

Title: Game Design and Theories of Children's Play

Project period: 04.02.13-31.05.13

Semester theme: Master's Thesis

Supervisors: Martin Kraus

Projectgroup no.: mta131038

Members:

Jeppe Tobias Hatting

Copies: 2

Pages: 34

Appendices: 0

Abstract:

There is no unified theory of game design, instead designers are limited to collections of principles and best practises. Jesse Schell presents in his book *The Art of Game Design* 100 of such principles. Limited research has been conducted in order to explain these principles, but a lot of studies have been conducted in the field of children psychology in order to understand what play is, why children play, what impact play has on the development of children and how good play is established. In this master thesis I have tried to explain the lenses of Jesse Schell through theories of children's play. By starting with a comparison between play as described in child psychology and games as described by Schell, I have accounted for how the lenses can be explained and supported by theories of children's play and described what this new perspective on game design principles can add to the use of them. It turns out that many of lenses can actually be explained and supported with theories of children's play and this thesis serves as the foundation for a deeper scientific research of the principles. Along with the examination of the lenses I have developed a Breakout game to demonstrate some of the lenses. The game contains various versions of the same game; one basic version containing only the core mechanics and several others each demonstrating one of the lenses.

Titel: Game Design and Theories of Children's Play

Projekt periode: 04.02.13-31.05.13

Semester tema: Speciale

Vejleder: Martin Kraus

Projekt gruppe nr.: mta131038

Gruppemedlemmer:

Jeppe Tobias Hatting

Kopier: 2

Sider: 38

Appendices: 0

Synopsis:

Der findes ingen komplet og samlet teori indenfor spildesign, designere må nøjes med samlinger af principper og velkendte løsninger. Jesse Schell præsenterer i hans bog *The Art of Game Design* sådanne 100 spildesign principper. Det er begrænset hvor meget videnskabeligt arbejde der er blevet gjort for at redegøre for disse principper men der er foretaget mange studier i børnepsykologi med det formål at klargøre hvad leg er, hvorfor børn leger, hvilken indflydelse leg har på børns udvikling og hvordan den gode leg bedst skabes. I dette speciale har jeg forsøgt at redegøre for Jesse Schells linser ved hjælp af teorier omkring børns leg. Ved at starte med at sammenligne leg som beskrevet i børnepsykologi og spil som beskrevet af Schell har jeg redegjort for hvordan linserne enkeltvis eller i mindre grupperinger kan forklares og understøttes ved hjælp af teorier omkring børns leg, samt beskrevet hvad dette nye perspektiv kan tilføje til brugen af principperne. Det viser sig at Schells linser i høj grad kan beskrives ved hjælp af teorier omkring børns leg og dette speciale er starten på en mere dybdegående videnskabelig gennemgang af disse principper om spildesign. Sammen med disse redegørelser har jeg udviklet et Breakout spil hvori jeg demonstrerer nogle af linserne. Spillet består af en række forskellige versioner af det samme spil; en basis version hvor kun de mest centrale mekanikker er tilstede og en række andre versioner der hver især demonstrerer et af principperne fra linserne.

Preface

This report documents my master's thesis in Medialogy with Specialisation in Games made during the the spring semester of 2013. For the thesis I have investigated how the game design principles of Jesse Schell can be explained and supported through theories of children's play. Along with this investigation I have create a game for Android devices in which I demonstrate some of these principles.

This report is accompanied by a DVD containing the report in PDF-format, a video documentation of the thesis and the game as an APK-package and as a Unity3D web build. Note however, that the game is developed with Android phones as target devices and hence is optimised for those.

I would like to thank Martin Kraus for his supervision.

Contents

1	Introduction	1
1.1	Demonstration of Lenses	2
1.1.1	Breakout	2
1.1.2	Breakout for this Project	3
2	The Lenses	5
2.1	Play and Games	5
2.2	The Lens of the Essential Experience	7
2.2.1	Demonstration	7
2.3	The Lenses of Surprise and Fun	8
2.4	The Lenses of Feedback and Juiciness	9
2.5	The Lenses of Curiosity and Endogenous Value	10
2.6	The Lenses of Problem Solving and Challenges	12
2.7	The Lens of Competition	14
2.7.1	Demonstration	15
2.8	The Lens of Cooperation	17
2.9	The Lens of Competition vs Cooperation	18
2.9.1	Demonstration	19
3	Discussion and Future Work	21
3.1	Investigating the Lenses	21
3.2	Testing the Lenses	21
3.2.1	The Effect of Employing Game Design Principles	21
3.2.2	Divergent and Convergent Problems in Games	22
3.2.3	Juiciness in Guiding The Player	23

List of Figures

1.1	Atari 2600 Breakout. <i>http://en.wikipedia.org/wiki/Breakout_(video_game)</i>	2
1.2	The basic version of Breakout. <i>Screenshot from the game</i>	3
1.3	How paddle is treated as a paddle. <i>Drawing</i>	4
2.1	The glass blocks are shattered by the rock. <i>Screenshot from the game</i> . .	8
2.2	The Impossible Quiz. <i>http://www.notdoppler.com/theimpossiblequiz.php</i> .	14
2.3	Players can compete in getting most points by breaking blocks. <i>The competitive mode. Screenshot from the game</i>	16

Resumé

Der findes ingen komplet og samlet teori indenfor spildesign. Spildesign som fag låner fra en masse forskellige andre fag der blandt andet inkluderer kommunikation, matematik, økonomi, historie og psykologi. For at kunne skabe et godt spil kræves det at designerne har viden indenfor alle disse fag. At designe spil i er sin kerne at designe oplevelser og helst oplevelser som spillerne vil nyde. For at kunne designe sådanne oplevelser kræves en forståelse for hvad en oplevelse er og hvad sådan en indebærer. I hans bog *The Art of Game Design - A Book of Lenses* tager Jesse Schell udgangspunkt i spil som oplevelser og præsenterer principper omkring 100 spildesign, kaldet linser, der hver et især giver et nyt perspektiv på det spil man designer ved at stille en række spørgsmål. Linserne som Schell præsenterer er inspireret fra alle områder af spildesign, lige fra at definere hvad et spil er og hvad den essentielle oplevelse i spillet er, til hvordan ideen bedst pitches til en udgiver. Mange af linserne er anerkendte principper der flittigt bliver brugt i industrien, men det er begrænset hvor meget videnskabeligt arbejde der er blevet gjort for at redegøre for dem. Når man skal prøve at forstå begreber som leg og spil kan det hjælpe at kigge til børnepsykologien hvor disse begreber er blevet arbejdet intenst med i mange år. Mange studier er blevet foretaget med det formål at klargøre hvad leg er, hvorfor børn leger, hvilken indflydelse leg har på børns udvikling og hvordan den gode leg bedst skabes. Hvis begrundelsen og virkningen af principper fra spildesign kan forklares ved hjælp af børnepsykologi kan det give os en bedre forståelse af disse principper og gøre os i stand til at bruge dem bedre, hvilke i sidste ende resulterer i bedre spil.

