Inland Norway University of Applied Sciences

Faculty of Education

Caroline Skymoen

Master's thesis

Be my player 2?

Collective problem solving in collaborative games

Digital communication and culture

2023

Contents

Abstract

This thesis investigates the distinctive features of collaborative games by analysing three games in order to understand how they foster collective problem solving through gameplay and narrative. Using textual analysis, this study examines the games' characteristics and their potential impact on player collaboration.

The starting point of this study argues that there is a difference between collaborative and cooperative games, taking a basis in Zagal et al.'s (2006, p. 25) definition of collaborative games. This thesis claims that an addition to the definition is needed in order to better distinguish the terms and adds the requirement of mutual engagement and dependence for a game to be truly collaborative. This claim takes a basis in learning theory and the requirements are proved to be present in the games of analysis.

The findings were that collaborative games feature complementary roles and abilities that make the players interdependent on each other. The games also featured a noticeable lack of distraction from the task of collaboration, by featuring linear level design and narrative, minimising the roles of non-playable characters and having little room for exploration on their own and selfish decisions. The collaborative games that displayed various information on their screens emphasized communication through verbal interaction, whereas the final game aimed to promote team problem solving by incorporating a rich narrative to illustrate the significance and impact of collaboration. These findings highlight the potential of collaborative games as a tool for possibly enhancing collective problem solving and teamwork. They also provide insights into the design principles that could enhance the effectiveness of such games for educational or professional purposes.

Norwegian Abstract (Sammendrag)

Denne masteroppgaven undersøker karakteristiske trekk ved kollaborative samarbeidsspill ved å analysere tre spill, og har som formål å forstå hvordan disse fremmer felles problemløsning gjennom gameplay og historiefortelling. Ved hjelp av tekstlig analyse undersøker denne studien spillenes egenskaper og deres potensielle innvirkning på samarbeid mellom spillerne.

Utgangspunktet for denne studien argumenterer for at det er en forskjell mellom kollaborative og kooperative samarbeidsspill, tatt fra et utgangspunkt i Zagal et al.s (2006, p. 25) definisjon av kollaborative samarbeidsspill. Denne oppgaven hevder at et tillegg til denne definisjonen er nødvendig for bedre å kunne skille mellom de to sjangrene, og legger til behovet for gjensidig engasjement og avhengighet for at et spill kan kalles kollaborativt. Denne påstanden tar utgangspunkt i læringsteori, og dette kravet viser seg å være oppfylt i samtlige av analysespillene.

Funnene viser at kollaborative samarbeidsspill gir spillerne kompletterende roller og ferdigheter som gjør at de er gjensidig avhengige av hverandre. Spillene hadde også en betydelig mangel på distraksjoner fra samarbeidsoppgaven ved å ha et lineært nivådesign og en lineær historie, ved å minimere rollene til ikke-spillbare karakterer og ved å ha et begrenset rom for utforskning på egenhånd og å ta egoistiske avgjørelser. De kollaborative samarbeidsspillene som viste ulik informasjon til hver spiller la vekt på kommunikasjon gjennom verbal interaksjon, mens det siste spillet hadde som mål å fremme lagbasert problemløsning ved å inkorporere en rik historie som illustrerte betydningen og virkningen av samarbeid. Disse funnene fremhever potensialet for kollaborative samarbeidsspill som et verktøy for å forbedre kollektiv problemløsning og lagarbeid. Funnene gir også innsikt i designprinsipper som kan fremheve effekten av slike spill for utdanningsmessige eller profesjonelle formål.

Acknowledgments

First of all, I would like to thank my supervisor, Associate Professor Håvard Vibeto, who has been an invaluable asset to this thesis. As well as providing valuable feedback, he has been a source of knowledge in the field of game studies, has ensured progress, motivated, served as a hobby psychologist and much more, by far exceeding the role as a supervisor, for which I am grateful beyond words.

Secondly, I would like to thank all my player 2's, but most importantly my dear friend Sandra Bae who has had to suffer through repeated plays, and endless requests of "can you log on just for a bit? I just need to check something." She has spent a lot of her time on games not necessarily to her liking, for me to be able to write this thesis, which I appreciate immensely.

My life's player 2, my wonderful husband Asgeir Skymoen, has my gratitude for doing most of the heavy lifting at home, taking care of both house and children while I have been busy with schoolwork. To our beloved daughters, Ragnhild and Astrid, I want to thank for having been so patient with mommy, when I have had to spend weekends and evenings studying and writing.

Finally, I want to thank all my classmates, and most especially to Malin and Kjersti, for being my study partners at school, who has shared my frustrations and provided me with advice and encouragement.

