in Figure 40 and summarized in Box 16 spanning the following three pages. It is worth noting that this illustration and description also include engagement as a property of the player, which arises as a consequence of his or her cognitive appraisal of the experienced stimuli, the experienced emotions and associated pleasures of the mind.

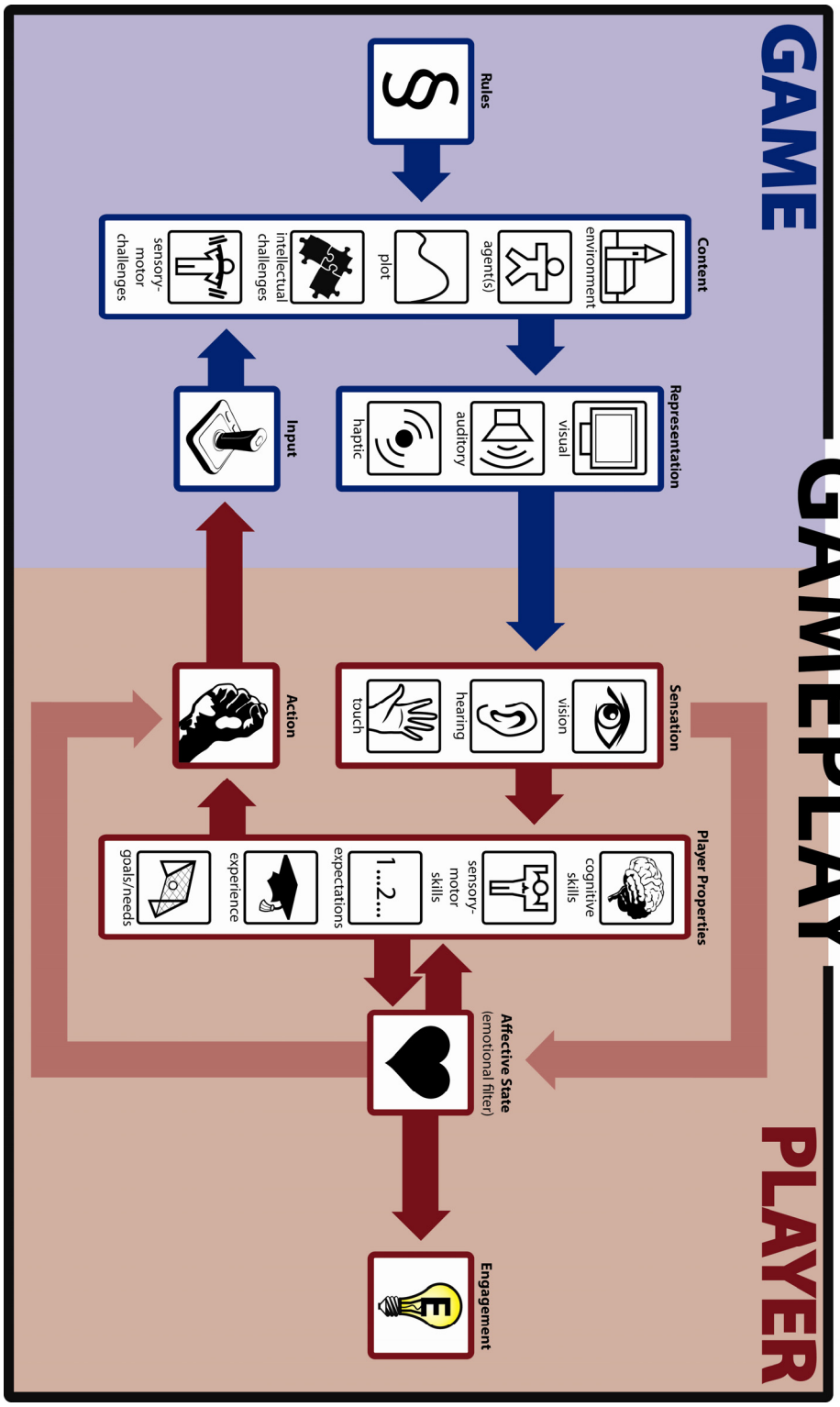


Figure 40 – The Gameplay Model: The cyclic process of gameplay illustrating a selection of the influential features of the player and the game which should be considered when one is aspiring to design potentially engaging gameplay. The individual elements in the figure are described in Box 16 on the following page. In the remaining part of this thesis, this model will be referred to as the Gameplay Model.

Box 16 –The Cyclic Processes of Engaging Gameplay

Input: The game registers the premeditated physical actions of the player by means of an input device and transforms these into their respective virtual correlates in correspondence with the game rules e.g. through mouse, keyboard, joystick etc.

Rules: The player's actions and the game's responses are restrained by the game rules. –That is, the system of laws, determining the boundaries and possibilities within the game's content, restraining the player's actions and facilitating the game components e.g. plot, challenges etc.

Content:

Environment: The player influences the games diegetic space by navigating through it and manipulating the objects inherent to it. All in accordance with the game rules.

Agent(s): The player operates the agent(s) occupying the diegetic space "who" in turn responds in accordance with the rules of the game.

Plot: By navigating the diegetic space and influencing narrative agents the player influences the progression of the game's overarching plot. The player's influence may be more or less explicit depending on whether the structural composition of the narrative is susceptible to change or if the player simply influences to progression of a pre-designed narrative. Regardless of the level of influence permitted the causally related events of this narrative play out in accordance with the game rules.

Sensory motor challenges: The diegetic space, and the objects and agents inhabiting it can be designed as manifestations of challenges testing the player's sensory motor skills.

Intellectual challenges: The diegetic space, and the objects and agents inhabiting it may be shaped or behave in a manner that makes them pose a challenge to the player's intellect, that is, his or her cognitive capacity and/or mental acuity.

Representation: The content – the virtual correlates of the player's actions and the corresponding reactions pertaining to the diegetic space, objects and agents – is represented as iconic, indexical and symbolic information and communicated to the player through graphical, auditory or haptic displays.

Sensation: The player's senses the mediated information by means of the sensory modalities, vision, hearing and or touch.

Player properties:

Cognitive skills: The player's cognitive capacity and mental acuity determine how well the player can cope with challenges to his or her intellect. Both capacity and acuity are continuously increased and improved when put into use.

Sensory motor skills: The player's sensory motor skills determine how well the player can cope with challenges of his or her ability to respond with suitable physical actions when faced with particular stimuli. These skills are continuously improved when put into use.

Experiences: The player's prior experiences with gameplay in general and the particular gameplay being experienced in particular influences his capacity for action since they influence skills and expectations. As the player plays he or she continues to accrue new experiences.

Expectations: The player's expectations are as suggested determined by his or her prior experiences with the game and influence action since the performance of said action is done in accordance with expectations of how particular desirable outcomes might be achieved.

Goals and needs: The goals and needs of the player dictate his or her behavior since he acts or reacts with the purpose of fulfilling these. A need will in some capacity also constitute a goal however it is the urgency of fulfilling a need which determines its position in the player's goal hierarchy. The player's goals may correspond with the ones of the agent he or she controls (diegetic goals) or not (non-diegetic goals).

Affective state: The player's affective state comprises both the experienced emotions and associated pleasures of the mind. The cognitive appraisal objectives, *Relevance detection*, *Implication assessment*, *Coping potential determination* and *Normative significance evaluation* involves, but are not limited to, an evaluation of the player properties and external events. They influence the player's subjective feeling state and his or her tendencies, which direct actions in a manner pertinent to the event encountered. By virtue of their valence and intensity the experienced emotions act as the filter ultimately determining whether the player derives pleasure from the gameplay. That is to say, emotions determine whether the gameplay elicits pleasures of the mind (e.g. curiosity, virtuosity or suffering)

Engagement: If the player have adopted the goals inherent to the game, or made his or her own ones based on the events of the game, and experiences pleasures of the mind while striving to attain said goals, through challenges and usage of skills, he or she may find the gameplay engaging.

Action: The player proceeds to take action in accordance with his or her appraisal of the situation and affective state, and within the limits of his sensory motor and mental skills.

8.2 The Processes of Engagement

The individual types of engagement are, as apparent from the previous, not explicitly presented in Figure 40 – which will in the remaining part of this thesis be referred to as the *Gameplay Model*. The explanation is that the individual types in the original framework first and foremost were described in terms of their eliciting events (e.g. visual stimuli) and the corresponding emotional responses (e.g. curiosity). Moreover it should be noted that the Gameplay Model in its current form should be fully capable of illustrating the processes leading to each of four types of engagement considered pertinent to the current project, sensory, physical, intellectual and dramatic engagement. The following subsections will provide concise description of how the processes leading to each of the four may be described in terms of elements featured within the Gameplay Model presented throughout the preceding pages. For the sake of clarity these processes will be described by example. These particular examples are more specifically based on a make-believe game where the player takes on the role of the proverbial knight in shining armor on a quest to save the princess kept captive in a tower surrounded by a forest and guarded by a malicious troll. Before proceeding it should be noted that the specifics of the involved cognitive appraisal processes have been omitted for the sake of brevity.

Figure 41 – The three agents featured in our make-believe game, the knight, the troll and the princess (adapted from (deviantart.com)).

A sense of things to come

Following the description of the original framework sensory engagement is brought about by the experience of the game's visual, auditory or haptic representation of its content. The content of the game is necessarily continuously mediated to the player, but this does as previously described not imply that the corresponding sensations

necessarily always will lead to sensory engagement. However, the player playing our make-believe game does experience sensory engagement. After navigating the game environment for some time, all in accordance with the games rules, he finds himself at the outskirts of a forest. The game representation of this forest is dark and gloomy, but a faint light is visible between the trees. When confronted with the representation of the forest and the faint light the player appraises the stimuli he is sensing. After wandering a deserted wasteland for a while he asserts that this place presumably is of relevance for his long term goal of rescuing the princess. However, he knows from his prior experiences with this game and other games that dark places usually are associated with some form of danger. Yet the light incites him to take action and enter the forest. The sensory stimuli has in other words given rise to a sense of curiosity – one of the pleasures of the mind – since the player wishes to explore the forest in order to determine the origins of the light. The player experiences a feeling of suspense as he enters the forest. The representation of the forest gradually becomes dimmed as the player forces his virtual representation passed the fringe. His evaluation of the stimuli in the light of his prior experiences and presumed coping potential leads to a feeling of suspense, which, like the experience of curiosity, primarily is brought about by the game's representation. Suspense, is as previously described also a prospect-based emotion however associated with the pleasure of suffering. Had this negatively valenced emotions exceeded the player's threshold for tolerating negative affect then he would probably have turned off the computer and disengaged.

A demand for physical skill and mental acuity

Physical engagement is as previously described the result of joy of perfecting one's physical interaction with the game controller; and secondly one may become engaged as consequence of the pleasure derived from the effortless interaction accompanying a high level of proficiency. These types of engagement are also experienced by the player at the centre of our fictional example.

Half way through the forest the game confronts the player with an agent intended to pose as a challenge. This agent is represented to the player as a troll. The player's appraisal of this agent leads to negative attribution and attraction emotions, which leads him to believe that the troll is malicious. This along with a belief that he will be

able to cope with the impending danger spurs him to take action and fight the troll rather than flee. In either case, the player's personal survival assumes a higher position in his momentary hierarchy of goals and needs. Notably the slaying of the troll also allows him to pursue his long-term goal of rescuing the princess. The player has become skilled at controlling the input device and by implication the knight's sword. This process of perfection has led to many pleasurable emotions on behalf of the player. However, this agent behaves differently than his previous adversaries and the knight does on more than one occasion evaluate that he might not end up being victorious. He is once again experiencing negatively valenced prospect-based emotions associated with the pleasure of suffering. Had the troll posed less of a challenge this situation might not have given rise to such emotions; and in the event that the player cared little about the goals of saving the princess or further exploring the games diegesis, this might have dissolved the experience of engagement. The fact that he despite his confidence is uncertain of the outcome of the fight spurs prospect-based emotions, but after an intense period of manipulating the input device he ends up being the victor. This leads to a positively valenced fortunes-of-others emotions leveled at the player himself, along with well-being emotions. The player is in other words experiencing the pleasure of the mind virtuosity, that is, the joy of being proficient. This experience is in some capacity non-diegetic in nature as the player derives pleasure from being proficient at manipulating the input device. It may, however, also be spurred by the games diegesis since the knight now is one step closer to rescuing the princess.

Once slain, the player finds a map within the troll's garments. Since the rules of the game dictate that the player can only carry two items at the time he is forced to leave his shield behind. An event which elicits negatively-valenced prospect based emotions on behalf of the player. The visual representation of this map is, however, difficult to decipher. As it happens this is an intellectual challenge imposed on the player by the game. He evaluates that deciphering the map is important for the achievement of his goal and he appraises his own coping potential. As the player has little or no experience with this form of challenge, he experiences shame in the form of negative attribution emotions leveled at himself and negatively valenced attraction emotions towards the games design. However, after some scrutiny he discovers that he possesses the mental acuity necessary in order to decipher the map and subsequently takes action by using it for navigation in the game environment and finding the

princess. This experience gave rise to a strong experience of virtuosity, and by implication intellectual engagement. As a result the player later on derives pleasure from engaging in intellectual challenges despite the negative emotions they sometimes lead to. However, if this event had given rise to a higher level of negative affect then the outcome would probably have been the opposite.

A dramatic journey

Dramatic engagement does, as previously described, arise as a consequence of the player's experience of singular or causally related dramatic events, the latter being tantamount to the overarching narrative of the game. As it happens, the player in our example has experienced both forms of dramatic engagement. He has been able to identify with both the princess in distress and the knight, which he had been controlling, since he possessed the capacity for adopting both of their goals and concerns as his own. Even though his encounter with the troll did not lead to identification it did in similar manner lead to fortunes-of-others emotions The player has in other words experienced a wide range of both positively and negatively valenced emotions, which in turn have given rise to pleasures of the mind. Moreover it should be noted that the encounter with the troll in isolation may be considered as a dramatic event eliciting dramatic engagement by virtue of the pleasures of the mind it involved.

The example of the proverbial quest to save the princess used to illustrate the processes is necessarily simplistic in nature and it has far from described all of the ways in which the elements outlined in the Gameplay Model might influence engagement. It is, however the hope that this simple example illustrates how the Gameplay Model may be used to describe the experience of engaging gameplay and ultimately serve as a resource when aspiring to design such gameplay.

8.3 States of Play

The purpose of the described Gameplay Model was as previously suggested not to provide a recipe for the design and study of engaging gameplay, as this is nearly impossible seeing as no player is the same and gameplay by implication also is unique. Instead it is the hope that the model might help make both designers and scholars aware of some of the factors which influence the experience of engaging gameplay. In

order to make the model more useful to the scholar aspiring to analyze engaging gameplay and the designer striving design such experiences, one additional concept can be introduced, namely gameplay states, which can be described in terms of the player and the game state. The notion of player and game as systems with continuously changing states is, however, by no means a novel insight as apparent from the description of Cook's five states of skill mastery described in the chapter *Engaging by Design*. One particular description of such states does seemingly lend itself particularly well, considering the description of the Gameplay Model presented throughout the preceding sections, namely the one proposed by Järvinen (2008). Järvinen, who previously was cited in relation to the description of gameplay as emotional experience, does more specifically provide the following description of how he conceptualizes game states:

> *"[G]ame states function as temporal reference points to an event in a game; they represent specific moments in time where the game and its players, and all information concerning them, are in a certain configuration."(Järvinen, 2008 p. 88)*

This description of a state describing the certain configuration of the features inherent to both player and game, at a certain point in time, seems easily applicable to the Gameplay Model. However, in order to avoid any confusion this type of state will be referred to as a gameplay state since it includes the properties of the two active agents – game and player. The argument here is that it on equal terms is possible to describe the momentary state of both game and player, that is, the game and player state. By considering the two as separate, yet symbiotically coexisting, we are able to discuss how a particular configuration of game elements might influence the player and elicit emotions and pleasures of the mind on his or her part. Conversely, these states also provide us with a lens through which to discuss a particular player experience and make assumptions about how to design the corresponding eliciting events.

Figure 42 – The gameplay is constantly evolving when a player interacts with a game, therefore it makes sense to talk of states, both for gameplay, but also its two subcomponents; player and game.

8.4 The Answer is '42'

If you are familiar with Douglas Adams' cult book *Hitchhiker's Guide to the Galaxy* – or the motion picture based on said for that matter – you will know that the super-computer Deep Thought, after millions of years of contemplation, presents the number '42' as the answer to the ultimate question of life, the universe, and everything. However, this answer makes little or no sense to anyone because, as the computer argues, to understand the answer, you must first know the real question. When we first started studying game design we encountered the term *gameplay*, and as apparent from the preliminary analysis, the usage of the term seemed just as perplexing for game designers and academics as the answer '42' was for the people in Adams' fictional universe. Gameplay was apparently the answer to the question of how to design a good game, but we had little or no clue of what to make of this curious term and it seemed that nobody else really had any clear notion either. The question really became that of how you design games, so that the answer gameplay makes sense. The Gameplay Model presented in this chapter is the outcome of this question. So what is it useful for now when we got both question and answer understood?

Figure 43 – The super computer 'Deep Thought' (the golden figure in the middle of the screen) gave the answer '42' to the ultimate question of life, the universe and everything. As little sense as '42' made for the people of Douglas

Adams' fictional world, the answer 'gameplay' as a goal parameter for game design made little more for us (image adapted from (Jennings, 2005)).

If we start with viewing the framework in relation to previous mentioned models it casts some light on the matter. As have been presented throughout the previous chapters, several models of player and game interaction and experience have been proposed by academics and game designers alike. So, how does the Gameplay Model, proposed here, set itself apart and does it bring anything new and useful to the table? Well, we start of by studying Ermi and Mäyrä's model for gameplay experience again for a moment. This model was criticized for being non-practical in terms of gameplay design. To be more precise, what their model illustrates is gameplay as a hybrid between *game* and *player* with an immersion focus. Though both *player* and *game* are shown containing some components, the research done in this project suggests that they are not adequate to support and explain the revised engagement principles extracted from Schønau-Fog and Bjørner's framework. Nor is it possible to extract any understanding of the process that occurs when viewing the gameplay state as a whole. The belief is that the Gameplay Model presented in this chapter, makes it possible to get an overview of the processes from *rules* to *engagement* and vice versa. On this note, it is important to further point out that the view forming the basis for the Gameplay Model is influenced by the MBA model, which main unique feature is that it brought to the attention, the fact that game designer and player view the game experience from opposite corners. Still, the MBA framework suffers from the same limitations as the gameplay experience model in regards to lack of practical application and process understanding.

Last, but not least, the PNRC model proposed Daniel Cook is rather innovative in comparison with the previously mentioned models in the sense that it outlines a design practical loop containing player, need, reward and skill. Furthermore, the PNRC model is directly applicable – in game design terminology – which is its greatest strength – being designed by a game developer it would seem odd otherwise. Conversely, the gameplay model proposed here does not highlight the specific states the player goes through, but rather outlines the factors that can influence his or her gameplay experience. As was outlined in the beginning of the current thesis the problem with understanding game design was that it relied heavily on an understanding of the term gameplay that was simply not existent – or at best, so diverse that it was not practical in any way. The hope is that the current Gameplay

Model will help explain what elements constitutes gameplay in a way that will aid the understanding of what is needed of anyone who wants to design a game or aspect of same, which has the potential to elicit engagement.

These seeming benefits aside there are points of critique that must be mentioned in order to understand the model in full. As presented in the various frameworks and models in this thesis, along with the statement of academics and game developers alike, there is always a fiery debate about which elements are of most importance and what influence they have on other elements in various hierarchies. This debate extends to the Game Model as well. The components constituting the model are chosen and defined according to our research and the beliefs of its authors. Others might feel that e.g. goals and needs are separate entities all together, whereas some may argue that the division between intellectual and sensory motor challenges is not broad enough and should include all eight of Crawford's challenge/reasoning types. Whatever the case, there are plenty of subjective views to be offered. Nevertheless, one counterargument can be made in this regard since the Game Model would not be invalidated by the addition, splitting or removal of components given that the fact that it is constructed in a way that it allows for such alterations.

As explained, the model is in essence not only an understanding of which processes might lead to engagement, but also what the term gameplay encompasses based on the research and discussion presented in the preliminary analysis of this thesis. At that point several attempts at defining gameplay were presented that both excluded and included various components of the gaming experience. The most widely accepted of these was Sid Meier's "*a series of interesting choices*" (Rollings, et al., 2003) which serves as no practical help at all in either engagement or game design terminology. In the end we have presented arguments for gameplay as being a hybrid term consistent of all elements inherent to both player and game, which can lead to various mental states – including engagement. This eventually entailed the description of the Gameplay Model, which in turn has signified a possible new definition of the term gameplay. As stated above, the model presents a causal chain where it is possible to view the components of both game and player state. This chain is actually a cycle, which outlines how the components are connected and experienced. On this basis, we can then define gameplay as being the cyclic process between a game and player, which if done successfully, can lead to engagement.

CHAPTER 9 - USER CENTERED GAME DESIGN

Based on the conclusions drawn from the previous discussions of engagement from the perspective game design and player psychology the preceding chapter detailed an attempt at constructing a model intended to make the concept engagement more readily palpable to game designers and academics alike. The model was more specifically founded upon the premise that gameplay may be viewed as a cyclic exchange of information between the player and game, which under the right circumstances may be experienced as engaging. The current chapter focuses on the more general design philosophies underpinning the concepts usability and playability and introduces User Centered Design as a the method of choice when aspiring to design potentially engaging gameplay by means of the model outlined in the previous chapter.

By way of introduction, the section *What is UCD?* outlines the concept of UCD from an overall perspective. The intention with the section is to introduce the basic underlying principles of UCD, in order to assist the comprehension of how it forms the basis for the concept of player centered design in games. Since usability is a key concept of UCD, the subsequent section *Usability in games* discusses usability in productivity applications in comparison with games and why the concept is so important in a game context, being a prerequisite for engaging gameplay. The concept of game playability has its origins in the philosophy of usability and introduces a whole new dimension revolving around the player experience instead of the user experience. Notably, the concept engagement corresponds to a high level of playability. The final section *UCD in a Game Context* introduces the concept of playtesting as an acknowledged way of testing a game's playability, and by implication the experience of engagement. In continuation hereof, contemporary game design heuristics are investigated in preparation for the development of a set of principles to be used in combination with the Gameplay Model during the design and evaluation of the WobbleActive prototype.

9.1 What is UCD?

The International Organization for Standardization (ISO), has created a standard entitled *Human-centred design processes for interactive systems* (ISO 13407), which provides guidance on User Centered Design activities in relation to interactive computer-based systems (ISO, 1999). In accordance with the ISO 13407 standard, there are four main principles one should strive to follow when performing such activities (ISO, 1999) (Maguire, 2001 pp. 587-643):

- *Active involvement of users:* It is important to actively involve users who have real comprehension of the context in which a given application is to be used.
- *Appropriate allocation of function between user and system:* It should be determined which aspects of a job or a task should be carried out by the user and which should be performed by the system. For instance, it is desirable to let the user focus on the aspects that require his or her expertise by limiting the amount of tiresome routine work.
- *Iteration of design solutions:* Iterative design solutions are based on the feedback from end-users who have tried out earlier design solutions.
- *Multi-disciplinary design teams:* UCD is a collaborative process which implies involvement and exchange of different competences from various parties who have insights and expertise to share.

In line with the ISO 13407 standard, there are five overall UCD activities out of which four are iterated throughout the duration of the project, until the objectives are satisfied. These five activities, which should be performed in order to incorporate usability into the software development process, are illustrated in Figure 44 below.

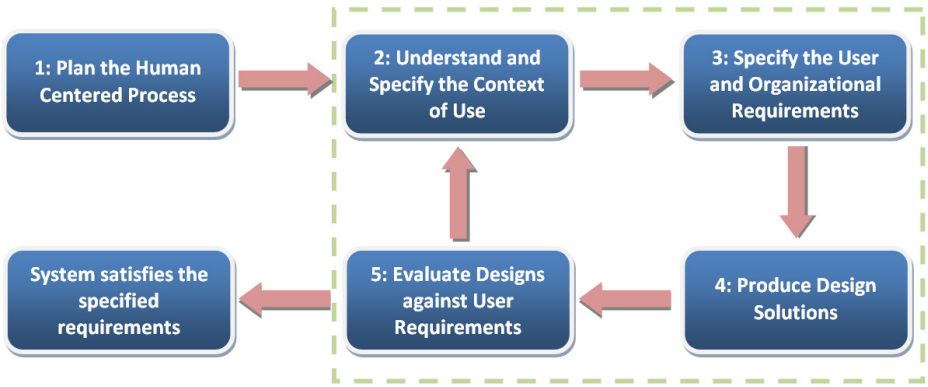


Figure 44 – Overview of the five essential UCD activities in accordance with the ISO 13407 standard (the figure is adapted from (ISO, 1999)).

It is important to stress that the progression to an activity only should be performed when all aspects of the preceding activity are satisfied and all information has been covered. To further clarify the five activities the following subsections provide brief outlines of what each stage of the process includes (ISO, 1999)(EMMUS, 1999):

Plan the human centered process

The first activity requires a consultation with all project stakeholders and their commitment to the UCD philosophy to ensure a consensus that users are involved throughout the whole design process and not only in the end. The outcome of the first activity is a validation plan to make sure that a sufficient amount of time is spent on iterative user testing. It specifies the requirements, methods and success criteria for the activities in the iterative UCD process. Producing the plan is an iterative process in itself since it should be constantly reviewed, extended, updated and maintained during the design and development process.

Understand and specify the context of use

The quality of a system depends on the understanding and specification of the context in which the system will be used. The purpose of this activity is to investigate the systems external environment and especially the physical and social context of the user. The output of the activity documents the systems context of use in terms of:

- The user characteristics (significant attributes)
- The tasks to be performed by the user (a hierarchical breakdown)
- The system's overall goal of use
- The environment in which the system will be used (physical, social, organizational, technical etc.)

The context of use for the proposed system, including relevant characteristics of both the user and system, is an iterative process of documentation that can be redone or extended throughout the project life cycle.

Specify the user and organizational requirements

In most software design processes it is a major activity to specify the functional requirements for the system based on the above mentioned context of use. In UCD,

the activity is extended to the formulation of an explicit document containing the user and organizational requirements for the system i.e. the user-centered requirements. In order to specify the relevant requirements, one must consider aspects such as:

- Identification of all needed stakeholders including relevant users and other personnel in the design process
- Provision of clear design goals and acceptance of the goals by all stakeholders
- Continuous communication and cooperation between all stakeholders (especially users)
- Acknowledgement of legislative or statutory requirements, including safety and health
- The quality of the human-computer interface (HCI)
- The quality- and allocation of user tasks as well as the user's motivation, comfort and safety
- The quality of task performance, especially in regards to usability

Produce design solutions

The next activity involves the production of design solutions based on the context of use, system- and user requirements as well as experience and established state of the art. The activity involves the following processes:

- Using existing knowledge to produce a design solution (e.g. guidelines, heuristics, standards, examples of other similar systems)
- Creating a more concrete design solution by use of e.g. low fidelity prototypes, mock-ups and simulations
- Presenting the design solution to users and allowing them to perform tasks, with or without assistance of observing evaluators
- Improving the design solution in light of the feedback provided by the user
- Iterating this activity until UCD (or usability) objectives are met

The level of prototype fidelity and amount of iterations depends on several factors including the level of emphasis put on the optimization of the design. Early prototypes can be nothing more than paper mock-ups or screen visualizations. While progressing through several stages of iteration, the prototypes can become high fidelity and evaluated in a more realistic context.

Evaluate designs against user requirements

Evaluating design solutions is an essential activity in UCD. Generally, the most effective usability evaluations are carried out at an early stage and continuously throughout all phases of the product life cycle. There are two overall ways of evaluating:

- *Formative evaluation:* Provides feedback to improve the design throughout the design and development phase.
- *Summative evaluation:* Provides information on the product's efficacy. That is, whether or not the design meets user and organizational objectives, thereby achieving what it was designed to do.

Early stages in an iterative design process focus on obtaining feedback (typically consisting of a range of usability defects) to improve the design, whereas the realistic prototypes developed later focus on the product's overall efficacy. Regardless of the type of evaluation, it is important to understand that the results are only as reliable as the context in which the product is tested in. If the product is evaluated in an unrealistic environment, the results might be misleading in comparison with realistic usage.

Although the ISO provides recognized guidance on general UCD activities, the concept of user-centered design is still a much discussed topic with no universally agreed upon definition. Gulliksen et al. defines UCD as *"[…] a process focusing on usability throughout the entire development process and further throughout the system life cycle"* (Gulliksen, et al., 2003 p. 401). UCD therefore revolves around the users of a product in order to determine their needs, wants and limitations at each step of the design process. By involving users through the planning, design and development process of an interface, developers can foresee how it is most likely to be used. The ISO 13407 standard is according to Gulliksen et al. not sufficient when trying to maintain a UCD approach in an arbitrary project. More specific principles are needed to supplement the guidelines provided by the standard. As a result of a thorough study, Gulliksen et al. have identified 12 key principles for UCD which are concisely summed up below in Box 17.

Box 17 – The 12 key principles of UCD

1. **Focus on users:** At an early stage, all project members must understand the goals of the activity, the context of use as well as the user's needs, goals and tasks.
2. **Involve user actively:** Representatives of the intended user groups should participate actively throughout the entire development process. Plan the user participation in terms of when and how to involve the users.
3. **Use iterative design:** Throughout all stages of the production, developers must iteratively *design*, *implement* and *evaluate* in accordance with user feedback.
4. **Use simple design representations:** The iterative design representations must be simple, intuitive and comprehensible for all stakeholders.
5. **Apply early and continuous prototyping:** Use multiple and continuous prototypes throughout the entire development process to elicit requirements, visualize ideas and solutions and support the creative process. Start with low-fidelity materials such as quick paper sketches and mock ups, and continue with high-fidelity realistic prototypes.
6. **Evaluate use in context:** Evaluate the design against baseline usability goals and criteria in cooperation with end-users, in context.
7. **Design activities should be explicit and conscious:** The outcome of the system design should be a result of professionally and carefully planned interaction design based on dedicated and conscious design activities.
8. **Keep a professional attitude:** The team must be multidisciplinary in order to make the development more effective and professional with input from various sets of skills.
9. **Use a usability expert:** A usability expert should always be given authority to decide on usability matters.
10. **Design holistically:** All aspects that might affect the future use situation must be considered while developing. This includes social and physical environment, health and safety aspects, manuals, user training etc.

11. **Customize the UCD process:** The UCD activities should be adapted and customized to fit the needs of the particular project in question. Existing techniques and methods can be reused if they comply with the context.
12. **Establish a user-centered attitude:** All project stakeholders must be aware of as well as committed to the importance of user involvement and usability.

The 12 principles above can be used during the development, communication and evaluation of usable interactive interfaces in that it covers analysis, design, implementation and testing. As it appears, there are many benefits with applying these 12 principles, since they emphasize the focus on users and usability throughout the entire development process. It is almost impossible to implement all principles in one round. Therefore, gradually application, as the project progresses, seems to be more feasible and practicable.

It is however crucial to comply with the principles as much as possible at any point in time. Since the principles are rather abstract and general in nature, they must be modified and adapted in accordance with the project on which they are to be applied (Gulliksen, et al., 2003 p. 403). By applying these UCD principles or other user-centered principles as opposed to alternative design philosophies, the user interface will be optimized around how people can, need and want to work, rather than forcing them to work in a way that accommodates the software developers approach.

Since usability and user involvement are the key concepts of UCD, the question is then raised: Is there a role for these concepts in game development? If so, are they equally as important within a game context as they are in the development of productivity applications? In order to address these questions the following section details a description of usability from a more general point of view, followed by a discussion of the role of usability within the context of games. Subsequently, the notion of UCD is discussed specifically in relation to usability and game development in general, to further clarify the concept and the pros and cons related to it in a game context.

9.2 Usability in games

Usability can loosely be defined as 'the ease of use' (Nielsen, 1994 p. 26). One of the most recognized descriptions of usability comes from Jacob Nielsen, who states that usability has multiple components and includes the five measurable attributes *learnability*, *efficiency*, *memorability*, *errors* and *satisfaction*, which have been summarized in Box 18, below (Nielsen, 1994 p. 26).

Box 18 – The five measurable attributes of usability
1) Learnability: For the user to quickly start getting work done, the system must be easy to learn.
2) Efficiency: For the user to achieve a high level of productivity, the system must be efficient to use.
3) Memorability: For the casual user to be able to return to the system after a while of not having used it, the system must be easy to remember.
4) Errors: For the user to make as few errors possible and recover easily from them, the system must have a low error rate.
5) Satisfaction: For the users to be subjectively satisfied, the system must be pleasant to use.

In order to improve the user experience of games, traditional productivity metrics such as the five listed above can be important to consider. Nevertheless, games are a very diverse class of applications, since they obviously serve a completely different purpose than productivity applications.

9.2.1 Usability in games and productivity applications

Pagulayan et al. discuss five overall differences between productivity and entertainment oriented applications (Pagulayan, et al., 2003 pp. 883-906). First of all in games, obstacles are purposefully created to challenge the player, whereas productivity applications eliminate as many constraints as possible. Second, games are not committed to achieve productivity, but instead they are designed for enjoyment and optimum experience. The important thing about a game is the intrinsic reward

the player gets from the process of play, unlike in productivity applications which are dependent on outcome-based rewards. It is not only about reaching a certain destination, but also about enjoying the journey. Third, whereas a productivity applications' visual space strive towards maximum consistency, a digital game world emphasizes a variety of visual experiences. Fourth, there is a wide range of different and alternative input devises a player can apply to interact with a game. And fifth, whereas elements such as graphics and sound serves to communicate a function in productivity applications, they serve as means of supporting the games narrative and environment while striving to achieve engaging gameplay.

One must remember that Nielsen's five usability attributes only refer to common user-interface concepts such as desktop applications, and therefore many of the usability components only have limited meaning in a game context. They can be useful in uncovering a certain amount of usability problems in games, but they do not address several issues such as providing intuitive control mappings or appropriate camera angles when displaying the game world.

Continuing the discussion on productivity applications versus games, one may even argue, that the delicacy of player experiences and the heavy competition on the market actually makes usability equally important for games and productivity applications. There are not that many word processors or spreadsheet applications to choose from and having a fun time while working is not necessarily a top priority compared with the achievement of high productivity.

According to Schaffer, the five usability attributes proposed by Nielsen can be narrowed down to *learnability*, *memorability* and *satisfaction* in a game context (Schaffer, 2007 p. 2). Since games are not committed to achieve productivity, Nielsen's second usability attribute, *efficiency*, cannot be regarded as an attribute, which is relevant for usability in games. Furthermore, *errors* are usually undesirable in productivity applications, but expected in games to challenge the players and force them to develop new skills in order to achieve the objectives inherent to the game. From this perspective, it seems that errors are not a result of usability related frustrations (Pinelle, et al., 2008 p. 1453). Then again, one could instead regard bugs – hard or software flaws – as being an error pertaining to usability. For instance, if a player finds himself undesirably stuck because of a flaw in the system, without being able to

get out regardless of his skills, the generated frustration is a result of a usability related issue. Such instances of frustration would constitute negatively valenced attraction emotions leveled at the game and the hardware used to interact with it. Although system errors might result in major frustrations, human errors should be avoided as well. This raises the question about where the line is drawn between system- and human errors in games. For instance if a player finds himself stuck and must use acquired skills or logical thinking to get out, it is considered a challenge as opposed to an error in the traditional sense. With this in mind, a human error can rise from a challenge which is too hard, resulting in the player getting stuck without knowing what to do. To prevent this kind of human error, the player must feel that there is room for a few mistakes and know which step to take next (further elaborated on in the section *Using Heuristics for Game Design and Evaluation*).