I dette speciale har jeg forsøgt at redegøre for Jesse Schells linser ved hjælp af teorier om børns leg. Ved at starte med at sammenligne karakteristika mellem leg som beskrevet i børnepsykologi og spil som beskrevet af Schell har jeg beskrevet hvordan linserne enkeltvis eller i mindre grupperinger kan forklares og understøttes ved hjælp af teorier omkring børns leg, samt beskrevet hvad det nye perspektiv kan tilføje til principperne. Sammen med disse redegørelser har jeg udviklet et Breakout spil hvori jeg demonstrerer nogle af linserne. Spillet består af en række forskellige versioner af det samme spil; en basis version hvor kun de allermest centrale mekanikker er tilstede og en række af andre tilstande der hver især demonstrerer et af spildesign principperne.

Grundet tidsrestriktioner og at det ikke er alle principperne det giver mening at redegøre for ved hjælp børnepsykologi er der i dette speciale blevet fokuseret dem der forholder sig selve spilleren; enten i form af spillerens oplevelse af spillet, spillerens interaktion

med spillet eller spillerens interaktion med andre spillere.

Det viser sig at Schells linser i høj grad kan beskrives ved hjælp af teorier omkring børns leg og dette speciale er starten på en mere dybdegående videnskabelig gennemgang af disse spildesign principper. Blandt andet kan det testes hvor stor effekt disse principper har på spillerens oplevelse af spillet og om brugen af nogle af principper har større effekt på spillerens oplevelse af spillet end andre.

1

Introduction

With the exception of some niche approaches, like mused-based game design, there is no unified theory of game design [1, 2]. Game design borrows from a wide palette of fields including communication, mathematics, economics, history and psychology. To create a good game, designers require knowledge from all these fields. They must be able to design the underlying complex and engaging mathematical system of a strategy game, know how a story should be told and be able to tell the player how to play the game. Designing games is in essence, designing experiences, and preferably ones the player finds enjoyable [1]. To design such experiences, one must have an understanding of what an experience is and what constitutes a good one. One comprehensive collection of good practices for designing a game (experience) is the book *The Art of Game Design - A Book of Lenses* by Jesse Schell in which he establishes 100 *lenses*, each one being a different perspective on the art of designing games. These lenses, each one comprised of a set of questions, are inspired from all the various fields of game design and helps the designer view his or her design from a new perspective. In lens #2 *The Lens of Surprise* and lens #3 *The Lens of Fun* he argues that fun and surprise are important aspects of play and therefore important in game design. He then goes on to examine existing definitions of play and comes up with his own. Indeed, in order to design good games, one must understand what play is and what it constitutes. In understanding play and what its role is to us humans one might look to the field of child psychology. In child psychology the purpose and role of play in children has been thoroughly analysed and multiple theories on it have been developed. These theories try to explain why children play, why they derive pleasure from it and what the benefits of it are. All these questions are also relevant for games and the designers of them.

In this thesis I will examine and try to explain the lenses proposed by Jesse Schell through theories of children's play. If the best practices and rules of thumb for designing a good game can be explained through theories of children development and motivation for playing, then perhaps there's is more from this field of study that can be used when designing good games. Also, gaining a better understanding of the game design principles available will enable the designers to better employ them. Due to the nature

CHAPTER 1. INTRODUCTION

of the lenses and time constraints not all lenses will be examined. Many of Schell's lenses concern aspects of game development such as pitching, development cycles, working in teams and with clients. Such lenses will not be touched in this study. The focus will be on lenses which concerns how the player experiences the game and how the game should be designed to create a good experience for the player.

1.1 Demonstration of Lenses

Martin Jonasson and Petri Purrho have previously demonstrated the principle of juiciness in a Breakout-like game [3]. Along with the examination of Jesse Schell's lenses I will try to expand upon this idea and demonstrate some of the other principles and findings done in this report. To do this demonstration, a Breakout-like games was created in Unity3D featuring a different game mode for each of the lenses demonstrated, along with a basic standard version of the game. The game was built for Android devices.

1.1.1 Breakout

The goal of Breakout is to destroy all the blocks in the level by hitting them with a ball bouncing off a player-controlled paddle in the bottom of the screen, see Figure 1.1.



Figure 1.1: Atari 2600 version of Breakout

If the player fails to bounce the ball of the paddle he loses one of his finite number of lives. The game, or level, is won when all blocks are destroyed or lost if the player loses all his lives. The game developed for this project will feature one level with unlimited lives unless the demonstration requires otherwise. Other implementations of Breakout may contain power ups which can be collected from destroyed block and multiple levels featuring different types of blocks, but the one developed for this project will be kept simple in order to illustrate the purpose of the lenses.

1.1.2 Breakout for this Project

The basic version of Breakout developed for this project is a version with only the very core mechanics of Breakout. It is not designed to be a fun game or a great experience but to be a platform to which the game design principles can easily be applied. The game was developed for Android smartphones. In Figure 1.2 a screenshot of the basic version of the game for this project can be seen. It features the ball, the paddle and rows of blocks to be destroyed. The paddle can be controlled by tilting the screen or holding a finger on side of the paddle that you want it to move towards. When the ball hits a wall or a block it is reflected on the normal of the surface of the contact point. If the ball misses the paddle it is instantly reset to the paddle. The ball is launched by giving the device a light shake.

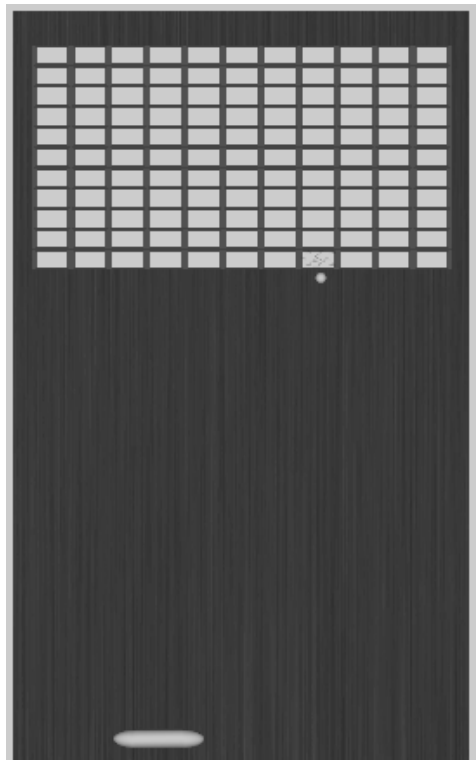


Figure 1.2: The basic version of Breakout

The paddle is shaped like an extended cylinder but it is treated as a being the top of a large sphere, see Figure 1.3 for reference image. A point below the paddle is specified and treated as the centre of the sphere. When the ball collides with the paddle the direction between the point of contact and the point below the paddle is used as a

CHAPTER 1. INTRODUCTION

normal for the ball to reflect upon. This ensures that the ball does not keep flying around in the same angle, allowing the player some control over the direction of the ball.