1. Introduction

I consider myself an experienced gamer, having played video games and since I was a child. Growing up in the 90's, owning consoles was not as common as it is now, and the lucky few who owned one never had to be alone after school. I remember wanting to visit classmates just because I wanted to play their Super Nintendo or PlayStation One. When I first got my first console, the Nintendo 64 in 1997, I got to experience first-hand how social gaming could be. Even the "cool boys" wanted to come home with me and try my games. This was before mainstream internet and that meant that every problem, puzzle or challenge we faced in video games had to be solved without help from the rest of the world. True, we had internet in the 90's, but with the dial up modem hogging the telephone line, and the computer being expensive and "not a toy for children" it was rare that we were allowed to access it. Today, you can just type in the name of the game and "walkthrough" in Google, and the solution takes seconds to find. Back then, we could discuss and try possible solutions for problems for days before finding the correct one, unless someone had an older sibling or cousin who had finished the game and could come to our rescue. However frustrating at the time, the joy was even greater when we were finally able to make progress in the game. These sessions of collective problem solving made us grow closer as friends, to the degree that one of these gaming friends from elementary school is still my go-to co-op buddy today, even though we live in different parts of the country and rarely see each other in real life.

The interest in this research topic started to manifest after a discussion with a friend about different social issues and ways to overcome them. I immediately thought of games as a tool to address these issues and started looking into research about these subjects. Recently, there has been a rise of popularity in traditional cooperative games. (Totilo, 2021) and I found that a lot of research had been done and found several studies of positive effects cooperation in video games can have on various groups of people, but I found the research papers lacking in detail about the games themselves. Today, there are many video games that focuses on solving problems with a partner, and these are the games I want to examine closer. I want to see how these games, games that are made solely for collaboration between two people, are designed to ensure collective problem solving.

1.1 Research question

A study of how collaborative games are made to encourage collective problem solving can lead to improved research on what elements of the games work best for certain social effects, educative purposes etc., which can lead to more specialized and optimized games for those purposes, which in turn can lead to even better effects and so on.

This thesis' purpose is therefore to create an awareness and understanding of what kind of challenges players face while playing these games, and how they need to overcome these challenges together with a partner by solving problems as a team. I want to see what kind of puzzles and problems players encounter during gameplay and how and why they need to be two in order to solve them. Since these games are played together with someone, I also want to look at communication. I want to map out where and when communication is needed for players to progress in the game, as well as seeing what kind of information needs to be communicated and how.

By having a focus on both the challenges encountered, and how they are meant to be overcome collectively, as well as the communication needed for this purpose, I am most interested in studying the gameplay of these games, to see and experience first-hand how these challenges are presented, and how to overcome them together with a partner.

Also, as I will explain further in the following chapter, both game content and the fact that the games are played collaboratively plays a role in what kind of effects they can provide to a player. For example, Dolgov et al. (2014) suggests that cooperation have more impact on social outcomes than the content of the game. However, they do not distinguish between cooperative games and collaborative games, which makes it difficult to know what kind of teamwork is necessary to create this effect. As I will explain shortly, many people researching the effects of these games does not necessarily consider the differences of these types of games, and this makes the results of these studies less clear than if they had been aware of the differences. By focusing this thesis on collaborative video games, I hope to help spread awareness of the distinction between terms, which in turn can lead to more precise research e.g., by seeing if the social effects differ if the game played is a cooperative video game or a collaborative one.

In addition to this, by having a background in literature, I have a special interest in storytelling and narrative in video games. As with many other genres of video games, there

are varied degrees of storytelling in collaborative videogames, with some having next to no story and some having the story making up a big part of the game content. I have chosen to analyse games that do feature some degree of storytelling in order to find out if the story can contribute to encouraging collective problem solving by making the players wanting to figure out what happens next in the story, or piece together two halves of the story. However, I will be mentioning similar games without much of a story throughout this thesis, to compare them with my chosen games to see if the story really matters or not.

I also want to look at different forms of narrative in these games, and if - and how these helps make up a story, and for that I will take a basis in Salen and Zimmerman's (2004) terms of *embedded* and *emergent narrative*, which I will explain further in chapter 3. By analysing these different forms of narrative, and seeing them together as a whole, it is possible to find out to what degree these games feature a narrative, and what significance they have on the process of solving problems collectively.

Combining these elements of interest, I have therefore formulated my research question as follows: **How does gameplay and narrative encourage collective problem solving in collaborative games?**

The overall goal with this question is to serve a dual purpose. The first one is being an independent study of these types of games because of their beforementioned increasing popularity and as such they say something about the society we live in and human nature, which is important on its own. The other is for this study to be seen as a pre-study in regard to what social effects these games can result in if we get a better understanding of them and gain knowledge of how and when to use them.