According to Pinelle et al. game usability is defined as *"[...] the degree to which a player is able to learn, control and understand a game*" (Pinelle, et al., 2008 p. 1453). This presupposes the exclusion of all obstacles to engagement on behalf of the player. The main purpose of usability in games is therefore to deliver a better, more intuitive and deeper experience by eradicating unnecessary interruptions, bugs and challenges that are not intentionally included in the design by the developers.

9.2.2 The importance of usability in games

The importance of usability within games is perhaps best illustrated by drawing a parallel to a real life game, namely soccer. When playing the players are continuously challenged and aspects of the game such as goals, tactics, opponents, rules etc. all contribute to the experience of engagement on behalf of the involved players. However, would the act of playing be equally as engaging, if the ball was deflated and thus impossible to control; if the referee was unaware of the rules and therefore constantly interrupting the game on erroneous grounds; or if the players' boots were too small, making the physical act of playing painful? The answer to this question is almost certainly no. As these issues all may be described as real world counterparts to usability issues it seems reasonable to assume that usability indeed is a prerequisite for engaging gameplay, regardless of whether it takes place in the real or a virtual world.

Figure 45 - A metaphorical line can be drawn between a digital game and a game of real life soccer in terms of defining the aspects pertaining to usability in games (the image is adapted from (sportsnet)).

Although good usability does not ensure the experience of engagement it still plays a pivotal role, since *"[...] failure to design usable game interfaces can interfere with the larger goal of creating a compelling experience for the users, and can have a negative effect on the overall quality and success of a game*" (Pinelle, et al., 2008 p. 1453). In terms of the Gameplay Model outlined in the previous chapter such failures would correspond to the disruption of the cyclic flow of gameplay and in the event that the experienced negatively valenced attraction emotions exceed the player's subjective threshold for tolerating negative affect he or she would stop playing. It would in other words appear that good usability is of great importance for game design, since it is a prerequisite for the experience of engaging gameplay.

Figure 46 - Usability is an important underlying aspect of gameplay. If the usability is poor, the gameplay in its entirety will suffer and it is less likely to be experienced as engaging.

In continuation hereof, it is worth referring to Sellar (2004) who describes that players find game interfaces much more satisfying when they are easy to interact with (Sellar, 2004 p. 676). Moreover, Lazzaro concur with the belief that bad usability may cause the player to disengage when stating that players may abandon games entirely because of interface difficulties (Lazzaro, 2004 pp. 22-26). The game interface

includes not only the user interface but also the control peripherals, the game interaction mechanisms, be it handheld controllers, steering wheels, motion sensitive controllers or other alternative devices. Regardless of the type of controller, all interaction mechanisms should be intuitive, easy to learn, comfortable and perform effectively so as to avoid any frustrations and negative influences on the overall gaming experience (Sellar, 2004 p. 676). In a gaming context, pressing a button to fire a weapon is a usability related feature and should be easy, whereas aiming and deciding *when* and *who* to shoot is an in-game consideration which must be challenging.

In a study about how game interface usability influences player engagement, Febretti et al. (2009) state that during user testing they found that there is a significant decrease in the player engagement when a usability problem manifests itself during a game session. Here it should be noted that the definition of engagement employed by Febretti et al. in many regards is similar to the one used within the context of the current project, that is, they define long term engagement as *"[...] the degree of voluntary use of a system along a wide period of time"* (Febretti, et al., 2009 p. 4063). Moreover, Febretti et al. describe that the study indicated that unless the usability problem was severe enough to prevent any further action, the players took the time to overcome the problem and continue the game as illustrated in Figure 47 below (Febretti, et al., 2009 p. 4067). So, it would appear that, the smaller the usability problems, the easier it is for the players to overlook them and become engaged once again.

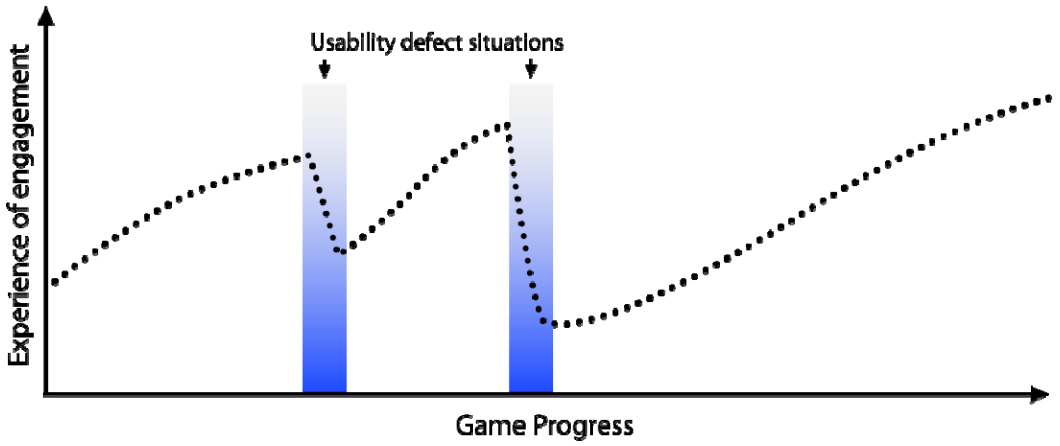


Figure 47 – Typical flow of experienced engagement and the effect of experienced usability defects (the figure is adapted from (Febretti, et al., 2009 p. 4067))

Moreover it would seem that the player experience is very sensitive to usability problems and the player should not have to struggle with obstacles that make playing less engaging. What appears to be the smallest error or glitch in the user interface might render otherwise good gameplay a rather bothersome experience. For instance, bad mappings and camera angles or inconsistent interface or game world make the game tedious and unpleasant. Modern games are big and extensive programs with lots of menus and different ways in which the player can interact with the system. The interaction with the interface must be as intuitive as possible, to leave room for the player to be challenged by the obstacles intentionally incorporated in the gameplay.

To sum up, there are many reasons why usability is important in a game context. Evidently, usability is a prerequisite for a successful gaming experience since failure to achieve good game usability can interfere with the larger objective of creating engaging gameplay. Usability should thereby be a prime concern when one is striving to design games facilitating engaging gameplay. This conclusion is drawn upon the knowledge that a player's experienced level of engagement is inversely proportional to the number of usability related issues he or she encounters during play. It is the belief that a further study of how to practically ensure good usability is necessary in order to enable the creation of engaging gameplay which might serve as a source of intrinsic motivation. Consequently, the following sections discuss UCD in games from a more concrete and practical perspective before elaborating on the notion of usability and the new dimensions which it brings along in a game context.

9.3 UCD in a Game Context

It has been established that UCD in general terms revolves around the evaluation and design of usability through iterative user involvement. This begs the question, if the core principle of the UCD philosophy is to promote usability, and usability is fundamental to engaging gameplay, where *exactly* does UCD fit in a game context?

As outlined in the previous section, there is a significant difference between usability in productivity applications and usability in games. The general definition of UCD remains the same when this concept is applied to game design. Nevertheless, there is a significant difference between applying UCD in a game related context and UCD in the development of productivity applications, from which the philosophy originates.

This is evidently because of the fact that productivity applications, as the name implies, are committed to achieve productivity while games are designed with the purpose of providing hedonic and autotelic experiences, that is, engage the players.

In a study regarding the design of adaptive videogames, Gilleade et al (2004) argues that UCD should be applied to remedy what they refer to as *at-game* and *in-game* frustrations. At-game frustrations are essentially results of a struggle with the user-interface, for instance, a non-responsive input device, bad mappings and camera angles etc. On the other hand, in-game frustrations are caused by failure to know how to e.g. overcome an obstacle or complete a given challenge. In-game frustrations are regarded as a bit more subtle though, since a certain degree of this type of frustrations aids the gameplay in terms of allowing the player to prevail and succeed. The challenge for the game designer is then to balance the level of in-game frustrations, so that the player enjoys the game instead of being annoyed by it (Gilleade, et al., 2004). While in-game frustrations can be pleasurable to some degree – depending on the player's capacity for negative effect – at-game frustrations cannot. Roughly, at-game frustrations are those pertaining to usability issues whereas in-game frustrations are the more complex ones caused by intentionally or unintentionally designed game obstacles, goals, challenges etc. So while in-game frustrations may lead to the pleasure of the mind dubbed suffering and thus engagement, at-game frustration will all most certainly be the result of negatively valenced attraction emotions leveled at the system and thus disrupt the experience of engagement.

In terms of the real life soccer analogy presented in the beginning of the previous section the at-game or usability issues are those caused by e.g. a deflated ball and the in-game issues would be a result of the challenges, goals, tactics, opponents, rules etc. In conclusion it would seem that both in-game and at-game aspects should be considered when one is aspiring to design a game facilitating engaging gameplay. Moreover this implies that UCD also will be relevant to the design of a potentially engaging gameplay. Not only can iterative user involvement be applied to design for usability in games, it may also serve as a means of designing and evaluating the in-game features of gameplay described throughout the preceding chapters. The following subsections present brief descriptions of the three concepts *playtesting, iterative playtesting,* and *game design and evaluation heuristics* which all may be central to the application of UCD within the context of game design.

9.3.1 Playtesting at-game and in-game aspects

When evaluating the user experience in productivity applications, the focus lies on the functional values including test of extend to which the usability is sufficient. In games, a designer has to consider both at- and in-game values. This latter includes the various elements discussed throughout the preceding chapter, such as storytelling techniques, character design, and the design of challenges and goals. When using UCD in games and iterative user involvement to test all at-game and in-game aspects, *playtesting* (or *playability testing*) is a commonly applied method. Per definition, playtesting is the process by which the game designer tests all aspects of the game before launching it. This includes, but is not limited to usability, controls, goals, challenges, pace, narrative, flow, immersion, entertainment value etc. In other words, playtesting is about testing the *playability*, that is, the degree to which a game is usable and enjoyable (Foraker, 2010). Considering the discussion of engagement presented throughout the preceding chapters it would appear that this in turn implies that a high level of playability is virtually identical to the experience of engaging gameplay. Moreover this implies that the principles used to design and evaluate a game's playability also should be applicable when one aspires to design engaging gameplay.

Even though the concept playability is based on usability, it also encompasses the degree of enjoyment and entertainment. While these are the primary objectives, they are very subjective concepts, as apparent from the previous chapters on engaging gameplay. Playability entails an extension of the user experience characteristics with the *player's dimension* including a wide range of properties and attributes to measure the player experience. In a study concerning usability and playability in games, Sánchez et al. (2009) define playability as *"[…] a set of properties that describe the Player Experience using a specific game system whose main objective is to provide enjoyment and entertainment, by being credible and satisfying, when the player plays alone or in company"* (Sánchez, et al., 2009 p. 67).

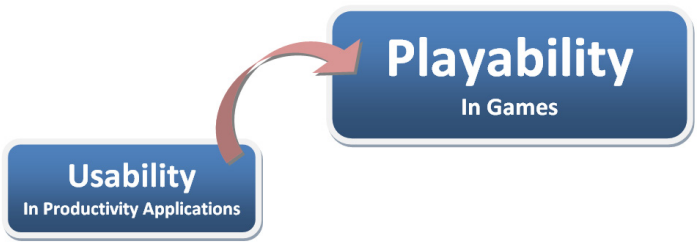


Figure 48 – The term "playability" in games originates from usability in productivity applications. Playability is thereby an extension of usability, with the addition of a wide range of attributes to measure the player experience.

The design and evaluation of the at-game aspects encompassed by the game's usability is the foundation of playability. Nevertheless, it is still important to remember the in-game objectives which are a lot more subtle and difficult to measure due to the high degree of subjectivity. Playability is thereby characterized by attributes pertaining to usability, but it is much more comprehensive in a gaming context. Although playability and usability are two side of the same coin, Kücklich et al. (2004) argue that there is an important difference between the two: "*While increasing the usability of media technology usually means making its functionality as accessible as possible to the user, playability often depends on withholding certain options from the player. It is quite crucial in many games that the player does not have access to the full range of options the game offers initially, but only after she has invested some time in the game. The playability of a game is actually increased by this strategy of deferral, because it challenges the player to spend an increased amount of time playing the game*" (Kücklich, et al., 2004 p. 22).

In sum, playability, and by implication engagement, is affected by both at- and in-game aspects such as control, intensity of interaction, customizability, responsiveness as well as immersion, flow, narrative, challenges, goals, realism, strategy, quality of graphics and sound etc. It thereby refers to what can be considered as the quality of the gameplay (Sánchez, et al., 2009 p. 67), that is the experienced level of engagement.

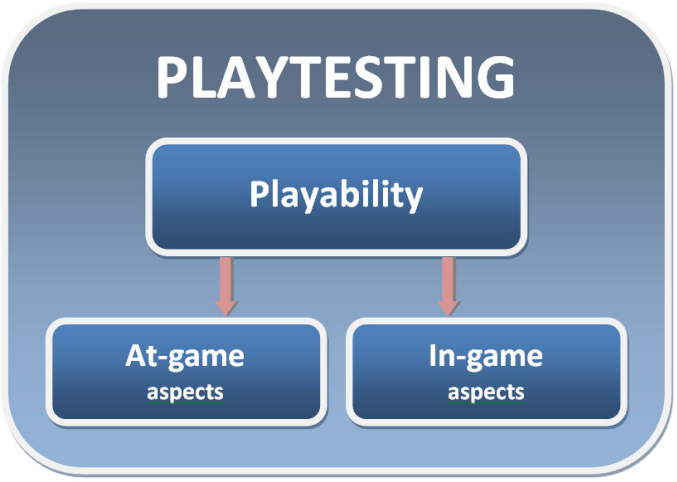


Figure 49 - Playtesting is a process that measures a game's playability, that is, the quality of the gameplay. It tests for the at- and in-game aspects including those pertaining to usability and the more complex and subjectively perceived in-game aspects (encompassed by the term *engagement* – as discussed below).

Gameplay evidently refers to a wide range of different features of the player experience and it does thus seem natural to distinguish between aspects of gameplay pertaining to usability and those pertaining to engagement. However, this distinction is somewhat equivocal because the experience of engagement presupposes good usability, since a player cannot experience engaging gameplay if he or she has to struggle with usability issues. Ambiguity notwithstanding, the remaining part of this thesis will maintain the distinction between usability (the at-game aspects as described in the section *Usability in games*) and engagement (the in-game aspects described throughout the preceding chapters) as this distinction presumably will ease readability.

Playtesting can consequently be applied as a means of detecting usability problems in the game as well as assessing the emotional responses, which are central to the experience of engagement. So even though usability is a prerequisite for engagement, the two terms will be separated and individually treated throughout the remaining part of this thesis and referred to as at-game and in-game aspects. In this sense, the focus on at-game and in-game aspects assists the way the gameplay should be designed and evaluated in the current project. Although the two aspects are interlinked, there is a big difference in the way they are designed for and evaluated, as will become apparent from the following.

Figure 50 – The bifurcation of the gameplay aspects is in the current project constituted by at-game and in-game aspects, which assists the design and evaluation of the gameplay. Although the two terms clearly overlap each other, they will be separated and individually treated throughout the remaining part of this thesis.

9.3.2 Iterative playtesting

Although UCD is an acknowledged philosophy in the development of productivity application and digital media, it is not always a common practice in the design of games. It is best practice to involve end-users already in the early stages of development in digital media projects. However, the term UCD is hardly ever mentioned in professional game design literature. Instead, all necessary UCD aspects are covered by the term *playtesting* which is the preferred design practice nowadays, involving end-users (Moschini, 2006 p. 142). During the formative days of game design, playtesting was about gathering a few friends or acquaintances to test the effectiveness of a given game. Nowadays, playtesting has evolved into a much more rigorous process. A growing number of game design publications and guides emphasize the importance of playtesting game prototypes in order to facilitate and support the user experience. Despite the fact that testing is a crucial component of successful game design, it is often performed throughout the final stages of the development process to identify potential loopholes in relation to the game mechanics or refine certain aspects of the gameplay, rather than to influence and improve the core game concept (Moschini, 2006 p. 142). In response to this, a new player centered approach to game design has emerged – the iterative design process – where player feedback is acquired, analyzed and implemented into the design throughout the entire game development cycle, following the basic idea of UCD in traditional usability engineering. In the words of Sánchez et al. (2009): *"Finally, we recommend using playability tests [playtests] during the entire development process using playability properties to validate and verify the requirements of playability and ensure the quality of playability in the final product."* (Sánchez, et al., 2009 p. 72)

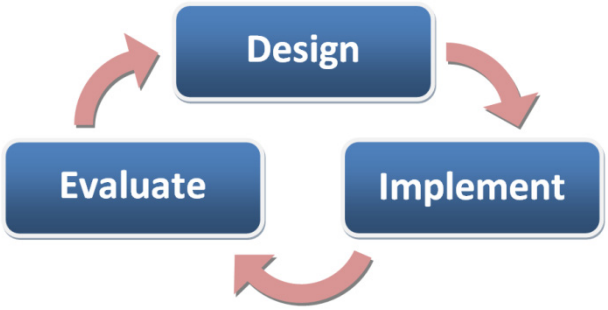


Figure 51 – The core concept of UCD, whether it is in game design or traditional usability engineering, is about involving the users/players in an iterative design process that includes design, implementation and evaluation throughout the entire development process.

Salen et al. (2004) give the following definition of iterative design in a game context: "*Iterative design is play-based design process. Emphasizing playtesting and prototyping, iterative design is a method in which design decisions are made based on the experience of playing a game while it is in development*" (Salen, et al., 2004 p. 11). While playtesting prototypes in a traditional game design approach is a means of refining the game and fixing inconsistencies of the gameplay towards the final stages of development; iterative playtesting forms the basis of the entire design process throughout all stages of the development. Salen, more specifically describes that "*[t]he game is prototyped during its development, and then played by the designers as well as outside testers. Design decisions are based on the results of the playtests, and a new prototype is created, which is playtested again*" (Salen, et al., 2006 p. 21). Continuous playtesting of prototypes is clearly recommended. On one hand it is obvious to playtest for at-game usability related issues throughout the entire development cycle. On the other hand, it is a bit more difficult to iteratively playtest in-game objectives relating to engagement, since certain gameplay elements (challenges, goals etc.) must be fully implemented before they can be tested. It is therefore a challenge for the game designer to successfully playtest in-game aspects iteratively in early stages of the development. The core benefit of a user-centered iterative design process is that in the early stages of the development process, changes are relatively inexpensive since they demand less effort. The further the development process has progressed and the more defined the game is, the more expensive the changes will be. Applying user evaluation only in the end of the development process may be prohibitively expensive; and not considering user-involved iterative testing earlier in the process, might turn out to be a waste of effort.

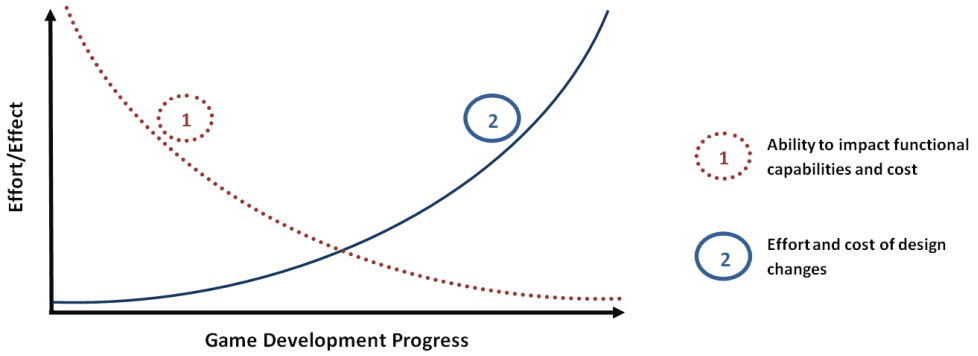


Figure 52 – In the early stages of the development phase, changes are relatively inexpensive and easy to implement. When the project is nearing the end, changes become more expensive and difficult to implement (the figure is adapted from (Macleamy, 2009)).

Although iterative playtesting is an increasingly widespread process, it would be wrong not to mention the main drawbacks with applying it. First and foremost, the process can be extremely time-consuming and demanding for the game developer. Players might reject the different gameplay elements completely, thereby prolonging the production phase due to endless cycles of prototyping and testing; and ultimately postpone the final deadline for the completion of the game. Salen et al. elaborate on this issue by describing that a "*[…] danger with an iterative process is that it can lead to a never-ending list of tweaks and adjustments. Particularly in commercial videogames, the time and effort required to implement changes must always be taken into account*" (Salen, et al., 2006 p. 22). In this sense, with iterative playtesting, it is about knowing when enough is enough. In continuation of the issue of time consumption, the application of an iterative playtesting process might also lead to issues of legal nature. Innovative and ground-breaking ideas are highly valuable commodities for the game industry. So, if game designers involve members of the target audience, throughout the development process, they risk exposing the production to unwanted scrutiny and early disclosure of vital project details (Moschini, 2006 p. 143).

Despite the potentially critical drawbacks of iterative design in games, the pros seemingly compensate for the cons, which is evident from the ever increasing application of UCD in contemporary game development projects. An iterative user-centered game design process can be extremely rewarding when it comes to enhancing the overall appeal to the target audience by maximizing both at-game as well as in-game objectives (Moschini, 2006 p. 143). Just as importantly this approach to game design seemingly lends it well to designers aspiring to design gameplay that facilitates an engaging experience.

9.3.3 Using Heuristics for Game Design and Evaluation

It appears that it will be a while before the game industry will put forward a generally agreed upon and accepted framework for the development and evaluation of digital games and the experience they are intended to create. A standard for the assessment of game experience, such as the previously described UCD standard ISO 13407, is not likely to emerge any time soon. This can partly be ascribed to the fact that game research is a relatively novel academic discipline which only recently has been acknowledged as a topic worthy of scholarly investigation. Game development

encompasses an incredibly varied set of applications, defying a one-size-fits-all methodology (IJsselsteijn, et al., 2007 p. 4).

In compliance with of the lack of a one-size-fits-all approach in game development, game designers are in need of useful methods for identifying problems both in early as well as more mature prototypes (Desurvire, et al., 2004). As established throughout the previous sections, playtesting is one of the most common ways of detecting in- and at-game design issues. Still, playtesting calls for a playable prototype when testing for in-game elements which is normally not available until late in the development process.

Although there are no formal methods to allow less resource demanding testing of games to be carried out, one technique has proven to be successful in the evaluation of game prototypes, namely heuristic evaluation. By definition, a heuristic method is a way to rapidly come to a solution hoped to be the optimal one. A heuristic can be regarded as a recognized principle or an educated guess for solving a problem. Heuristic evaluation is an inspection technique used by evaluators to explore an interface using a set of heuristic principles. It is a discount usability engineering approach *"[…] for quick, cheap, and easy evaluation of a user interface design"* (Nielsen, 2010). Within the area of productivity applications, heuristic evaluation is the most popular and commonly applied usability inspection method. The goal is to find the usability problems in the design systematically, so they can be dealt with early in the iterative design process (Nielsen, 2010). So, besides acting like a set of principles to guide the design process, heuristics can also be applied in the evaluation of an application. For instance, the heuristics can form the basis for written or oral questions for the user in the evaluation of the interface, since they often outline almost all aspects that need to be examined. The technique is very flexible and can be adapted various domains – including game development.

Since heuristic evaluation does not make assumptions regarding the purpose of an application or the tasks connected with it, it has the potential to be valuable tool for evaluating games. The technique gives the evaluators freedom in how to evaluate the game and studies point out that heuristics help designers find crucial issues that are not always detected by the players during testing (Pinelle, et al., 2008 p. 1454). On the other hand, player testing is the benchmark of playability evaluation and can also

uncover many issues not found by the application of heuristics. Both heuristics and user testing can therefore be applied when developing a usable and playable game (Desurvire, et al., 2004 p. 1512).

Although the heuristics developed throughout the last couple of decades are divided into multiple different categories, they overlap each other quite a lot and many heuristics are more or less repeated among the authors. A common problem with playability heuristics is that they are often too general to directly apply. In an attempt to concretize the principles with game design, Schaffer (2007) and Pinelle et al. (2008) developed a more specific and directly applicable set of heuristics exclusively focusing on game usability in preference of engagement and fun. Conversely the heuristics proposed by Federoff (2002) and Desurvire et al. (2004)(2009) are very general and strongly oriented around engagement and fun, without much considering of usability in much detail.

The removal of usability from the area of engagement (and fun etc.), corresponds to the previously mentioned at- and in-game bifurcation outlined in this thesis. However, it is would seem that there is no such thing as a specific and concretized set of in-game heuristics and this form of heuristics consequently have to be tailored to the design and evaluation of the particular game in question. Typical examples of general in-game heuristics include "*play should be fair*" (Federoff, 2002), "*create a great story line*" (Federoff, 2002), "*the game is enjoyable to replay*" (Desurvire, et al., 2004) and "*challenge, strategy and pace are in balance*" (Desurvire, et al., 2009). Naturally, general at-game heuristics also need to be reconsidered and adapted to fit the particular game in question; but not nearly as much as in-game heuristics. This is due to the fact, at-game heuristics are generally a bit more specific and concrete and thereby easier to apply to any given game, since many of the usability issues are the same across the different game genres. Typical at-game heuristics include "*avoid large blocks of text*" (Schaffer, 2007), "*all relevant information should be displayed, such as life points, lives and ammunition"* (Schaffer, 2007), "*controls should be customizable and default to industry standard settings*" (Federoff, 2002), "*allow users to skip non-playable and frequently repeated content*" (Pinelle, et al., 2008) and "*allow users to customize video and audio settings, difficulty and game speed*" (Pinelle, et al., 2008).

According to Cockton et al. (2002), heuristics, and discount usability methods in general, are best suited for early design iterations, that is, for formative evaluation rather than summative evaluation (Cockton, et al., 2002 pp. 13-18). Still, it is a bit different in a game context, as discussed in the section *Iterative playtesting*. It is true that at-game heuristics are best suited for the early design iterations and formative evaluation throughout the entire development, since e.g. mappings, controls, mechanics etc. can be designed and tested along the way. Still, in-game heuristics also need to be considered throughout the entire design process. However, the in-game objectives such as challenges, goals and storyline cannot be properly evaluated until the game (or level) is more or less fully developed, thus rendering the in-game heuristics more suitable for summative evaluation.

Box 19 and Box 20, on the following pages, outline two sets of game heuristics, one for at-game aspects and one for in-game, which both seemed to be pertinent to the current project. The two sets of heuristics have been identified based on the writings of Federoff (2002), Desurvire et al. (2004), Schaffer (2007), Pinelle et al. (2008), Febretti et al. (2009) and Desurvire et al. (2009). Considering that the experience of a high level of playability is tantamount to engaging gameplay it seems reasonable to assume that it might be beneficial to use these heuristics in combination with the Gameplay Model described in the previous chapter, when performing the next iteration in the design of the WobbleActive.

It should, however, be noted that the two boxes do not include all of the heuristics described by the respective author as the heuristics which seemed to be of little or no relevance have been discarded. Two of the discarded heuristics are "*If possible, users should be able to play mobile games with one hand*" (Schaffer, 2007) and "*Possibility to work in slow internet connections*" (Febretti, et al., 2009). The remaining heuristics have been revised and organized into respectively 12 at-game heuristics and 13 in-game heuristics. Moreover it should be mentioned that the two lists at times do overlap since there is no universally acknowledged distinction between what constitutes an at-game and an in-game heuristic.

Box 19 – At-game heuristics

1. Controls: Controls should be consistent and adequate with an appropriate level of sensitivity and responsiveness. They should be customizable (e.g. on a PC), to make it harder to hit the wrong button. The controls should furthermore adhere to standard conventions to shorten the learning curve.

2. Feedback: Auditory and visual feedback should be applied. To emphasize player control, the game should respond consistently, immediately and predictably in accordance with the players' actions. All feedback (auditory, visual, haptic, tactile etc.) should be immediate, appropriate and meaningful.

3. Mapping: Mappings should be natural and intuitive so that new players need as little instruction as possible. If there are standard conventions in the industry, the mappings should follow them.

4. Menu: All items in the menu should be intuitive, navigable, obvious and consistent and allow a quick setup of the game. The menu layers should be as logic, well-organized and minimized as possible without rendering the options unintuitive.

5. Interface and Heads Up Display (HUD): The Heads Up Display (HUD) and the game interface in general should be experienced as a non-intrusive part of the game. Only relevant information should be displayed. This could for instance include character status (e.g. life points, lives, health, armor, ammunition, time, score and a mini-map that shows the player's location in the game world), teammates, enemies and objectives. Do not rely on the players' memory. The more important the information is for the game, the more it should stand out.

6. Text and symbols: All text should be clear and concise without abbreviations. Symbols should be easily interpreted.

7. Introductory information: Minimize the information needed for the players to start playing. Once turning on the game the players should have enough information to start playing. Although there should be no need for a manual, a tutorial level can involve the players quickly and easily if necessary.

Continued on the following page

8. Error prevention: Player errors should be avoided and the players must feel that there is room for a few mistakes. Throughout the game, the goal should be clear as well as the next step towards reaching it and how to reach it, in order to prevent the players from getting stuck or feel lost. Failure conditions should easily be identified. Warning messages should be used for error prevention and recovery.
9. Mechanics: Basic mechanics such as game physics, enemy behavior, character movement and hit detection should feel natural and appropriate for the situation the players are facing.
10. Game objects: Important game objects should stand out by adjusting size and contrast with the background (light/dark, color, texture, movement etc.). The players must not misinterpret power ups, enemies or obstacles. Objects should do what they look like they would do. For instance, objects that make the character bounce higher should look springy and things that kill should look dangerous.
11. Customizability: A game's difficulty level, pace, audio level and video quality is not always appropriate for all players. In order to accommodate their individual needs, the players should therefore be provided with the possibility of changing properties related to audio and video (e.g. excluding audio and adjusting the graphics) as well being able to customize the speed/pace of the game and the level of difficulty. The possibility of adjusting the level of difficulty is not always crucial if it is increased progressively throughout the game.
12. Camera view: The players must have an appropriate, clear and unobstructed view to the current actions and all the visual information that is tied to them, that is, the play area. For instance, a 3D game might need to shift between different camera angles depending on the scenery (whether it is fighting sequences, flying scenes, small and large rooms etc.).

Box 20 – In-game heuristics

1. Challenges: Challenges should vary and match the individual players' abilities, resulting in a positive game experience rather than a negative one. The difficulty level should be variable and increase concurrently with the players' abilities. The players should get hints, but not too many. The game should thereby be easy to learn, but hard to master.

2. Goals: The game goals must vary and be clear and there should be multiple of them on each level. The overriding goal of the game should be presented early and the short term goals throughout the game play.

3. Skills: Specific skills needed to attain certain goals should be taught right before they are needed.

4. Rewards: The game should reward the player. Rewards could include power ups, ammo, weapons etc. but also the acquisition of skills and capabilities, for instance, expanding the ability to customize.

5. Penalties: The players should not be penalized repeatedly for the same failure, nor should they lose any hard won possessions. They should experience fairness of outcomes.

6. Game story and world: The game world should be consistent and built as though it is "going on" regardless of the character's presence. It should react to the players and remember their passage through it. Players should be able to change the game world and these changes should be noticeable in case they decide to back-track. The game story should be consistent, interesting and capturing to suspend disbelief. Players should somehow be able to relate to the story and ponder on different possible outcomes. There should be an emotional connection between player and game world as well as character.

7. Introduction: The first ten minutes of play are crucial and the gameplay must capture the players. There should be an interesting and immersive tutorial that mimics the game play.

8. Computer controlled units: Computer controlled units (or artificial intelligence) should be clearly visible and display a reasonable and consistent yet unpredictable behavior that matches the players' expectations. The units should be balanced with the players' play and their settings should be customizable to match all levels of players. AI enemies must be challenging enough, to let the players try out different tactics against it.

Continued on the following page

9. Player control: The players should feel in control and be able to influence the game world. They should be given the information and time to respond to opportunities and threats.
10. Props: There should be plenty of interactive props for the players to interact with.
11. Pace: The pace of the game should be adjusted to apply pressure on the players without frustrating them.
12. Variation: The game should support a variety of game styles with no repetitive or boring tasks in order to keep the players' interest. There should be multiple ways of winning.
13. Innovation: The game should offer something new and different so as to attract and retain the players' interest.

CHAPTER 10 - CONCLUDING REMARKS

This second part of the thesis has described the research conducted in order to help provide an answer to the question posed in the final problem statement presented in the last paragraph of the delimitation. The current and final chapter of this part of the thesis provides a brief summary of the important conclusions presented up until this point as these formed the basis for the design and implementation of the WobbleActive prototype, which will be described in the following part.

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10.1.1 Summary of and Concluding remarks on the Analysis

The analysis presented throughout the current part of the thesis sets out with one ostensible goal, namely to gain a better understanding of the complex relationship between player and game – gameplay – and the associated processes which may lead to the experience of engagement. Recall from the preliminary analysis that engaging gameplay by definition incites players to desire more gameplay and thus make them continue playing. This understanding should in turn make it possible to perform the next iteration in the design of the WobbleActive, so that the final prototype would facilitate engaging gameplay while simultaneously ensuring correct proprioceptive ankle training.

The first chapter of this part have detailed a more elaborate, yet concise, description of Schønau-Fog and Bjørner's original framework, which formed the basis for the subsequent chapters. This was concluded with the claim that the study of engagement with games would prosper from viewing this curious phenomenon from the perspective of game design and with an outset in player psychology.

Based on this assumption the subsequent chapter *Engaging by Design* presented a discussion of how the types of engagement deemed relevant within the context of the current thesis – sensory, physical, intellectual and social engagement – might be described in terms of established game design theory and principles. Moreover this chapter strived to explicate how engagement, like immersion, may be experienced both on a diegetic and a non-diegetic level as when a player adopts goals, which do not pertain to the game's diegesis.

The succeeding chapter *The Feeling of Engagement* raised an important point of criticism against Schønau-Fog and Bjørner's framework by presenting the argument that it makes little or no sense to regard emotional engagement as a separate type of engagement. This critique was more specifically based on the argument that emotional engagement by and large is a prerequisite for the experience of engagement altogether. The implication of this claim was necessarily that the framework was believed to consist of five and not six types of engagement. With an outset in this assumption of the pervasive role of emotions this chapter subsequently discussed the influence of emotions on gameplay in general and engaging gameplay in particular. This discussion did more specifically lead to a description of how it seemed possible

to combine Järvinen's theory of gameplay as emotional experience with Scherer's appraisal based sequential check theory and thus gain a better understanding of how emotions arise during gameplay. Subsequently this theory introduced Järvinen's description of a possible categorization of gameplay emotions, which in turn may be used to describe the experience of so-called pleasures of the mind. These pleasures are voluntarily sought out by players – either consciously or unconsciously - and were consequently believed to contribute to the experience of engagement. That is to say, a player may find a game engaging because it facilitates these pleasures of the mind in spite of the fact that said player is ignorant of his or her own aspiration of experiencing these pleasures.