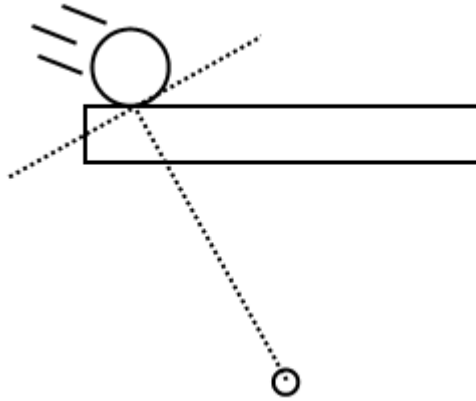


Figure 1.3: How the paddle is treated as a sphere

2

The Lenses

In this chapter the lenses of Jesse Schell will be analysed and theories of children's play will be used to explain why these principles works when designing games. What this new perspective can add to the lenses is described at the end of each section in a blue box as illustrated below.

Just like this.

2.1 Play and Games

In order to discuss the lenses of Jesse Schell and how they relate to theories of children's play we must first agree on what play and games are and how they relate to each other. For both play and games many definitions exists and the relationship between them can be hard to define. In *Rules of Play* Katie Salen and Eric Zimmerman define two ways play and games can be related to each other [4]. The first is that play is an element of games. When you play a game, part of the experience is that of play. The other relation is that games are a subset of play. Of all the things one can play, games are one subset of them. Some of the more formalised and less loose forms of play are what can be called games. In Piaget's definition of play and games he defines three different types of play, each one reflecting a certain stage in the intellectual development of the child [5]. The final stage of development is the operational stage and the type of play associated with it is games with rule. That stage is reached when the child is able think in concrete formal operations. To help further establish what is play and what is a game, the characteristics of them can be compared. In child psychology an activity can only be considered play if it contains five essential characteristics[6]:

- Intrinsically motivated
- Freely chosen
- Pleasurable

CHAPTER 2. THE LENSES

- Non-literal
- Actively engaged

Schell reviews a series of definitions of games and comes up with this list of qualities important to a game [1]

- Games are entered wilfully
- Games have goals
- Games have conflicts
- Games have rules
- Games can be won and lost
- Games are interactive
- Games have challenges
- Games can create their own internal value
- Games engage players
- Games are closed, formal systems

Schell does, however, note that lists of characteristics might not be the best way to define something, but it is clear that there is overlap between the two sets. All of the characteristics of play can be found in some form in the characteristics of games, but not the other way around. Games can be said to be intrinsically motivated and freely chosen as they are wilfully entered. This might, however, exclude professional sport as being a game as football players might have a bad day and not feeling like playing but are forced to due to their contract. Games can be seen as being pleasurable in the sense of the pleasure of overcoming challenges and conflict. A player might lose a game, but the potential of pleasure is there. The conflict in a game and the internal value it can create are non-literal. Conflicts in games are artificial in the sense that they are not real [4]. The terrorists trying to place a bomb in Counter-Strike are not real, but the threat they pose within the game is accepted and the player must stop them [7]. Lastly, games as well as play require the players to be actively engaged. If a child is not active in play, then the play does not exist and if a player is not active in a game, the game comes to a halt. With this in mind that games are a form of play, we can begin to look at the lenses of Jesse Schell and try to explain them with the theories from of children's play.

2.2 The Lens of the Essential Experience

The very first lens Schell presents is *The Lens of The Essential Experience*. The purpose of it is to help the designer pinpoint exactly what kind of experience it is he wants the player to have and what the essential parts of that experience is. He uses the example of a snow ball fight and how a snow ball fighting game could have the characters breath condensate or use the sound of a chill wind to convey the experience of the cold that would be involved in such a fight. It is about simulating the essential aspects the game to make the player feel like they are in a snow ball fight. Making the player experience a snow ball fight while in fact he is doing something completely different (sitting in front of a computer) is very much what symbolic play is about. Symbolic play, or pretend play, is when the child uses symbols to stand in for other objects. A wooden stick might stand in for a sword, a teddy bear might be a ferocious dragon and the child itself might not be a child but a valiant knight. In such the child can enjoy the experience of being a knight, slaying a dragon and saving a princess without actually doing it. Symbolic play appears in the child's second year and at first the child's ability to decontextualise, substitute one object for another, is somewhat primitive and the child will use substitutes that are similar to the object being substituted. Later the complexity of the decontextualisation will increase and the child will be able to do greater leaps of imagination in substituting one object for another [8]. The ability to decontextualise might explain why even games with simple graphics can give great experiences. It just needs to capture the essential elements. In Space Invaders the player-controlled figure at the bottom of the screen might not look much like a space ship, but playing the game can still convey the experience of defending against an alien invasion [9].

When trying to determine what the essential elements of an experience is, the designer should perhaps try imagining what a child would do if it were to play the experience. If the child wanted to play being a knight, would a stick being used as a sword be enough, or would the child also require an armour? If the player needs to field like a commander of a space ship, what would he require to do so? This might especially be true for games with stylised or non-realistic graphics as those games could be argued to require a greater leap of imagination for the player.

2.2.1 Demonstration

The essential experience for a Breakout-like game is one of destruction. The main goal of the game is to destroy all the blocks using a ball and destroying a block takes

CHAPTER 2. THE LENSES

two hits. The analogy of destroying one type of objects with another type could be represented in many ways. It could be a wrecking ball destroying a wall, a computer virus destroying a firewall or a rock smashing windows. For this demonstration the last example is used. Though smashing glass produces both a satisfying shattering sound and a pleasing visual effect of glass shards flying everywhere, smashing glass is rarely allowed in the real world. In the game, the experience of smashing glass is conveyed by representing the blocks as windows and the ball as a rock. When the rock hits the glass once, it cracks and produces a cracking sound. When it is hit the second time, the glass shatters into many pieces and a shattering sound is played. Through this, the game is not about destroying all the generic blocks in the level, but about smashing all the glass giving the game a more enjoyable feeling. See Figure 2.1 for a screen shot.