Therefore, I aim to examine how collaborative games incorporate collective challenges that require teamwork and communication among players, the role of narrative within these games, and the significance of the collaborative gaming genre. Through this analysis, I hope to gain a better understanding of these games and how they can be utilized.

In order to do this, I first need to explain what I mean by collective problem solving, and the significance of problem solving in video games. A simple way of explaining problem solving is that "problem solving is that thinking which results in the solution of problems."(Taylor, 2013, p. 48) In *The Art of Game Design,* Jesse Schell explains the process of solving a problem, which can be simplified into understanding the problem, identifying potential

solutions, working towards reaching the goal, and either defeating the problem or be defeated by it. (Schell, 2008, p. 36). This process done together with someone as a team is what I mean by collective problem solving.

In *Understanding Video Games* (Egenfeldt-Nielsen et al., 2016, pp. 257–258) the authors explain that as a cognitive area, problem solving in relation to video games has received the most research attention over the last three decades. These studies have not indicated that real problem solving is improved by playing computer games, but there are no sources provided on this statement, so it is unknown to what degree this applies to collaborative games. However, it is important to note that this thesis isn't about measuring problem solving abilities in themselves, but rather how the games encourage solve problems collectively with a focus on the *collective* part. In many ways the question could be how these games encourage collaboration, but by focusing on problem solving it narrows the question down to the actual gameplay. There is no doubt that problem solving constitutes an important part of video games and games in general, with game designer Jesse Schell even claiming that a game is in itself a «problem-solving activity which is approached with a playful attitude» (Schell, 2008, p. 37). What I define as a game diverges from this, and is further explained in chapter 3.1, but the definition by Schell stands to prove that problem solving plays a crucial part in many video games, and as such is a topic worthy of study.

1.2 Why study collaborative video games?

Why should we study cooperative and collaborative video games in particular? What makes them so different from single player or competitive video games? Who can benefit from knowing more about collaborative video games?

First of all, I need to address an issue with terminology in this chapter. In my analysis I differ between the term cooperative and collaborative video games, as explained further in chapter 3.1.2. However, this distinction between terms is not made by everyone. In the article Game Design Patterns for Collaborative Player Interactions" (Reuter et al., 2014, p. 14)the authors notes: "Although there is a difference between collaborative and cooperative games […],the term "cooperative" is used almost exclusively to describe games in which players work together.", and thus much of the research presented in this chapter uses the terms cooperative and collaborative synonymously, which can lead to confusion. For example the articles "Effects of cooperative gaming and avatar customization on subsequent spontaneous helping behavior" (Dolgov et al., 2014) and "There's no "I" in team: Effects of cooperative video games on cooperative behavior" (Greitemeyer & Cox, 2013) are both studies of collaborative gameplay, not cooperative, if we make the distinction. Therefore, readers need to be aware that the results presented in this chapter goes under the wider term of cooperative, meaning games you play together with somebody else to achieve a desirable outcome for everyone involved, and does not necessarily include just collaborative games, where you share the same outcome and win or lose together as a team. Because of this, I will in this chapter only, be using the term *cooperative games* as an umbrella term that includes both cooperative and collaborative games, to avoid misunderstandings of making it appear as the results of these studies are of collaborative games only.

So, to whom are studies of cooperative games important? To have knowledge about cooperative games is useful for a wide range of professions, like game designers, game researchers, educators, and people researching psychological behaviour in humans, for example psychologists who has an interest in social issues. This is because the effects of cooperative video games come with a range of elements that is worth studying, but in order to keep it short I have narrowed them down to three major categories: popularity, educational purposes, and social effects.

1.2.1 Popularity

If we look at *multiplayer* games, meaning all types of games where you play with or against somebody else, a study from 2014 found that 68% of Germans played multiplayer games. (Quandt et al., 2014). This study targeted Germans of all ages. If we look at teens, an American study of 2008 showed that 76% of American teens (aged 12-17) occasionally played games with somebody else, either by playing in the same room together, or via the internet. (Lenhart et al., 2008). And since these studies, it seems that multiplayer games have become increasingly popular. A survey made by Unity Technologies in 2022 stated that 77% of gamers of all ages and of different nationalities, play multiplayer games (Unity Technologies, 2022). Since such a large percentage of people play multiplayer games, it is important to learn about them and what effects they have on their players. However, the term multiplayer covers every game that involves more than one player. In traditional game theory a distinction is made between multiplayer games that are played competitively, and multiplayer games that are played cooperatively (Zagal et al., 2006, p. 25). The market research company Quantic Foundry, who researches gamers motivations, found in a survey consisting of 1200 video game players that playing cooperative video games with friends scored higher in appeal than playing competitive games. (Embaugh, 2016). So, by looking at the popularity of multiplayer games, and combining this with the knowledge that cooperative games scores higher in appeal than competitive, there is reason to believe that the amount of people playing cooperative games is high.