Based on the writings of these three chapters, *The Cycle Of Engagement* described an attempt at constructing a model intended to make the concept engagement more readily palpable to game designers and academics alike. This model, referred to as the Gameplay Model, was inspired by Crawford's definition of interaction as *"[a] cyclic process in which two active agents alternately (and metaphorically) listen, think and speak"* (Crawford, 2005 p. 76) and gameplay was in turn viewed as a cyclic exchange of information between the two active agents – player and game. The Gameplay Model itself detailed how the various features inherent to both player and game may enter into this cycle and under the right circumstances may be experienced as engaging. In order to make the Gameplay Model more useful to the scholars aspiring to analyze engaging gameplay and the designer striving design such experiences, one additional concept was introduced, namely gameplay states, described in terms of its two constituents – the player and the game state. By considering the two as separate, yet symbiotically coexisting, we are able to discuss how a particular configuration of game elements might influence the player and elicit emotions and pleasures of the mind on his or her part. Conversely, these states were also believed to provide us with a lens through which to discuss a particular type of player experience (e.g. engagement) and make assumptions about how to design the corresponding eliciting events. Although the initial division of gameplay was illustrated in the Gameplay Model as being a cyclic process constituted by game and player, compared with the other models for game and player interaction presented throughout this thesis, the Gameplay Model has both its merits and limitations. As opposed to the PNRC model it cannot be used directly in a given gameplay situation as an outlining of how and

what to do, but it serves as an overview of the components and their relationships that may facilitate an easier approach to both game and engagement design.

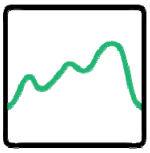
The final chapter of the analysis, entitled *User Centered Game Design*, presented a discussion of usability and playability in games which led to the conclusion that usability is a prerequisite for engaging gameplay and that engagement ultimately is an expression of a high level of playability. Moreover this chapter introduced the concept playtesting as a means of testing the game's playability, and by implication whether said game facilitates engaging gameplay. In conclusion this chapter underlined the belief that the design, implementation and evaluation of the WobbleActive prototype might prosper from the application of user centered design and game design heuristics in combination with the model proposed earlier in the analysis.

Even though the preceding chapters treated the concept engagement in detail it should be stressed that not all of Schønau-Fog and Bjørner's types of engagement seemed equally pertinent. Box 21 presents a concise outline of why some types, rather than others, should be assigned more importance during the design and implementation presented throughout the following part of the thesis.

Box 21 – Types of engagement pertinent to the design of the WobbleActive

Physical engagement: The physicality associated with the use of a traditional wobble board – first and foremost balancing - does presumably already pose a challenge to novice users. It did consequently seem very relevant to expand upon this existing element of challenge.

Sensory engagement: Sensory engagement did also seem to be of pertinence since the associated pleasure of the mind, curiosity, might incite players to continue playing. It should, however, be stressed that the complexity of the sensory information should be kept relatively moderate during the early stages of gameplay as novice users during this period might devote much of their attention to the act of balancing itself.

	**Dramatic engagement:** Even though novice users might find a complex narrative too difficult to comprehend while struggling to maintain their balance, dramatic engagement did seem relevant as the feeling of urgency accompanying singular dramatic events might be pleasurable in their own right.
	**Intellectual engagement:** Intellectual engagement did seem to be of relevance. However it should be stressed that first time users might not possess the attentional surplus necessary in order to both engage with the challenge of learning to balance on the board while simultaneously tackling challenges requiring high levels of cognitive capacity and mental acuity.
	**Social engagement:** It was established in the preliminary analysis that social engagement has little relevance to the current project as using the WobbleActive primarily is a solitary activity. This does, however, not mean that the prototype cannot be used within a social context if it was simply designed for this purpose.
	**Emotional engagement:** Emotions were undoubtedly relevant to the production, however, since emotional engagement was considered as a prerequisite for engagement altogether this type of engagement should not be included in the form which it was originally described in Schønau-Fog and Bjørner's framework.

PART III - DESIGN & IMPLEMENTATION

The following part utilizes the previously presented Gameplay Model as a framework for designing the game, which targets engagement as a mean of creating motivation. As opposed to normal conventions both design and implementation of the individual Gameplay Model components are presented collectively, as opposed to dividing them into two separate sections. This is necessitated by the focus on iterative tests, which influenced the design of the game continuously throughout the development.

The part is divided into two chapters *What We Know* and *Game Development*. The first outlines the assumptions that can be made in regards to the player following the theories and discussions presented in the preliminary analysis and the analysis. Here the player components of the Gameplay Model are discussed in turn as a reflection of the ramifications and restraints it puts on the game design phase.

The second chapter deals with the practical development of the game in regards to respectively design, iterative tests and implementation, which builds on the assumptions on the player's state which is outlined in the first chapter.

Before continuing with this part we highly encourage the reader to play the game, which is included on the appended CD. Note that this is a slightly altered version of the game where the arrow keys on the keyboard can be used as controls instead of a wobble board. It is important to emphasize that the intention is not to attempt to create the same experience as when playing the game using the wobble board, but instead merely to give the reader a better understanding of the basic game mechanics and functionality.

CHAPTER 11 - WHAT WE KNOW

As stated in the introduction to this part of the thesis, the Gameplay Model outlined in the analysis will be used as a practical design framework for the development of the game for the new iteration of the WobbleActive prototype. First of all, we need to get an overview of what we can assume at the present stage about the usage of the wobble board and consequently what we think we know about the player.

11.1 The Basic Ingredients

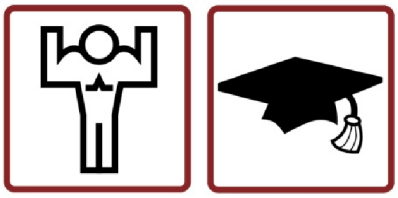
Since a wobble board is designed uniquely to afford proprioceptive ankle training the two main aspects from the Gameplay Model are known from the beginning.

The first point to make is that any game design must be dictated by the exercises that the users of the wobble board have to practice in order to rehabilitate their ankles – as outlined in the preliminary analysis. These movements correspond to the 'Action' box in the Gameplay Model and this consequently dominates all other aspects of the design. This is not necessarily a starting point for any design based on the Gameplay Model, but since we deal with an exertainment tool it is the obvious place to start since the interaction with the game must be done as a consequence of these outlines.

Obviously, there are no exercises without the wobble board itself and the truly unique aspect of this design is also that it must rely on this board as a controller or as denoted in the Gameplay Model; the 'Input'. This curiosity not only refers to the board itself, but also the information it can send on into the game's 'Content'. This will be outlined further in the following chapter.

11.2 The Player in the Equation

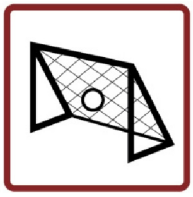
The title of this chapter, *What We Know,* refers to elements in the Gameplay Model that we can use as a foundation for the game's components. However, when venturing into the realm of 'Player Properties' we are dealing with assumptions rather than facts. Consequently, we can make certain suppositions about the nature of the player, but we must be particularly careful of since they can be subject to change. This change can be not only in the form of deviations from the basic assumptions we are about to make in the body of text below, but also as a change of player state continuously throughout the gameplay session. With this in mind, we can start to look at the 'Player Properties' as we assume they are at the outset of the gameplay session.



As stated above, considering both the wobble board and the physical movements performed by the user to undergo proper proprioceptive training is paramount to the game design. Therefore, the 'sensorymotor skills' of the 'Player Properties' is an aspect we know will be drawn into focus quickly in the gameplay session. What we can assume from the knowledge accumulated throughout the previous WobbleActive project and the present one is that the player's sensorymotor skills are a limitation to the game design since people generally have a hard time getting accustomed to the wobble board as a precision game-controller. This is of course also related to the 'experience' component, since the design has to take into account that the eventual test of the project will generally not be conducted on participants who are accustomed with the board. Nevertheless, since people have a varying degree of sensorymotor skills we can simply assume that they in general neither have an abundance of experience with using a wobble board nor a high level of proficiency on part of the player. An additional factor we know will affect the eventual design to a high degree is the fact that users of the wobble board experience fatigue after relatively short time in comparison with normal mouse-keyboard gaming since the wobble board relies heavily on physical dexterity. At this point in the process it is not safe to say how long a player can endure playing the game. Therefore the design must eventually accommodate changes based on the results of iterative usability related tests conducted in early stages of the development.

Remembering the argument presented in the analysis, that there is a limit to a player's cognitive capacity, we can infer that since the 'sensorymotor skills' are to be a dominant factor in the game design, there might not be a mental surplus to contemplate intellectual challenges. However, as with 'sensorymotor skills' the assumptions we can make in regards to 'cognitive skills' are made in relation to a very broad target group. But we might infer that the 'cogntive skills' are dependent on the level of 'sensorymotor skills' since merely maintaining balance while standing on the wobble board might be a major challenge in itself for some.

The lack of experience with the board and the effects it has on 'sensorymotor skills' and 'cognitive skills' also affects the 'expectations' components of the 'Player Properties'. Again, we must assume that the general part of the final test participants will not have any experience with the board. Logically, this can lead to the conclusion that their expectations of proficiency with the board as a game controller are even slighter. However, expectations in regards to possibilities within the game are dependent on the player's subjective understanding of numerous game components. Although we know little about this, expectations are something that can be used to the advantage of the game designer to create not only a sense of things to come during the gameplay session, but also a sense of success if these expectations are met with a successful outcome.

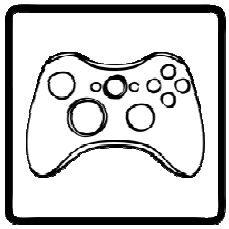


The final component of the 'Player Properties' box is entitled 'goals/needs' and here we must consider the matter as a result of respectively diegetic and non-diegetic goals and needs. First and foremost, as stated previously, we are dealing with an exertainment tool which means that the ultimate goal of the gameplay session is to rehabilitate the ankles of the player through correct proprioceptive exercise. This is both the goal of the designer as well as with the player himself. However, since the foundation of this project relies on the user lack of motivation to exercise it would seem that the non-diegetic goal of ankle improvement alone is not enough to spur on a continuous usage of the board. Therefore, it is here that the game has to create diegetic goals and needs that motivate the user to a continued usage of the board. These goals have to be implemented as part of the challenges and other game components that are within the sphere of the game itself.

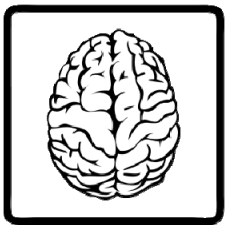
11.3 The Player Motivation

Using goals and needs as a motivational asset in the game design heavily relies on the two final player components – 'Affective State' and 'Engagement'.

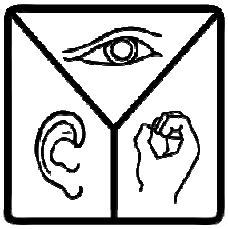
Directly related to the motivation issue is that of achieving engagement through the gameplay experience. Previously, we have defined engagement as the willing and continued commitment to the act of playing, which infers that the player is motivated enough to continue his exercise session with the wobble board – the goal of the WobbleActive. Furthermore, through the modified engagement framework discussed in the analysis, we have established four types of engagement that we believe will dominate the experience of playing the game:



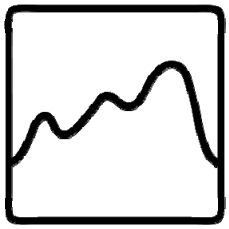
Physical Engagement



Intellectual Engagement



Sensory Engagement



Dramatic Engagement

First of all, we know that physical engagement is a primary concern for the design since it can be achieved through physical challenge and application of sensorymotor skills on behalf of the player. This is especially the case with the application of the wobble board since the 'Input' in this case is extremely dominant in the overall design. As outlined in the analysis Schønau-Fog and Bjørner differentiate between physical engagement as a result of gaining proficiency and that of acting out a high level of proficiency. This can in essence be connected to a sense of accomplishments that the game must facilitate. From this we can infer that the game design must present challenges that allow the player to gain proficiency through the gameplay session and consequently to be able to use this proficiency to overcome said challenges. Furthermore, it was argued in the analysis that a third kind of cause for physical engagement was available through the correlation between physical actions and virtual representations in the game's content. For the design this means that the player will benefit, engagement-wise, from a connection between the wobble board and the in-game avatar.

Secondly, we deal with the question of intellectual engagement in the game. To make a short recap, intellectual engagement can come from two causes: overcoming challenges by use of one's intellect, being high-level cognition and expressing oneself creatively in the game environment. Relating back to Crawford's challenge and reasoning types, previously described in Box 12, page 84, we see examples of game design challenges that can be linked to intellectual engagement. However, as argued in relation to the 'cognitive skills' component of the Gameplay Model, we can assume that the player does not have the cognitive surplus to engage in demanding challenges that can lead to intellectual engagement. Thus, we strongly assume at this stage that intellectual engagement is not going to have the same dominance as physical engagement and that we must be prepared to adjust how much we can hope to achieve intellectual engagement by judging from the results of early test iterations. Nevertheless, intellectual engagement can be gained from a sense of progression and proficiency which can be related to the player's continued joy of learning how to utilize the game's 'Content'.

Thirdly, sensory engagement is achieved as a result of a desire to experience the game through visual, auditory and haptic feedback, as outlined in the Gameplay Model under 'Representation'. At this stage we are aware of the fact that we have no haptic feedback options with the board. One could argue that the technology to produce such could be implemented, but it simply does not make sense to add anything that interferes with the already challenging aspect of balancing on the wobble board. However, sensory engagement can be achieved by creating a sense of wonder, curiosity, anticipation or suspense, which can be achieved through both the representation of in-game objects and a level design that will facilitate an exploring nature of behalf of the player.

Finally, we need the means to achieve dramatic engagement through the game's 'Content' and 'Representation'. Directly this refers to the 'Plot' component which essentially deals with the narrative of the game. As stated in analysis in the section *Engaging by Design,* the narrative can lead to the player deriving pleasure from adopting the goals of the fictional character ('agent') in the narrative upon himself. From a pure practical game design perspective this means that the narrative in a game can be used to create a sense of purpose through in-game goals. Thus the overall coherent narrative is a means that directly affects the player's

'goals/needs' component, which can lead to dramatic engagement. However, as with any game plot it can follow both linear and non-linear paths, but the limitation of intellectual engagement from a cognitive overload should be applied in this regard as well. Here we deal with a situation where a narrative that entails a considerable amount of contemplation would affect the gameplay experience negatively. However, since dramatic engagement can also be achieved through singular dramatic events it would seem more opportune to utilize such moments through challenging situations, where the movements performed on the board is still controlled. Since the design must rely heavily on physical engagement the sense of accomplishment is central to the overall experience of the gameplay. Thus, it is imperative that we give the player the a feeling of being able to succeed even against tough odds, but at the same time not making the experience boring or frustration as a result of poor usability or making it too easy to prevail. Usability issues are, as described in *User Centered Game Design*, key to achieving engagement, thus the following chapters on design and implementation will cover this area extensively as part of an attempt to avoid usability issues interfering with the engaging experiences the game is designed to facilitate.

Since we opt to design gameplay that facilitates physical and intellectual engagement, the experience of said gameplay should involve the pleasure of the mind virtuosity. That is to say, the players should experience a gradual improvement of their skills and thus feeling of achievement. Moreover, as the prototype is being designed for a broad user group we should strive to avoid intense negatively valenced emotions associated with the pleasure of the mind suffering e.g. fear or anxiety. This does, however, not preclude the option of making the gameplay relatively suspenseful since this may lead to dramatic engagement while simultaneously making the experience of virtuosity even more intense once the suspenseful challenges are overcome. Finally, sensory engagement may be achieved by inciting an experience of the pleasure of the mind curiosity associated with prospect-based emotions leveled at future events of the game.

CHAPTER 12 - GAME DEVELOPMENT

Building on the stated assumptions presented in the previous chapter the following outlines the design and implementation of the game, including the findings and related changes made on the basis of the iterative tests. As stated in the introduction to this part of the thesis, both the design and implementation sections are intermingled with one another following the influence of the iterative tests. For further reference, it is recommended to read appendix A, *Iterative Tests,* at the end of the thesis. Again, it must be emphasized that a keyboard-controllable version of the final game is included on the enclosed CD and we strongly recommend that the reader try the game prior to reading this chapter, since it makes it easier to understand the various elements of the game as they are described in the following section.

12.1 The Wobble Board as a Controller

The following section outlines the 'Input' component in the Gameplay Model. In this project the 'Input' denotes the wobble board conversion to a game controller including a comparison with the original WobbleActive prototype.

The physical interface design of the original WobbleActive prototype consisted of four bending sensors, which were attached inside metal hinges under the board (see Figure 53).

However these bending sensors were very fragile and could not withstand the stress from repeated use. In addition, the accuracy and resolution of the measurements were relatively low and the system had to be continuously calibrated to compensate for the inconsistent output.

Another problem was reading the data from the bending sensors. This could not be done directly, but needed additional software (Max/MSP) to interpret the data and forward it to Flash, which was used for the game development.

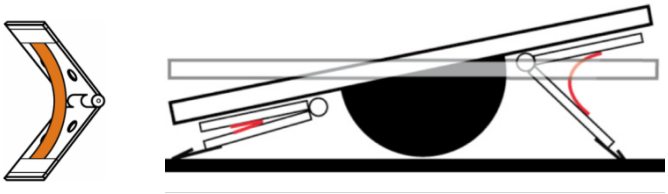


Figure 53 – Illustrations of the original wobble board design. The left illustration shows how the bending sensor is placed inside the hinge and on the right we see how the hinges were attached to the underside of the board. (Asp, et al., 2007a)

All these problems led us to the decision to completely rethink the design for the new wobble board.

Instead of bending sensors we decided to use an accelerometer to measure the tilting angle of the board. An accelerometer is far more accurate and stable than the bending sensors, and it is not exposed to any physical stress. This makes it much more feasible for use in a game controller, which must be able to withstand repeated use.

We chose the Phidgets accelerometer (see Figure 54) (phidgets.com, 2010) because of the easy integration with Unity (a multiplatform game development tool), which is used to create the game for the project. The Phidgets API (Application Programming Interface) provides out of the box USB support and there is no need for additional software to forward the data, instead a simple plug-in can be imported into Unity and read the data directly from the accelerometer.

The accelerometer is placed inside the hollow spherical base of the wobble board for protection against physical stress (see Figure 54) upon which it is closed with a lid. This means that the controller basically looks like a regular wobble board with a USB cable, which can help to increase the recognizability of the controller as something the user can identify and knows how to use.

Figure 54 – Left: The Phidgets accelerometer used to measure the tilting angle of the wobble board. Middle: The accelerometer attached in the center of the board. Right: Close-up of the accelerometer attachment.

To determine the tilting angle from the acceleration a simple trigonometric calculation is performed using the unit circle as a representation of the gravitational acceleration of 1G (see Figure 55).

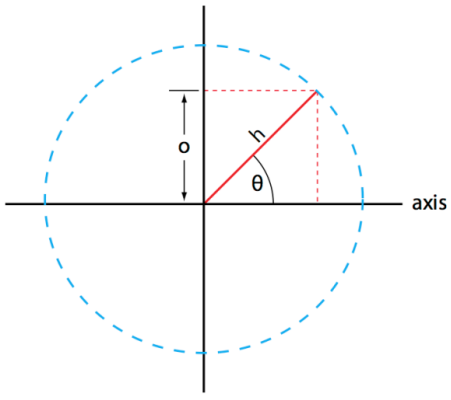


Figure 55 – Example of a tilting calculation on one axis based on the acceleration of the device (phidgets.com, 2010).

Here we see an example of how to calculate the angle of tilt (θ) on one axis from the acceleration (o) using the gravitational acceleration (h). The resulting formula is:

$$\theta = arcsin(o/h)$$

In this example the acceleration read from the accelerometer on the given axis is 0.7071G meaning that the calculation is arcsin(0.7071G/1G), which gives a tilting angle of 45°.

This calculation is performed on both the x- and y-axis and transmitted via the plug-in to Unity giving us the current tilting angle of the wobble board in the xy plane.

As the fixed axes on the accelerometer is mapped to specific movements in the game it is important that the user is standing correctly on the wobble board, i.e. face the board in the right direction. To ensure that the user knows how to stand we have added a set of footprints to the board indicating the correct direction the board should be facing relative to the user (see Figure 56).

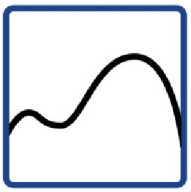
Figure 56 – The physical design of the wobble board was already sufficient to allow for the required exercises. However, since the placement of the accelerometer dictates the heading of the tilting it was necessary to add a directional icon/logo to the board that indicated how to mount the board so that the movements corresponded to the in-game movements.

The original wobble board did not have any buttons; instead we designed the games to be controlled without the use of such activators. This worked well and supported the simplicity of the design, while also keeping the focus on the movements on the wobble board. Therefore we decided to continue with the "button-less" physical

interface and design the game based solely on the tilting of the board as a way of player interaction.

12.2 The Game Creation

At this stage the player components that are assumed to be known have been stated along with the functionality of the wobble board as a game controller in its updated state. Having these elements in mind, we can now precede to the actual design and practical implementation aspects of said. As with the previous chapter in this part of the report, the Gameplay Model functions as a design document that outlines the approach to creating an engaging experience. In the following section we will focus on the 'Content' box of the game and the effects these elements will hopefully have on the player state. Furthermore, though the following part of the report will be entitled *Testing,* iterative tests have been performed throughout the design and implementation process and the conclusions derived from these will affect the design of the game directly. As previously mentioned, is recommended to browse through appendix A – *Iterative Tests* for further insight into the iterative tests conducted throughout the development of this project. Finally, on an author's note in regards to the following section of the report, it is neccesary to point out each element of the game will be explained in accordance with the component of the Gameplay model it belongs to.



12.2.1 Plot

The plot deals with the overall narrative of the game and this lies as a foundation for the rest of the game's 'Content'. The first aspect to consider is the theme of the game. Here we can build on the previously stated intentions of the 'Affective State' that outlines that negative emotions are to be avoided. This is related to the general dilemma of a broad target group, since various genres logically falls out of bounce e.g. horror games. Even though horror games can facilitate engagement through emotions such as fear it is a very slim target group that can find enjoyment from experiencing these emotions. Therefore, it seems more prudent to play with emotions that can lead to a humorous experience. During this process various suggestions were made within the brainstorming process including both an underwater scenario and the idea of

labyrinth navigation – both being themes that could easily be connected to sensory engagement through visual and auditory stimuli as a means of suspense. However, in the end, the results from the first the WobbleActive prototype suggested that the UFO theme implemented at that stage was sufficiently effective in attracting players across a broad age group. This was chiefly illustrated at the Next no.5 conference where the board was showcased in public. Additionally, we know that dramatic engagement can be achieved as a result of a diegetic and coherent narrative. Therefore the following narrative was created (here in the form of an elevator pitch):

> *A marsian invasion of Earth is imminent and you, the player, are tasked to travel to Earth and scout out and abduct specimens of Earth most intelligent inhabitants. When you arrive to Earth this is revealed to be cows. The cows are collected and have to be delivered to a mothership for further research.*

This narrative gives the player a diegetic goal and need to seek out and accomplish the stated tasks. This will hopefully function as a motivational factor for continuing the exercises. Additionally, following the advice of game designers like Chris Crawford that advocates utilizing elements from the film industry to promote narrative in games (Crawford, 2004), the Hollywood model is decided to be used as a structure for suspense building in the game through a three part division of the game's narrative. Following the elevator pitch as stated above, the parts can be divided as follows:

(1) Fly to Earth
(2) Abduct cows
(3) Deliver cows to mothership

This division is furthermore connected to both the challenges of the game, since they give rise to suspense, but also theories of usability and game design issues that dictates that players need to be eased into a gameplay experience – especially if it offers something innovative that cannot build on experience. This will be covered in more length in the following sections.

However, following the statements that the player might feel that his cognitive capacity is overloaded if too much information is thrown his way, it is decided that the game's narrative should not only be kept very simple, but also not interfere with

the active gameplay experience in the levels. Therefore, the story is presented as short texts in-between levels, which is the only time where the player can take his attention away from the sensorymotor skills.

Box 22 below illustrates the components of the player in the Gameplay Model that are affected by the 'plot' according to the design.

Box 22 –Player components influenced by 'plot'

	 Dramatic engagement is targeted through a coherent narrative.
	The 'cognitive skills' are affected since a complicated narrative might have overloaded the player's mental capacity while still having to deal with the wobble board as a game controller.
	The UFO theme can possibly relate to previous experiences with UFO themed movies, books and games. The focus on 'cows' as the target for the abductions seems to be a common theme.
	The coherent narrative of the game facilitates an understanding and acceptance of the 'goals/needs' that are present in the game's diegesis.
	The 'Affective State' is influenced through the theme which is intended to bring about positively valenced well-being emotions.
	The player's 'Action' component is driven by an understanding of the game's narrative and consequently the goals stated in said.

12.2.2 Agent

The agent(s) in the Gameplay Model serves as a manifestation of the player in the game's diegesis. However, it may also include characters and elements that are not directly controlled by the player, but can

influence or counteract the player's performance.

Following the outlined pitch presented in the previous section, we are dealing with two main agents in the game. Firstly, we have the UFO, which functions as the player's diegetic avatar; and secondly, we have the cows to be abducted.

The choice of using a UFO as an agent was partly because of the visual resemblance with the wobble board. We hypothesized that by animating the UFO's tilt to match that of the wobble board it would help the player to a better understanding of the board's current tilting angle and thus make it easier to make any necessary balance adjustments. This also relates to the aforementioned third cause of physical engagement, being the correlation between physical action and visual representation. Additionally, the third at-game heuristic that dictates that auditory and visual feedback should respond predictably can be said to add to the credence to the UFO as an 'agent' of the player since the tilting of the UFO will correspond with the tilting of the board. Once again, this makes the connection between movement and visual feedback more intuitive.

Figure 57 – Shows the visual resemblance between the wobble board and the UFO in the game.

When using a flying object there are also more degrees of freedom in terms of movement and rotation, i.e. it can be mapped to move in all three dimensions as opposed to a car, which is restricted to driving on a 2-dimensional plane. This opens up for more design possibilities when creating the different parts of the game. The model for the UFO was created in Autodesk Maya and allowed for substantial higher number of polygons. This was permitted in the design, since the figure would be present and relatively close-up to the camera through the whole gameplay session.

Secondly, there is the focus of the abduction task, namely the cows. Even though it is possible to animate the cow model within Maya we decided to utilize Unity's built-in

ragdoll physics instead of animation sequences. This can possibly affect the well-being emotions of the player because of the comical movements that a ragdoll character exhibits. As mentioned, Unity includes support for both animated sequences of the 3D model, which can be triggered by in-game events, as well as ragdoll physics, which can produce relatively realistic real-time movements by using the joint-skeleton hierarchy of the 3D model and adding colliders to the individual body parts (in our case legs, tail and head, see Figure 58 below). This enables the cow model to react to physical interaction with other game objects such as the UFO and the ground.

In this regard, an additional positive side effect of utilizing the ragdoll physics in Unity, contra to pre-defined animation cycles, is the possibility of creating agents, which react much more realistic to gravity and other external forces in the game environment. Furthermore, the player will never experience a frame by frame repetition of a specific action, but always be presented with a new reaction from the agent.

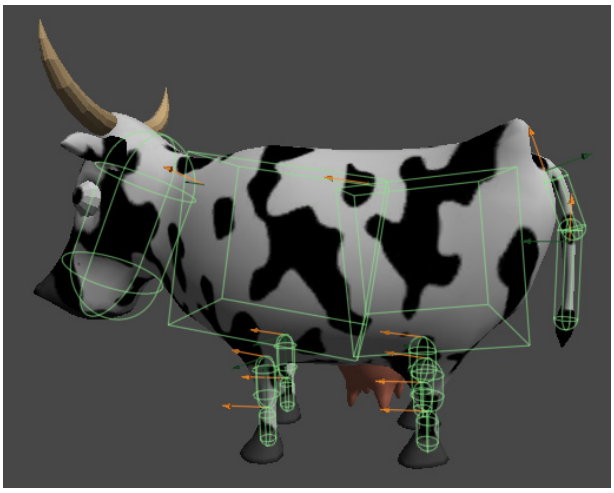


Figure 58 – Illustration of the cow ragdoll components. Each collider is attached to a bone in the skeleton and the bones are attached to each other using joints.

Additionally, the design phase included the addition of a third agent in an antagonist function. It was believed the task of maneuvering through the game's environment could end up becoming a trivial and dull undertaking for the player if additional challenges were not implemented. By implementing aggressive human opponents it was believed that the player could be both more challenged and at the same time be

forced to strategize their actions to avoid the humans, which could facilitate intellectual engagement. However, since the limited timeframe of this project hampered the development phase to such a degree that modeling, texturing, rigging, animation and programming AI for the human antagonists proved less of an option, this third agent was quickly scraped following the first few iterative tests. These proved that the player's simply did not have the mental surplus to deal with it while concentrating on maneuvering on the wobble board.

Box 23 below illustrates the components of the player in the Gameplay Model that are affected by the 'agent' according to the design.

Box 23 –Player components influenced by the 'agent'

	 Sensory engagement is designed to be achieved through the joy of experiencing the audiovisual game agents.
	The design of the 'agent'(s) in the game is meant to influence the well-being emotions of the player. This is done by the use of caricature forms.

12.2.3 Sensorymotor Challenges

Following the arguments presented in the previous chapter that emphasizes that 'sensorymotor skills' and consequently physical engagement is the primary focus for the game design, it reasons that sensory challenges will dominate the gameplay experience. Thus, this aspect of the game is pivotal for the overall gameplay experience. However, these challenges are required to follow the exercise doctrines which target the various methods of exercising on a regular wobble board. This means that the 'Action' component of the Gameplay Model dictates part of the design of 'sensorymotor challenges'.

As stated in the section entitled 'Plot' the division of the game into three separate components connected by a coherent narrative, meant that it was possible to divide the game into three different levels that each functions as an element of the Hollywood model. The design of each of these levels are then based firstly on the

attempt to create a dramatic curve through the game, however not as a result of a narrative, but rather the challenges presented to the player. Having established the agents of the game it now depends on how to incorporate the wobble board exercises in the game.

It should be mentioned that a sandbox level, also often referred to as a prototype level, was created for the iterative testing. The sandbox level contained the same physics as the individual levels, so that each challenge and game object could be tested both by ourselves in the role as developers and consequently by the participants of the iterative tests described in Appendix A – *Iterative Tests*.

Throughout the game the player is continuously presented with visual hints consisting of icons representing the current challenge and a short description on how to complete it. If at any point the player is in doubt of what to do next he can refer to the hints to find out how to progress in the game.

Figure 59 – The player is continuously presented with visual hints consisting of an icon for easy recognition and a short textual description of how to complete the task.

Level 1 - Asteroid Field

In the first level the UFO needs to get to Earth. However, game designers recommend that games make use of a tutorial level that eases the player into the controls and the gameplay (Rouse III, 2005) and the 7th in-game heuristic concurs on this point. Since we deal with so unusual a game controller as a wobble board this level is then designed to allow the player to get comfortable with the new controller. At the same time it is important to remember that the game targets engagement as a motivational factor. Previously, it was mentioned that dramatic engagement is a possible outcome of the plot, but as the research and discussion in the analysis emphasizes, dramatic engagement can both come from singular dramatic events and the player's need for disclosure. In terms of the overall gameplay experience, this

level, being designed as a relatively easy one, might ruin the sense of disclosure and surprise if the actual game environment was presented in a far too easy gameplay state. What is meant by this is that the tutorial level is aimed not to disclose too much of the actual gameplay, since this experience should be reserved for a situation where the player has gained a somewhat stable proficiency with the board. The following levels will also require that the player has sufficient mental surplus to deal with information regarding new challenges and environment changes. Nevertheless, the sensorymotor challenges that the player will encounter in this level should not be tedious to a degree where the player experiences frustration or a negative emotional response. On the basis of the Gameplay Model we know that the component 'Affective State' is a filter which can lead to engagement, so frustrating the player at this stage of the gameplay experience would in any way be counterproductive. A tutorial level would further be in accordance with the third in-game heuristic if viewed for all three levels, since the tutorial level will equip the player with sensorymotor skills needed in the following levels.

Following the 'plot', the player is required to fly from mars to Earth in order to start the abduction of the cows. Practically, this infers that we have a level goal that player can reach by flying towards Earth. However, since the design should force the player into acquiring proficiency with his 'sensorymotor skills' a 'sensorymotor challenge' needs to be applied between point A (Mars) and point B (Earth). Logically, since we place the player's agent in space, the obstacle facing the player is a frequent space phenomena – the asteroid, or rather a whole field of these. The player then has to maneuver carefully through the asteroid belt to reach Earth.

Following Cook's 'skill atom' theories we know that at the beginning of the game the player's skill is categorized as unexercised. Additionally, since the challenge facing the player in this level must be very easy as a result of the level's function as a tutorial level, it is important to remember that the challenge can easily lead to frustration if the difficulty is set too high. However, an important element of physical engagement is the sense of achievement through gained or mastered proficiency. Therefore the very first view of the game is designed to depict an extremely dense asteroid field, which might seem a daunting task to venture through unscathed.

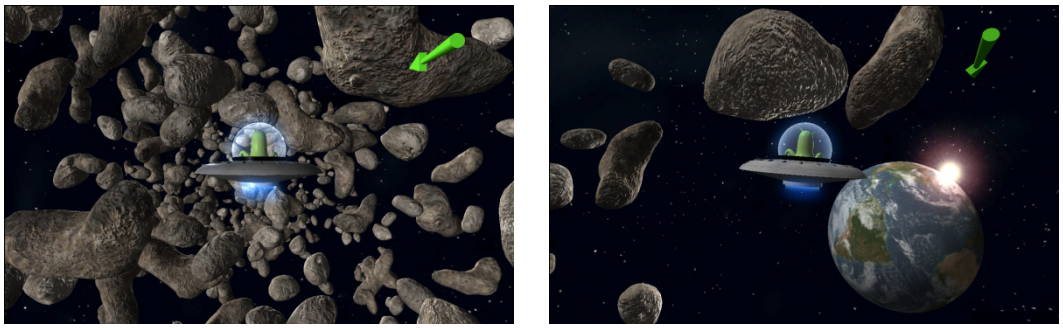


Figure 60 – Left: Screenshot from the first level in the game showing the extensive asteroid field between the UFO and Earth. Right: Screenshot of the final part of the first level, here the UFO has gotten through the asteroid field.

However, the division and size of the asteroids were regulated so that it was still relatively easy to fly through and reach the final destination. Additionally, the hit-boxes of the individual asteroids are scaled down so that they are slightly smaller than the physical object itself. This design choice is made in the hope that even though players might feel that they have to avoid asteroids with nothing but a hair's width between them and damnation, the actual game mechanics are nowhere near as punishing. This can give rise to both dramatic and physical engagement in the sense that the player hopefully feels that he experiences a dramatic event with high stakes, without the actual stakes were at risk, and simultaneously feel that he has proficiency to deal with the in-game challenges. Nevertheless, according to the 5th in-game heuristic the player should feel a sense of fairness in penalties, which means that the punishment of hitting an asteroid should not give rise to a sense of injustice or frustration. However, turning the tables around one should also remember that a punishment is necessary as part of the challenge, since it could simply get too easy otherwise.