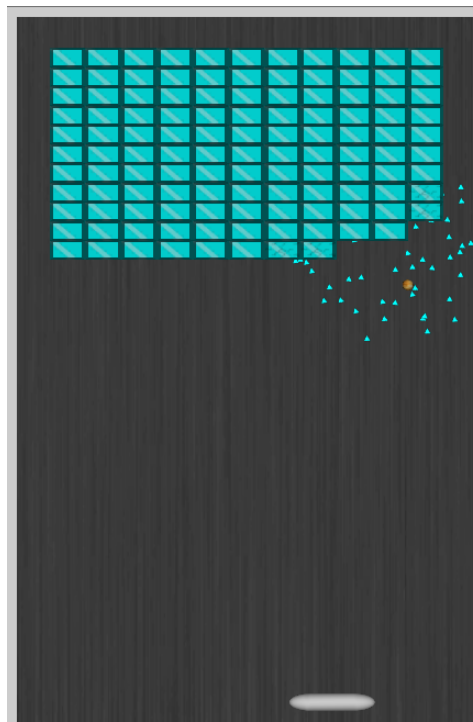


Figure 2.1: The glass blocks are shattered by the rock

2.3 The Lenses of Surprise and Fun

Lenses number 2 and 3, *The Lens of Surprise* and *The Lens of Fun* respectively asks the designer how the game will surprise the player and which parts of the game needs to be fun. Fun as a term is hard to define but Schell argues that *fun is pleasure with surprises* and that surprise is an important part of having fun. But pleasure can be

2.4. THE LENSES OF FEEDBACK AND JUICINESS

found in many things, not just surprises. For a two-year old the main source of pleasure in their play is from the sensory exploration of their environment and their toys. The act of feeling, seeing, hearing, tasting and smelling in their play is of more importance than the results of their play [10]. Another source of pleasure is the pleasure of being the cause, which is simply the joy of a successful action [5]. The successful action does not have to produce the expected effect, if there even is one, it just needs to have an effect to cause pleasure. When a child discovers an enjoyable activity, it often leads to *practise play* or *sensorimotor play* which is the repetition of the activity just for the pleasure of doing it. We know that play must be pleasurable or else it is not considered play, but how can we make sure that our game contains these surprises? In order to be surprised by something it must contain some level of uncertainty. For games, uncertainty is found in what is called *complex systems* [4]. Complex systems are systems in which the outcome cannot be accurately predicted. The individual parts of the system might not be overly complex but together they interact in a way that makes the whole bigger than the parts. When the player explores and plays within complex systems he or she will experience surprises, which will yield pleasure to the player. For a game designer it is desirable to create a game, a complex system, which motivates the player to playful exploration. Exploration and play can be largely indistinguishable as exploration has been divided into different types, *inspective behaviour*, *diversive behaviour* and *affective exploration* [11, 12]. The last type, *affective exploration*, is the maintenance of an optimal hedonic tone but not for reduction of uncertainty as is the case for *inspective behaviour*, nor is it boredom relief which is the case for *diversive exploration*. In general, play follows exploration: At first a child, or player, is unfamiliar with an object or game and will start to explore it, try to figure out what they can or can't do, what parts move and how it can be manipulated. As the child, or player becomes familiar the object the exploration will turn into play and the focus will shift from trying to understand the object to trying to derive pleasure from it [10].

When designing games, the designer should remember that at first the players will not play the game, but explore it and as they become better and more familiar with the system of the game, they will begin playing it. The game should then continue to yield surprises to the players, new things to explore and new ways to manipulate and master the system, making a pattern of shifts between exploration and play.

2.4 The Lenses of Feedback and Juiciness

The Lens of Feedback and *The Lens of Juiciness* both concerns what kind of response the game gives the players in reaction to his or hers actions. The lens of feedback

CHAPTER 2. THE LENSES

asks what the players need to know and want to know at the moment, what does the designers want the players to feel at the moment and what kind of feedback the players should have in order to support this feeling. The Lens of Juiciness is about how *juicy* the interface of the game. Juiciness is a term for the amount of second-order motion a system has; that is, actions that derive from the initial action of the player, the more second-order motion there is, the juicier it is said to be. These second-order motions rarely have any effect on the actual mechanics of the game, but it does affect the amount of and type of feedback provided to the player. Children also prefer reactive toys to non-reactive toys and a toy that provides feedback to distinct actions are preferred over toys that provides feed no matter how it is handled [10]. In the development of a child's sensorimotor play the child undergoes three phases of *circular reactions* in the way they play with objects, each involving discovering a pleasurable effect [5]. The first, or primary, circular reaction is simply the actions of the child themselves, not the object they perform the actions on. It is in the secondary circular reaction that the effects of the child's actions becomes of interest. The child will take pleasure in repeating the same action simply because of the effect of that action, what Piaget calls *the pleasure of being the cause*. This pleasure is further developed in the tertiary circular reactions in which the child will engage in a trial and error approach to create and then recreate pleasurable experiences.

Just as children prefer reactive toys, players will prefer games with a high amount of second-order movement to their actions. It is mainly the secondary circular reactions that relates to juiciness and feedback. The act of discovering an self-caused effect and then repeating the effect for the enjoyment of it can be used in game design to guide the player the way the designers want them. All actions the player performs within the game should give feedback, but when the player performs an action that the designers want them to perform the feedback should clearly indicate such by being very pleasurable and juicy. If this juiciness principle is used the designer should make sure they are consistent with it. If the players have had good pleasurable feedback previously in the game, they will expect that level of juiciness in the remainder of the game and may be confused or lost if an otherwise correct action does not provide the proper feedback.

2.5 The Lenses of Curiosity and Endogenous Value

Continuing from surprise, fun and exploration, into *The Lens of Curiosity* and *The Lens of Endogenous Value*. The lens of curiosity is about the true motivations of the player. Its purpose is to make the designer reflect on which questions the game puts into the

2.5. THE LENSES OF CURIOSITY AND ENDOGENOUS VALUE

players head, how the designer can make the player care about these questions and what can be done to make the player invent even more questions. The game proposes goals for the player to complete, and conflicts the player must resolve. These goals are all extrinsic motivations for the player, something the game wants the player to care about. However, as play is intrinsically motivated there is no guarantee that the player will actually care about these goals and play the game unless there is an overlap between the intrinsic motivations of the player and possibilities within the game. The motivations for the player to play the game might not correspond with the goals set by the game, the player can actually be completely indifferent to the goals of the game and only be motivated by goals set by himself. In a racing game the goal may very well be to complete the course the fastest, but the goal for the player might be to explore how far off track one can drive, examine the environment and test the limits of the game. A child which sets his own goals for the play is participating in what Piaget calls *games of construction* which can arise from symbolic play [5]. This type of play is normally associated with drawing, painting and building with blocks but they are characterised by the child using his own imagination to reach a goal set by himself, much like a player who within a game tries to reach goals not originally intended by the game. Much the same can be said about The Lens of Endogenous Value. The purpose of this lens is to examine what within the game has value to the player. Games often awards the player with scores, currency and points for completing goals within the game, but the player might not care about these scores. If the points collected can be used to progress your game by upgrading equipment, unlocking new levels or even just acquiring purely cosmetic artefacts then the points suddenly have endogenous value and it will be more likely that the player cares about collecting these points. The endogenous values within the game will still only be valuable to the player if his motivations corresponds to the goals set by the game. If the player only cares about completing the game as fast as possible, then it does not matter how big his score gets. The designer wants to create a game that provokes the player to accept the conflicts and the values of the game, giving it endogenous value. However, the designer cannot know what the motivations of the player will be.