These numbers show that there is a big market for cooperative games, and as such, game designers should be interested in knowing what is so appealing in these games, and how they should design games in order to sell their games. For game researchers it is important to have knowledge of these types of games for the same reason game research in general is important. Since so many people play multiplayer games, these games say something about the society we live in, be it our social lives, creative practises, or our everyday life in general, and in the words of Frans Mäyrä: “Study of games and our near-universal fascination with them can also teach about the human nature and about our attraction to interactivity.” (2008, p. 6).

For educators, the number of teens playing indicate that many of their students are familiar with, and takes an interest in, these types of games, and therefore it should be useful to know about these games with regards to gamification of education and integration of video games in schools.

1.2.2 Educational purposes

According to a survey conducted by the Norwegian Media Authority in 2020, 86% of children between 9 and 18 play video games. (Medietilsynet, 2020). This is an increase since the last survey in 2018 and educators have started taking advantage of this increased interest and incorporated the use of video games in their educational practices. The Norwegian Directorate of Education (Skaug et al., 2017) and Statped, the Norwegian organization that oversees special education services (Statped., n.d.) conveys information on why one should use video games in education, how to use them, as well as listing some possible games that can be used for educational purposes. However, compared to the number of video game titles available today, the lists of examples of games that can be used for educational purposes are very short. In order to develop new games targeting education we need to find out what types of challenges in video games lead to better learning of the skill in question.

In "Framework for Basic Skills", The Norwegian Directorate for Education and Training lists five skills as basic to learning in school, work and social life. These are oral skills, reading, writing, numeracy and digital skills (Norwegian Directorate for Education and Training, 2012). Utilizing collaborative video games as an educational tool can simultaneously incorporate multiple skills, if not all of them. However, for the purpose of this explanation, I will focus on oral skills and digital skills as they are the most prominent ones in collaborative games.

If we first look at oral skills, many of the challenges players need to overcome requires communicating information to each other orally. Two of the three main video games in this thesis conveys different information on the screen, depending on if the player is player one or player two. To solve challenges, player one need to communicate what he sees to help player two progress, and the other way around. This requires all four sub-categories listed under oral skills in the "Framework for Basic Skills" (Norwegian Directorate for Education and Training, 2012, p. 6): Players need to *understand and reflect* on the information being conveyed to them from the other player, and use the information to *assess* the situation and find a solution to the problem. The players also need to *produce* their own oral expressions so they can be understood by their partner and *communicate* different ideas on possible solutions in order to overcome the problem together.

Second, we have digital skills. That playing a digital game requires some level of digital skill is a given, and also within this category it is possible to apply all sub-categories listed

(Norwegian Directorate for Education and Training, 2012, p. 12): First of all, the players need to be able to *search and process* in order to navigate in the game. They need to understand, and navigate in the game world, and interpret the digital information they encounter. They also need to *produce* by using different tools in the game and applying them in different situations. Maybe they need to use different digital elements and put them together in order to make a new product to solve a challenge. Also, they need to *communicate* using digital tools. Verbal communication can for example be done by using programs like *Discord* to speak to each other. Other types of communication can be to send each other signs, signals and messages in-game. The players may also need to show *digital judgement* by using tools in the right way, being aware of the game's rules and understanding how breaking the rules might impact the game, e.g. by cheating. Digital skills are thus needed throughout the whole process of playing a game. From the ability to turn on the computer and navigating to the game in question, to exploring the game, understanding the game mechanics and so on.

Also, in addition to these basic skills, the ability to collaborate with others is a skill that is needed throughout a person's lifetime, in every culture and in every age. One is not born with skills to collaborate with others, it needs to be taught. (Johnson et al., 2006, p. 99). Johnson et al. proceeds to list five steps to teaching collaboration skills (Johnson et al., 2006, pp. 108–109):

1. Help the students to see the need for the skill.
2. Ensure that the student understands the skill
3. Arrange practice sessions
4. Ensure that the students consider and re-evaluate their use of the skill
5. Make sure the students are persistent in training the skill

These five steps are covered by playing collaborative games. The game won't let the players progress unless step one, two and four is fulfilled, and there are opportunities to practice throughout the whole game, covering step three and five. This does not mean that collaborative games can be used as the only mean to teaching collaborative skills, but they might be worth considering as a supplement to teaching these skills.