In addition to aid the dramatic and physical engagement, there are also the technical considerations of defining the asteroids and their hit-boxes. The asteroid models are relatively detailed, and if their mesh should be used to calculate collisions it would be much too computationally expensive, especially considering that there are 500 asteroids in the level. As a result the frame rate would drop to a degree where the game would become unplayable. Instead we define simple hit-boxes for each asteroid constructed of spherical colliders that emulate the detailed mesh collider, but require much less computation (see Figure 61).

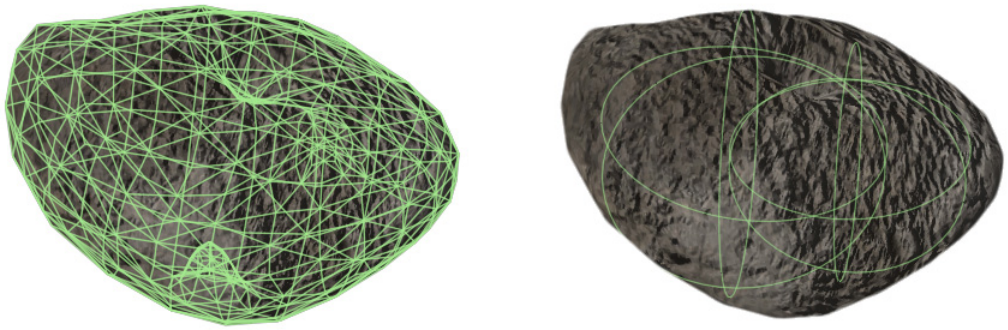


Figure 61 – Left: Complex collider that uses the mesh of the asteroid for collision detection, but is computational expensive. Right: Same model, but with two simple spherical colliders that are much faster to calculate.

The result of this compromise is that the collision detection is not always completely accurate, but as mentioned above this can have a positive effect on the dramatic and physical engagement as long as the hit-boxes are not larger than the asteroid itself. Otherwise, this could result in collisions where the player gets punished just for flying close to an asteroid and thereby causing unjust frustration.

Following the third iterative test, which showed that two out of five participants crashed into an asteroid, the asteroid field was slimed down so that it was possible, through a little strategic thinking or plain luck, to fly around the asteroid field and complete the task easily.

Since the first level is set in outer space it is natural to allow the player to move in all three dimensions, but given that we are limited to the two axes of the wobble board it is not possible to control both up/down, left/right and forward/backward motion. Therefore we decided to give the UFO a constant forward speed to allow the player to control the up/down and left/right rotation to maneuver through the level. The player controls the UFO similar to a flight simulator where up/down movement corresponds to the pitch and left/right movement corresponds to the roll (see Figure 62).

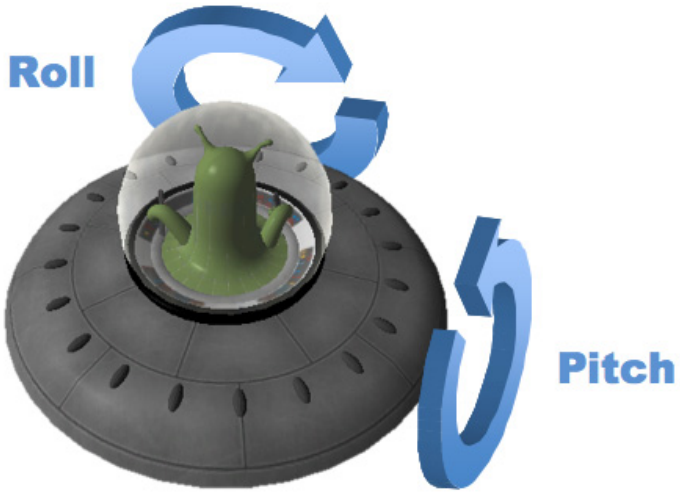


Figure 62 – The control scheme of the first level, where the wobble board is used to control the UFO's pitch and roll.

Level 2 - Cow Abduction

At the second level of the game the player's agent has arrived at earth and is tasked with collecting cows. These are to be found various places in the landscape and delivered back to a container next to a giant alien canon, which function will be revealed in the following and final level. In the following section the sensorymotor challenges implemented into the second level will be outlined and explained individually. In a later section entitled *Environment* the spacing of these challenges within the level will be explained in more detail.

This second level contains the main part of the gameplay, which means that this is where the player is going to spend the most of his time during the play session. In this level the player should have the opportunity to experience as many of the exercise methods as possible. Thus the challenge of the cow abduction is divided into several stages, each a sensorymotor challenge on its own, but relying on the physical exertion of different exercise methods. Seeing as the tutorial level has facilitated a familiarity with the wobble board as a mean to control the UFO, it is hoped that the game Flow, meaning the correct mixture of skill and challenge, can be moved to a higher level of difficulty.

Locating the cow: The first challenge that the player faces is to maneuver around the landscape to locate a cow for abduction. This challenge basically allows for all the

exercise types (balancing, tilting from side to side, forwards and backwards and circular movements) since the player has to correct his bearing continuously. As with all the following challenges, this can lead to a sense of physical engagement, since the player can gain an increasing proficiency in maneuvering the UFO.

We decided to restrict movement to two dimensions, namely left/right and forward/backward. This way the player is able to control the speed of the UFO. Based on the findings of the first and second iterative tests concerning basic mapping and control, we designed an adaptive control scheme that changes automatically depending on the current challenge. The results from the tests showed that when navigating the level a combination of rotating when tilting the board from side to side and accelerating when tilting it up/down (forwards and backwards) was the most intuitive and effective.

Below is a segment from the game code, which shows how the input from the wobble board is used to control the UFO in the second level.

```
ufoSpeed += angleY / 10000;
plr.transform.Translate(Vector3.forward * ufoSpeed);
plr.transform.Rotate(0, angleX / 30, 0);
```

Here `angleX` and `angleY` are the tilting values received from the wobble board. `angleY` is used to control the UFO's (`plr` object) speed by manipulating the value `ufoSpeed` while `angleX` controls the UFO's rotation around its y-axis. Note that the values of both `angleX` and `angleY` are adjusted to a level that corresponds to an appropriate transformation of the UFO's speed and rotation over time.

A more comprehensive coding reference can be found in Appendix C and furthermore the complete collection of code files is included on the appended CD.

Figure 63 – Screenshot from the second level of the game depicting the UFO navigating the environment.

Abducting the cow: This challenge focuses mainly on the exercise of balancing steadily on the board. Here the player has to hover steadily above the cow while using the tractor beam on the UFO to retrieve it. However, the iterative tests showed that the control scheme was not optimal when performing precise movements and hovering. To solve this we automatically changed the control scheme when the player moved close to a cow, into the *abduction zone*. When entering the abduction zone the mapping changes to left/right strafing and up/down speed instead of acceleration (see Figure 64). Also the sensitivity of the controls is reduced to provide an appropriate level of challenge. When the abduction task is successfully completed or the player moves outside the abduction zone the mapping automatically returns to the initial control scheme.

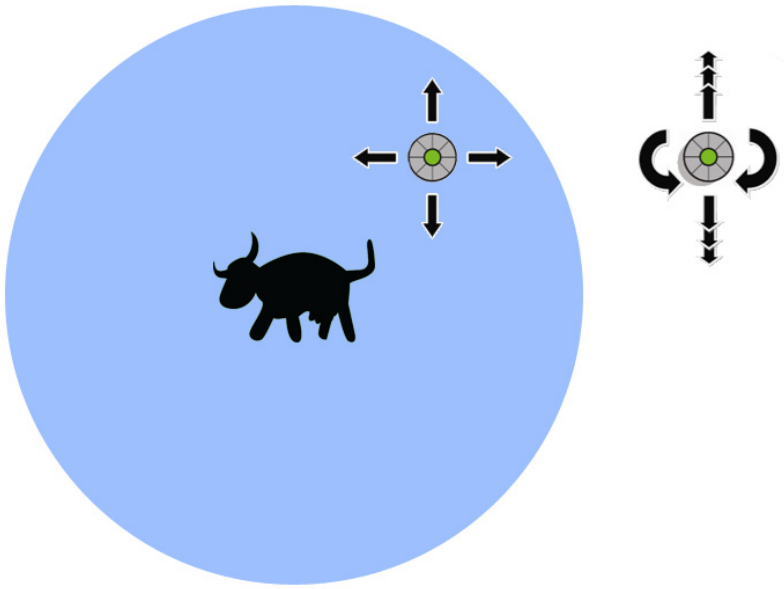


Figure 64: Illustration of the adaptive control scheme. When inside the abduction zone (blue circle) the mapping automatically changes to accompany the task of hovering steadily above the cow.

When the player moves into the abduction zone the camera position automatically changes to a near top-down view to help the player get a better view of where the UFO should be positioned in order to lift the cow and complete the abduction task. When the task is complete the camera returns to its initial position behind and slightly above the player to give a clear view of objects on the ground and still enabling him to see ahead for navigating through the level.

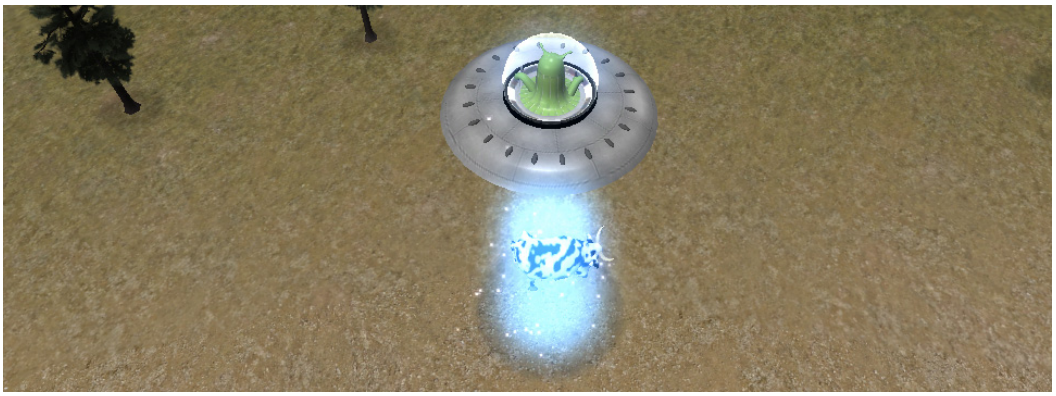


Figure 65 – Screenshot from the game showing the UFO abducting a cow.

Returning the cow: This challenge is more or less the same as the first, since the player has to navigate back to the container to drop off the cow. However, the sensorymotor challenge is made slightly more difficult, since the proficiency of the player should steadily rise with the completion of maneuvering and beaming up cows. The reason for this will be explained further in the 'Rules' section further down.

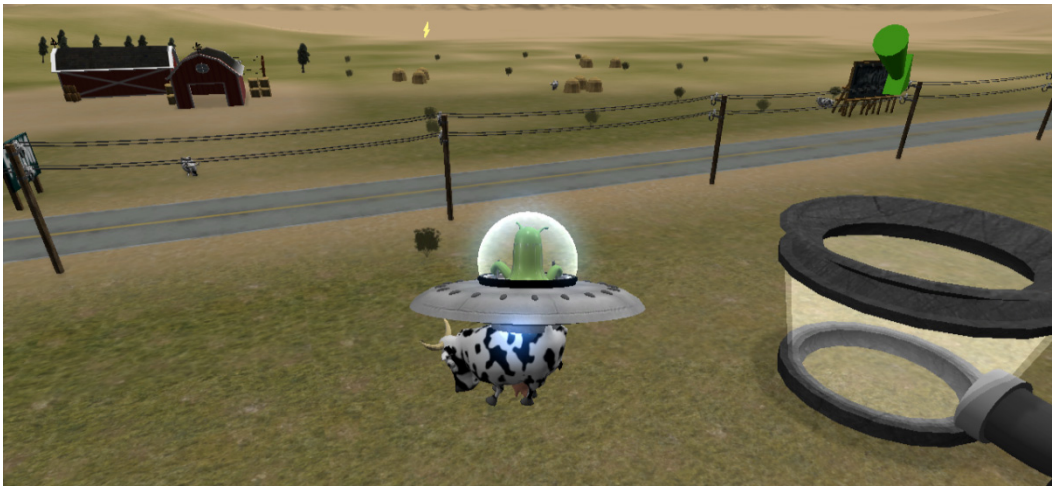


Figure 66 – Screenshot of the UFO returning a cow to the container (to the right).

The 'Rules' component of the Gameplay Model further outlines how the challenges are connected and what success criteria exist in the second level for being allowed further on to the third level.

Audio is used throughout the game mainly in an attempt to enhance the sensory engagement. This includes a combination of background music, environmental sound effects and non-diegetic sounds to emphasize events. Especially in the Cow Abduction level sound effects are implemented to aid the player in completing challenges by providing auditory clues.

One example is the UFO engine sound, which is a looping audio clip that changes pitch dynamically based on the current speed of the UFO. This functionality can be seen in the code segment below:

```
ufoSound.GetComponent<AudioSource>().pitch = 2 +
Mathf.Abs(ufoSpeed * 8);
```

Here the pitch of the audio clip is manipulated based on the `ufoSpeed` variable. Since `ufoSpeed` can be negative if the player is moving backwards the absolute value is used to ensure that the pitch does not decrease in this case. Another example is when the UFO's tractor beam is lifting a cow from the ground, which triggers a "beaming sound". If the player moves so the beam no longer touches the cow the sound immediately stops to signal that the abduction attempt has failed. The cows themselves also react by mooing loudly when being abducted. To make auditory experience more diverse the game randomly chooses between 14 different moo sounds.

Level 3 - Cow Launch

Sensorymotor challenge-wise the final level relies on the player's proficiency with three exercises, these being titling back and forth, titling side to side and finally balancing steady. These are employed as the player must aim the cannon at a gate on the alien mothership hovering in the distance. This is also where it is revealed that the number of cows collected in the previous level has a direct influence on the player's 'ammunition' which is the cows themselves. However, this might have been inferred from the physical connection between the canon and the container.

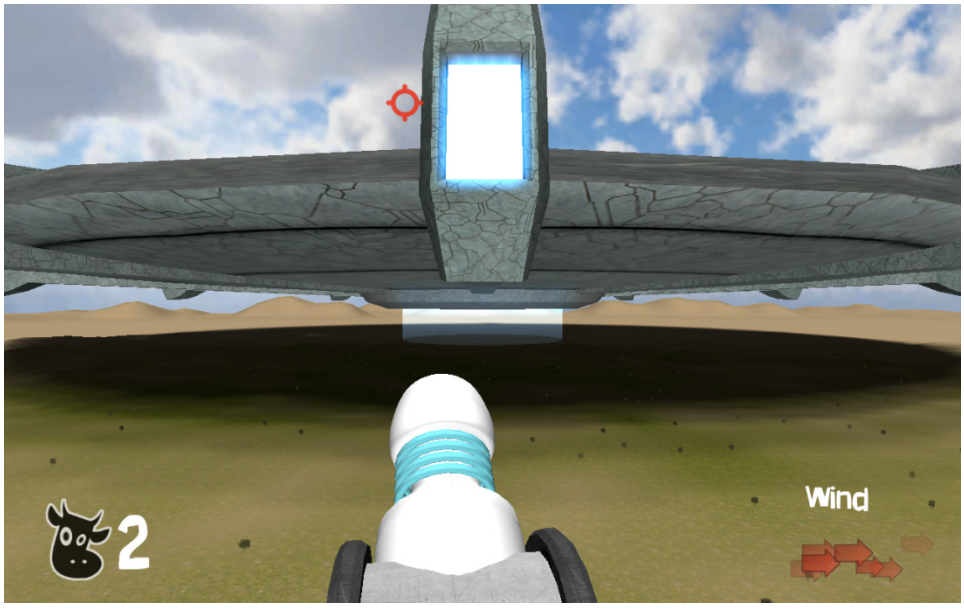


Figure 67 – Screenshot from the game depicting the third level where the player has to launch the cows into the mothership.

The crosshair moves in accordance with the tilting angle of the wobble board, i.e. the more the board is tilting to one side the faster the crosshair will move in that direction on the screen. There is however the problem of firing the canon with the wobble board, which as mentioned earlier does not have a button. Our solution is to enable the player to trigger the 'launch sequence' by moving the crosshair within the vicinity of the target, i.e. the mothership gate. The launch sequence consists of a 3 second countdown after which the cow is fired from the canon. It is the player's task to maintain the aim of the crosshair while the countdown is running or the cow will miss and drop to the ground.

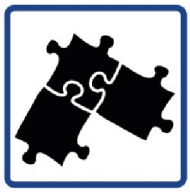
In this case the sensorymotor challenge does not only build on physical engagement, but also on dramatic and sensory engagement. The first of these are designed to be achieved by the experience of heightened suspense as the cow is launched from the canon and hurled towards the gate of the mothership. The stakes are more drawn up in this level than in the previous and consequently the win/fail criteria are clearer. Additionally, the cow's ragdoll physics plays on the well-being emotions mentioned earlier in the section 'Agent'.

Figure 68 – Screenshot from the third level of the game showing a cow as it is being hurled towards the gate of the mothership.

The sense of sensorymotor skills proficiency should have reached its highest point at this level of the gameplay experience. Thus it is feasible to assume that the player has

the mental surplus to consider other elements of the game than merely using the board as a controller.

During the fourth iterative test we discovered a potential usability problem regarding the objective of the level. The hint in the beginning of the level stated that the player should "Aim for the portal on the mothership". However both test subjects misunderstood this and aimed for the engine of the mothership, which visually resembles the tractor beam on the UFO (see Figure 67). Since the beam had been used to abduct cows in the previous level they thought it was the same principle in this level. To fix this we changed the hint to "Aim for the gate on the side of the mothership".



12.2.4 Intellectual Challenges

As stated in regards to the player property 'cognition skills' the sensorymotor skills constitute such a dominant mental factor that the game should not offer much in the way of intellectual challenges.

However, though we may theorize that most players will not have the cognitive capacity, at least not in the first try, to understand and respond to an intellectual challenge, some might acquire the sensorymotor skills quickly enough to feel that it may be viewed as an automated response rather than anything else, thus making the game tedious or even frustrating. Thus, the design needs to implement elements that allow these players to seek out and experience other forms of engagement than the physical. It can be argued that the audiovisual style, playing on the well-being emotions can facilitate sensory engagement and dramatic engagement arises from time to time as part singular dramatic events. Nevertheless, those players who have the surplus to seek intellectual engagement should not search in vain.

As mentioned in regards to the first level (asteroid level) for those players that find it next to impossible to maneuver through the asteroids within dying the option of flying around the asteroid field was implemented. However, it could be argued that for the player to realize that this option is available to him requires the mental surplus to use cognitive skills, which can eventually lead to intellectual engagement. However, it is assumed that most players would seek out the challenge even though the

knowledge that an easier path is available. Additionally, a player that lacks the sensorymotor skills to steer the UFO might quickly get so far off course that he stumbles on the option of flying around the asteroid field by accident. At least, this option is not designed as a reward for people that find the sensorymotor challenges in the first level too undemanding.

Since intellectual challenges are excluded from the first level, being a tutorial level that focuses on sensorymotor proficiency, and most of the time is spend in the game's second level it makes more sense to implement it at that stage. Nonetheless, still remembering that that the assumptions of the player's proficiency is backed up by the iterative tests, so overcoming the intellectual challenge should not be a requirement.

Thus, in the second level two means were implemented that could be a course for intellectual engagement. These both take the form of power-ups bonuses. These power-ups are part of what Chris Crawford refers to as resource management, which we categorized as being a cause to intellectual engagement. It can be categorized as such since the power-ups' availability is limited and usage of them means depleting the resource – in other terms once a power-up is used it disappears. Thus, an extended usage of them forces the player to think strategically about how to use them to collect as many cows as possible. Furthermore, they can be thought of as rewards for proficiency, since usage of them allows the player to accomplish more in shorter time if the player can master them. This follows the guidelines of the 4th in-game heuristic.

The power-ups consist of two different bonuses, which can be used to collect cows faster and more efficiently. The first is a speed power-up which makes the UFO fly faster for a limited time. This allows the player to move through the environment quickly, but at the same time raises the proficiency level required of the sensorymotor skills, inferring that the player must think about the strategically opportune moment to utilize them. Failing to do this or simply not using the power-up to move in the right direction will be counterproductive and waste time. We chose to use a lightning bolt as a representation of speed.

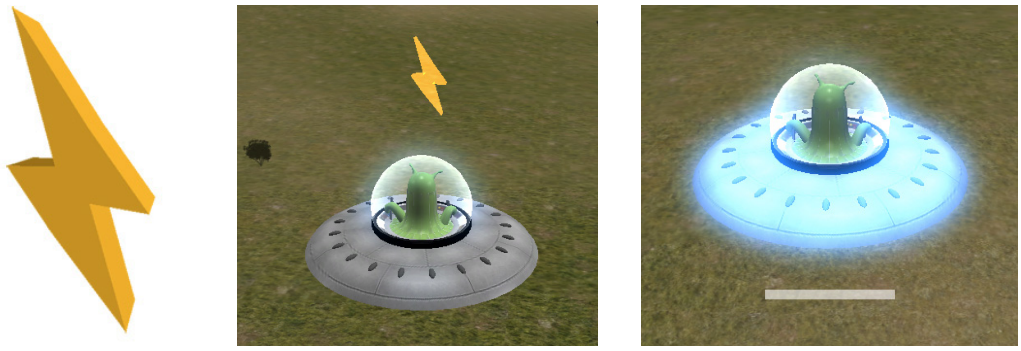


Figure 69 – Left: Close-up of the speed icon represented by a lightning bolt. Middle: The speed power-up in-game. Right: The UFO glows when affected by the speed power-up and an indicator bar below the UFO shows how long the speed boost lasts.

The second power-up is a cow locater, which, as the name indicates, shows the direction to the nearest cow by way of a yellow arrow in the corner of the screen. This power-up only functions as a bonus, since it does not have any negative consequences unlike the speed power-up, which requires a higher level of sensorymotor skills to control.

Figure 70 – Left: Close-up of the magnifying glass icon. Middle: The cow locator power-up in-game. Right: The power-up grants the player an arrow that points in the direction of the nearest cow.

Initially the cow locator power-up was not a magnifying glass but a representation of a cow. However we realized that this could cause confusion if the player mistook them for the cows that should be collected since the icon was much more eye-catching than the actual cows on the ground. We then proceeded to change the icon to an arrow to indicate that taking the power-up would point the player in the right direction. In the third iterative test we found that this was also confusing as people thought that the power-up arrow itself was pointing to something. The confusion was

not reduced by the fact that power-ups are animated to rotate around themselves. After this test we changed the icon to the current magnifying glass.

12.2.5 Environment

At this point the challenges of each level have been described and the various other elements of the game have been outlined. The environment component deals with the spacing of said challenges and other elements within the game world. Essentially, this refers to what is entitled *level design* in game design terminology. This part deals mainly with the second level, since the first level is already explained in relevant details in the previous section. The final level is further merely an extension of the style of the second level, but as will be explained in the final part of this section, the iterative tests forced some reworking.

As mentioned in regards to the usage of ragdoll physics on the cows to invoke well-being emotions the whole environment is created in accordance with the physical appearance of the game agents. Thus each object in the game world is made to look like stereotypes e.g. the stereotype for a barn can be seen in Figure 63. In theory all of these objects, agents included, should result in positive reactions such as joy or pleasant surprise.

Figure 71 shows the initial level map design, which outlines the location and number of cows and power-ups. As can be seen power-ups and cows are placed in each corner of the map as prizes for players who feel like exploring the edges of the level. Since sensory engagement is targeted as part of the environment the curiosity of exploring should be rewarded rather than punished. Neglecting this would also go against the 4th (rewards) and 5th (penalties) in-game heuristic. Additionally, sensory engagement following the need for exploration and curiosity is implemented through in-game objects that point towards interesting areas. As apparent from the level map, the farm area is hidden behind a ridge, which excludes any visual observation of it from the starting point (indicated by a UFO icon). Two visual clues indicate that there is something of interest in that area, namely the road and the sign reading 'Farm up the road'. At the farm the reward of easily accessible cows are immediately apparent, however the far off and secluded location of the farm makes the usage of strategically placed speed power-ups a necessity to gain anything from the discovery.

This also facilitates the intellectual engagement previously mentioned in regards to the power-ups.

Additional elements that could spark curiosity through auditory stimuli were also considered, including the use of Indian drums that would lead to an Indian reservation where some cows could be found.

The map size should also be large enough and include environment props e.g. trees and buildings that would force the player to search for most of the cows on the map. The idea is that the 'search and rescue' for the cows will lead to further sensory and physical engagement.

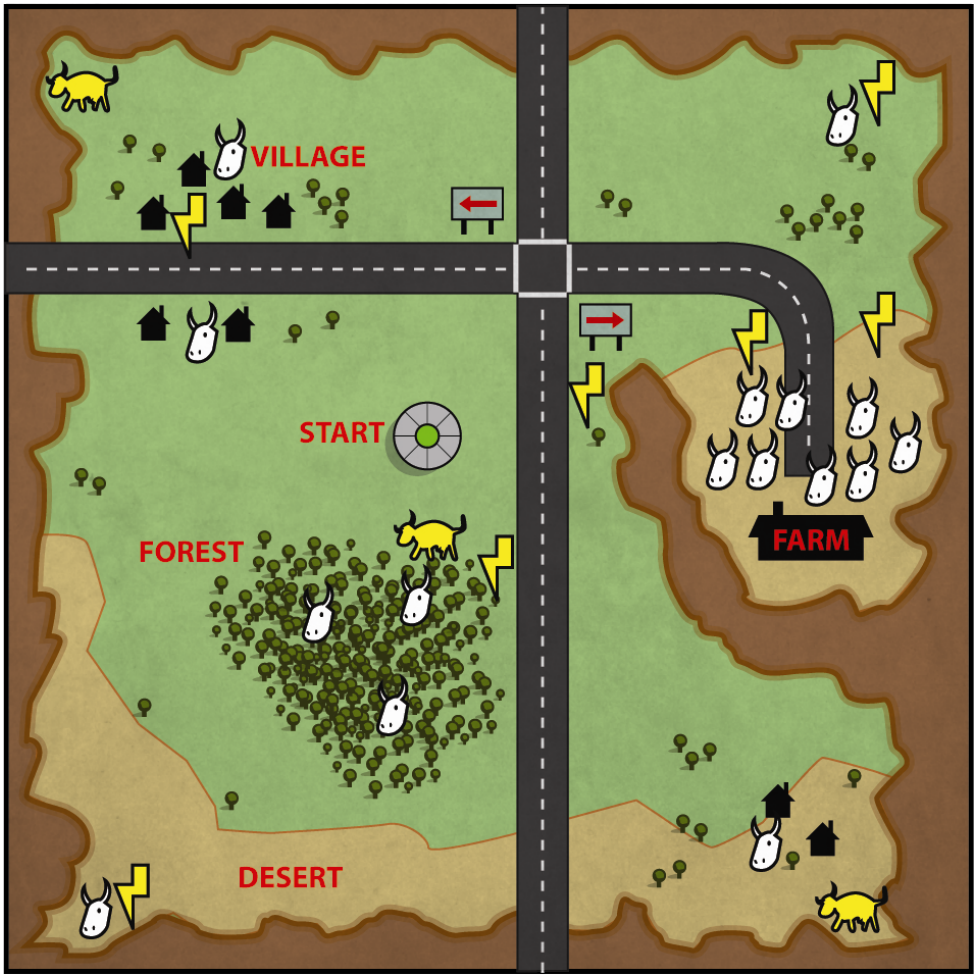
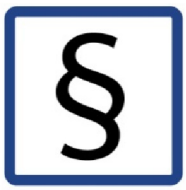


Figure 71 – The design map for the second level.

However as a result of the third and fourth iterative test we came to the realization that the map size and complexity had to be severely reduced as it became evident that the players simply did not have the cognitive surplus to consider anything other than the main task of collecting cows. We therefore had to disregard the part of the sensory engagement that we had hoped to target through curiosity, e.g. the hidden farm. In addition to this, there was the practical problem of having to fly over long distances, which quickly became boring and time consuming meaning that players lost interest and there was not enough time for the actual cow abduction tasks. In the end the map size was reduced to a level where the player can fly from one end to the other in just 15 seconds and all the props and cows are placed within this area resulting in a much better balance between the different challenges.



12.2.6 Rules

This component of the game state should be considered the physical laws and divine intervention of the game developers all in one. In the design, the audiovisual environment suggests that the physical laws of the game world resemble that of real physics, since all objects resembles real life objects to a great extend – however iconic they appear. Furthermore, in regards to divine intervention, the rules of the game serve as regulatory means to either punish the player or limit the effects of real physics.

In the third level we have added a random variable in the form of wind. The key concept behind this addition was the fear that the player will have acquired a sufficiently high proficiency with the wobble board so as to consider just balancing with the crosshair in the middle of the gate too easy a challenge. The wind adds to the cognitive ability required to complete the game successfully. To some degree this can be linked to Crawford's sequential reasoning, since the player will be required at least one test shot to understand the degree to which the cow is affected by the wind. Accordingly, this does not only add to the sense of dramatic engagement, but also intellectual engagement as the player must contemplate the placement of the cursor following the force of wind and its direction.

As stated in the section *Relevant Exercises* in the preliminary analysis, it is not desirable that the wobble board user touches the ground with the edges of the board during

exercising. To prevent this we have implemented penalties if the player tilts the board too much. These penalties are only present in the second level for several reasons. The main reason is that the control scheme of the first and third level does not benefit from excessive tilting of the board. In the first level this would simply result in the UFO spinning around itself and the third level is focused around balancing the board to control aim. Also, since the first level is meant as an introduction, penalizing the user at this early stage is not desirable. However in the Cow Abduction level the player can use the floor as support when navigating the environment and thereby bypass the physical exercise. Therefore we implemented different penalties depending on the current state. If the player has abducted a cow and is returning it to the container excessive tilting will first trigger a warning message (see Figure 72) and if the player does not recover quickly the cow will drop to the ground. If the player does not currently have a cow the penalty is instead enforced by flipping the UFO on its head and bringing it to a complete stop while it recovers resulting in time loss.

Figure 72 – The warning message shown if the player tilts the wobble board too much while returning a cow.

The time limit in the second level is implemented to add to the feeling of suspense dictated by the previously mentioned Hollywood Model, which adds to the sense of dramatic engagement. As the game progresses the player should feel a rising sense of suspense, which will eventually peak as the game changes to the third level and the border between failure and success are made apparent.

From a practical viewpoint the time limit also ensures that players do not get stuck in the level. For instance, if the player had to collect five cows before being allowed to progress it might take inexperienced wobble board users significantly longer than the set time limit and physical fatigue could cause them to simply give up and abandon the game. As a result of the fourth iterative test the time limit was set to four minutes, which was found to be a good balance between giving players enough time to collect a reasonable number of cows, without experiencing physical fatigue.

PART IV - TESTING

This part of the thesis details the methodological underpinnings, practical execution, and results of the tests performed in order to evaluate the design and implementation of the WobbleActive prototype, described throughout the previous part. This design was more specifically informed by the research described throughout the analysis of the current thesis and intended to provide its potential users with engaging gameplay while simultaneously ensuring correct proprioceptive ankle training. The ostensible goal of this test was in other words to help provide an answer to the question posed in the final problem statement presented in the last paragraphs of the preliminary analysis.

The first chapter *Test Methodology* presents the two primary objectives of the test and describes the methodologies employed in order to fulfill said objectives.

Subsequently the chapter *Results* details the results obtained from the test. These results will be subjected to further scrutiny and discussion throughout the final part of the thesis *Discussion and Conclusion*.

CHAPTER 13 - TEST METHODOLOGY

This chapter is, as suggested, intended to provide the reader with an understanding of the methodological underpinnings and design of the tests conducted in order to provide an answer to the final problem statement presented in the last paragraph of the preliminary analysis, page 58. Considering the question posed in this statement, the objective of the test was twofold; to assert whether the test participants found the gameplay engaging; and to determine whether the said participants performed correct proprioceptive ankle training while using the prototype. Consequently the current chapter treats the methodology associated with of each of the two test objectives in turn.

First the section *Expert Evaluation of Proprioceptive Training Efficacy* provides a description of how and why it was decided to consult an expert on the topic of ankle training and rehabilitation in an attempt to assert whether the prototype afforded correct proprioceptive ankle training.

Subsequently, the second section *Measuring the Experience of Engagement* details the considerations forming the basis for the decision of measuring engagement by means of self-reported metrics, followed by a more detailed description of the methodology used to assert the participants' experience of engagement. That is, the employed sampling technique; the instructions designed with the intention of ensuring that all participants were provided with identical information prior to the test; the test setup; and the questionnaire design.

13.1 Expert Evaluation of Proprioceptive Training Efficacy

In accordance with the last part of the final problem statement, besides developing an interactive game for the wobble board that facilitates engaging gameplay, the appertaining game should ensure that the players perform correct proprioceptive ankle training. Even though physiotherapist Anders Heckmann gave the original WobbleActive prototype a seal of approval in terms of it being ergonomically correct (Asp, et al., 2007b p. 7) the current project includes a further development that entails a whole new gameplay. So, despite the fact that the gameplay was designed to accommodate correct proprioceptive training, it was the belief that an expert, within the area of physiotherapy would need to approve the ankle movement performed on the board by the player during gameplay. It is important to acknowledge that the movements performed while playing the game will alter every time it is played due to the unpredictability of player movement as well as the location of random game objects. Furthermore, even though the gameplay is intentionally designed to facilitate appropriate ankle training, the ankle movements afforded by the board and provoked by the gameplay might exceed the previously described standard wobble board exercises (reprinted below). In case that these recommended movements are exceeded, the question is then whether or not it has a positive or negative effect on the player's proprioceptive ankle training.

Box 24 – Reprint: Common wobble board exercises (Asp, et al., 2007a p. 22)

Balance while keeping as steady as possible

Move the board steadily back and forth

Move the board steadily from side to side

Circular movement clockwise and counterclockwise

The illustrations have been adapted from (Ideal Fitness Inc, 2010)

13.1.1 The expert

When attempting to evaluate the degree to which the gameplay facilitated correct proprioceptive ankle training it was decided to consult an expert on the topic, namely Anders Laun who is a 6th semester physiotherapist student at Professionshøjskolen Metropol in Copenhagen. Even though Laun has yet to become a fully certified physiotherapist, he was still considered sufficiently knowledgeable as he currently specializes within the field of proprioceptive training.