CHAPTER 2. THE LENSES

Game design is a second-order design problem as a designer cannot know how the players will experience the game or what their motivations for playing it may be, he can only design rules of the system, but as described in the previous section he can design the game to be a complex system with the depth to encourage playful exploration and emergence [4]. As play is intrinsically motivated it can be argued that it does not matter what the goals of the game are, only that the game can support the motivations of the player. While the goal of the game can set the pace and direction of the game, the player should not be discouraged, but encouraged to try out different ways to play the game. Self-set goals does not necessarily rise automatically, but emerges when the players are already engaged in the game. The game should therefore be designed for flexibility, allowing players freedom to choose which rewards to get or how to use collected points along with flexibility in how problems can be solved.

2.6 The Lenses of Problem Solving and Challenges

Lenses number 6 and 31 are *The Lens of Problem Solving* and *The Lens of Challenge*. These lenses asks the designer what the problems and challenges are that the player is supposed to solve in the game. The Lens of Problem solving involves the general problems of the game, if there are any hidden problems that emerge as part of the gameplay and how the game can continue to generate new problems in order to keep the player coming back. The problems of the game are the main goals of the player to solve in order to complete the game. The Lens of Challenge concerns the challenges the player will face when trying to solve the overall problems. The lens asks which challenges there are, whether they are difficult enough and whether they can match different skill levels, how difficulty increases and whether there is enough variety in the challenges. The challenges of the game are the smaller goals the players must complete in order to solve the greater problem.

Two different approaches to problem solving exist in children's psychology, *convergent problem solving* and *divergent problem solving* [10]. The first approach deals with problems like puzzles which only have a single correct solution. The process of convergent problem solving involves gathering all the facts that exists and using logic to reach the answer. The second approach is the more creative one which does not come up with a single answer but a myriad of answers inspired from the problem. The process of divergent thinking involves coming up with different ideas and finding unusual connections. The two approaches also exists in play. Some play is more divergent (as clay and paint) whereas other forms of play are more convergent; e.g., puzzles. Lego is an

2.6. THE LENSES OF PROBLEM SOLVING AND CHALLENGES

example play which can be both convergent and divergent. If the child is following a schematic it would be considered convergent play, but if the child is just building from his or her imagination it could be considered divergent play. Computer games have traditionally been of convergent nature, featuring puzzles and obstacles which can only be overcome in a single or a few specific ways. A reason for this may be that it is hard to evaluate solutions to divergent problems. Games with a divergent nature does however exist. The *The Sims* series in which players controls the lives of one ore more so called sims is in a sense nothing more than a digital doll house, but the nature of the game is to some extend more like a toy than an actual game as there is no clearly defined goals or conflicts in the game. The same is true for the game *Minecraft* in which the players can build large castles, cities, dungeons with materials found in the game. In the game some monsters does appear at night, but surviving those are only an obstacle in the game and not the end goal. Such games allows for divergent play with problems determined by the players themselves. Studies have shown that divergent play increases the creativity and innovation in both divergent and convergent problem solving, whereas convergent play leads to the use of more strategy in the problem solving but with the risk of becoming rigid in the process, unwilling to abandon a reasonable but incorrect strategy [13]. When designing challenges for a game the designers might want to keep in mind what kind of challenges they present to the players. If the game has featured a lot of puzzles, the player might not be prepared to face a challenge demanding them to think outside the box and it will come off as harder than it is supposed to be. On the other hand, a game which allows a great freedom in the way challenges are overcome, the player might find it frustrating when a challenge demands them to find the single correct solution and the variety of other solutions they have come up with are not accepted.

The online flash game *The Impossible Quiz* makes good use of convergent problems which requires divergent thinking to be solved [14]. The game is a quiz with 100 sequential questions; however, the questions require abstract thinking and are often devoid of any conventional logic. In Figure 2.2 one of the questions can be seen. To correctly answer the question, the user must click the word "Answer" in the question. In another question the screen is filled with dots of various sizes; the question asks the player to click the smallest dot. The smallest dot is, however, not one of the dots in the main area but the small dot above the "i" in "click". While this game does require divergent thinking the problem is still convergent as there is only one correct answer.

CHAPTER 2. THE LENSES

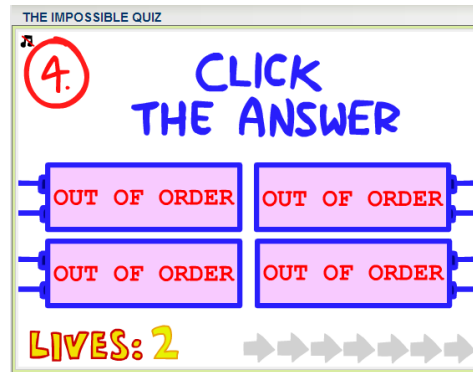


Figure 2.2: Screenshot from *The Impossible Quiz*

Designing a game with divergent problems set by the designer is harder as the problems would have no clear solution which could be deemed right or wrong to allow the player to progress. For a true divergent problem many answers are right and solutions should be rewarded for the amount of creativity and innovation used in the answer. However, as games traditionally have been of convergent nature, there might be potential in creating games of a divergent nature. Designers must not only think of the difficulty of the challenges according to the skills of the player but also according to the difficulty of previous challenges of similar nature. The overall nature of the problem of the game might be of convergent nature but adding creative challenges adds to the variety of the game to keep the feeling fresh. As divergent problems does not have a single correct answer they are also a good way of adding replayability, allowing the player to try new things on following play troughs.