To function in a society, you need to learn how to cooperate and solve problems together. In most professions you must be able to communicate with others. This can be challenging for some people. There are people who might suffer from social anxiety, autism, or experience other social difficulties. It might just be as simple as not having learned how to express themselves in order to be understood by others. To help these people learn how to socialize

better, collaborative games might be a solution, seeing how many young people already is familiar to video games. For example, a study on at-risk students showed that co-op video games increased social inclusion through allowing them to participate in overcoming challenges. (Hanghøj et al., 2018). This shows that playing cooperative video games doesn't only help to improve basic skills for learning, but also skills to function socially in a society.

This brings us over to the next reason why cooperative games should be studied, the fact that there is much evidence that playing cooperative video games has many positive social effects.

1.2.3 Social effects

The studies of social effects of cooperation in video games are numerous, and I cannot go through them all in this chapter, so I will just mention a few as examples on what kind of positive social effects cooperative gaming can have.

First of all, in the research article "There's no 'I' in team: Effects of cooperative video games on cooperative behaviour" (2013), Greitemeyer and Cox found that cooperatively playing a video game can increase cooperative behaviour, writing that "Mediation analyses revealed that cooperative team play promoted feelings of cohesion, which activated trust (i.e., the expectation of reciprocal cooperation), which in turn increased cooperative behavior." (2013, p. 224). In the same article they argue that the effects of cooperatively playing a game might not only increase cooperative behaviour, but also reduce aggressive behaviour and decrease in-game killing of game characters, which in turn shows reduced aggression towards individuals who did not take part in the gameplay as well as their partner. (2013, p. 227). Preceding Greitemeyer and Cox, Mike Schmierbach found similar results with "partial support for the idea that cooperative play modes prompt less aggressive cognition" (Schmierbach, 2010, p. 256). He also suggests that this effect is explained by social learning.

In the research report "Effects of cooperative gaming and avatar customization on subsequent spontaneous helping behavior" (2014), Dolgov et al. found that playing a game cooperatively increases prosocial behaviour. They found that spontaneous helping behaviour was increased after playing a game cooperatively, and even suggests "that in-game cooperation and competition have more bearing on social outcomes than game content." (Dolgov et al., 2014, p. 49). This shows that studying the cooperation-part of these games are significant.

There are several more studies of positive social effects of playing video games cooperatively. For example, it has been found that these types of games increases empathy (Emmerich & Masuch, 2013; Greitemeyer, 2013), and creates a more positive attitude towards outgroup members. (Stiff & Bowen, 2016; Velez et al., 2014). As these studies shows, the positive social effects of playing cooperative video games are many. Because of this, it is important to know more about the games themselves in order to understand what triggers these positive effects. With so many studies of the effects of these games, it is surprising to see that there are so few studies of the games themselves. In order to develop and expand upon the positive social effects, we need to know what causes them and how.

2. Methodology

Since game studies is such a multidisciplinary field, with many different subjects of study, there are many different methods used as well. (Mäyrä, 2008, p. 152). To put it differently, there is no particular "game studies method", as there is too much variety in the research objects studied. Therefore, the method used heavily depends on what perspective the researchers choose for their analysis, and the method used should be decided by the theme and research question for the thesis (Østbye et al., 2013, p. 6).

According to Egenfeldt-Nielsen, Smith and Tosca (2016), there are five main perspectives of analysing video games, and they have different suggested methods for each of the perspectives listed: The first is the perspective of the game itself, where you look at the game's design choices and structure, and how it is made to "achieve the player experience which the game designer aims for." (2016, p. 11). The second is the perspective on the players, and the study of how players use the game or game communities. The third is the focus on gaming culture, where you look at games as cultural objects, the fourth is ontology, which takes on a more philosophical approach and focuses on more general statements of games, and fifth and last, Egenfeldt-Nielsen, Smith and Tosca lists the perspective of metrics, where quantitative methods are used to examine player behaviour. (2016, p. 12). Since I want to look at gameplay and narrative and how these elements are used to achieve collective problem solving, my type of analysis falls into the category of the first perspective listed, that of the game itself.

The method Egenfeldt-Nielsen, Smith and Tosca lists as a common methodology for an analysis of the games themselves, is textual analysis. This is opposed to for example interviews, surveys, or observation if the focus of analysis was on the players. (2016, p. 11). Similarly, Frans Mäyrä suggests that studies that involves individual games often uses methodology typical for the humanities, and goes on to list textual analysis as a preferred method of the humanities. (Mäyrä, 2008, pp. 156–157). Since my focus is on three particular games, I find this method to be the most relevant for my studies and so I have chosen textual analysis as my preferred method for this thesis.