13.1.2 Expert consultation procedure

The expert consultation was divided into two sessions: Expert testing and expert observation. The expert testing involved Laun's subjective and professional evaluation of the proprioceptive training afforded by the gameplay, after and while he was playing the game. The second session, involved expert observation, since Laun was asked to observe the ankle movement of a member of the group while said member was playing the game, before evaluating the efficacy of the performed proprioceptive training. The data gathering method used for the expert evaluation was a think-aloud approach and an informal open-ended (or unstructured) interview. The former was used to gather data while Laun was trying the prototype himself while the latter was used during and after his observations of the group member playing the game. The informal interview did more specifically take place as an exploratory conversation around the topic with the intension of gaining in-depth data about the efficacy of the proprioceptive training facilitated by the prototype. Throughout both rounds of the expert evaluation a member of the group made notes on a laptop. This data gathering technique was deemed suitable since it presumably would be less time consuming to analyze theses notes compared to data gathered by means of e.g. audio or video recordings. According to Sharp (2007) this approach yields a lot of unstructured data and the notary should thus strive to be selective in his or her way of taking notes so as to make it easier to analyze the data. This data gathering method relies on a good notary since the selection process is already a crucial first step of the data analysis. Moreover it is worth noting that this method is very flexible and unobtrusive and the disturbance of the interviewee is very low (Sharp, 2007 p. 297).

13.2 Measuring the Experience of Engagement

The theoretical concept engagement can, as previously suggested, be described on two distinct, yet intrinsically, connected levels. That is to say, on one level it is possible to describe engagement as the player's general experience of willing and continued commitment to the act of playing; and on the other it is possible to describe engagement in terms in terms of the five types of engagement. These reason why these two layers are virtually inseparable is necessarily that it is the player's experience of the individual types of engagement which causes him or her to become willingly committed in the first place and entail that the level of commitment is maintained. This intrinsic connection notwithstanding, it seemed reasonable to assume that the evaluation of whether the users of the prototype had found the gameplay engaging should involve assessment on both levels. The test should in other words both assert whether the test participants generally found the gameplay engaging and whether said gameplay gave rise to the types of engagement the prototype was explicitly intended to elicit, that is, sensory, physical, and dramatic engagement.

13.2.1 A subjective metric of a subjective experience

This necessarily brings about the question of how to operationalize engagement, that is, what metric or measure to employ when assessing whether the test participants did indeed find the gameplay engaging. When aspiring to measure curious concepts such as engagement we have a wide range of metrics at our disposal, which in broad can be classified as falling under the category of either behavioral, physiological, performance or self-reported metrics. Readers, who are unfamiliar with these categories of metrics, may refer to Box 25, on the following page, which provides a concise description of each of the four. At first glance it might appear that a behavioral metric would be measure of choice when assessing engagement on a general level. That is to say, it would be possible to determine whether users would play repeatedly without encouragement by making the prototype available to them at all times. Then by registering the time spent playing during each play session and the frequency of play sessions (the users' behavior) it should be possible to assert whether the users would in fact experience a willing and continued commitment to the act of playing.

Box 25 – Possible classification of different metrics

A metric, or measure, does in general terms refer to a particular way of evaluating or measuring a particular phenomenon, whether this be physical, physiological or psychological (Tullis, et al., 2008 p. 7). It should, however, be noted that the distinction between the four metrics – behavioral, physiological, performance and self-reported metrics – is somewhat ambiguous since the terms at times are used interchangeably or used to describe subsets of one another.

Behavioral metrics: Behavioral metrics do as implied by the name refer to measures of the behavior exhibited by individuals. Such metrics may include, but are not limited to, facial, body and eye movement. Moreover it should be stressed that the types of behavior elicited by individuals may vary greatly in terms of how conscious and explicit they are (Tullis, et al., 2008 p. 167).

Physiological metrics: Measures falling under the category of physiological metrics does, as the name implies, refer to measurements of the physiological responses of the body of an individual. This category includes galvanic skin responses (a measure of skin conductance often used to measure emotional arousal and anxiety); electromyograms (recording of muscle activity oftentimes used to measure tension or stress); and electroencephalogram (measurement of electrical activity within the brain used to measure brain arousal) (Cozby, 1997 p. 132). This category may be viewed as a subset of behavioral metrics (Tullis, et al., 2008 p. 167).

Performance metrics: This class of metrics does essentially refer to measurements of how individuals perform when asked to perform a given task or complete a particular scenario. These types of metrics are consequently oftentimes operationally defined as: task success, completion time, number of errors, efficiency, or change in performance over time (Tullis, et al., 2008 p. 63). These measures may be considered as a subset of behavioral metrics as you essentially measure behavioral performance (Cozby, 1997 p. 132).

Self-reported metrics: Self-reported metrics does simply refer to data obtained based on statements made by individuals and may be the product of questionnaires, interviews, or other forms of written or oral communication (Tullis, et al., 2008 p. 63).

All illustrations have been adapted from (flickr.com).

However, considering the limited temporal scope of the current project and the limited resources available, the solution of logging frequency and duration of use was not regarded as feasible. Moreover behavioral metrics in the form of video recording based observations could have been made in order to determine whether particular gameplay states involved the emotions associated with the pleasures of the mind and the experience of the individual types of engagement. To elaborate such recordings could help determine the correlation between eliciting events – particular game states – and the player's experienced emotions, which are part and parcel to the player state. Recall from the chapter on the feeling of engagement that emotions generally are believed to include a behavioral component such as e.g. facial or vocal expression. However, even if such a test would make it possible to establish that the participants e.g. found a particular game state frustrating this information would not suffice in and by itself. That is to say, it would not be possible to determine whether the level of frustration exceeded the participants' threshold for tolerating negative affect and thus hampered the experience of engagement.

Somewhat similar points of criticism apply to the use of both physiological and performance metrics. Physiological metrics such as galvanic skin response might yield information about the test participants' experience of emotional arousal, but without additional information it would not help determine whether this level exceeded the threshold or what emotion it was associated with for that matter. Moreover it seems plausible that physiological measures might be influenced by the fact that the users do perform physical activity while using the prototype. It would in other words be harder to determine whether the increase in, say galvanic skin response or heart rate, was caused by emotional arousal or the general physiological response to the physical activity.

Performance metrics, on the other hand, might provide an indication of the balance between the participants' skills and the difficulty of challenges which the prototype confronts them with. However, the information gathered would pertain to the skills and challenges in an objective sense (e.g. response time and sensitivity of the controls) and not the participants' subjective experience of this balance. Following writings presented throughout the analysis it should be apparent that this objective balance matters little in comparison to the subjective experience as it ultimately is the latter which influences the experience of engagement.

The points of criticism raised throughout the preceding paragraphs might come forth as somewhat blinkered and it is important to stress that they by no means should be understood as a claim that the evaluation of engagement has nothing to gain from behavioral, physiological and performance metrics. Rather the argument is that none of the three in isolation are able to account for the inherently subjective experience of engagement.

This implied that it was necessary to resort to a self-reported measure of engagement, which in itself does not come without complications. The previously cited author and emotion theorist Elaine Fox does, more specifically describes that *"[o]ne reason why introspection is often not trusted by cognitive psychologist or neuroscientists arises from evidence that we are not particularly good at looking into our own minds. For example, people generally have a poor understanding of the causes of their own behavior"* (Fox, 2008 p. 36). Solving the problem of introspection is evidently far beyond the scope of the current thesis as this issue has been a recurrent one within the field of psychology since its formative days (Fox, 2008 p. 35).

This problem notwithstanding, it is important to stress that it in the past neither has kept scholars nor usability practitioners from employing self-reported metrics. In fact, Fox describes that many emotion theorists are proponents of the view that the subjective experience of emotions, feelings, "[…] *can only be reported from a first-person point of view […] no-matter how many other components or correlates of emotion we measure, we cannot replace the direct report of the person experiencing the feeling"* (Fox, 2008 p. 29). This belief seemingly concurs with the points of criticism raised against the three potentially objective metrics. Considering that the experience of engagement, within the context of the current thesis, is considered inseparable from the player's subjective experience of emotions, this citation seemingly lends some credence to the claim that subjective reports should be applicable. Moreover self-reports, and more particularly questionnaires, are widely recognized measures of phenomena such as immersion, flow, presence and absorption (for a description of a selection of these see (Brockmyer, et al., 2007)). With this being said it should be emphasized that these measures do not lend themselves to direct application within the context of the current project as they essentially pertain to different experiential phenomena. In the first chapter of the analysis it was described that experiences qualifying as engaging form a subset of a wider range of immersive experiences, and that experiences

involving flow similarly make up a subset of the ones involving engagement. This does, however not imply that the test described in the current chapter necessarily also should assess the immersive potential of the prototype and its capacity for inducing flow. Considering that it during the iterative testing was discovered that the act of balancing on the board while playing demanded the full attention of novice users, it would seem that an evaluation of the test participants' experience of immersion would yield little information about their experienced level of engagement. To elaborate, it seems reasonable assume that almost all novice users will experience immersion, since immersion, within the context of the current thesis, is defined as attentional surrender on part of the player. The participants' experience of the equilibrium between challenges and skills, inherent to flow, may on the contrary be of relevance. However, it is important to recall that the experience of flow by definition is positive in nature and that an engaging experience may be accompanied by negative emotions as long as these do not exceed the individual's capacity for tolerating negative affect. Moreover the concept flow does not account for the engagement derived from experiencing the game's diegesis.

Based on the reflections summarized throughout the previous paragraphs it was decided that the use of a self-reported metric would be necessary given the subjective nature of engagement. Again it is should be emphasized that behavioral, physiological and performance metrics also could have been applied, albeit not with complete disregard from inquiry into the subjective experience of the individual. More specifically, it was decided to employ questionnaires as these require few resources to produce and little time to analyze (Korsgaard, 2008 p. 1). Questionnaires thus seem particularly useful given the limited temporal scope of the project. A more elaborate description of how the general experience and the individual types of engagement was operationalized as a self-reported metric will be presented in the subsection on questionnaire design.

With this methodological issue out of the way, the following subsections will detail the individual steps of the test procedure in their chronological order. First the sampling technique will be described; followed by descriptions of the experiment instructions; the test setup; and the questionnaire design.

13.2.2 Sampling technique

The test participants partaking in the test comprised fellow students and staff from Medialogy, Aalborg University Copenhagen as well as guests invited particularly for the occasion. This does in turn imply that the employed sampling technique qualify as convince sampling, which in broad strokes can be described as a non-probabilistic sampling technique favoring easy access to participants over the ability to generalize to some predefined population (Cozby, 1997 p. 92). Since the potential user group of the prototype, as described in the preliminary analysis, comprise people of all ages and professions as anybody may suffer ankle-injuries it was not regarded as feasible to perform probabilistic sampling. The inability to generalize necessarily imposed some restrictions on the inferences which could be drawn from the obtained data. However, considering the resources available and the fact that we were not aspiring to describe a particular attribute of a limited population the inexpensiveness and convenience of this approach seemingly outweighed its shortcomings. Here it is worth noting that non-probabilistic sampling is commonly used within academia due to exactly its inexpensiveness and convenience (Cozby, 1997 pp. 92-93). It should, however, be noted that all participants were required to be reasonably proficient in English as the all textual feedback and information in the game was presented in this language.

13.2.3 Test instructions

Each test participant was provided with a set of written test instructions prior to partaking in the test. This was, more specifically, done in order to ensure that all test participants would receive the same information prior to partaking in the test and to reduce any potential bias induced by their preconceived thoughts on the purpose of the test (Rademacher, 2002 p. 20). Since the test was to be conducted on campus a particular concern was the one we refer to as unwarranted pleasing. This issue is in many regards comparable with what behavioral researchers refer to as the problem of demand characteristics. Cozby does, more specifically, describe that experiment participants oftentimes aspire to confirm the experiment hypothesis if they are of the belief that they know the demand characteristics of said experiment (Cozby, 1997 p. 136). Even though we are not trying to substantiate or invalidate a hypothesis but test, the issue remains the same. That is to say, the test participants' self-reports might

not reflect their actual opinions, but instead be an expression of an inclination to provide positive responses. Cozby describes that one way of counteracting this inclination is to make use of deception. That is, inciting the participants to believe that the purpose of the experiment, or test, is one thing while it in fact is another (Cozby, 1997 p. 136). Box 26 details the test instructions, which will be briefly described throughout the subsequent paragraph.

Box 26 – Test instructions

1 We are currently conducting a test where we ask people to try out different
2 versions of a game and a game controller we have created. You will be asked to
3 try one version. When playing the game you control a UFO by means of a
4 wobble board, which is normally used for ankle training and rehabilitation. After
5 playing you will be asked to answer a questionnaire about your experience of
6 playing. Please note, that there are no right or wrong answers, since we solely are
7 interested in how you experienced the game. On this note, it is important to
8 stress that we are conducting the test with the intention of gathering information
9 about different possible design solutions and we will consequently only benefit
10 from genuine replies. So we encourage you to answer as honestly as possible and
11 you are naturally welcome to ask us if questions arise while you are filling out the
12 questionnaire. We are grateful for your participation and value all feedback.

Lines 1 to 6 introduces the test participant to the test and explicates what he or she will be asked to do while partaking, that is, playing the game and subsequently answering a questionnaire about the experience of playing. Notably the test participants are given the impression that he or she will be trying one out of a series of versions of the prototype. This statement is obviously untrue since all participants did in fact try the same version. The intention of lines 6 and 7, which makes the participants aware that there are no correct or incorrect answers to the questionnaire, is to *"[…] reduce any anxiety, by telling participants that they are not being scored on their performance"* (Rademacher, 2002 p. 20). Lines 7 to 10 reminds the participants of the make-believe purpose of the test and emphasizes that since we are comparing different design solutions we will only prosper from genuine responses. Finally lines 10 to 12 encourage the participants to answer honestly and ask questions as they please after which they are thanked for their participation.

Some might find it unethical to deliberately lie to the participants. However, considering that it is a relatively harmless untruth and the fact that deception, as previously described, is a common way of reducing such bias, ethics were not considered an issue. Once the participants had read the instructions they were asked to play the game on the setup described in the following sub section.

13.2.4 Test Setup

The test setup was designed with the intention of fulfilling three primary objectives: To keep all extraneous variables, which might have an influence on how the test participant experienced the game, constant; second, to resemble the setup a player might use if he or she was playing the game within the comfort of his or her own home; and third, to ensure the safety and comfort of the participants.

In order to accommodate the first objective all participants should experience the game on identical auditory and visual displays, and be placed at an identical distance from the screen. At first circumaural headphones were believed to serve as an ideal auditory display since these would minimize interference produced by sounds not immediately related to the act of playing. However, considering that the iterative tests indicated that balancing in itself was very difficult, thus leaving the participants vulnerable, it was feared that said participants might find the experience uncomfortable if they were aurally cut off from their surroundings. Alternately it was decided to use speakers for auditory displays. In addition to decreasing discomfort, speakers were also believed to resemble the type of auditory displays likely to be used by players if these were to play the game at home. Moreover, it was the belief that it would be best to use a relatively large monitor as this also would make the setup resemble a home theater while making it easier for the player to observe the actions on the said monitor. Finally it is worth recalling that the iterative tests indicated that novice players might need occasional physical support while playing. Consequently, it was decided to place a chair in front of the participants as this should ensure their safety and provide them with a physical aid to reduce any discomfort brought about by the fear of falling. Figure 73 illustrates the setup devised based on the requirements described throughout the preceding paragraphs.

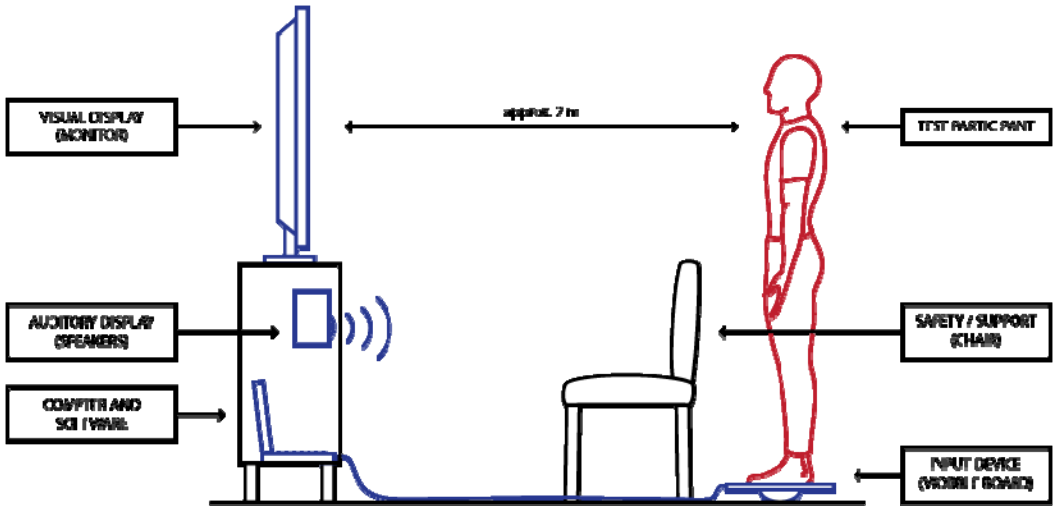


Figure 73 – Illustration of the setup used for the test of the prototype.

13.2.5 Questionnaire design

In the introductory paragraphs of this section it was argued that the test both should assert whether the participants generally found the gameplay engaging and whether said gameplay gave rise to the types of engagement the prototype was explicitly intended to elicit, sensory, physical, and dramatic engagement. The questionnaire designed for the evaluation of the prototype revolved around exactly these two levels while simultaneously asserting the system's usability and addressing the question of whether the participants, despite their limited attentional surplus, might have experienced intellectual engagement. It should, however, be emphasized that the aspiration was to make the questionnaire as concise as possible. This aspiration was more specifically based on the knowledge that lengthy questionnaires pose a problem in that they both deter participation and completion (Sharp, 2007 p. 311). The fear was in other words that if the questionnaire was too comprehensive then the participants might respond with great haste or even refrain from completing the questionnaire.

The final questionnaire comprised a total of 19 items pertaining to the participants' experience of the game and five additional items related to demographic information. Following the advice of Sharp, the items were divided and presented in accordance with general topics in order to make the questionnaire easier and more logical to complete (Sharp, 2007 p. 311). Firstly, the participants were asked to answer

questions pertaining to their general experience of the interaction with the game, before answering questions related to each of the three levels of the game. Finally the questionnaire featured items related to their general experience of the game and the items pertaining to the demographic information. With exception of the questionnaire items pertaining to the participants' experience of the difficulty level, and their personal information, all of the featured items required the test participants to rate their level of agreement on six point Likert-scales. On these scales '1' signified strong disagreement and '6' indicated strong agreement. The decision of using a six point scale was essentially informed by the knowledge that scales with an even number of check boxes prohibits the participants from displaying indifference (Sharp, 2007 p. 316). Figure 74 illustrates the type of Likert-scale used in the questionnaire.

Figure 74 – The type of Likert-scale used for the majority of the items featured in the questionnaire.

It is worth noting that the participants filled out a digital version of the questionnaire as this prohibited them from purposely or inadvertently providing erroneous replies (e.g. marking the space between two check boxes). An additional benefit of using a digital questionnaire was that no time had to be spent on digitizing the replies once the test had been conducted. The digital version of the questionnaire can be found on the CD appendix in the folder *Test Material*. The following paragraphs present concise descriptions of each of the items featured in the questionnaire. However, in order to make the connection between the objectives of the test and the featured items more readily apparent said items will not be presented in the order which they were featured in the actual questionnaire. Instead the items have been grouped in accordance with the more general questions they were intended to answer: 1) How was the usability of the prototype experienced? 2) Did the gameplay give rise to physical engagement? 3) Did the gameplay give rise to dramatic engagement? 4) Did the sound and visuals contribute positively to the participants' experience of the game and did they employ any form of strategy while playing? 5) Did the participants experience a willing and continued commitment to the act of playing the game and did the game successfully impose goals on the participants?

Prototype usability

According to the research documented in the analysis, good usability is a prerequisite for achieving the experience of engaging gameplay. The selected questionnaire items pertaining to the participants' experience of the prototype's usability are outlined in Box 27 below. Given the aspiration to keep the questionnaire as short as possible the usability items below are the ones deemed most important to include based on the at-game heuristics presented in the Box 19, page 150.

Box 27 – Items pertaining to usability

- The movement of the UFO corresponded to the movement of the wobble board.
- It was easy to understand the text and symbols displayed throughout the game.
- At some point I felt annoyed by the text and the symbols displayed throughout the game.
- I was never in doubt of what I was supposed to do in the game.

The experience of physical engagement

The prototype was as described in the previous part designed with the aim of facilitating physical engagement, which is associated with the joy of progressively improving and the feeling of being highly proficient. That is to say, it hinges upon the experience of the pleasure of the mind virtuosity.

Consequently, it was decided to ask the players to rate their subjective experience of their own performance while playing each of the three levels, as apparent from the first three questionnaire items featured in Box 28. High ratings on the accompanying Likert-scales would suggest that the participants had experienced virtuosity. Similarly, it was decided to include a question pertaining to their more general experience of improvement as this should provide information about the presence or absence of virtuosity during the experience of the game as a whole.

Box 28 – Items pertaining the virtuosity

- Once I made it through the asteroid field I felt a sense of achievement
- I was satisfied with the number of cows I collected
- I was satisfied with the number of cows I returned to the mothership
- I felt that I gradually became better at playing the game

The experience of physical engagement is as described in the analysis also dependent upon the player's experience of the relationship between perceived skills and the perceived difficulty of the faced challenges. This necessarily also ties to the experience of virtuosity in the sense that challenges, which are perceived as too difficulty, are unlikely to entail this pleasure of the mind. This does, however, not imply that difficult challenges cannot lead to virtuosity. Quite contrarily it would seem that the positively valenced attribution emotions, associated with virtuosity, might be even more intense, when the challenge is perceived as very difficult.

One way of inquiring into the appropriateness of the difficulty could have been to pair one Likert-scale item pertaining to the experienced difficulty level – ranging from very low to very high – with another asking the participants to clarify whether they would have preferred a lower or higher difficulty level. This should have made it possible to determine both whether a particular challenge had been experienced as difficult, and whether this difficulty was too high or too low. However, considering the aspiration to make the questionnaire comprise as few items as possible an alternative solution was chosen. Instead it was decided to include one question asking the participants to rate the difficult level as either 'too low', 'low', 'moderate', 'high' or 'too high' as apparent from Figure 75. In the questionnaire the word 'too' was written with capital letters in order to emphasize that the poles of the score represented negative experiences of the difficulty level, that is, the challenge was either perceived as trivial or exceeding the participants capacity for action.

Figure 75 – The scale used for the questionnaire items pertaining to the difficulty level of the three game levels.

Since each of the game's three levels comprised very different challenges it was decided to address the difficulty level of each of the three. Box 29 details the three items featured in the questionnaire, which were answered by performing the rating just described.

Box 29 – Items pertaining to the perceived difficulty level

- When trying to avoid the asteroids I found the difficulty level:
- When trying to collect cows I found the difficulty level:
- When trying to hit the mothership's gate with the cows I found the difficulty level:

The experience of dramatic engagement

In the previous part of the thesis it was described that one aspiration was for the intensity of the game to follow a traditional dramatic curve, including an intense beginning and ending. It was in other words the aspiration to incite an experience of dramatic engagement during the first and last level. Dramatic engagement is, as described in the analysis, closely tied to uncertainty leveled at the outcome of events involving substantial risk.

Consequently, it was decided to explicitly ask the participants to rate the degree to which they had experienced the prospect-based emotion, worry, while facing the challenges of the two levels. High ratings on the accompanying Likert-scales would suggest that the participants had found the experience of said levels suspenseful and thus experienced dramatic engagement. Box 30 details the two questions phrased with the intention of eliciting these responses.

Box 30 – Items pertaining to dramatic engagement

- I was worried about whether I would make it through the asteroid field
- I was worried about whether I would be able to hit the mothership's gate with my cows

Audiovisual appeal and strategic thinking

During the iterative design process it was discovered that the participants' limited attentional surplus in all probability would entail that they almost exclusively focused on the challenges at hand while playing. Nevertheless it was regarded as interesting to determine whether the participants did in fact employ a minimum of strategic thinking while playing the second level as this would suggest that they might have experienced intellectual engagement. As a result, the first of the two items presented in Box 31 was included in the questionnaire. The second item presented in this box pertained to the participants more general experience of the sound and visuals of the game. Even though the attentional limitation presumably would make the participants less likely to explore the game world because of the audiovisual stimuli it, said stimuli could still have contributed positively to the experience. So even though the sound and visuals did not explicitly incite the player's to explore, these might still have an influence on whether the player would wish to continue playing the game.

Box 31 – Items pertaining to intellectual and sensory engagement

- I devised a strategy for collecting the cows and returning them to the container
- The sound and visual style made me like the game more

The general experience of engagement

The final three rating scale items were related to the participants' general experience of engagement. Since one of the preconditions for the experience of engagement is that the player either adopts the goals of the game or makes his or her own, it was decided to include one item pertaining to this issue. Considering that the ostensible goal of the game is for the player to collect as many cows as possible and subsequently return them to the mothership it seemed prudent to determine whether this task did in fact matter to the participants. The first item presented in Box 32 was included with the intention of determining whether this was the case. The second item in this box was included in order to determine whether the players did in fact experience a willing and continued commitment to the act of playing the game. This item, asking the participants to rate the extent to which they wanted to continue

playing once the game was over, was paired with an item pertaining to the level of fatigue induced by the game.

Box 32 – Items pertaining to adoption of goals, general engagement and fatigue

- It mattered to me how many cows I managed to collect and return to the mothership
- I would have liked to continue playing once the game was over
- I was too tired to continue playing once the game was over

Demographic information

In addition to the items related to the experience of the game, five items pertaining to the characteristics of the test participants were included. These were more specifically included with the intention of supplying general information about the participants – age and gender – and information about their prior experiences, which might have influenced the experience of engagement and their general performance.

Box 33 – Items pertaining to the characteristics of the test participants

- Gender:
  ☐ Male ☐ Female
- Age: _____
- How often do you normally play computer/video games?
  ☐ Daily ☐ Weekly ☐ Monthly ☐ Never
- Have you trained with a wobble board before?
  ☐ Yes ☐ No
- Are you currently suffering from any injuries that influenced your performance?
  ☐ Yes ☐ No

CHAPTER 14 - TEST RESULTS

The following chapter details the results of the two tests conducted in accordance with the methodology described throughout the previous chapter.

First the section *Expert Consultation Data* presents the results obtained from the expert consultation with the 6th semester physiotherapist student Anders Laun. The review of the interview data presented throughout this section has been read and approved by Laun himself.

Subsequently the section *Questionnaire Data* details the results pertaining to the test participants' experience of engagement. The complete data set and all of the associated descriptive statistics can be found in the excel sheet *Questionnaire Data and Descriptive Statistics* on the enclosed CD in the folder *Test Material*.

14.1 Expert Consultation Data

The consultation with the expert within the area of physiotherapy, Anders Laun, was conducted May 16th 2010 on the campus of Aalborg University Copenhagen. It should be mentioned that the gathered data did not undergo excessive analysis and interpretation since it was the belief that the utterance of an expert in this case more or less could be taken for gospel truth.

A mutual discussion was spurred between Laun and everyone involved in the development of the prototype. Consequently, the following qualitative results, which are based on the expert statements contributed by Laun, are both summarized in bullet point form as well as explanatory body text depending on the necessary level of elaboration.

- The ankle's range of motion from a neutral position with the foot at a 90° angle is: 0-50° downwards, 0-20° upwards, 0-35° inwards and 0-25° outwards. Regardless of the movements made on the wobble board as a result of the feedback provided by the gameplay, it is not possible for the player to injure his/her ankle per se, since the design of the wobble board makes it impossible for the player to exceed the ankles' range of motion.
- Although the wobble board does not exceed the ankle's range of motion, Laun still recommended that the players (especially elderly people) should be able to support themselves to e.g. a chair in case the needed it, in order to avoid any accidents.

Laun discussed the wobble board and the gameplay based on the physiotherapeutic principles of postural control, that is, the body's ability to control its position in space to achieve stability and orientation. He specifically emphasized the body's anticipatory postural control and adaptive postural control which relates to respectively proactive balance and reactive balance. Proactive balance is the ability to control preprogrammed sensory and motor skills related to expected postural demands. For instance, the proactive balance is used when walking or doing other preprogrammed/expected movements. Reactive balance on the other hand refers to the ability to regain balance after an unexpected disruptive action. For instance, if

someone is unexpectedly startled or shoved while walking, the person's body uses reactive balance to compensate for the disruption and regain balance.

- Ordinary wobble board training is considerably leaning towards proactive training because of the preprogrammed/expected movements the user has to make. For instance, moving the board side-to-side or front-to-back does not entail anything unexpected (unless the person standing on it losses balance and stumbles).
- The gameplay adds an extra reactive dimension to the wobble board training, since the player has to compensate for the onscreen disruptive actions such as avoiding suddenly appearing asteroids or controlling the movement of the UFO when accidently hitting a prop or a speed power-up.
- The proprioceptive training is stimulated with both proactive and reactive training, as long as the ligaments are stimulated by controlled movements and the ankles do not exceed the range of motion. The gameplay complies with all the necessary demands by affording controlled proactive and reactive movements.
- In comparison with ordinary wobble board training, the gameplay prompts a lot of static tension where the ankles are constantly working. This tension, resulting in physical fatigue, is more intensive than the one caused by a regular wobble board where the user can rest a split second every time the board is tilted from one side to another.

Laun stressed that ankle sprains can be classified into three grades depending on their severity. A grade 1 sprain is mild and resulting from slight stretching and damage to the fibers of the ligament. Grade 2 is a moderate sprain caused by partial tearing of the ligament resulting in swelling and tenderness coupled with less range of motion and feelings of instability. A severe strain is a grade 3 which implies a complete tear of the ligament potentially resulting in the need for physical therapy or surgery.

Depending on the grade, the sprain recovers through 3 phases. Phase 1, which has a duration of approximately a couple of days to one week, includes resting following the RICE method (Rest, Ice, Compression, Elevation), thereby reducing the swelling to initiate healing. Phase 2 is the rehabilitation phase of recovery with the duration of typically two weeks. This phase includes engaging in exercises to restore range of motion, flexibility and strength. When reaching phase 3, the person suffering from

the ankle sprain can gradually return to the activities that do not entail twisting or turning the ankle too much. Subsequently, the person will be able to once again do activities that require sharp and sudden turns including sports. Phase 3 normally has a duration ranging from weeks to months.

- In the case of rehabilitation, the motor challenges provided by the prototype should start out low and increase progressively.
- Since the gameplay prompts reactive balancing, it would be irresponsible to recommend the prototype to people who had just recently suffered from an ankle sprain. Whereas ordinary wobble board training can be introduced early in phase 2, the prototype would on the other hand be suitable for those who have reached the last part of phase 2 since it is not sensible to expose patients to such reactive training until this stage.

14.2 Questionnaire Data

The quantitative test of the prototype's ability to facilitate engaging gameplay was conducted on May 19th 2010 on the campus of Aalborg University Copenhagen. The participants partaking in the test comprised 40 adult volunteers (average age 28 years, 30 males, and 10 females). The participants were students at either Medialogy Aalborg University Copenhagen or Copenhagen University College of Engineering, or guests invited particularly for the purpose of the test. Before playing the game all participants were encouraged to read the written test instructions described in the previous chapter. All participants played the game on an identical setup and were placed approximately two meters from the visual display, which was comprised by a 50" plasma monitor (Samsung PPM50H3Q). The auditory display was comprised by a set of stereo speakers (Creative SBS 250). After playing the game the participants gave written informed consents and were offered a beverage for participating. All 40 test participants successfully answered the questionnaire.

It is worth noting that it was decided (ad hoc) to register the participants' performance, that is, the number of cows collected and returned, and which power-ups the participants consciously or inadvertently used. The data pertaining to these performance metrics will not be described throughout the following but have been enclosed in *Appendix B,* which also details a summary of the demographic

information and presents a selection of cross comparisons of the different questionnaire items and other data. The results of these comparisons will be addressed throughout the discussion presented in the final part of the thesis *Discussion and Conclusion*.

The following subsections detail the results obtained from the questionnaire items described throughout the previous chapter. These results will be presented in accordance with the categorization used during the description of the questionnaire. First the results pertaining to prototype usability will be presented; followed by the results related to the participants' experience of physical, dramatic, sensory and intellectual engagement; and finally the results associated with the general experience of engagement will be outlined.

Please note that all data obtained from the six point Liker-scales were treated as interval data. The central tendencies will be presented as the mean rating of each questionnaire item while the corresponding variability is presented as the standard deviation. Moreover, the data obtained from said scales were reduced to nominal data, thus making it possible to report how many participants who respectively agreed and disagreed. The data obtained from the items pertaining to the perceived difficulty of the three game levels were treated as ordinal data and the central tendency summarized by the mode associated with each item (Cozby, 1997 pp. 175-176, 180-181).

Finally, it should be stressed that since convenience sampling was employed, the results do *not* reflect the experience of some greater population, but solely the one of the participants partaking in the test. To exemplify, it seems reasonable to assume that the obtained results do not necessarily reflect the experience of say elderly people.

14.2.1 Usability

The usability of the prototype was, as previously described, assessed by means of four questionnaire items, asking the participants to rate their level of agreement on six point Likert-scales. Figure 76, on the following page, illustrates the average ratings associated with the four questionnaire items related to the usability of the prototype.

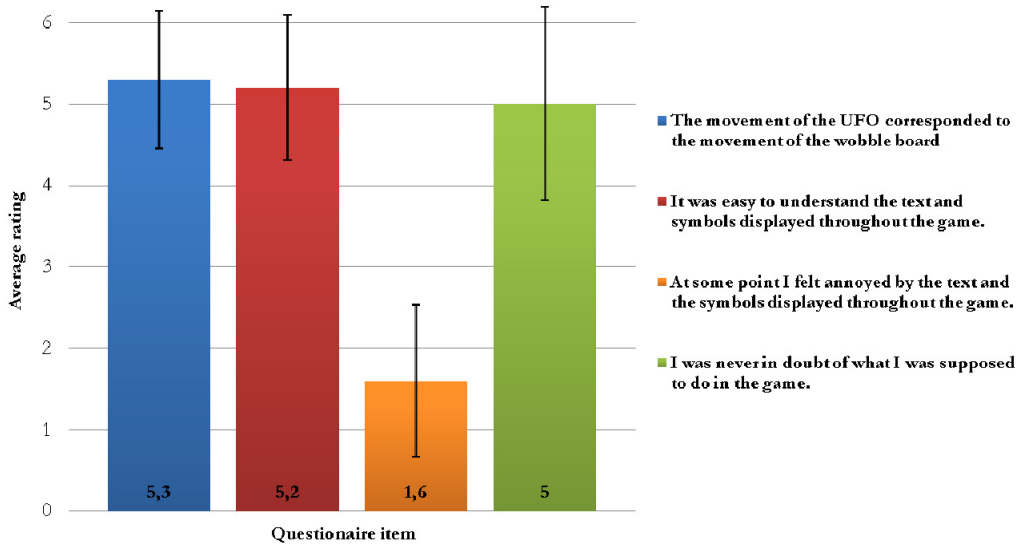


Figure 76 – Average ratings of the four questionnaire items pertaining to the usability of the game. Error bars indicate ± one standard deviation from the mean.

The average rating produced from the item asking the participants to rate whether they had experienced a correspondence between the movement of the UFO and the wobble board was 5.3±0.8 (39 participants agreed with the statement and one disagreed). The item regarding how easy it was to understand the supplied text and symbols yielded an average rating of 5.2±0.9 (38 agreed and one disagreed). The average rating of the item asking the participants to rate the degree to which they had been annoyed by the text and symbols was 1.6±0.9 (three participants agreed and 37 disagreed). Finally the item asking the participants to rate the degree to which they had been in doubt of what to do in the game produced an average rating of 5±1.9 (36 agreed and four disagreed).