2.7 The Lens of Competition

The Lens of Competition examines whether the game is one in which the player wishes to compete in. It asks if the game gives a fair representation of the player's skills, whether players are motivated to win the game and whether it is something they can be proud of and it asks how the game is balanced according to differences in skill among players. Though in decline in recent years, more than half of the games released on the Xbox 360 and the Playstation 3 features multiplayer functionalities [15]. Having good multiplayer functionality is often a reason for players to keep playing a game, why it is important to understand the nature of competition in players. In general, competition comes in two forms; *task-oriented competition* and *other-referenced competition*. Task-oriented competition reflects a child's own personal desire to be successful and

2.7. THE LENS OF COMPETITION

other-referenced competition is the desire to prove that one is better than other. It has been found in sports that other-referenced, or ego-oriented, children are often seen as aggressive. They are very focussed on winning instead of participating and they judge themselves according to their ability; all of which contributes negatively to their social acceptance and resulting in that they do not enjoy the game as much [16, 17]. Task-orientated children on the other hand are more focussed on the participation in the game, they are more willing to cooperate with others, they judge themselves according to the amount of effort they put into the game and are more intrinsically motivated, leading them to enjoy the game more than their other-referenced counterparts .

If the child enjoys the game, the child is much more willing to play it, so perhaps it is wrong of the lens to ask if players want to win the game and instead, or at least also, ask if the players want to participate in the game. The designer should strive towards creating a game which encourages task-oriented competition instead of competition for the sake of ones ego. As task-oriented children determine their level of success according to the effort they put into it, the game should reflect that and reward players according to their effort and not just by their ability to win. There is of course some correlation between the effort and the ability to win, but an untalented player giving his best might still lose to a highly skilled, but unfocused player. Instead of just rewarding the winner, the loser (or players coming second, thirds etc. depending on the type of game) also receive some credit for their contribution in order to help them progress at least some even without winning. Also, players should be matched against similar skill level so the effort put into winning more closely matches the ability to win. In a game where players are matched regardless of skill level the ego oriented players will be able to satisfy their desire to dominate others further encouraging that type of behaviour.

2.7.1 Demonstration

Breakout is traditionally a singleplayer game. To compete with other players, one is limited to comparing high scores. For the thesis, a version of Breakout was created, featuring a multiplayer mode with both players playing at the same time. To add a layer of competition between two players in the game it is not simply enough to add another player controlled paddle at the other end of the screen. Doing so could potentially encourage players to cooperate in destroying all the blocks, instead of competing. To encourage competition a few alterations are made to the level and the mechanics. A screenshot of the game can be seen in Figure 2.3.

- The second player will control his or her paddle on the top of the screen and start

CHAPTER 2. THE LENSES

with his or her own ball.

- Balls can now be lost at both the top and bottom of the screen.
- When a ball is lost on your side of the screen it will respawn belonging to the other player, unless that player already has a ball ready to be launched.
- The blocks are now centred on the screen.
- Players will now receive points for destroying blocks; 25 for hitting it the first time and 100 for destroying it.
- If a Player A touches Player B's ball that ball will be captured and now generate points for Player A until it is lost or Player B recaptures it. When all blocks are destroyed, the player with most points win.

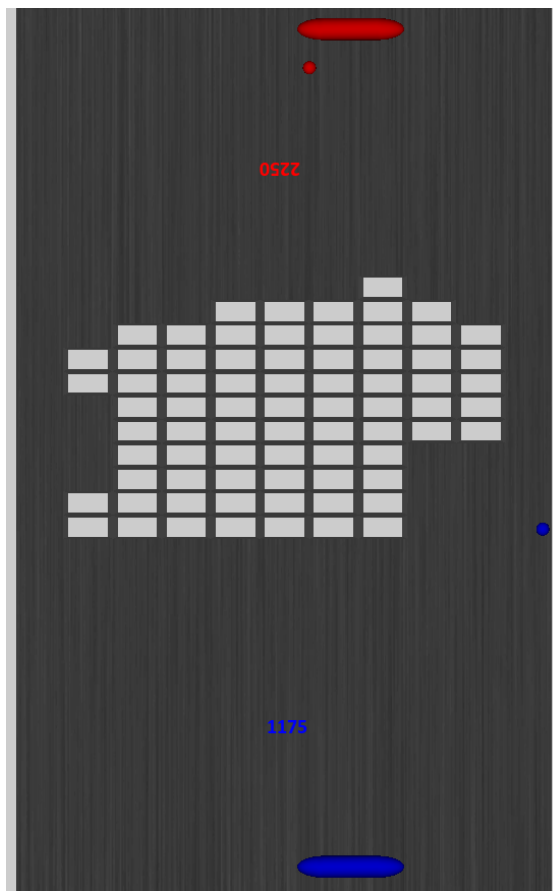


Figure 2.3: Players can compete in getting most points by breaking blocks

This mode also requires some changes to the controls as shaking the device to launch the ball would cause a conflict with two players who might not need to launch the ball

simultaneously. Therefore a launch button is added to each player's part of the screen. Moving the paddle is handled the same way as before, except tilting is turned off. Touching the bottom half of the screen will move the bottom paddle and touching the top half will move the top paddle.

These changes will allow players to compete in getting the most points and adds a layer of strategy to the game. Situations will emerge where the players will be forced to choose between risking losing both at the chance of owning two balls. Also, the players' skill in aiming will determine the efficiency of their play, making it a contest on both strategy and skill. In this version, in contrast to traditional Breakout it is generally not desirable to get your ball behind the blocks as that will allow the other player to capture it.

2.8 The Lens of Cooperation

The *Lens of Cooperation* examines how the game handles cooperative elements of the game. The lens examines how the cooperative aspects of the game are supported, how the players can communicate, whether cooperation allows for synergies and whether the roles and tasks in the game supports the cooperative aspects of the game. In psychology, play involving more than one child is called social play and is divided into five increasingly socially sophisticated types [10]. *Solitary play* is the lowest form of social play and is in fact not social at all, the child is playing completely by itself even if other children are present. *Onlooker play* is the next type of social play and — as the name suggests — it describes a child watching one or several other children play, perhaps even commenting and making inquiries about the play but the child does not actively participate in the play of the other children. The next type is *parallel play* in which children play the same thing side by side and while still playing on their own, they draw some inspiration from their peers. Children engaged in this type of play often become engaged in more sophisticated types of play. In *associative play*, like in parallel, the children play on their own but know there is significant amount of social interaction between the children, trading items, communicating and taking interest in each other's play. It has been observed that children in poor families seem to engage more in associative play than their richer counterparts [18]. The last type is full on *cooperative play* in which the children are actively engaged in the same activity play working towards the same goals. It should also be noted that in the recent years onlooker play has become more popular in digital gaming. A recent world tournament in the team competitive games *League of Legends* had over 8 million unique viewers [19], but also non-tournament, singleplayer games are being spectated live through services such as twitch.com and ustream.tv. On youtube.com the user *PewDiePie*, who uploads

CHAPTER 2. THE LENSES

recordings of himself playing various games, has close to 8 million subscribers [20].