2.1 Textual analysis

When I write that I will be using *textual analysis* as a method for game analysis, I use the term in a semiotic sense, meaning the interpretation of how "meaning is produced within the context of a sign system" (Mäyrä, 2008, p. 157). When we use the term *text* in this way, it includes all forms of expression that are used to convey meaning, and they can be read, described, and analysed. These forms of expression may for example be text in the literal sense, pictures, video/film, speeches, video games, etc. (Mäyrä, 2008, p. 157; Østbye et al., 2013, p. 64). So, whenever I refer to video games as texts, know that I am using the term in this wider sense.

The purpose of textual analysis is to discover something new about the texts that are being analysed. The way of gaining this knowledge is to deconstruct the text, and then reassembling it again in way that can provide new insights of the text as a whole, but particularly in regard to answering the research question. (Østbye et al., 2013, p. 66). A way of doing this is by applying a hermeneutic mindset during the study process, using the hermeneutic circle as a tool. The hermeneutic circle tells us that in order to understand the text as whole, we need to pay attention to the details of the text. When we discover new details, we get a new understanding of the whole, which again leads to the discovery of new details and so on.

This mindset will make us constantly adjust our perception of the true meaning of the text as we gain a better understanding of it. (Jordheim et al., 2008, p. 226). Calling this process a circle can be a bit misleading, because a circle doesn't lead anywhere. Instead, Frans Mäyrä claims it is more like a spiral: "…as more is learned about the details, a better conception of the whole is acquired, which in turn helps researcher to understand the role of each particular detail better." (Mäyrä, 2008, p. 153). This means that every time you complete a "circle" of obtaining data, analysing and interpretating, and found new details, you will have made progress to your understanding of the text.

In practice, this will mean that even though I have played through my chosen video games from start to finish and have an initial understanding of the games as a whole, I need to revisit the games again and again to look at smaller sections of the games and discover the details of the problems presented in my research question. This will in turn lead to a better understanding of the game as a whole, and discoveries of new details to be analysed. In the end I will obtain a thorough understanding of the game.

Even though textual analysis is listed as a method, the term doesn't only cover one, but a wide range of analytical approaches. The theory, perspective and terminology used in the analysis should therefore be closely connected with the research question (Østbye et al., 2013, pp. 61–62). In my case of studying problem solving in video games, theory about game design is very relevant in regard to analysing problems encountered during gameplay. Since I am studying two-player games, theory about communication is also important, since I want to see how problems are solved collectively and communication between the two players is a necessity for this. Lastly, theory about storytelling and narrative in video games is important since I want to see if the narrative contribute to solving problems collectively.

Since I look at different elements of these games (gameplay and narrative), with a goal of understanding the genre as a whole, the approaches I use for analysing the texts will also differ slightly. I consider an objective, formalist approach, where you look at the text isolated from sender and social context, to be a good starting point to studying gameplay.

The central elements in this approach is the text's inner structure and its relations to its precursors. (Lankoski & Björk, 2015, p. 23; Østbye et al., 2013, p. 76). In "Formal Analysis of Gameplay"(2015), Lankoski and Björk writes that "formal analysis focuses on the different elements of a work, that is, asking questions about the elements that constitute the parts of the work and the role of each element in the composition as a whole" (2015, p. 24). From this quote it is possible to draw parallels to the hermeneutic mindset and to the hermeneutic circle of looking at smaller parts to understand the whole, although the sender and social context cannot be disregarded in hermeneutics.

Although a formal analysis that exclude the interpretation and meaning is a good starting point to an analysis in order to map out different elements of the game, I need to eventually consider a second approach, one that Østbye et al. calls a symptomatic (no: *symptomal*) approach where you look at hidden meanings, or meanings that is not necessarily apparent for the player straight away. (Østbye et al., 2013, p. 76). This hidden meaning can be hidden from the creators of the games as well, as it can be a product of the subconsciousness, and can only be found through interpretation.

A third approach is listed in Gripsrud's (1999) book on media culture and society. By applying a *sympathetic* approach the analyst tries to the best of her ability to interpret the text by focusing on what she assumes is the text creator's intention with the text.(Gripsrud, 1999, p. 147). In the case of video games this would mean interpreting gameplay and narrative from

the analyst believes the game designer's intention is. In my analysis I will be using a combination of these approaches, in order to get a better understanding of the games as a whole.

Also, it is important to remember that texts are characterized by their medium, and as such it is important for the researcher to reflect upon the distinctiveness of the medium. (Østbye et al., 2013, p. 67). Video games differ from for example books and films in that they are interactive, and the outcome depends on choices made by the player (Egenfeldt-Nielsen et al., 2016, p. 8). To study the content of video games, it is therefore important to play the games. According to Espen Aarseth (2012, p. 181) a game researcher needs to experience the game personally to prevent misunderstandings. This is because the players experience of a game cannot be fully understood through merely observing others play. One of the problems is, as Aarseth explains, that nonplayers cannot "distinguish between functional and decorative sign elements in the game." (Aarseth, 2012, p. 181). Therefore, in order to fully understand these games, I need to play the games myself.