14.2.2 Physical Engagement

The questionnaire items pertaining to the participants' experience of physical engagement did as described in the section on questionnaire design revolve around two aspects of their experience, namely the pleasure of the mind, virtuosity, and the participants' experience of the difficulty level. Figure 77 illustrates the average ratings

associated with the four questionnaire items related to the participants experience of virtuosity.

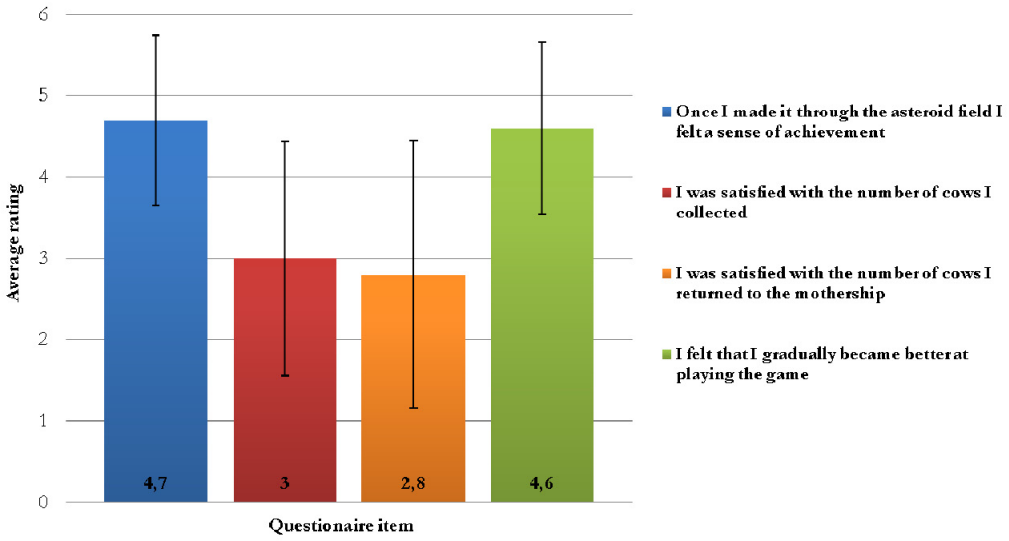


Figure 77 - Average ratings of the four questionnaire items pertaining to the participants' experience of virtuosity. Error bars indicate ± one standard deviation from the mean.

The average rating obtained from the first of the four items, asking the participants to rate the level of achievement experienced after completing the first level of the game was 4.7±1.0 (36 agreed and four disagreed with the statement). The average rating pertaining to the degree of satisfaction with the outcome of completed challenges was 3±1.4 (14 agreed with the statement while 26 disagreed) for the challenge of collecting cows and 2.8±1.6 (34 agreed and six disagreed) for the challenge of returning the cows to the mothership. Finally the question of whether the participants had experienced gradually becoming better while playing yielded an average rating of 4.6±1.0 (34 agreed with the statement while six disagreed).

The data obtained from three items pertaining to the perceived difficulty of the three levels of the game was as previously described treated as ordinal data and the results thus presented as the frequency of ratings. The results associated with the participants' experience of the first level have been illustrated in Figure 78.

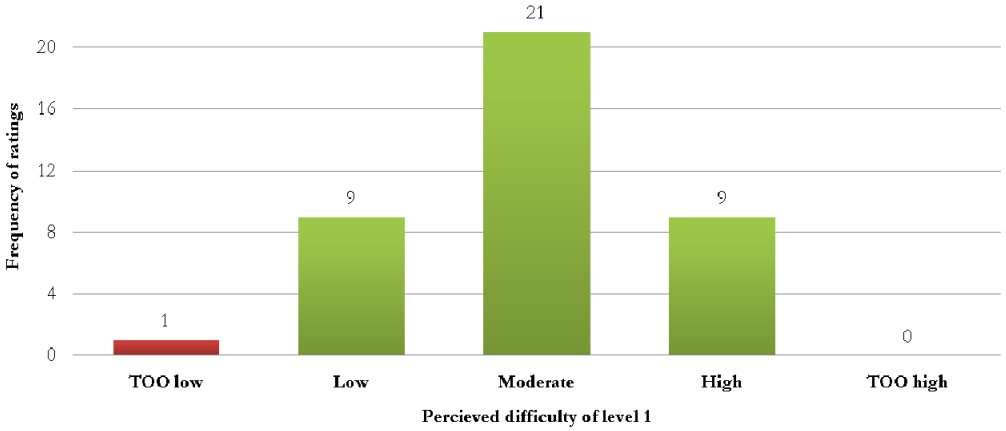


Figure 78 - Frequency distribution of the ratings of perceived difficulty pertaining to the first level where the participants had to maneuver through an asteroid field in order to make it to Earth.

The responses to the question of how difficult the participants found the challenge of avoiding the asteroids in the first of the three levels ranged from 'TOO low' (one response) to 'High' (nine responses) with the most frequently occurring rating, the mode, being 'Moderate'. Figure 79 below, shows the corresponding set of results for the second level.

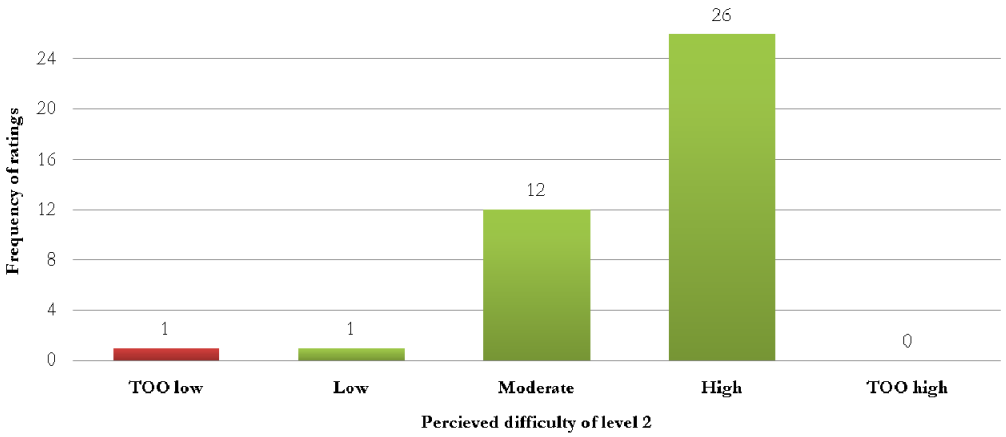


Figure 79 - Frequency distribution of the ratings of perceived difficulty pertaining to the second level of the game where the participants had to collect as many cows as possible within a period of four minutes.

The responses to the question of how difficult the participants had found the challenge of collecting the cows in the second level also ranged from 'TOO low' (one response) to 'High' (26 responses) with the most frequently occurring rating being the latter of the two.

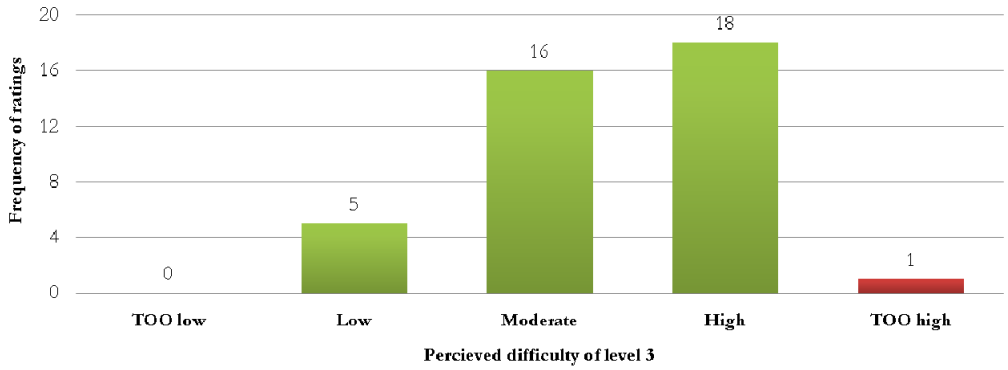


Figure 80 - Frequency distribution of the ratings of perceived difficulty pertaining to the third level where the participants had to return the collected cows to the mothership by shooting them through the gate on its side.

Finally the responses to the question of how difficult the participants found the last of the three levels where they had to return the collected cows to the mothership ranged from 'Low' (five responses) to 'TOO High' (one response) with the most frequently occurring rating, being 'High'.

14.2.3 Dramatic engagement

The two questionnaire items pertaining to the participants' experience of dramatic engagement did, as described in the previous chapter, ask the participants to rate the degree to which they worried about their own ability to complete the first and third level of the game. Figure 81 illustrates the average ratings associated with the two questionnaire items.

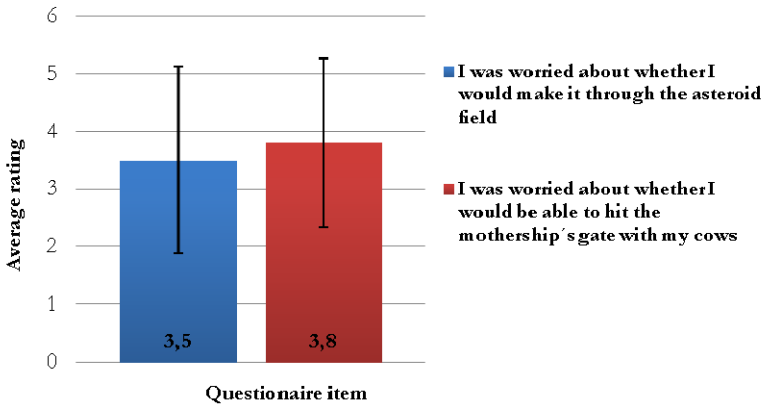


Figure 81 - Average ratings of the two questionnaire items pertaining to dramatic engagement in the first and third level. Error bars indicate ± one standard deviation from the mean.

The first of the two items, which asked the participants to rate the degree to which they were worried about whether they would make it through the asteroid field of the first level, yielded an average rating of 3.5±1.6 (21 agreed with the statement while 19 disagreed). The average rating of the second item pertaining to feelings of worry while attempting to return the cows to the mothership was 3.8±1.5 (23 agreed and 17 disagreed with the statement).

14.2.4 Sensory and Intellectual Engagement

The two questionnaire items related to the participants' experience of sensory and intellectual engagement did as previously suggested ask the participants to account for whether the they had employed strategic thinking while playing and whether the sound and visuals had contributed positively to their experience of the game. The average ratings obtained from the associated Likert-scale items is illustrated in Figure 82 below.

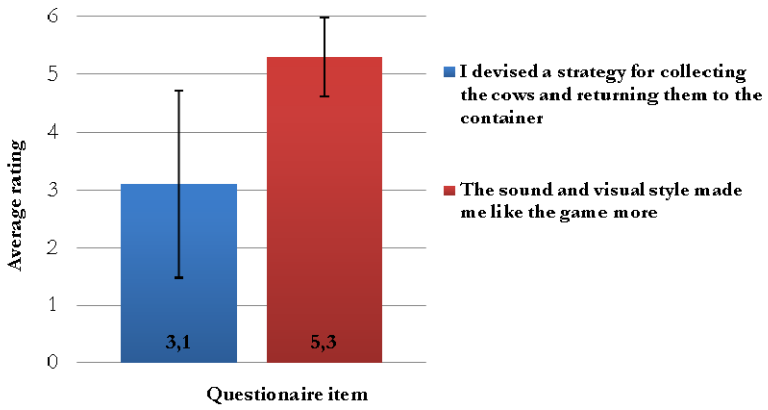


Figure 82 - Average ratings of the questionnaire item pertaining to the use of strategy and the one related to the influence of the sound and visuals on the gameplay. Error bars indicate ± one standard deviation from the mean.

The item pertaining to the use of strategic thinking yielded an average rating of 3.1±1.6 (16 agreed and 24 disagreed) while the average rating related to the degree to which the sound and visuals had a positive influence was 5.3±0.7 (all 40 participants agreed with the statement).

14.2.5 The general experience of engagement

The last three items of the questionnaire yielding quantitative data about the participants' experience of the game related to whether they had adopted the goals of the game, whether they would have liked to continue playing, and the level of fatigue experienced once the game was over.

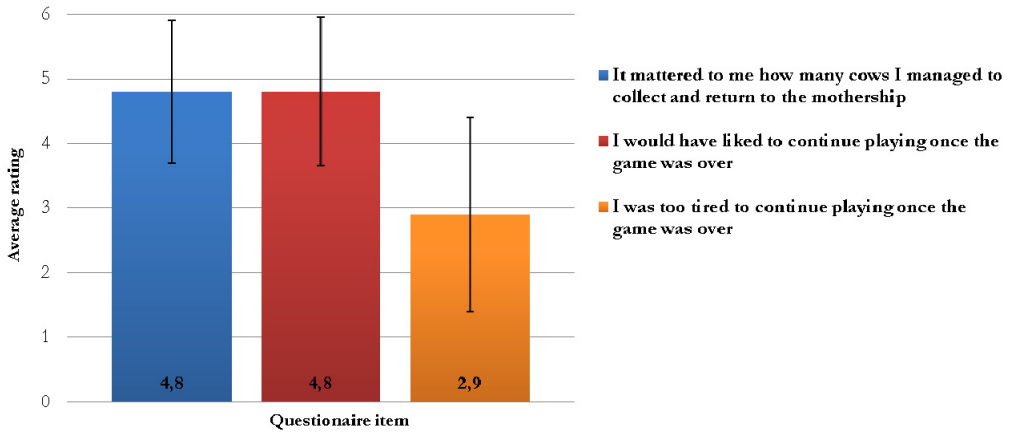


Figure 83 - Average ratings of the questionnaire item pertaining to the use of strategy and the sound and visuals' positive influence on the gameplay. Error bars indicate ± one standard deviation from the mean.

The first of the three items, asking the participants to rate the degree to which the task of collecting and returning cows to the mothership mattered to them yielded an average of 4.8±1.1 (33 participants agreed while seven disagreed). The average rating of the second item, where the participants rated the degree to which they wanted to continue playing once the game was over, was 4.8±1.2 (34 agreed while 6 disagreed with the statement). Finally, the item pertaining to the experience of fatigue produced an average rating of 2.9±1.5 (12 agreed with the statement and 28 disagreed).

PART V - DISCUSSION & CONCLUSION

This fifth and final part of the thesis details a discussion of the two central topics featured in the final problem statement. The first chapter discusses the results described throughout the previous chapter and addresses the question of whether the prototype has been successful in facilitating gameplay while simultaneously ensuring correct ankle rehabilitation. The second chapter presents more general reflections on the project as a whole and discusses whether it has in fact lead to a better understanding of the complex relationship between player and game and the processes, which may lead to the experience of engagement. Finally the chapter *Conclusion* concludes upon the topics addressed during these discussions.

CHAPTER 15 - DISCUSSION OF RESULTS

Contrary to the last chapter of the previous part, which presented the results of the conducted test with complete disregard for the meaning of the obtained averages and frequency distributions, the current chapter more explicitly attempts to analyze and interpret said results. This does in other words imply that the chapter addresses the question of whether the prototype has in fact been successful in facilitating gameplay while simultaneously ensuring correct ankle rehabilitation.

First the section *An Expert's Seal of Approval* presents a concise description of the implications of the expert evaluation and subsequently the section *Prototype Usability* discusses results pertaining to the participants' experience of the prototypes usability. The following sections present discussions of the results obtained from the self-reported measures of physical, dramatic, sensory and intellectual engagement, before finally discussing the results related to the participants' more general experience of engagement.

Once again, it should be stressed that, since convince sampling was employed, the discussion does *not* attempt to describe the experience of some greater population, but solely the one of the participants partaking in the test.

15.1 An Expert's Seal of Approval

The expert evaluation was described in the previous part of the thesis performed with the intention of answering the question of whether the developed prototype did in fact facilitate correct proprioceptive ankle exercises. According to the interviewed expert, the prototype was approved for proper proprioceptive training since it affords controlled proactive as well as reactive training. Seeing as the gameplay causes a lot of static tension and there are game elements included that generate the need for reactive balancing, the training session is more intense than with an ordinary wobble board. Consequently, if used in connection with ankle rehabilitation, the prototype should not be introduced to patients who have not yet reached the last part of the rehabilitation phase (phase 2). If the users are not acquainted with wobble board exercises, they should be able to support themselves in case it is needed and the motor challenges should slowly increase over time.

15.2 Prototype Usability

The results of the four questionnaire items pertaining to the usability of the prototype all suggested that the participants generally found it usable. The average rating and standard deviation related to the question of the correspondence between the movement of the UFO and the wobble board suggested that most of the responses lie above 4.5 implying that the movement of the two generally corresponded well. The ratings associated with how easy the text and symbols were to read yielded similar results, which indicate that the participants generally found it easy to understand these. Few of the participants found the text and symbols annoying as implied by the relatively low average rating of 1.6 and the associated standard deviation of 0.9. Finally the results pertaining to the fourth items suggested that most of the participants had little doubt regarding what to do while playing. These results were necessarily viewed as positive indications since usability generally is a prerequisite for the experience of engagement. That is to say, bad usability may hamper the general experience of engagement and make the player less willing to continue playing.

15.3 Virtuosity and Perceived Difficulty

In addition to evaluating the prototype's usability, the test set out to assess whether the experience of playing had given rise to physical engagement on behalf of the participants. In the analysis, physical engagement was defined as the form of engagement resulting from the joy of perfecting one's interaction with the game and the joy derived from the effortless interaction accompanying a high level of proficiency. Consequently, it was decided to assess whether the participants had in fact experienced the pleasure of the mind, virtuosity while playing each of the game's three levels and whether they more generally experienced a sense of improvement.

The obtained average and standard deviation pertaining to the sense of achievement experienced during the first of the three levels suggested that most of the participants' ratings lie within a range of 3.7 and 5.7 on the score ranging from one to six. It would in other words seem that the successful experience of maneuvering through the asteroid field lead to a more or less intense sense of achievement on behalf of a number of the participants. This does in turn imply that these participants may have experienced virtuosity, albeit in different intensities. However, the results obtained from the two questions regarding the participants' satisfaction with the number of collected and returned cows painted a somewhat different picture. These questions yielded lower averages of 2.8 and 3 respectively and a higher spread in the distribution of the scores. The lower averages and larger spread indicates that the level of satisfaction varied far more amongst the participants, thus making it unlikely that the experience of virtuosity was the norm. The seeming difference in the experience of virtuosity brought about by the first and the two succeeding levels could be the product of the different phrasing of the questions. The first question asked the participants to rate the degree to which they had felt a sense of achievement while the other two asked them to account for how satisfied they were with their performance. Imagine the sensation of a former jogger who after years of inactivity goes for a run. He might feel a sense of achievement after completing an exhausting two kilometer run, since he knows that it has been years since his last run. Nevertheless, he need not feel satisfied with the result since he used to run five times the distance without even losing his breath. Even though it is a possibility that the difference in results may be ascribed to the different interpretation of the questions, it seems just as likely that the participants' response to the two questions regarding satisfaction do imply that the

experienced positively valenced attribution emotions leveled at themselves were less intense. This does not necessarily imply that the participants actually performed better during the first level, but their experience of their performance may have been more positive. After all the criterion for success in the first level was simply to make it to Earth and no information was provided about whether the participants had done so quickly or slowly. The two subsequent levels did conversely provide the participants with far more explicit information about their performance – number of cows collected and delivered to mothership – even though no criteria for success were specified in advance.

Here it is interesting to note that the questionnaire item pertaining to whether they had felt that they gradually became better yielded an average rating of 4.6 with a standard deviation of one. This does in turn suggest that a number of the participants did in fact experience some level of continual improvement as the game progressed. It would in other words seem that even though the experience of the second and third level did not lead to an intense virtuosity, the participants may still have experienced some positively valenced attribution emotions leveled at themselves. Since this question did not explicitly address the particular feeling state of the participants it is necessarily hard to determine whether this was actually the case. This uncertainty notwithstanding, it should still be regarded as a positive sign that they experienced a sense of improvement as this implies that the seeds have been sown for the experience of more intense experiences of virtuosity. Here, it is worth recalling the description of Kubovy's five pleasures of the mind presented in the analysis. It was more specifically described that the five essentially constitute mental states which players actively seek out when they engage with games. So, it is not necessarily the experience of virtuosity which makes an experience engaging but rather the prospect of this affective state. On this note it is worth mentioning that a comparison of the data pertaining to the participants' experience of improvement and their willingness to continue playing yielded very vague, yet interesting, indications. The participants who, according to their ratings, had experienced a sense of progressive improvement did in average also provide a higher rating when asked whether they would have liked to continue playing, compared to the participants who experienced less of an improvement. It should, however, be stressed that the associated Pearson r coefficient was 0.47, which suggest that the positive relationship between the two were rather vague. Moreover it should be mentioned that the reported averages

forming the basis for this comparison at times were based on a small number of participants and that no conclusions consequently can or should be drawn (A graphical representation of this comparison can be found in *Appendix B*, page 266).

The second set of questionnaire items related to the experience of physical engagement pertained to the participants' experience of the difficulty of the three game levels. Interestingly each level only received one rating reflecting a negative experience of the difficulty level. That is, the difficulty of the first and second level was rated 'TOO low' once, while the difficulty of the third level was rated 'TOO high' by one participant. This alone can be seen as a positive indication if we assume that the vast majority of the participants refrained from making these ratings, because the challenges neither were trivial nor exceeding their capacity for action. The most frequently occurring difficulty rating associated with the first level was 'Moderate' (21 ratings) while both 'Low' and 'High' were selected by nine participants. The most frequently selected rating for the second level was 'High' (26) while 12 selected 'Moderated' and the mode of the ratings pertaining to the third level was similarly 'High' (19), but in this case an almost identical number of participants found the difficulty level 'Moderate' (16 participants). With some caution, one may view this as an indication that the first level generally was easier than the succeeding ones. An indication which is favorable considering that the first level was supposed to pose less of a challenge and serve as introduction to the act of controlling the UFO by means of the board. It should, however, be stressed that the participants' experience of the difficulty may have differed from person to person since the asteroids field they had to maneuver through was randomly generated. Moreover the difficulty ratings seem to suggest that many of the participants found the third level easier than the second one. Even though this description of the variation of difficulty does not necessarily apply to all of the participants it does suggest that the game at least in part lives up to the aspiration of making the third level moderately easier than the previous one. Recall from the part *Design and Implementation* that this decision was based on the heuristic stating that one should aspire not to deprive the player of his or her hard won possessions.

It is interesting to note that no correspondence seemed to exist between how frequently the participants normally played and how difficult they found the three levels. This can probably be ascribed to the fact that the input device of the prototype

differs from what individuals who play frequently are accustomed to, thus making proficiency in controlling games by means of traditional input devices less of an advantage. Moreover, a comparison of the perceived difficulty of players with and without experience with the wobble board did not yield any obvious tendencies across the three levels in the game. This does, however, not come as a big surprise as the question regarding the participants' previous experiences with the wobble board did not require them to specify when and how much they had trained with a wobble board (graphical representations of the comparison between the perceived level of difficulty and the different groups of participants can be found in *Appendix B*, on page 262 to 263).

15.4 Level of Worry

The test was also conducted with the intention of asserting whether the participants had experience dramatic engagement while playing the first and third level of the game. This was more specifically done by asking the participants to rate the degree to which they had experienced the negatively valenced prospect-based emotion worry while playing the two levels. Recall from the discussion of the relationship between emotions and engagement that individuals may derive pleasure from experiencing negatively valenced emotions, as long as these do not exceed the individual's internal threshold for tolerating negative affect. This pleasure of the mind was referred to as suffering. The results obtained from neither of the two questions yielded readily apparent tendencies. The average and standard deviation pertaining to the worry experienced during the first level suggested that the majority of the ratings lie between 1.9 and 5.1 which in turn implies that there was no agreement amongst the participants. The results obtained from the similar question regarding the third level were similarly inconclusive. Some participants may in other words have experienced a low level of suspense or worrying, but such emotions were by no means common to all of the participants. One reason why the ratings related to the first level was so scattered could be that the asteroid field as previously mentioned was randomly generated, thus making the challenge vary in difficulty while appearing more intimidating to some participants, than to others. The circumstances surrounding the participants' experience of the third level did also vary from person to person since some had collected more cows than others. That is to say, participants with a lower number of cows at their disposal may have been more worried about whether they

would hit with the individual cow or not. Even though this assumption does seem reasonable no obvious connection was found between the number of collected cows and the intensity of the experience of worry and this assumption thus remains unverified. The calculated Pearson r coefficient was more specifically -0.04, which suggest that no relationship were to be found (a graphical representation of the relationship between the number of cows collected and the experience of worry can be found in *Appendix B*, on page 265). Consequently it seems just as likely that the high spread in the ratings is caused by the differences in terms of how prone the individual participants were to the experience of this form of negatively valenced emotions. Meaning, some participants may have been more naturally inclined to become worried than others. Just as one member of a cinema audience may find the movie highly suspenseful while another finds it relatively undramatic.

15.5 Strategic Thinking and Visual Appeal

Even though it was assumed that the test participants would not possess the attentional surplus necessary in order to perform strategic decision-making, it was still regarded as interesting to assert whether the participants felt that they had done so. Surprisingly, the average rating related to the question of whether strategies had been devised was 3.1 and the standard deviation indicated a relatively large spread in the ratings. Considering the nominal treatment of the data it would seem that 16 of the participants felt that that they to some extend had devised a strategy. It should, however, be stressed that this rating provides no information about what the participants consider to be a strategy or whether they managed to execute it. So, some participants may have regarded the act of purposely trying to collect the closest cow as a strategy while others may have view the tactical use of the included power-ups as a strategy. Recall that said power-ups were included with the intention of allowing the player to approach the challenge of collecting cows in different ways. However, a comparison between the data pertaining to the use of strategy and the performance metric related to the use of power-ups showed no relation between the two (a graphical representation of the relation between the two can be found in *Appendix B* on page 265).

The average ratings associated with the question of whether the sound and visuals contributed positively to the participants experience did, contrary to the ambiguous

results described above, yield interesting indications. All 40 participants agreed with the statement that the sound and visuals made them like the game more and the average rating and standard deviation suggests that most of the scores lie above 4,6. These results does evidently not make it possible to determine whether the sound and visuals created the humorous mood they were intended to do, but they do suggest that the choice of visual and auditory style generally was well received.

15.6 Adoption of goals, Willingness to Continue and Fatigue

Since one of the preconditions for the experience of engagement is that the player either adopts the goals of the game or makes his or her own, an additional objective of the test was to determine whether the game had in fact successfully imposed goals on the participants. The data related to the question of whether it mattered to the participants how many cows they managed to collect and return to the mothership yielded an average of 4.8 with a standard deviation indicating that the majority of the responses lie within 3.7 and 5.9. This does in turn suggest that it to some extent mattered to most of the participants whether they successfully reached the goal of collecting and returning as many cows as possible. Moreover it is interesting to note that some participants were curious to know what the highest number of collected and returned cows was. Moreover several participants expressed that they would have liked to try once more to get a better score or to beat the score of a particular fellow participant. This may arguably be interpreted as an indication that the game incited some participants to make goals of their own, namely beating their own, their friends' or the general high score of the game. The data pertaining to the participants willing and continued commitment to the act of playing yielded an average of 4.8 with a standard deviation indicating that most of the scores lie within 3.6 and 6. Moreover, the reduction of the ratings to nominal data suggested that 34 out of the 40 participants to a higher or lower degree wanted to continue once the game was over. This was viewed as a positive indication as engagement generally is defined by this willing and continued commitment to the act of playing. Finally, the results related to how tired the participants were once they were done playing suggested that the level of fatigue varied greatly from participant to participant. That is, the average rating was 2.9 with a standard deviation of 1.5. Here it is worth mentioning that a comparison of the data associated with the experience of fatigue and the willingness to continue playing indicated that the participants who felt tired after playing, in average were less

inclined to continue playing. The relationship between do is, however, by no means strong as the calculated Pearson r coefficient was -0.34, indicating a very vague negative relationship (a graphical representation of this relationship can be found in *Appendix B*, page 266).

15.7 Easy to Use, Harder to Play, and Worth Another Try

In summary it would seem that the usability of the prototype generally was at a level where it did not hamper the participants' experience of engagement. The question of whether the participants did in fact experience the pleasure of the mind virtuosity is, however, less easily answered. A number of the participants had seemingly experienced a sense of achievement after playing the first level, thus implying that they may have felt positively-valenced attribution emotions leveled at themselves. Yet, the corresponding ratings associated with the subsequent two levels were more spread and consequently suggested that fewer of the participants had been satisfied with their own performance. This uncertainty notwithstanding, a number of the participants did in fact seem to have experienced some level of continual improvement as the game progressed, which in turn suggested that they may have experienced virtuosity while playing, albeit not intensely. However, considering that physical engagement equally well may be the result of the pursuit for this pleasure of the mind it seemed reasonable to assume that a number participants had in fact experienced this form of engagement. The results pertaining to the experience of dramatic engagement were conversely more ambiguous as the intensity of the experience of worry varied greatly amongst the participants. It is, however, the belief that the difference in ratings may be ascribed to the fact that the participants were not equally prone to experiencing the experience of this form of negatively valenced emotions. It would in other words appear that some of the participants had been dramatically engaged, albeit far from all of them. Even though some participants reported that they had devised strategies while playing this did not appear to be the norm. Moreover it was not possible to conclude if these strategies involved strategic use of the power-ups, that is resource management. It was, however, observed that the participants who were allowed more than one try started to consciously use the power-ups and described how they generally used simple strategies in order to get better results. This has lead to the belief that the prototype may facilitate intellectual engagement, however primarily on behalf of users who has some experience with

controlling the game. It was not determined whether the participants had experienced the pleasure of the mind curiosity, which oftentimes is associated with sensory engagement, but the participants generally seemed to agree that the sound and visuals made the like the game more. It was in other words the belief that representation of the game had contributed positively to their experience and probably added to the general experience of engagement. Finally, a number of participants seemed have adopted to goals of the game and wanted to continue playing, which indicates that they generally found the gameplay engaging. It should, however, be stressed that it is less certain whether the game would remain engaging in the long run. However, it is the belief that the addition of more levels with an increasing level of difficulty, difficulty probably would help ensure the experience of long-term engagement.

CHAPTER 16 - REFLECTIONS ON THE PROJECT

Whereas the previous chapter first and foremost has discussed whether the prototype has been successful in facilitating gameplay while simultaneously ensuring correct ankle rehabilitation, this chapter will discuss the second topic featured in the final problem statement. The purpose of the current chapter is consequently twofold; to summarize the highlights of the research and practical work described throughout the preceding parts of the report; and to present general reflections on whether said research did lead to a better understanding of the complex relationship between player and game and the processes, which may lead to the experience of engagement.

16.1 From Motivation to Engaging Gameplay

In the first chapter of the thesis it was described that individuals in need of ankle training and rehabilitation oftentimes lack the motivation necessary in order to successfully complete the needed training or rehabilitation process. This problem could seemingly be reduced by leveraging games' potential as a source of intrinsic motivation. That is to say, the users may become motivated to perform the necessary exercises if these were performed while playing a game.

Since it was the impression that both game developers and academics view good gameplay as the cornerstone of any game design the chapter *Gameplay* compared and discussed various definitions of the curious concept gameplay. A discussion that culminated with the proposition that gameplay ultimately amounts to everything emerging from the meeting between player and game. Even though this discussion, and the resulting definition, did provide a valuable point of departure they did not answer the question of whether there exists some defining feature of the player's experiences that is symptomatic of good gameplay. In other words what is it about gameplay which makes the act of playing qualify as an intrinsically motivated activity?

In order to get closer to an answer to this question the concepts of immersion, presence, flow and engagement are reviewed and discussed in the chapter *Symptoms of Good Gameplay*. This discussion was essentially motivated by the knowledge that both game developers and academics frequently resort to terms such as these when describing why their game facilitates good gameplay or why their theory captures the essence of why players play games. It would, however seem such terminology is anything but self explanatory as these concepts arguably are shrouded in much ambiguity and contradiction like the phenomenon gameplay itself. This discussion was concluded with the proposition that the engagement seemingly was the concept that best described the experience of good gameplay, since it may be defined as the player's willing and continued commitment to the act of playing. Consequently it was decided to focus the further study on how gameplay may give rise to the experience of engagement.

Even though the decision of focusing on engagement still seem to have been well warranted it is important to stress that this does not imply that the study and

development of games stand to gain nothing from considering players' experiences of immersion, presence and flow.

One particular theory of engagement seemed to hold some promise, namely Schønau-Fog and Bjørner's framework for classifying player engagement with games and the associated types of engagement, physical, sensory, intellectual, social, dramatic and emotional engagement. This framework was more specifically regarded as useful since it seemingly was able to describe a variety of different experiences of engagement while remaining sensitive to the subtleties of the individual experience. It was, however, not deemed necessary to subject social engagement to any further scrutiny as the act of training and rehabilitating one's ankles largely is solitary activity.

16.2 The Processes of Engaging Gameplay

In the light of the seeming potential of Schønau-Fog and Bjørner's framework for describing player engagement the first chapter of the analysis was devoted to a description of said framework and its constituents.

Seeing as members of the game industry, since the dawn of digital games, have been able to produce games facilitating engaging gameplay the chapter *Engaging by Design* investigated the relevant types of engagement from the perspective of game design. The chapter, more specifically highlighted the issues and means available to facilitate an engaging experience for the player. It serves as a relevant perspective into the usage of engagement as a goal for successful game design, but conversely it emphasizes the fact that the game design elements are the key to achieving engagement altogether. In other words, it is the nuts and bolts of the game which must be connected properly in order for the gameplay to lead to an engaging experience. Furthermore, the discussions and statements presented in this section introduced relevant game design models which influenced the eventual formulation and design of the Gameplay Model.

The subsequent chapter *The Feeling of Engagement* raised an important point of criticism against Schønau-Fog and Bjørner's framework. That is, the argument that it makes little or no sense to regard emotional engagement as a separate type of engagement since emotional engagement by and large is a prerequisite for the experience of engagement altogether. The consequence of this claim was necessarily that the

framework was believed to consist of five and not six types of engagement, out of which four were pertinent to the current project, namely, sensory, physical, dramatic and intellectual engagement. With an outset in this assumption of the pervasive role of emotions, engaging gameplay was discussed from the perspective of player psychology. This discussion lead to a description of the processes inherent to the player, which influence the emotions which he or she experiences, and consequently also affect whether the gameplay is experienced as engaging. Moreover, a possible categorization of gameplay emotions and so-called pleasures of the mind was introduced and used to explain the subjective feeling states accompanying the individual types of engagement. Furthermore it was described that the experience of engagement may be described as the player's conscious or unconscious pursuit of these pleasures of the mind and the associated emotions.