When designing a game with multiplayer functionality it might be help to decide which types of social play types it would fall into. The more sophisticated types of cooperation requires more sophisticated means of interacting, but it might also be helpful to support some of the less sophisticated types of communication in order to encourage the players to engage in the higher types. If the designers wants a game in which the players need to interact regularly they should allow players to engage in parallel types of play and perhaps even onlooker play in order to ease players into interacting with each other. As children from homes with scarer resources apparently are more willing to engage in more associative play, designers might consider reducing the amount of resources available in the game in order motivate players to interact more. Due to the rise of onlooker play in gaming, game designers might want to ask themselves not only if the game would be fun to play, but also if it would be fun to watch being played.

2.9 The Lens of Competition vs Cooperation

The final lens of the three multiplayer-related lenses is *The Lens of Competition vs. Cooperation*. It asks how balanced the cooperation and competition elements of the game are, what sort of behaviour the players want to do and whether they have a choice in what to do and lastly whether team competition should be a feature in the game. The interesting dynamics which can emerge when both cooperation and competition is present in a game can take many forms. The type of multiplayer modes encountered most in games is the one of team competition in which one team cooperates towards winning against another competing team that also cooperates towards winning. Within each of those teams there might also be an element of competition though; the desire of all players to give their best, contribute the most or being superior to other members on the team. In more complex games that involves levels of diplomacy; cooperation and competition might take the form of alliances that benefit both players but ends with one player backstabbing the others. This type of cooperation vs. competition is exemplified in *the prisoner's dilemma* [21]. It has been found that children may be more inclined to cooperate in games such as the prisoner's dilemma [22, 23]. The type of play which is most prominent in a culture depends on the nature of that culture. Children from less technologically advanced cultures and children from rural areas are often engaging in more cooperative play and children from technologically advanced cultures and children from cities are more often found engaged in competitive play [24]. In another study it was found that when a group of children of mixed ages are to play there is a high

2.9. THE LENS OF COMPETITION VS COOPERATION

degree of cooperation and little to none competitive play [25]. The older children were willing to help and responded positively to requests for help from the younger children, they were also willing to modify the play activity to include younger children. This same principles might not be true for experienced gamers versus inexperienced players in the competitive environment of online play. In online play, inexperienced players are being scolded for not being able to participate or compete well instead of being helped and directed in order to improve their skills.

When determining how to balance competition and cooperation in a game, the designers might want to look into the culture of its intended target group. In some target groups a higher level of competition is desired at the loss of cooperation. If the game should appeal to a broad demographic of ages, the designer might want to try to recreate the cooperative and helpful environment from play within a mixed age group as it would encourage more players to engage in online play instead of scaring them away with scolding. If the game is marketed for a younger audience, the designers might want to tip the balance towards cooperation as that seems to be preferable by children and because aggressive behaviour is frowned upon and encourages a type of play which in the end leads to less enjoyment of the game as described in Section 2.7

2.9.1 Demonstration

In order to add the interesting dynamic which arises when both competition and cooperation is present in a game, the game will need to support some multiplayer functionality and have something the players can cooperate and compete about. The multiplayer mode that was added is similar to the one described in Section 2.8. In the competition mode the players received individual scores to motivated them to perform better than their opponent. In this game mode, the players will have the option of *defecting* or *cooperating* with the other player and the game now ends after a fixed amount of time has passed. Defecting in this mode is the act of letting the opponent's ball get lost and cooperating would be the act of saving it from getting lost. When a ball is lost the player must wait a short cooldown before he can relaunch the ball allowing the other player time to get more points in the meanwhile. However, each time you defect on an opponent the cooldown that both must wait grows, potentially hurting yourself if the opponent chooses to defect . In this scenario mutual cooperation would result in the largest score for both player while mutual competition would result in the lowest score for both players and lastly heavy defecting on a cooperating player cause the defecting player to gain a much higher score than the cooperating player.

CHAPTER 2. THE LENSES

		Player B	
		C	D
Player A	C	Greatly reduces cooldown	Increases cooldown
	D	Increases cooldown	Greatly increases cooldown

Table 2.1: The prisoner's dilemma for the game

3

Discussion and Future Work

3.1 Investigating the Lenses

In this master's thesis I have investigated and explained game design principles with theories of children's play. It turns out that many of the game design principles Jesse Schell presents in his 100 lenses can be explained and supported by theories of children's play, especially those concerning how the player experiences the game and those concerning how the game should be designed for the player. Supporting game design principles with theories from psychology can lead to a better understanding of them and allow game designers to better employ them. Due to time constraints, however, several of Jesse Schell's lenses remain open for investigation. To conclude this research, all of the relevant lenses should be investigated. Some of the lenses does however dos not concern the actual designing of game but the process of developing them, such as pitching the game idea and creating a business model. Besides from supporting and explaining the lenses through psychology theories, the lenses should also be tested. Below I propose some approaches for doing so.

3.2 Testing the Lenses

The game design principles described in this study are principles which have been tried and tested in the industry, but there has been conducted little scientific testing to investigate how much these principles affects the quality of the games and how well players perform in them. In the following I will describe a general approach to evaluating the effect of the lenses and some research questions relevant to specific lenses.

3.2.1 The Effect of Employing Game Design Principles

It is generally accepted that many games benefit from having a juicy interface, and that supporting and enhancing the essential experience of the game will improve the overall experience of it. It would, however, however, as little research have been conducted

CHAPTER 3. DISCUSSION AND FUTURE WORK

into game design principles it could be interesting to scientifically examine how much of an improvement it would be. One way of doing this would be to create two versions of the same game, one basic version and one with the applied game design principle, and then allow different groups of player to play them and ask them to evaluate how they liked the game. One would expect the version with the applied principle would perform better, the interesting part would be to investigate just how much better. Creating additional versions of the same game with other principles applied would allow one to compare the principles in effect and rank them according to importance for a game designer. In that experiment the main issue would be to create a game in which the basic gameplay is kept intact no matter which principles are applied. The core mechanics of the game should be well defined and kept through all versions of the game. It could be argued that even the slightest change to the game would result in a different game making it impossible to compare it with other versions. Some design principles, however, would only affect the aesthetics of the game and some would cause an overlap in the areas they apply. The lenses of *juiciness* and *essential experience* would be two lenses which can be applied to a game without changing any gameplay, but there could be some overlap in what they affect. Another issue would be how to evaluate the experiences. If questionnaires with Likert scales were used, ratings would be easy to compare, but they would lack some in-depth information as to the reasons for the ratings, which of course could be accounted for by asking player to explain their answers, but test persons have a tendency to give brief and unfulfilling answers to such. Another approach would be to observe the players, asking them to think aloud and taking notes of their reactions and facial expressions. Evaluating this would, however, require some degree of interpretation which could lead to bias. This could be compensated for by a follow-up interview with the test person to discuss his reaction. This approach would be somewhat time consuming though. Heart rate variability has been used to examine the effect of violent games contra non-violent games, but not enough research has been conducted in order to use it for a more general evaluation of gaming [26]. When the effects of the principles have been determined for one game, the experiments should be repeated in more games to validate and rule out that the findings are only true for that one game.