2.2 Playing the game

As stated above, analysing a game is different from analysing a film or a book. Although interpreting the latter media also requires analytical skills, video games differ in that they require "analysis practiced as performance, with direct feedback from the system. (Aarseth, 2012, p. 186). This "performance" is not without consequence for the interpretation. According to Bizzocchi and Tanenbaum (2011, pp. 300–301), the skill level of the player and difficulty of the experience contribute to the player's interpretation of details. Someone who struggles with the controls of the game will not see the same details as an experienced player. And at the opposite end, if a player is so experienced, he or she does things automatically, they can overlook details that a less experienced player may have noticed because they take them for granted. To try to counter these effects I will employ different layers of engagement in my analysis.

Aarseth lists seven types of 'strata' or layers in engagement of the player analyst. These being superficial play, light play, partial completion, total completion, repeated play, expert play and innovative play. (Aarseth, 2012, p. 188). Out of these seven I have employed two. The first is total completion. I have played through these games from both player's point of view, to get a feel of the game, and be comfortable with the controls and game mechanics. This means that I had an initial view of the game as a whole before starting the conscious hermeneutic process of interpreting meaning. The second strata employed is repeated play. After completing the game, I have gone back again and again and looked at different parts of the game in detail, after formulating my research question. This helped me discover details I had previously missed. These two types of 'strata' joined together creates a hermeneutic circle of using the whole, or in this case: the total completion, to find new details, and looking at details to get a new understanding of the whole through repeated play.

In hermeneutics, the prior experience of the analyst plays a significant role in the analysis. Every interpretation starts with the interpreter's prior understanding of the subject. This understanding is not fixed, but changes as the interpreter gains more knowledge about the subject. (Jordheim et al., 2008, p. 228). Everyone brings with them prior social and cultural experiences, what hermeneutics call *prejudices,* in meeting with a text to be analysed. However, having prejudices is unavoidable and not something negative, but it is important for the analyst to reflect upon oneself in order to provide increased self-awareness and personal

growth (Gripsrud, 1999, p. 141; Østbye et al., 2013, pp. 66–67). Therefore, I need to reflect upon what I bring to the table in regard to prior game experience and my own prejudices.

As a player of video games in general, I consider myself quite experienced, having played video games most of my life. I have played a wide range of genres, but prefer adventure games or strategy games, and many elements of these genres can also be seen in the two-player collaborative games. I am thus familiar with a lot of elements of these games prior to playing them and will therefore experience the challenges different from someone who rarely plays video games.

However, I was not very familiar with two-player collaborative games as a genre before I started researching them. As a player, I most often play single player games, but has also played a lot of multiplayer games such as World of Warcraft in my past. What has been most new to me as a player is to have to continuously communicate with someone else in order to progress, and to have to rely heavily on the skills of a partner and be dependent of that partner's success in order for myself to succeed.

My experience with video games means that I can, more quickly than a less experienced player, assert what the game wants from me, where I am meant to go, what I must to progress etc. By consciously following what the game wants me to do, I can take on a role of what Aarseth calls an "implied player", which is a term to describe "the role made for the player by the game" (Aarseth, 2007, p. 132) and is a way of understanding how the game's rules and mechanics shape the player's actions and choices within the game world. This term derives from Wolfgang Iser's "implied reader"(Iser, 1974) which is a term used as a way of understanding how the structure and conventions of a literary text shape the reader's interpretation and understanding of the text. Both the implied player and the implied reader are concepts that are based on the idea that the player or reader is an active and engaged participant in the text or game, rather than a passive recipient of information. They both focus on the interactive and dynamic nature of the player or reader's experience and the way in which the text or game shapes that experience.

However, there are also some important differences between the implied player and the implied reader due to the difference in medium. The implied player is specific to the interactivity in video games, while the implied reader is more broadly applicable to all forms of literature and the act of reading. The implied player is concerned with the player's

experience and agency within the game world, while the implied reader is concerned with the reader's interpretation and understanding of the text.

Overall, the concept of Aarseth's implied player is a useful and influential way of thinking about player experience in video games, but it is important to recognize its limitations and to consider other factors that may influence player experience and agency. Aarseth himself explains that while “the idea of an implied player is sufficient to understand the expectations laid down by the game for the player, it is not enough to explain real player behavior” (2007, p. 132) and goes on to use a player doing something that the game did not intend as an example of this behaviour. Kristine Jørgensen (2012, p. 376) criticizes the concept of an implied player because it doesn’t take into account that different players experience the game differently. The researcher taking on a role as an implied player will therefore have limited value since it only takes into account the researcher’s experience. Also, the concept of an implied player does not consider other factors that may influence the player's experience, such as their physical and mental state, their personal background and culture, and the social and cultural context in which the game is played.