Based on these investigations the chapter *The Cycle of Engagement* introduced the Gameplay Model which was devised in an attempt to make the relationship between player and game and the processes, which may lead to the experience of engagement being more easily understandable. The model did in broad strokes depict gameplay as a cyclic exchange of information between player and game. Moreover the model detailed how various features, inherent to both player and game, may enter into this cycle and influence whether the gameplay would be experienced as engaging or not. In order to make the Gameplay Model more useful to the scholars aspiring to analyze engaging gameplay and the designer striving design such experiences, one additional concept was introduced, namely gameplay states, described in terms of its two constituents – the player and the game state. Each of these essentially comprises a certain configuration of the features inherent to the player and game, at a certain point in time. It was more specifically the belief that these two states provide us with a lens through which to discuss a particular player experience based on a particular game state and thus make assumptions about a particular design may influence the player. It is, however, important to stress that the Gameplay Model by no means should be considered as a recipe for designing engaging gameplay. Instead it was intended as conceptual model highlighting a selection of the components of gameplay which one should consider when striving to design games facilitating sensory, physical, intellectual and dramatic engagement.

The final chapter of the analysis *User Centered Game Design* detailed a discussion of usability and playability in games, which led to the conclusion that a certain level of usability is a necessary for the experience of engagement. Moreover this chapter introduced the concept playtesting as a means of testing the game's playability, which was regarded as a measure of how engaging a game is. Finally this chapter underlined the belief that the design, implementation and evaluation of the prototype might prosper from the application of user centered design and game design heuristics in combination with the Gameplay Model.

It is the belief that the research documented throughout the analysis and the process of creating the Gameplay Model did in fact provide us with a better understanding of the complex relationship between the player and game, and the processes which may make or break the experience of engagement. We are aware that the number of player and game elements, included in the model, is limited to a select few, which may be supplemented by additional elements or subdivided to provide an even higher level of detail. With this being said, it should be mentioned that the decision of employing this level of detail was a conscious one, as it was the belief that a higher level of complexity might come at the cost of reduced comprehensibility. Moreover we feel relatively confident that the decision of eliminating emotional engagement and thereby assigning an even higher importance to emotions was a right one. It is in other words the belief that the inclusion of Kubovy's pleasures of the mind and the description of emotions as a filter for engagement adds strength to the framework. For one, this helps explain why gameplay that does not meet the criteria of flow because they involve negative emotions, still may qualify as good gameplay as long as the players' threshold for tolerating negative affect is not exceeded.

16.3 Design and Implementation of the Devised Theory

The design and implementation of both the wobble board as a game controller and the game itself is merged into a single part of the thesis entitled *Design and Implementation*. The whole part is structured around the Gameplay Model presented in the analysis and this structure served as a foundation for the whole design phase as well. The part contains two sections; the first of these, *What We Know*, outlined the assumptions of the player state which reflected on the design of the game itself. This especially referred to the limit of cognitive capacity on the part of the player in the

gameplay experience, especially if it is a first-time user of a wobble board. This consequently reflected on the designed challenges in the game, both physical and intellectual, as well as the engagement types they aimed to invoke on behalf of the player. This latter part was dealt with in the chapter *Game Development*, which explained the practical design and implementation in accordance with the previously stated player state at the outset of the gameplay experience. Furthermore, the chapter outlined how the design took into account the increasing proficiency of the player as the gameplay session progresses. As the first chapter was founded on an assumed player state, the second chapter was build on this foundation and made further assumptions in regards to the increase in player proficiency. However, as the design and implementation phase progressed it was possible to create a sandbox level, which functioned as a playtesting ground for the iterative tests conducted throughout the different phases of the game development. It is worth noticing that the iterative tests resulted in continuous changes to the design following the increasing deterioration of the assumptions initially made in regards to the player's sensorymotor skills. Essentially, the iterative tests proved to be fundamental in the understanding of player abilities and regulation of the prototype design. Acquiring this knowledge continuously throughout the development tailored the eventual outcome of the game and quite possibly resulted in avoiding erroneous assumptions on the player state affecting the final game.

It is the belief that the Gameplay Model works well as a design foundation for exertainment tools (tools combining exercise and entertainment), such as the one created within the context of the current project. The advantage was more specifically that the model includes the physical interaction with the controller as part of the gameplay process through the understanding of the 'Action' component within the player state. One could argue that the design of exertaiment tools for computer and video games naturally needs to be founded on the basis of the relevant physical movements connected with specific exercises. However, it may be argued that where the Gameplay Model delivers its true assistance to the design process is the illustration of the actions and components that need to be taken into account in terms of gameplay and their interaction as part of a cyclic process. With this being said, it must be emphasized that this project revolves around the creation of an exertainment tool, which have implications on the design process contra normal games. Thus it can only be theorized that the Gameplay Model would provide a

similar helpful insight into the initial design process. However, since the definition of gameplay does not counter-act the emphasis that the presented authorities has attached to the term, other than gameplay as an entirely positive state of play, the understanding of gameplay as a cyclic process could facilitate an increased compression of the usage and effects of standard game design methods e.g. the design and implementation of challenges. Conversely, one needs to keep in mind that the model on its own does not supply anything as clear as numerical data or a list of clear and defined answers to a specific design situation.

In practical design terms the model can help as a checklist for understanding a specific or desired game, player or gameplay state by looking at the components of either side individually and then trying to link the surrounding components in terms of affect and influence. As the *Design and Implementation* part elucidated the usage of the Gameplay Model in practical terms, some sections included boxes that explained the influence that each component was assumed to affect following the theories of affective states and engagement.

As illustrated in the *Design and Implementation* part, the usage of the model as a reflective documentation method deviates from the standard template for documentation at Aalborg University. As a rule of thumb the design and implementation is divided into two separate parts, the one building on the foundation of the other. The same is of course the case with the Gameplay Model in this thesis, but the division between the two is more blurred as a result of all the individual components being documented in terms of design, iteration tests and implementation all at the same time. The argument supporting this mingling of processes lies in the focus on iteration tests that both influenced the design and implementation continuously throughout the phases of development. The setup of the respective part allows for the mentioning of these iterations and their influence directly within the associated parts of the design and implementation. However, this particular way of documenting the development process is a result of the authors' choice and not truly a reflection on the Gameplay Model's validity. Alternatively, the documentation process could have been divided into respectively design and implementation as separate chapters in accordance with the traditional report structure at Aalborg University

16.4 Evaluation of the Prototype

Finally the preceding part of the thesis detailed the methodological underpinnings, practical execution, and results of the tests performed in order to evaluate the design and implementation of the prototype. Even though it is the belief that the choice of assessing engagement by means a self-reported measure had its merits, it is important to stress that other metrics also could have been employed. On this note it is worth recalling that a simple performance metric in fact was used, albeit in a very limited capacity. Moreover it is worth mentioning that the test probably would have yielded more detailed information about the participants' experience of the game if more items had been added to the questionnaire. However, considering that lengthy questionnaires, as previously described, may deter participation and completion it was regarded as a necessary to reduce the number of items.

Despite this limitation, it is the belief that the test gave rise to interesting information, which in turn makes it possible to draw some conclusions and thus provide an answer to the final problem statement.

CHAPTER 17 - CONCLUSION

The purpose of the following is to conclude upon the topics discussed throughout the preceding chapters and accordingly address the question posed in the final problem statement, which has been reprinted below for the sake of readability.

Box 34 – Reprint: Final problem statement

How can we, through an understanding of the complex relationship between player and game and the processes which may lead to the experience of engagement, perform the next iteration in the design of the WobbleActive so that the final prototype facilitates engaging gameplay while simultaneously ensuring correct proprioceptive ankle training?

Since the problem statement essentially revolve around two distinct, yet interrelated, topics these will be addressed in turn. That is, whether we in fact has gained an understanding of the complex relationship between player and game, and the processes leading to engagement; and secondly, whether the prototype has been successful in terms of facilitating engaging gameplay while simultaneously ensuring correct training.

It is the belief that the research documented throughout the first parts of the thesis and the process of creating the Gameplay Model did provide us with a sufficient understanding of gameplay in general and engaging gameplay in particular. The distinction between player and game states does presumably make it possible to form a clearer picture of how a particular configuration of game elements may influence the player at a given point in time. That is to say, how the player, while pursuing his or her goals and needs, copes with the particular events based on his or her current level of sensorymotor and intellectual skills; how the player's experience of the configuration of game elements is influenced by his or her prior experiences and associated expectations; and finally how these experiences may be lead to emotions, which act as a filter and help determine whether the player does in fact find the gameplay engaging or not.

On the topic of the prototype's efficacy, the expert consultation affirmed that it did ensure correct proprioceptive ankle training. It should, however, be stressed that said consultation also made it clear that the prototype should not be used during the first stages of a rehabilitation process.

Even though the quantitative test results did not unequivocally prove that all of the participants had experienced a strong sense of willing and continued commitment to the act of playing, the results did indicate that a number of the said participants did experience engagement. It is, more specifically, the belief that some level of virtuosity was experienced by a number of the participants and that the prospect of becoming proficient at playing in many cases brought about a wish to continue playing, thus implying that they experienced physical engagement. Moreover it is the belief that some participants had been dramatically engaged, albeit far from all of them. This difference in experience can presumably be ascribed to the participants' varying propensity for experiencing negatively valenced emotions, such as worry, through a gameplay session. Additionally, even though some participants reported that they did devised strategies it remains uncertain whether they in fact did experience intellectual engagement. Observations of players who were allowed to play the game repeatedly once the test was over did however indicate that players, if given the time, may devise more elaborate strategies as part of overcoming challenges and reaching goals.

The test did not determine whether the participants had experienced the pleasure of the mind curiosity, oftentimes associated with sensory engagement, but the participants generally seemed to agree that the sound and visuals made them like the game more. It is in other words the belief that the representation of the game contributed positively to their experience and consequently added to the general experience of engagement. Finally, a number of the participants seemed to have adopted the diegetic goals of the game and expressed a desire to continue playing, which indicate that they generally found the game engaging. So it would seem that we can be cautiously optimistic and conclude that the prototype did in fact facilitate engaging gameplay.

APPENDIX A - ITERATIVE TESTS

In accordance with the chapter on user centered design in the analysis, iterative tests have been conducted throughout different stages of the development to further improve the game design. The following appendix outlines four such tests. The first two tests were conducted at a very early stage of development and therefore they exclusively focus at-game (usability) aspects, more precisely, basic mappings and control. Since the progression of the development entails the completion of important game elements, the third test, which is considered an initial playtests, includes in-game aspects as well. The fourth test is a beta test conducted at a 'nearly done' stage, with the objective of polishing the design and rectifying last minute errors before conducting the final playtest. For each test; the objective, procedure, questions, important overall results and discussion and conclusion is summed up very concisely.

Since the all four iterative tests have a considerable focus on at-game aspects, classic qualitative usability methods were applied for each. This included observations, the think-aloud method (participants sharing their thoughts while playing) and a subsequent open-ended (or unstructured) interview. For further elaboration on the applied test methods see the section on expert testing in the chapter *Test Methodology*.

Figure 84 - All tests were performed in a secluded room on a 50" plasma screen with extra speakers. A chair was always present in front of the participants in case he/she needed support to maintain balance.

Due to the considerable focus on game usability on the tests throughout the different stages of development, only five test subjects participated in each test (except the beta test). This is based on Nielsen's claim that *"Elaborate usability tests are a waste of resources. The best results come from testing no more than 5 users and running as many small tests as you can afford"* (Nielsen, 2000).

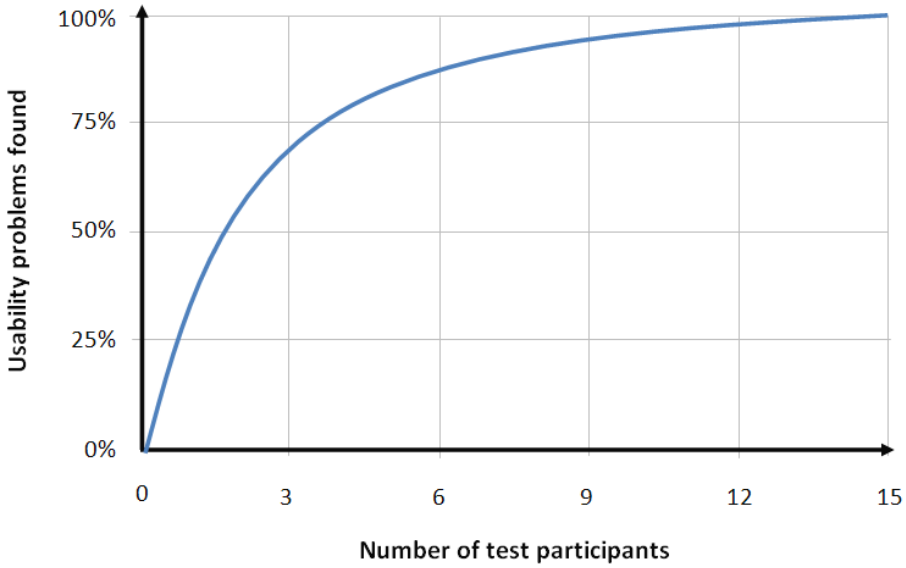


Figure 85 - According to Nielsen (2000), there is no need to test usability related aspects with more than five participants at a time. Although the curve clearly indicates a need for 15 participants to discover all usability related problems, Nielsen (2000) underlines that it is pays off even more if e.g. the 15 participants are spread across three smaller tests.

All four tests outlined in the following were performed at Aalborg University Copenhagen. The test subjects participating in the tests included students and faculty members at Aalborg University Copenhagen and Copenhagen University College of Engineering as well as guests visiting the facilities. All participants were guaranteed anonymity.

Test No. 1 – Basic Mappings and Control 1

Objective:

The objective was to determine which of two control schemes was the most intuitive for navigating around in the cow-abduction level. The two conditions to test included *strafing* and *rotating*. Tilting the wobble board front and back respectively controls the UFO's forward and backwards onscreen movement. This test determined whether the UFO should either strafe or rotate around itself when tilting the wobble board to either side.

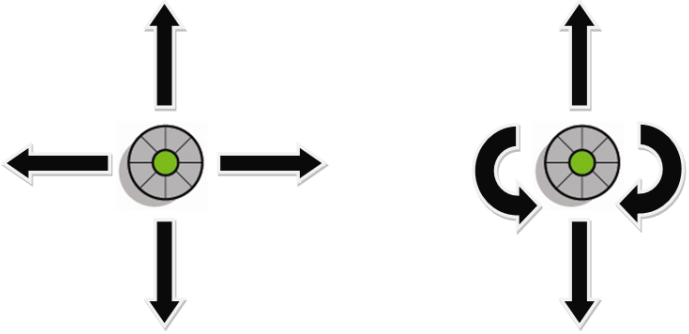


Figure 86 - Top-down view. Left: Tilting the wobble board left and right makes the UFO strafe to the tilted side. Right: Tilting the wobble board left and right makes the UFO rotate around itself to the tilted side.

Procedure:

The test participants were asked to navigate the UFO freely around in a very early sandbox level. The level included a desert terrain and a few game objects placed randomly in the scene to be inspected by each participant during the game session. The participants were furthermore asked to perform a task that included a zigzag maneuver through five tall water towers. All participants performed the task using both of the aforementioned control schemes (strafing and rotating) in an arbitrary order.

Questions:

The open-ended question revolved around investigating whether the overall control mapping was intuitive and feasible when navigating a UFO around in a plane above the desert scene and whether the test participants preferred strafing or rotating of the UFO when tilting the wobble board sideways.

Important Overall Results:

- All participants felt the general mapping was intuitive in the sense that the movements made on the wobble board corresponded to what happened on the screen in a natural way. The UFO behaved as expected when applying either of the two control schemes.
- All participants found the second control scheme (*rotating*) the most intuitive when navigating the UFO around in the desert.

- Four out of five participants found it easier with the first control scheme (*strafing*) when performing precision tasks such as zigzagging through the water towers.

Discussion and Conclusion:

Based on the observation of the test participants as well as their performance and comments, it seemed that they felt a natural correspondence between the movements on the wobble board and the movement of the onscreen UFO. Navigating the UFO around in a fixed plane located above the ground seemed perfectly natural considering the wobble board's limited control possibilities (e.g. natural control mapping can either allow the UFO to move upwards or ahead when tilting the wobble board down in front).

The *rotating* control scheme seemed to be the most desirable when it comes to flying around in the scene. On the other hand, when performing tasks that needed a certain degree of precision, the *strafing* control seemed to be the best choice. Furthermore it became apparent that the strafing control scheme was not an option for ordinary navigation since the participants could not just turn around and go back when the edge of the scene was reached, but instead they had to back the UFO (if so, the camera angle was bad).

Test No. 2 – Basic Mappings and Control 2

Objective:

The objective was to determine which of two control schemes were most intuitive and suitable for forward and backward movement of the UFO when flying around in the cow abduction level. The two conditions to test included *speed* and *acceleration*.

The previous test determined how the UFO should react to sideways flipping of the wobble board. The current test determined how the UFO should move when tilting the board front and back. With the first condition, *speed*, the angle of the forward and backward movement of the board determines the speed of the UFO. For instance, the more the board is tilted forward, the faster the UFO moves ahead and when the board is perfectly horizontal, the UFO does not move.

With the second condition, *acceleration*, the forward and backward movement of the board determines the acceleration of the UFO. For instance, every time the board is tilted forwards, the UFO accelerates until it reaches maximum speed. For instance, if maximum speed has been reached, a perfectly horizontal board will not decrease the speed but tilting the board backwards on the other hand decelerates the obtained speed. The acceleration is perhaps best illustrated using a space shuttle as an example. The space shuttle uses jet boosters to move around in zero gravity vacuum. If a jet boost moves the shuttle ahead, it will not stop until it gets a boost in the opposite direction.

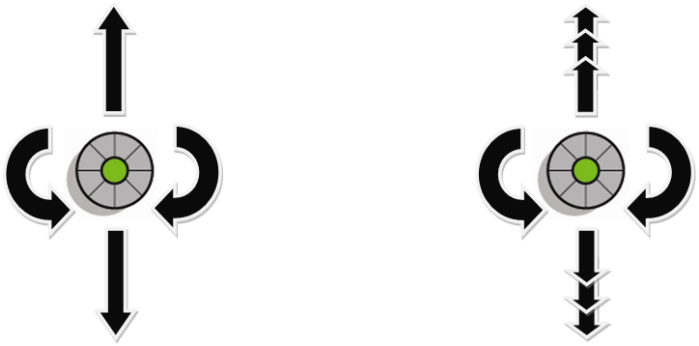


Figure 87 - Left: The angle at which the wobble board is tilted to the front or back determines the *speed* of the UFO. Right: The angle at which the wobble board is tilted to the front or back determines the *acceleration* of the UFO.

Procedure:

In the first round the test participants were asked to perform the same task as in the first test, that is, a zigzag maneuver through five tall water towers but now with the addition of afterwards holding the UFO still and hover steadily above a truck. In the second round the test participants were asked to perform a task that included bumping into four water towers spread across a larger area.

The test was conducted in an early sandbox level and all participants performed the two tasks using both of the aforementioned control schemes (speed and acceleration) in an arbitrary order.

Questions:

The open-ended questions revolved around investigating which of the two conditions, speed and acceleration, were most the most intuitive for forward and backward movement of the UFO.

Important Overall Results:

- All five test participants could easily notice the difference between the two test conditions.
- The movements of the UFO were generally very jerky with the speed condition in comparison with the acceleration condition which caused the movement of the UFO to be a lot smoother. Though jerky, the speed condition seemed intuitive for precision tasks (zigzag maneuvers), but it failed when flying over a longer distance since it was generally exhausting and trivial that the board constantly had to be tilted to the front to maintain speed ahead.
- All five participants preferred the acceleration condition. The UFO was generally more intuitive, smoother and easier to control during the acceleration condition – especially over longer distances.
- With either condition, all participants found it hard to make the UFO hover steadily above the truck during the second task.

Discussion and Conclusion:

There was a clear consensus that acceleration was the preferred condition, since all participants deemed it a smoother, easier and more intuitive way of controlling the forward and backward movement of the UFO.

Besides judging from the participants comments, observations confirmed the suspicion that the speed condition forced the participants to constantly keep the board tilted forward to maintain speed ahead. The wobble board was rarely tilted backwards since the participants did not move the UFO in reverse. This became especially apparent during the second round which included navigating the UFO over

a lager distance. On the other hand, during the acceleration condition, the participants were also forced to tilt the board backwards to decelerate. Furthermore, with acceleration, when maximum speed was reached the participants could focus on steering the UFO instead of maintaining speed.Another interesting observation was that practically none of the participants were able to make the UFO hover steadily above the truck during the first task.

Test No. 3. – Initial Playtest

Objective:

This test was performed with the intention of gathering information about a variety of different aspects of the gameplay, namely the mapping; sensitivity and speed; clarity of game objectives (goals); the quality of the iconic and textual feedback as well as the feedback associated with cow abductions; the penalty given when the board touches the ground; level of difficulty; and monotony of faced challenges.

Procedure:

The test was carried out in a sandbox level near the end of the development stage. Although many fine-adjustments and tweaks were yet to be done, the sandbox level clearly illustrated and early version of the final gameplay. It must be emphasized that the test did not include the final level where the cows are delivered to the mothership. All test participants thereby tried out early versions of the first two levels (asteroid level and cow-abduction level).

Questions:

In contrast to the two previous tests, the current test was conducted at stage where the first two levels were almost fully developed. As a result of this, the focus was not exclusively on testing at-game aspects (like the previous two tests) but also in-game aspects. The areas of investigation included, but were not limited to: *Mapping*: correspondence between player and onscreen UFO movements, navigation, transitions between mappings etc. *Goals*: clearness of the different goals (did the players know what to do?). *Feedback*: the perception of the heads-up display (guiding icons and text) and the feedback when interacting with probs. *Penalty:* the degree to

which the penalties in the game were understood. *Level of difficulty*: challenges, pace, time and sensitivity.

Important Overall Results:

Mapping:

- All participants felt a natural correspondence between their own movements and that of the UFO. There were no objections on the board sensitivity throughout the levels.
- The overall control mappings were deemed intuitive in both game levels by all participants and it was easy to adapt to the different mappings in each level.
- Although all participants felt that it was less sensitive and easier to navigate the UFO in the abduction zone, none of them noticed the mapping switching from *rotating* to *strafing*.

Goals:

- None of the participants had any doubts at any time, as to what they were supposed to do.

Feedback:

- All participants noticed and used the guiding arrow in the right corner of the screen to find the cows and the drop-off spot (cow container).
- All participants noticed the power-ups.
- One out of five participants utilized a power-up.
- Two of the participants mistook the arrow shaped power-ups for guiding arrows instead of a "cow locater" power-up.

Penalty:

- Two out of five participants experienced the penalty of the UFO flipping over when tilting the wobble board too much. They understood the penalty.
- Two out of five participants experienced the penalty of dropping the cow when tilting the wobble board to much. The understood the penalty.

Level of difficulty:

- The average amount of cows abducted was 2,6 (5 minute level).
- Two out of five participants crashed once during the intro/asteroid level.
- All participants needed to support themselves on e.g. a chair at some point to maintain balance.

Discussion and Conclusion:

It was definitely confirmed once again that the different control mappings throughout the game seemed intuitive to adjust to.

The goals were clear due to an intuitive HUD. Although the participants noticed the power-ups in the cow-abduction level, they did not really pay any attention to them, since they were too busy trying to fulfill the primary objective – collecting cows. In other words, the participants' attentional surplus was clearly limited due to the huge amount of effort spent on maintaining balance on the board. To remedy this, the participants often needed to support themselves to a chair. The one participant who used the power-ups made it clear that they were useful, but the fact that two participants misinterpreted the functionality of the rotating arrow-shaped "cow-locater" power-up, indicated a crucial flaw in the design.

Since all participants understood the warning message when tilting the board too much, only two of them experienced being penalized (UFO flipping over and cow being dropped).

The overall level of difficulty seemed appropriate for first time users. Still, since the cows abducted in one level should be fired at the mothership in the next level, the average of 2,6 cows was not enough in five minutes. In prolongation hereof, it took the UFO approximately 35 seconds to get from one side of the cow-abduction level to the other side. Conclusively, the level should be much smaller and/or the time should be adjusted, since the participants did not have the surplus to investigate the game objects.

Test No. 4 – Beta Playtest

Objective:

The objective of the test was to polish the design of the game and rectify small last minute errors and bugs in order to prepare the game for the final playtesting.

Procedure:

Since the test was carried out the day before the final playtest, the focus was on fine-tuning the game. Two participants tested a practically fully developed version of the game consisting of all three levels.

Questions:

Since the intention was primarily on locating last-minute bugs, there were no particular questions prepared for the participants. On the other hand, they were highly encouraged to comment on the game while playing it.

Important Overall Results:

- In the cow-abduction level, both participants abducted two to three cows each. They felt that they used too much time on locating the cows.
- In the final level, both participants were in doubt of whether to aim and fire the cows at the mothership's portal or tractor beam.
- In the final level, the wind indicated by leafs was not apparent enough.

- After the intro/asteroid level and the five minute cow-pickup level, both participants experienced physical fatigue.
- The shift to a 2D mapping in the final level where the players control a sight instead of a UFO seemed intuitive and easy to adjust to.

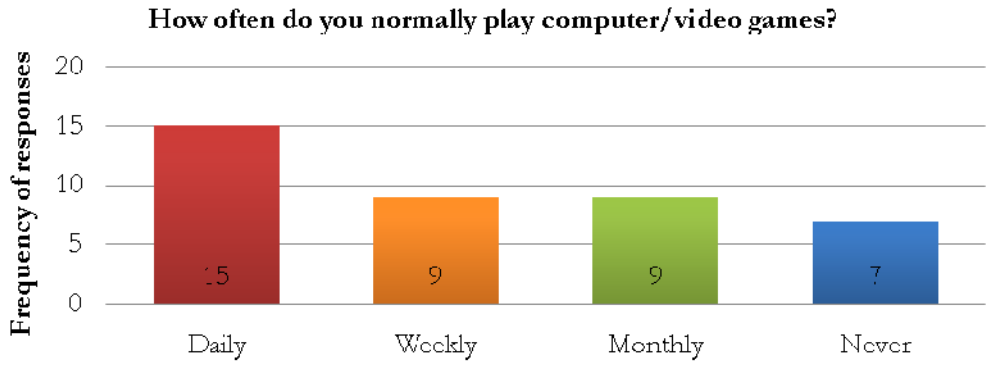
Discussion and Conclusion:

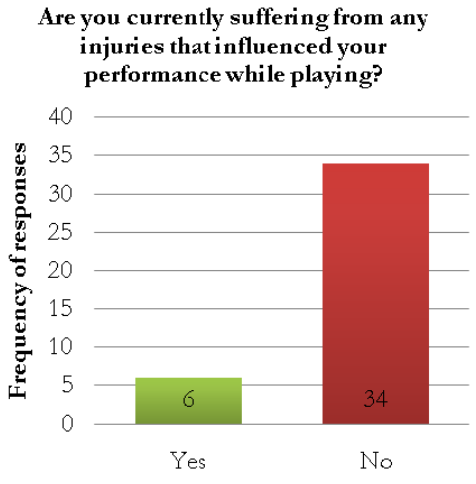
Although the level was made a lot smaller as a result of the last test, both participants still only abducted two and three cows because they used too much time on locating them. This indicated the need to increase the level's cow density. The fact that the wind indicator was not obvious enough and the tractor beam on the mothership could be mistaken for the gate, also called for minor but important changes in the design. Although the gameplay did not get trivial for any of the participants, it started getting a bit strenuous for the participants' angles towards the end of the five minute long cow-abduction level. As a result of this, the participants were exhausted during the final level. Like in the case of the first WobbleActive prototype, the participants had no problems with a 2D control mapping when controlling the sight of the cow-canon during the final level.

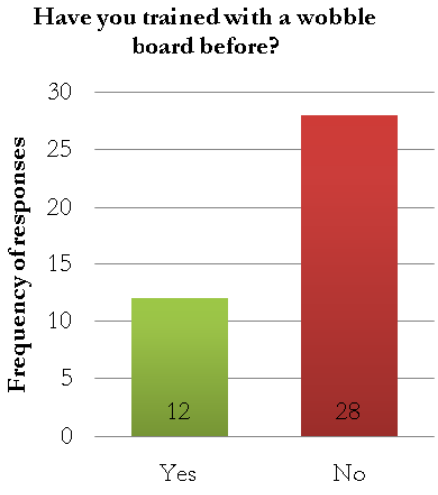
APPENDIX B - SECONDARY DATA & RESULTS

This appendix presents a summary of the demographic information gathered during the quantitative test described throughout *Part IV – Testing*. Moreover the appendix details a summary of the secondary results generated based on the participants' answers to the supplied questionnaire and the performance metrics employed during the test, that is, registration of the number of cows collected and returned, and whether the participants used any of the available power-ups during play. It is important to stress that the presented averages and percentages oftentimes are based on the responses of a relatively low number of participants and thus remaining inconclusive in that they provide vague indications at best.

Participant Information

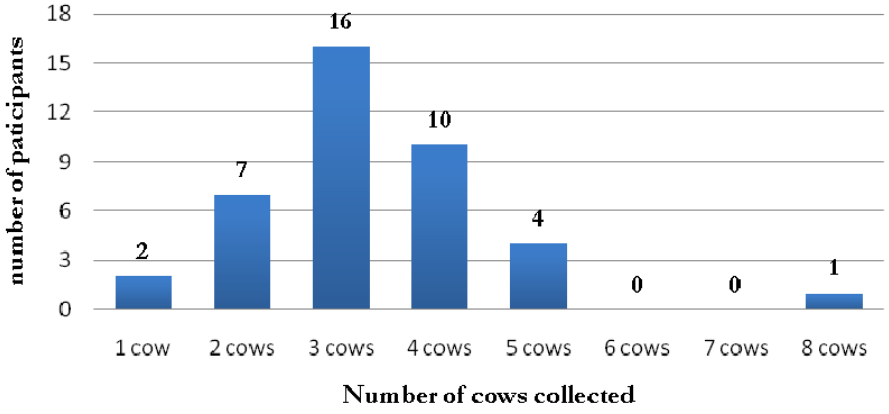


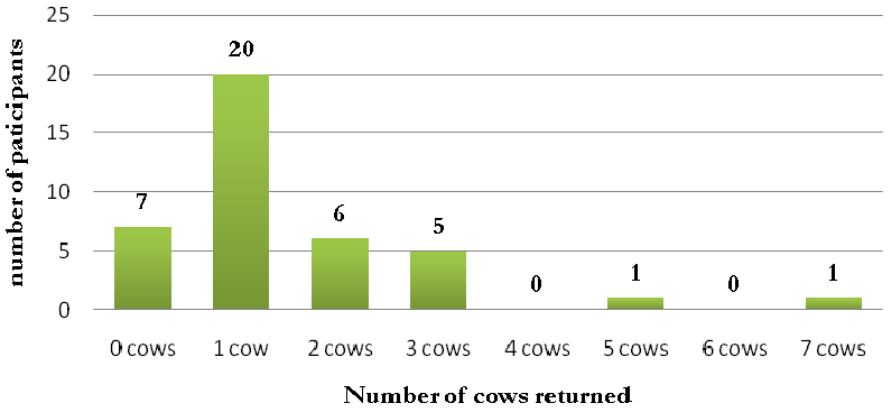




Summary of Performance Metrics

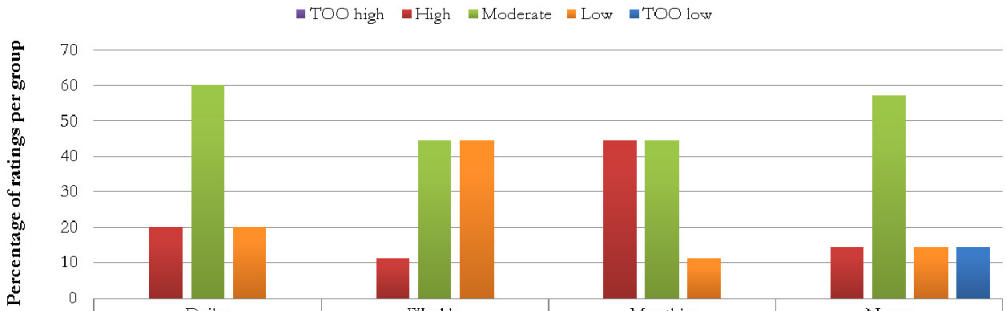
Avg. number of cows collected:	3.3
Average number of cows returned:	1.4
Number of participants using no power-ups:	15
Number of participants using just the speed power-up:	8
Total number of participants using the speed power-up:	15
Number of participants using just the cow locator power-up:	10
Total number of participants using the cow locator power-up:	17
Number of participants using both power-ups:	7





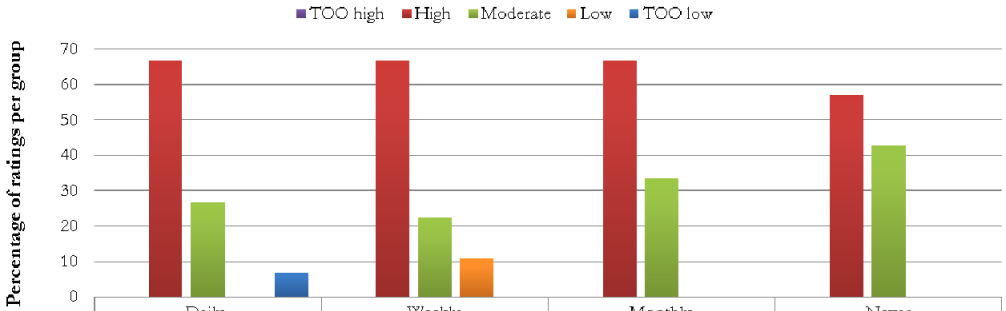
Perceived Difficulty vs. Frequency of Play

Distribution of the perceived difficulty ratings across the groups of participants who play daily, weekly, monthly or never (Level 1)

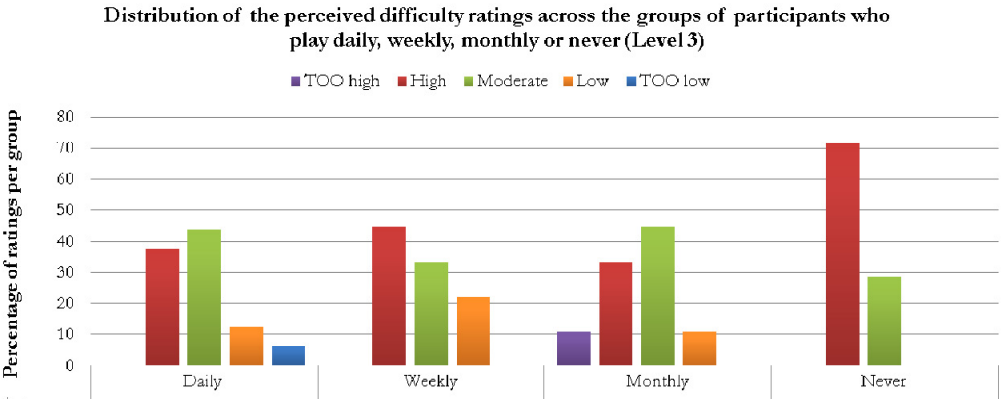


	Daily	Weekly	Monthly	Never
TOO high	0	0	0	0
High	20	11,11	44,44	14,29
Moderate	60	44,44	44,44	57,14
Low	20	44,44	11,11	14,29
TOO low	0	0	0	14,29

Distribution of the perceived difficulty ratings across the groups of participants who play daily, weekly, monthly or never (Level 2)