3.2.2 Divergent and Convergent Problems in Games

It has been proven that the type of play children are engaged in before solving a problem affects their approach to solving it [13]. It would be interesting to examine if the same is true for players in games. This could be done by creating a game with a set of divergent and convergent challenges. If the main part of the game consists of con-

vergent problems, puzzles and levels which can only be completed a single way, then at some point later in the game, the player is presented a challenge which requires divergent thinking. Evaluating how a divergent problem is solved can be difficult as the nature of the problem is that there is no correct answer. Players in a convergent mindset would be less creative in their solutions and more inclined to follow the same strategy in following challenges. Having one group of player face the convergent problems first and the other the divergent problems first would reveal if there is any significant differences in their answers and solutions. The experiment could be further expanded by ranking both types of problems in terms of difficulty. We know that being in one type of mindset positively affects solving problems of the same type. The players would first face a series of challenges of one type increasing in difficulty. This series is then interrupted by a challenge of the other type. Afterwards, when returning to the first type of challenges again, it should be noted whether the interruption of a problem of the other type has had an effect on the answers, if the player performs worse (or better) on challenges of the difficulty that player previously reached. For game designers this could be used to help to determine how difficult challenges in a game should be depending on which challenges the player has previously faced.

3.2.3 Juiciness in Guiding The Player

Players enjoy juicy feedback from the game and should be more likely to repeat an action if it yields a pleasurable and juicy feedback. This could potentially be used to guide the players in a game in much the same way attention steering is used in level design. Game designers already use principle of juiciness in their games to enhance *the pleasure of being the cause* in but it would be interesting to study how a juicy interface could guide, or misguide a player such that the juiciness of the interface not only affects the experience of the game but also the player's actual performance. Jesse Schell notes that lack of feedback can cause frustration as one does not necessarily know if the action have been registered by the system, but what if the system does provide ample, juicy feedback but only when the player performs incorrect actions. One could assume that such a scenario would cause immediate confusion to the player which would disappear as the player continues playing and associates the feedback with incorrect actions. Another approach to understanding the effects of a juicy interface would be to examine how inconsistent or shifting degrees of feedback would affect the player's performance and experience of the game. If a type of button in a game always opens a door, but the feedback it provides changes; sometimes providing a beep, other times an explosion or no feedback at all, would the player then be able to differentiate between the feedback and the action performed? If so the feedback should cause no

CHAPTER 3. DISCUSSION AND FUTURE WORK

effect on the performance in the game.

Bibliography

- [1] Jesse Schell. *The Art of Game Design - A Book of Lenses*. CRC Press, 2008.
- [2] Rilla Khaled. Muse-based game design. In *Proceedings of the Designing Interactive Systems Conference, DIS '12*, pages 721–730, New York, NY, USA, 2012. ACM.
- [3] Martin Jonasson and Petri Purrho. *Juicy Breakout*. 2012.
- [4] Katie Salen and Eric Zimmerman. *Rules of Play: Game Design Fundamentals*. MIT Press, 2004.
- [5] Jean Piaget. *Play, dreams and imitation*, volume 24. New York: Norton, 1962.
- [6] Kenneth H Rubin, Greta G Fein, Brian Vandenberg, et al. Play. *Handbook of child psychology*, 4:693–774, 1983.
- [7] Minh Le Jess Cliffe. *Counter-Strike*. Valve Corporation, 1999.
- [8] Larry Fenson. The developmental progression of play. *Play Interactions: The contribution of play materials and parental involvement to children development*, pages 53–66, 1986.
- [9] *Space Invaders*. Taito, 1978.
- [10] Fergus P. Hughes. *Children, Play & Development*. Sage, 2010.
- [11] Joachim F Wohlwill. A conceptual analysis of exploratory behavior: The "specific-diversive" distinction revisited. *Advances in intrinsic motivation and aesthetics*, pages 341–364, 1981.
- [12] Miranda Hughes and Corinne Hutt. Heart-rate correlates of childhood activities: play, exploration, problem-solving and day-dreaming. *Biological psychology*, 8(4):253–263, 1979.
- [13] Debra J Pepler and Hildy S Ross. The effects of play on convergent and divergent problem solving. *Child development*, pages 1202–1210, 1981.
- [14] Splapp-Me-Do. *The Impossible Quiz*.
- [15] Ben Kuchera. The incredible disappearing multiplayer: Mp features are disappearing, and no one seems to care. *The PA Report*, 2012.

Bibliography

- [16] Fulvio Tassi and Barry H Schneider. Task-oriented versus other-referenced competition: Differential implications for children's peer relations¹. *Journal of Applied Social Psychology*, 27(17):1557–1580, 1997.
- [17] Michael P. Boyd and Zenong Yin. Cognitive-affective sources of sport enjoyment in adolescent sport participants. *Adolescence*, 31(122):383, 1996.
- [18] Sally Dyer and Giovanni B Moneta. Frequency of parallel, associative, and cooperative play in british children of different socioeconomic status. *Social Behavior and Personality: an international journal*, 34(5):587–592, 2006.
- [19] Kate Cox. League of legends world championship draws over 8 million viewers. *kotaku.com*, 2012.
- [20] Youtube.com. Pewdiepie youtube-channel. <http://www.youtube.com/user/PewDiePie>, 2013.
- [21] Robert Axelrod. Effective choice in the prisoner's dilemma. *Journal of Conflict Resolution*, 24(1):3–25, 1980.
- [22] Lennart Sjoberg, Incvar Bokander, Lars Dencik, and Kerstin Lindbom. A comparison between children and adults in a prisoner's dilemma. *Scandinavian Journal of Psychology*, 10(1):158–166, 1969.
- [23] James T Tedeschi, Douglas Hiester, and James P Gahagan. Matrix values and the behavior of children in the prisoner's dilemma game. *Child Development*, pages 517–527, 1969.
- [24] Taylor H. Cox, Sharon A. Lobel, and Poppy Lauretta McLeod. Effects of ethnic group cultural differences on cooperative and competitive behavior on a group task. *Academy of Management Journal*, 34(4):827 – 847, 1991.
- [25] Jay Feldman. The educational opportunities that lie in self-directed age-mixed play among children and adolescents. 1997.
- [26] Malena Ivarsson, Martin Anderson, Torbjörn Åkerstedt, and Frank Lindblad. Playing a violent television game affects heart rate variability. *Acta Pædiatrica*, 98(1):166–172, 2009.