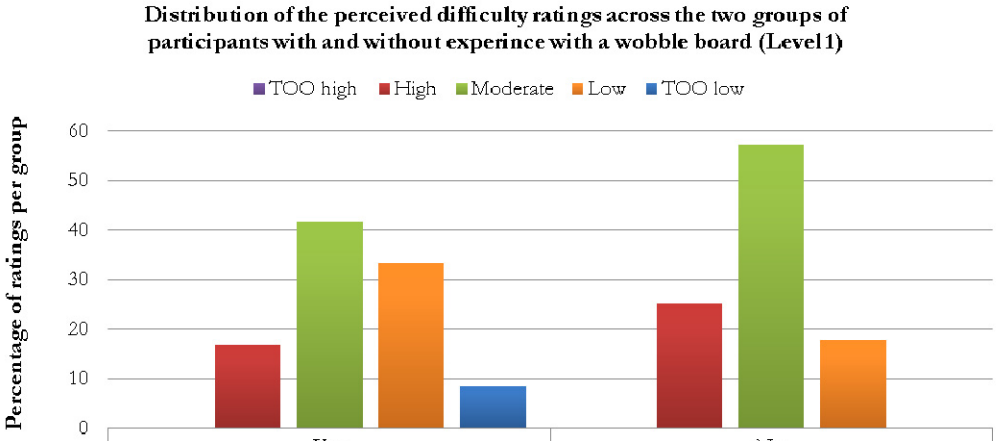


	Daily	Weekly	Monthly	Never
TOO high	0	0	0	0
High	66,67	66,67	66,67	57,14
Moderate	26,67	22,22	33,33	42,86
Low	0	11,11	0	0
TOO low	6,67	0	0	0



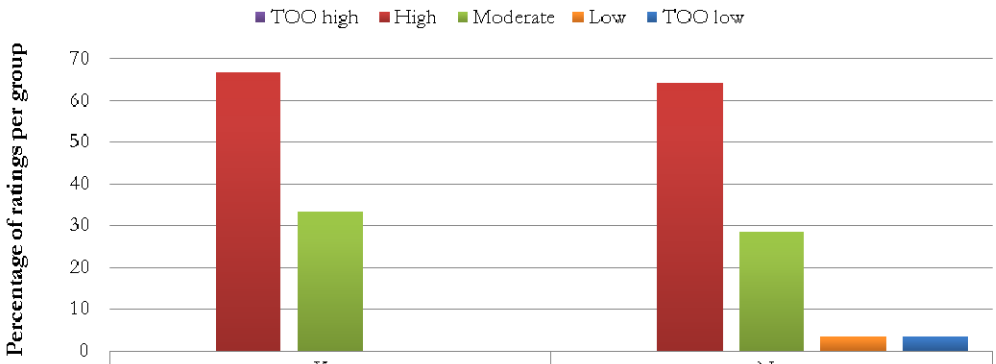
	Daily	Weekly	Monthly	Never
TOO high	0	0	11,11	0
High	37,5	44,44	33,33	71,43
Moderate	43,75	33,33	44,44	28,57
Low	12,5	22,22	11,11	0
TOO low	6,25	0	0	0

Perceived Difficulty vs. Experience with Wobble Board



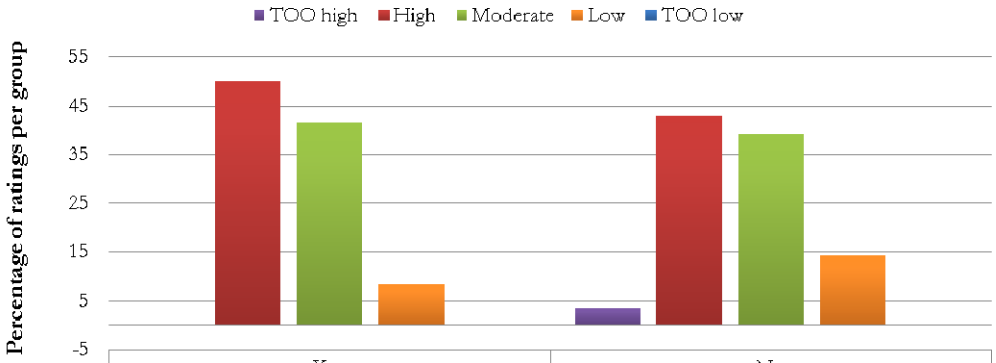
	Yes	No
TOO high	0	0
High	16,67	25
Moderate	41,67	57,14
Low	33,33	17,86
TOO low	8,33	0

Distribution of the perceived difficulty ratings across the two groups of participants with and without experince with a wobble board (Level 2)



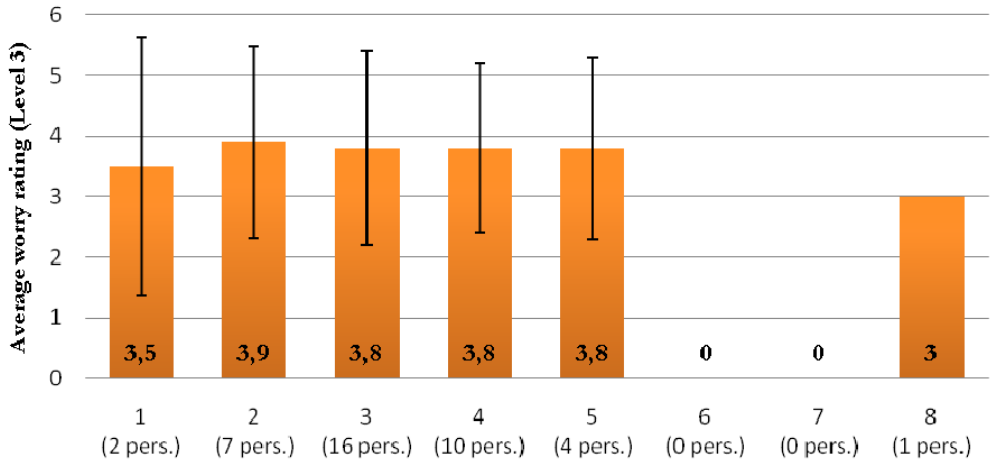
	Yes	No
TOO high	0	0
High	66,67	64,29
Moderate	33,33	28,57
Low	0	3,57
TOO low	0	3,57

Distribution of the perceived difficulty ratings across the two groups of participants with and without experince with a wobble board (Level 3)



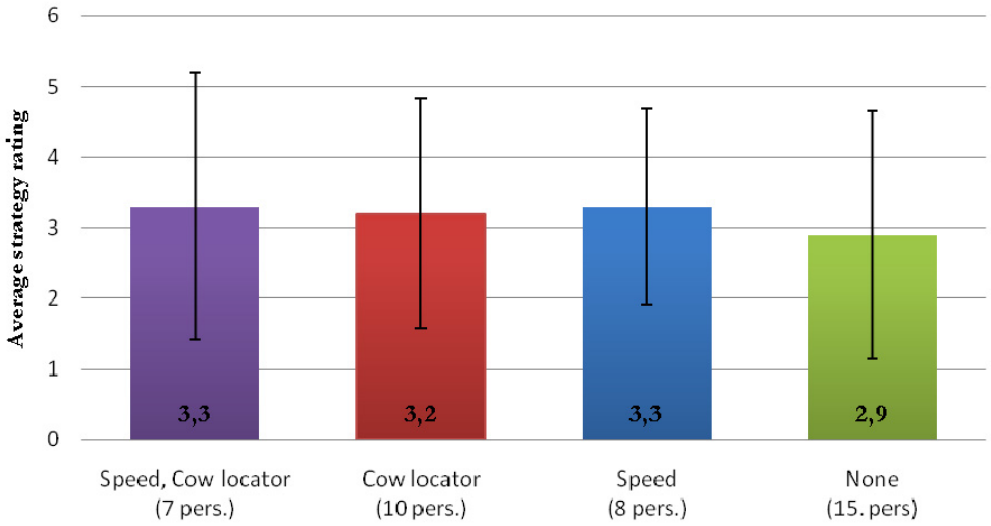
	Yes	No
TOO high	0	3,57
High	50	42,86
Moderate	41,67	39,29
Low	8,33	14,29
TOO low	0	0

Number of Collected Cows vs. Level of Worry



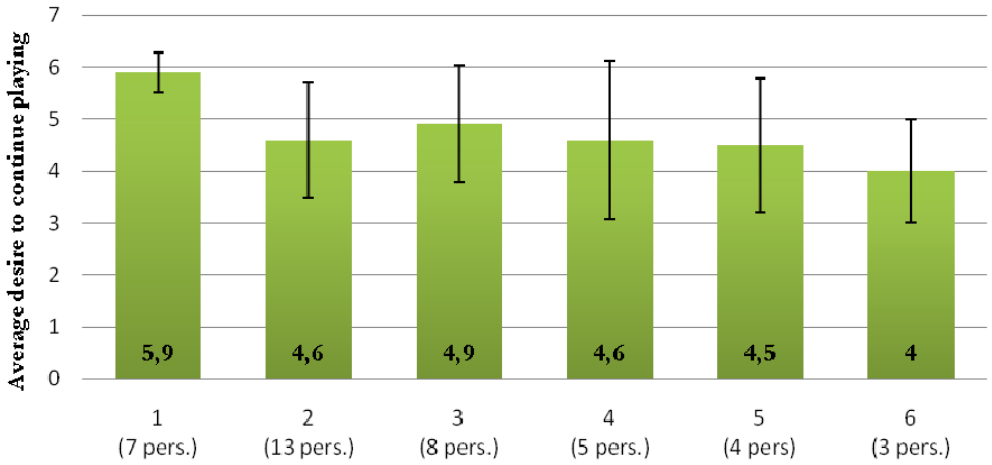
Number of cows collected & the number of paticipants collecting that number
(Error bars indicate ± one standard deviation from the mean, Pearson 4 = -0.05)

Power-ups Employed vs. Use of Strategy



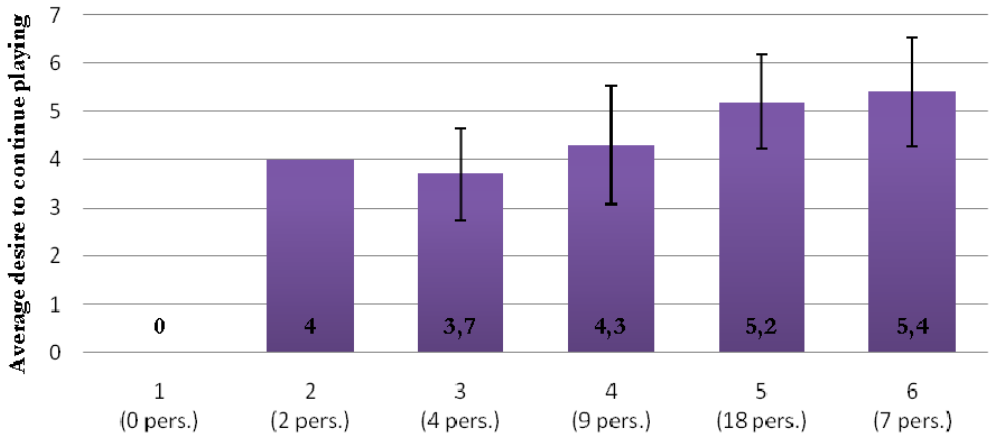
Types of pover-ups used & the number of paticipants using each type, none or both of the power-ups
(Error bars indicate ± one standard deviation from the mean)

Willingness to Continue vs. Fatigue



Rated degree of tiredness and the number of participants making each rating
(Error bars indicate ± one standard deviation from the mean, Pearson r = 0.34)

Willingness to Continue vs. Experience of Improvement



Rated degree of experienced improvement & the number of participants making each rating
(Error bars indicate ± one standard deviation from the mean, Pearson r = 0.47)

APPENDIX C - GAME CODE

The following pages detail a script from the game, which contains a lot of the functionality from the cow abduction level. The complete game code can be found on the appended CD in the folder *Game Code*.

```
using UnityEngine;
using System.Collections;

using System;
using System.IO;

public class HandleInput2 : MonoBehaviour
{
    // All the objects and variables are defined:
    GameObject plr;
    GameObject ufo;
    GameObject ufoTop;
    GameObject beam;
    GameObject gui;
    GameObject score;
    GameObject cowHangActive;
    GameObject ufoSound;
    public GameObject cow;

    public float ufoSpeed;
    public float maxSpeed;
    float scale;
    float dropCounter;
    public bool targetZone;
    public bool hanging;
    bool flipUfo;
    bool playFlip;
    int flipDir;
    public bool arrowPowerup;
    public bool speedPowerup;
    public float speedTimer;
    float ufoAlpha;
    float startCounter;
    bool show3;
    bool show2;
    bool show1;
    bool showGo;

    public AudioClip readySound;
    public AudioClip goSound;
    public AudioClip beamStartSound;
    public AudioClip beamEndSound;
    public AudioClip gotItSound;
    public AudioClip completeSound;
    public AudioClip lostSound;
    public AudioClip flipSound;
```

```
FileStream createFile;
FileStream writeFile;
StreamWriter dataWrite;
String logfile;
int datacounter;

// The start function is used for initialization:
void Start()
{
    Screen.showCursor = false;

    plr = GameObject.Find("Player");
    ufo = GameObject.Find("Ufo");
    ufoTop = GameObject.Find("Ufo Top");
    beam = GameObject.Find("Beam");
    gui = GameObject.Find("GUI");
    score = GameObject.Find("Score");
    ufoSound = GameObject.Find("Ufo Sound");

    ufoSpeed = 0;
    maxSpeed = 0.2f;
    scale = 0;
    targetZone = false;
    cropZone = false;

    startCounter = 12;
    show3 = true;
    show2 = true;
    show1 = true;
    showGo = true;

    hanging = false;
    dropCounter = 0;
    flipUfo = false;
    playFlip = true;

    arrowPowerup = false;
    speedPowerup = false;
    speedTimer = 0;
    ufoAlpha = 0;

    // Connecting to the Phidget plugin:
    PhidgetPlugin.openP();
```

```
        // Setting up the file for loggiing the wobble board data:
        datacounter = 0;
        DateTime logDatetime = DateTime.Now;
        logfile = "Data Logs/" + logDatetime.ToString("dd-MM-yyyy HH-mm-
ss") + ".txt";
    }

    void Update()
    {
    }

    // This function is called a fixed number of times each second:
    void FixedUpdate()
    {
        if(startCounter == 12)
gui.GetComponent<TextScript>().fadeHint("Collect as many cows as you
can", Color.white, 1);

        if(startCounter > 0) startCounter -= Time.deltaTime * 1.75f;

        if((int)startCounter == 6)
        {
            if(show3)
            {
                gui.GetComponent<TextScript>().fadeText("3",
Color.yellow, 1.5f);
                audio.clip = readySound;
                audio.Play();
                show3 = false;
            }
        }
        if((int)startCounter == 4)
        {
            if(show2)
            {
                gui.GetComponent<TextScript>().fadeText("2",
Color.yellow, 1.5f);
                audio.clip = readySound;
                audio.Play();
                show2 = false;
            }
        }
        if((int)startCounter == 2)
        {
            if(show1)
            {
```

```
                gui.GetComponent<TextScript>().fadeText("1",
Color.yellow, 1.5f);
                audio.clip = readySound;
                audio.Play();
                show1 = false;
            }
        }
        if((int)startCounter == 0)
        {
            if(showGo)
            {
                gui.GetComponent<TextScript>().fadeText("Go!",
Color.yellow, 1.5f);
                gui.GetComponent<GuiScript>().runCounter = true;
                audio.clip = goSound;
                audio.Play();
                ufoSpeed = 0;
                showGo = false;
            }
        }

        // Assigning the values from the wobble board:
        float angleY = PhidgetPlugin.getY() * 90;
        float angleX = PhidgetPlugin.getX() * 90 + 2.5f; // 2.5 is added
to calibrate the value

        // Controlling the speed of the UFO:
        if(ufoSpeed > maxSpeed) ufoSpeed = maxSpeed;
        if(ufoSpeed < -maxSpeed) ufoSpeed = -maxSpeed;

        if(ufoSpeed <= maxSpeed && ufoSpeed >= -maxSpeed)
        {
            ufoSpeed += -angleY/10000;
        }

        // Controlling behaviour when the player is in the Abduction
Zone:
        if(targetZone && !hanging)
        {
            plr.transform.Translate(new Vector3(0, 0, -angleY/800));
            plr.transform.Translate(new Vector3(angleX/800, 0, 0));

            // Enabling keyboard control of the UFO:
            if(Input.GetKey("up"))
plr.transform.Translate(Vector3.forward / 20);
```

```
            if(Input.GetKey("down")) plr.transform.Translate(-
Vector3.forward / 20);
            if(Input.GetKey("left")) plr.transform.Translate(Vector3.left
/ 20);
            if(Input.GetKey("right")) plr.transform.Translate(-
Vector3.left / 20);

            ufoSpeed = 0;

            StartBeam(new Color(0.07f, 0.25f, 0.58f, 0.0f));

            // The camera view changes to top-down:
            Camera.main.GetComponent<SmoothFollow>().height = 5;
            Camera.main.GetComponent<GlowEffect>().glowTint = new
Color(0.07f, 0.25f, 0.58f, 0.0f);
        }

        // Controlling behaviour when navigating the environment:
        else if(startCounter < 1)
        {
            plr.transform.Translate(Vector3.forward * ufoSpeed);

            // Enabling keyboard control of the UFO:
            if(Input.GetKey("up")) ufoSpeed += 0.005f;
            if(Input.GetKey("down")) ufoSpeed -= 0.005f;
            if(Input.GetKey("left")) plr.transform.Rotate(0, -1.0f, 0);
            if(Input.GetKey("right")) plr.transform.Rotate(0, 1.0f, 0);

            if(!flipUfo)
            {
                plr.transform.Rotate(0, angleX/30, 0);
            }
            EndBeam();

            // The camera view is changed back to normal:
            Camera.main.GetComponent<SmoothFollow>().height = 2;
        }

        // The top of the UFO rotates slowly around itself:
        ufoTop.transform.Rotate(0, Time.deltaTime * 50, 0);

        if(startCounter < 1)
        {
            if(!flipUfo) ufo.transform.localRotation =
Quaternion.Slerp(ufo.transform.localRotation, Quaternion.Euler(-angleY,
0, -angleX), Time.deltaTime * 1.5f);
```

```
            ufoSound.GetComponent<AudioSource>().pitch = 2 +
Mathf.Abs(ufoSpeed * 8);

            if(Input.GetKey("up")) ufo.transform.localRotation =
Quaternion.Slerp(ufo.transform.localRotation, Quaternion.Euler(40, 0, 0),
Time.deltaTime * 1.5f);
            if(Input.GetKey("down")) ufo.transform.localRotation =
Quaternion.Slerp(ufo.transform.localRotation, Quaternion.Euler(-40, 0,
0), Time.deltaTime * 1.5f);
            if(Input.GetKey("left")) ufo.transform.localRotation =
Quaternion.Slerp(ufo.transform.localRotation, Quaternion.Euler(0, 0, 40),
Time.deltaTime * 1.5f);
            if(Input.GetKey("right")) ufo.transform.localRotation =
Quaternion.Slerp(ufo.transform.localRotation, Quaternion.Euler(0, 0, -
40), Time.deltaTime * 1.5f);
        }

        // Controls outer-position penalties:
        if((angleX < -24 || angleX > 24 || angleY < -24 || angleY > 24)
&& (int)startCounter < 1 && !targetZone)
        {
            dropCounter += Time.deltaTime;

            if(hanging)
            {
                gui.GetComponent<TextScript>().fadeHint("If you tilt too
much you will lose the cow!", Color.white, 3, 0.8f);

                if(dropCounter > 1.5f)
                {
                    cowHangActive = GameObject.Find("Cow Hang Active");
                    Destroy(cowHangActive.GetComponent("FixedJoint"));
                    cowHangActive.transform.parent = null;
                    cowHangActive.name = "Cow Lost";
                    cowHangActive.tag = "Untagged";
                    gui.GetComponent<TextScript>().fadeText("Lost it!",
Color.red);
                    audio.clip = lostSound;
                    audio.Play();
                    hanging = false;
                    dropCounter = 0;
                }
            }
            else if(!flipUfo)
            {
```

```
                gui.GetComponent<TextScript>().fadeHint("If you tilt too
much you will tip over!", Color.white, 3, 0.8f);

                if(angleX < -24 || angleX > 24) flipDir = 1;
                if(angleY < -24 || angleY > 24) flipDir = 2;


                if(dropCounter > 1.5f)
                {
                    flipUfo = true;
                }
            }
        }
        else if(!flipUfo) dropCounter = 0;

        // Controls the penalty of flipping the UFO:
        if(flipUfo)
        {
            if(playFlip)
            {
                audio.clip = flipSound;
                audio.Play();
                playFlip = false;
            }
            dropCounter += Time.deltaTime;
            if(dropCounter < 5)
            {
                if(flipDir == 1) ufo.transform.localRotation =
Quaternion.Slerp(ufo.transform.localRotation, Quaternion.Euler(0, 0,
180), Time.deltaTime * 2f);
                if(flipDir == 2) ufo.transform.localRotation =
Quaternion.Slerp(ufo.transform.localRotation, Quaternion.Euler(180, 0,
0), Time.deltaTime * 2f);
            }
            if(ufoSpeed > 0) ufoSpeed -= 0.005f;
            if(ufoSpeed < 0) ufoSpeed += 0.005f;

            if(dropCounter > 5)
            {
                ufo.transform.localRotation =
Quaternion.Slerp(ufo.transform.localRotation, Quaternion.Euler(0, 0, 0),
Time.deltaTime);
            }

            if(dropCounter > 10)
            {
```

```
                flipUfo = false;
                dropCounter = 0;
                playFlip = true;
            }
        }

        // Controls the speed power-up effect:
        if(speedPowerup)
        {
            speedTimer += Time.deltaTime;

            if(ufoTop.renderer.material.color.a < 0.6f)
            {
                ufoAlpha += Time.deltaTime;
                ufoTop.renderer.material.color = new Color(1, 1, 1,
ufoAlpha);
            }
            if(speedTimer > 10)
            {
                maxSpeed = 0.2f;
                speedTimer = 0;
                speedPowerup = false;
            }
        }
        if(ufoTop.renderer.material.color.a > 0 && !speedPowerup)
        {
            ufoAlpha -= Time.deltaTime;
            ufoTop.renderer.material.color = new Color(1, 1, 1,
ufoAlpha);
        }

        // This function logs the data from the wobble board and saves it
in a txt file:
        if(datacounter == 10)
        {
            try
            {
                writeFile = new FileStream(logfile, FileMode.Append,
FileAccess.Write);
            }
            catch(IOException exc)
            {
                Console.WriteLine(exc.Message + "\nError Opening Output
File");
                return;
            }
```

```
            try
            {
                StreamWriter dataWriter = new StreamWriter(writeFile);
                dataWriter.WriteLine(angleX + "," + angleY);
                dataWriter.Close();
            }
            catch(IOException exc)
            {
                Console.WriteLine(exc.Message + "File Error");
            }
            writeFile.Close();
            datacounter = 0;
        }
        datacounter++;
    }

    // This function animates the beam when entering the Abduction Zone:
    void StartBeam(Color beamcolor)
    {
        if(scale > 1) beam.transform.localScale = new Vector3(scale,
1.0f, scale);
        if(scale < 1)
        {
            scale += Time.deltaTime * 1.2f;
            beam.transform.localScale = new Vector3(scale, 1.0f, scale);
            //mainCamera.GetComponent<GlowEffect>().glowTint = beamcolor;
        }

        GameObject.Find("Beam
Particles").GetComponent<ParticleEmitter>().Emit();
    }

    // This function animates the beam when exiting the Abduction Zone:
    void EndBeam()
    {
        if(scale < 0) beam.transform.localScale = new Vector3(0.0f, 1.0f,
0.0f);
        if(scale > 0)
        {
            scale -= Time.deltaTime * 1.2f;
            beam.transform.localScale = new Vector3(scale, 1.0f, scale);
        }
    }

    // This function is called when the player enters a trigger collider:
```

```
    void OnTriggerEnter(Collider trigger)
    {
        if(trigger.name == "Victim Zone" && !hanging && !targetZone)
        {
            audio.clip = beamStartSound;
            audio.Play();
        }

        if(trigger.name == "Drop Zone" && hanging)
        {
            cowHangActive = GameObject.Find("Cow Hang Active");
            Destroy(cowHangActive.GetComponent("FixedJoint"));
            cowHangActive.transform.parent = null;
            cowHangActive.name = "Cow Dropped";
            gui.GetComponent<TextScript>().fadeText("Well done!",
Color.green);
            gui.GetComponent<TextScript>().fadeHint("Collect more cows",
Color.white, 1);
            score.GetComponent<Score>().score++;
            audio.clip = completeSound;
            audio.Play();
            hanging = false;
        }
    }

    // This function is called when the player stays inside a trigger
collider:
    void OnTriggerStay(Collider trigger)
    {
        if(trigger.name == "Victim Zone" && !hanging) targetZone = true;
    }

    // This function is called when the player exits a trigger collider
    void OnTriggerExit(Collider trigger)
    {
        if(trigger.name == "Victim Zone" && !hanging)
        {
            targetZone = false;
            Camera.main.GetComponent<SmoothFollow>().height = 2;
            audio.clip = beamEndSound;
            audio.Play();
        }
    }
}
```

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GLOSSARY

At-game The overlapping bifurcation of the gameplay aspects is in the current project constituted by at-game and in-game aspects, which form the basis for the design and evaluation of the gameplay. The at-game aspects of a game are the ones solely focussing on the usability of the gameplay.

Behavioral metrics: Behavioral metrics refer to measures of the behavior exhibited by individuals and include, but are not limited to, facial, body and eye movement (Tullis, et al., 2008 p. 167).

Challenge-based Immersion: Challenge-based immersion refer to *"[…] the feeling of immersion that is at its most powerful when one is able to achieve a satisfying balance of challenges and abilities"* (Ermi, et al., 2005 p. 8)

Cognitive appraisal: An individual's cognitive evaluation of the relationship between the environment and the self. The appraisal process may include the evaluation of the meaning of occurring events, their relevance and his or her capacity for coping with them (Fox, 2008 pp. 8-9, 23).

Diegesis : *"The (fictional) world in which the situations and events narrated occur"* (Prince, 2003 p. 20).

Emotion: *"A relatively brief episode of coordinated brain, autonomic and behavioral changes that facilitate a response to an external or internal event of significance for the organism"* (Fox, 2008 p. 17). For a description of different categories of gameplay emotions please see the section *Categories of gameplay emotions* on 101.

Engagement: A player's willing and continued commitment to the act of playing a particular game, caused by the emotions brought about by the experience of sensory stimuli; physical or intellectual challenges; socialization, competition or cooperation; or ' singular or causally related dramatic events (the narrative). For an overview of Schønau-Fog and Bjørner's six types of engagement see Box 8, page 51.

Feelings: "*The subjective representation of emotions"* (Fox, 2008 p. 17).

Flow: The subjective state arising when an individual performs an activity of interest where the perceived challenges correspond to the perceived skills of said individual. The subjective state itself is characterized by intense and focused attention, merging of action and awareness, the loss of self-consciousness, a sense of control, distortion of temporal experience, and finally the experience of the activity as being intrinsically rewarding (Nakamura, et al., 2005).

Formative evaluation -Provides feedback to improve the design throughout the design and development phase.

Gameplay: Within the context of the current project gameplay was defined as everything experienced and occurring during the meeting between player and game. However, a number of different definitions have been coined by scholars and developers alike:

- **Adams and Rollings:** *"one or more causally linked series of challenges in a simulated environment"* (Rollings, et al., 2003).
- **Dini:** "*interaction that entertains*" (Adams, 2010 p. 9).
- **Ermi and Mäyrä:** "*gameplay is represented as interaction between a particular kind of game and a particular kind of player"* (Ermi, et al., 2005 p. 7).
- **Meier:** "*a series of interesting choices*"(Rollings, et al., 2003)
- **Rouse III:** *"A game's gameplay is the degree and nature of the interactivity that the game includes.*"(Rouse III, 2005 p. XX)

Gameplay Model: The devised model describing the cyclic process between player and game. The model can be found on page 116.

Heuristic Per definition, a heuristic method is a way to rapidly come to a solution hoped to be the optimal one. A heuristic can be regarded as a recognized principle or an educated guess of solving a problem. Heuristic evaluation is an inspection technique used by evaluators to explore an interface using a set of heuristic principles. It is a discount usability engineering approach "*for quick, cheap, and easy evaluation of a user interface design*" (Nielsen, 2010).

Iconic: "*A mode in which the signifier [see signifier entry] is perceived as resembling or imitating the signified (recognizably looking, sounding, feeling, tasting or smelling like it) - being similar in possessing some of its qualities (e.g. a portrait, a diagram, a scale-model, onomatopoeia, metaphors, 'realistic' sounds in music, sound effects in radio drama, a dubbed film soundtrack, imitative gestures)"* (Chandler, 2002)

Imaginative immersion: Imaginative immersion refers to the experience which occurs once *"[…] one becomes absorbed with the stories and the world, or begins to feel for or identify with a game character"*(Ermi, et al., 2005 p. 8) (See also Narrative Immersion)

Immersion (diegetic level): When immersed on a diegetic level the *"[...] the player is caught up in the world of the game's story"* (McMahan, 2003 p. 68).

Immersion (non-diegetic level): Immersed on a nondiegetic level *"[…] refers to the player's love of the game and the strategy that goes into it"*(McMahan, 2003 p. 68).

Immersion: Within the context of the current project immersion was defined as the attentional surrender on part of the player brought about by his or her involvement with the game on a diegetic or nondiegetic level. Elsewhere immersion has been defined as *"[...] the sensation of being surrounded by a completely other reality, as different as* water is from air, that takes over all of our attention, our whole perceptual apparatus"(Murray, 1998 p. 98) and as *"[…] a phenomenon that occurs when a layer of mediated data is pasted upon the layer of unmediated data with such vividness and extensiveness that it blocks the perception of the latter"* (Arsenault, 2005).

Indexical: *"A mode in which the signifier [see signifier entry] is not purely arbitrary but is directly connected in some way (physically or causally) to the signified - this link can be observed or inferred (e.g. smoke, weathercock, thermometer, clock, spirit-level, footprint, fingerprint, knock on door, pulse rate, rashes, pain)"* (Chandler, 2002)

In-game The overlapping bifurcation of the gameplay aspects is in the current project constituted by at-game and in-game aspects, which form the basis for the design and evaluation of the gameplay. The in-game aspects of a game are the ones focusing on all aspects of the gameplay except usability.

Interaction: Game designer and theorist Chris Crawford defines interaction as *"[a] cyclic process in which two active agents alternately (and metaphorically) listen, think and speak"* (Crawford, 2005 p. 76).

ISO 13407 The International Organization for Standardization (ISO), has created a standard entitled *Human-centred design processes for interactive systems* (ISO 13407), which provides guidance on UCD activities of interactive computer-based systems (ISO, 1999).

Metric: A metric, or measure, refers to a particular way of evaluating or measuring a particular phenomenon (Tullis, et al., 2008 p. 7).

Mood: *"A diffuse affective state that is often of lower intensity than emotion [see emotion], but considerably longer in duration"* (Fox, 2008 p. 17).

Narrative immersion: Narrative Immersion occurs when the player gets the "[…] *the feeling of being inside a story, completely involved and accepting the world and events of the story as real"* (Adams, et al., 2006 p. 30). (See also Imaginative Immersion)

Perceptual immersion: Perceptual immersion *"[…] is accomplished by blocking as many of the senses as possible to the outside world and making it possible for the user to perceive only the artificial world"* (McMahan, 2003 p. 77).

Physiological metrics: Physiological metrics refer to measurements of the physiological responses of the body of an individual and include galvanic skin responses, electromyograms, and electroencephalogram (Cozby, 1997 p. 132).

Playability Playability represents the degree to which a game is usable and enjoyable (Foraker, 2010).

Playtesting When using UCD in games and iterative user involvement to test all at-game and in-game aspects, *playtesting* (or *playability testing*) is a commonly applied method.

Pleasures of the mind: Collections of emotions, which are purposely sought out by individuals during experiences of entertainment such as games. For an overview of Kubovy's five pleasures of the mind see Box 15 page 105.

Presence as Immersion: See perceptual and psychological immersion.

Presence as medium as social actor: Relates to how individuals may treat the medium itself as a social actor (Lombard, et al., 1997).

Presence as realism: Presence as realism, hinge upon the *"[…] the degree to which a medium can produce seemingly accurate representations of objects, events, and people – representations that look, sound, and/or feel like the "real" thing."* (Lombard, et al., 1997).

Presence as social actor within medium: When experiencing mediated characters individuals *"[…] overlook the mediated or even artificial nature of an entity within a medium and attempt to interact with it"* (Lombard, et al., 1997).

Presence as social richness: The extent to which individuals engaged in some form of mutual interaction, find the medium facilitating the interaction sociable, warm, sensitive, personal or intimate (Lombard, et al., 1997).

Presence as transportation: Lombard and Ditton distinguish between three forms of presence as transportation, that is, *"You are there," in which the user is transported to another place; "It is here," in which another place and the objects within it are transported to the user; and "We are together," in which two (or more) communicators are transported together to a place that they share."* (Lombard, et al., 1997)

Presence: In general terms presence refer to *"[…] the perceptual illusion of nonmediation"* (Lombard, et al., 1997),

Psychological immersion: Psychological immersion *"[…] results from the user's mental absorption in the world"* (McMahan, 2003 p. 77).

Signified: *"[T]he mental concept represented by the signifier"* (Chandler, 2002).

Signifier: *"[T]he form which a sign takes"* (Chandler, 2002).

Slater's immersion: Slater views immersion as a term describing "[…] *what the technology delivers from an objective point of view"* (Slater, 2003 p. 1), implying that immersion simply a property of the system.

Strategic immersion: Tactical immersion refers to the form of immersion experienced when playing hectic action games where continuous demands for reactions to occurring obstacles give rise to an experience of complete engrossment (Adams, et al., 2006 p. 30).

Summative evaluation -Provides information on the product's efficacy. That is, whether or not the design meets user and organizational objectives, thereby achieving what it was designed to do.

Symbolic: *"A mode in which the signifier [see signifier entry] does not resemble the signified but which is arbitrary or purely conventional - so that the relationship must be learnt (e.g. the word 'stop', a red traffic light, a national flag, a number)"* (Chandler, 2002)

Tactical immersion: The experience you have when you are *"[…] deeply involved in trying to win a game, you are strategically immersed. You don't think about a story, characters, or the game but focus strictly on optimizing your choices"* (Adams, et al., 2006 p. 30)

Usability: Loosely defined as 'the ease of use' (Nielsen, 1994 p. 26). Usability includes five measurable attributes *learnability*, *efficiency*, *memorability*, *errors* and *satisfaction*. For an overview of the five attributes see Box 18.

User Centered Design Gulliksen et al. defines UCD as "*a process focusing on usability throughout the entire development process and further throughout the system life cycle*" (Gulliksen, et al., 2003 p. 401). UCD thereby revolves around users of a product in order to determine their needs, wants and limitations throughout each step of the design process. By involving users through the planning, design and development process of an interface, developers can foresee how it is most likely to be used.