To address these limitations of the implied player, I have used Lankoski and Björk’s strategies of maintaining validity and reliability (Lankoski & Björk, 2015, pp. 27–28). First of all, the gameplay will be thoroughly explained, so that others can follow my research, logic and how I have come to the conclusions I have. Secondly, I have tried to explain my background and previous experience in order to reveal any potential biases. I have also spent a lot of time with the games to acquire a better understanding of them and have constantly checked the definitions of my categories and descriptions, and these descriptions will in turn be checked by other, more experienced researchers. By using these strategies, I hope to achieve a reliable, nuanced analysis that ensures validity and applicability for all types of players.

2.3 Video game selection

According to Sigmund Grønmo (2016, pp. 97–98), it is the research question that should decide the study objects of an analysis. That does not mean that the selected objects should be chosen to prove any points or theories the researcher might have about the research question in advance, only that the games chosen should contain elements that the research question wants to know something about.

The purpose of studying a selection of video games is not to research specific qualities of the individual games, but to develop terms and theories that is assumed to apply for the genre as a whole. Another purpose is to develop a general knowledge of a genre that is made up by these types of games. This kind of theoretical generalizations are made up by *strategic selections*. (Grønmo, 2016, p. 102). A strategic selection is made up of the study objects that are most relevant and interesting for the research question, and are chosen on a basis of theoretic insight, empirical knowledge and methodological experience from earlier research (Grønmo, 2016, p. 102). I have chosen my three games after reading several research papers and having played many different games within the genre of collaborative video games, and the choices has been made with a purpose of having a representative selection of the genre.

In a strategic selection, the research objects are often limited to a few examples. This makes the researcher "gain direct information on only a part of the units in the universe, but this information makes up a basis for knowledge that is usually seen to be valid for the whole universe." (Grønmo, 2016, p. 98). For the purpose of this thesis, I have limited my selection of video games to three.

Sigmund Grønmo (2016) goes on to explain that the size and complexity of the study area should decide the size of the selection. The researcher needs to consider how much information should be gathered of each individual study object in order to gain general knowledge of the subject. The researcher needs to find a balance of the amount of information gained of the individual games with how much information it is possible to manage in the study. (2016, pp. 104–105). By limiting the study to three different games, I keep the selection small enough to be able to gain quite a lot of information of the individual games, and at the same time, three is enough to get an insight of the genre as a whole.

Today, there are many games that allows for cooperation across many genres. Since I want to see specifically at how the games encourage collective problem solving, I have chosen to only

look at games that are purely designed for collaboration. That means that these games do not have a single player option, and the games are designed to make the players win or lose as a team. This is because, as stated earlier in this chapter, the effects of playing a game together with someone are so numerous that the genre of collaborative video games deserves further research. Another reason for this limitation is that I want to help create an awareness of the fact that there is a difference between cooperative video games and collaborative video games.

Also, I have only looked at games that requires no more than two players. This means that the two players must interact with each other and be equally active participants in the problem solving. This is because one of the goals of this thesis is to shed light upon collaborative games in order to gain more knowledge about these games which hopefully, in turn, can lead to more specified research on what elements of these games can lead to positive educational and social effects. More players than two can lead to unequal participation where some team members leave most of the problem solving and communication to other team members. while this might be an interesting study for topics like group dynamics etc. this is beside my research topic of the games themselves.

I have chosen three main games of a newer date to analyse, and other than the reasons stated above, the selection is made with a purpose of having a broad selection that is representative for their genre. The games are chosen from a theoretic foundation from studies of patterns in game mechanics in cooperative games and patterns of interaction forms in multiplayer games. This theory will be covered in chapter 3. The chosen games have different game mechanics and interaction forms to represent some of these different patterns, and together the games make a representation of the genre as a whole. For example, the players will sometimes have skills that are complementary to each other, have unique abilities, have different physical challenges, need to have timed coordination etc. In addition to these three games, I will in chapter 4 also use other games within the genre of collaborative games to compare and substantiate any findings from my chosen three games. This is especially important in regard to storytelling in these types of games. I have chosen games that do feature a form of story, and therefore I need to compare these to similar games without much of a story to explore the differences and find if storytelling makes a significance on the collaborative problem solving.

From these criteria I have come up with the following games as my games as analysis:

2.3.1 It Takes Two

It Takes Two (Hazelight, 2021) is an action-adventure platform game which can be played either online or locally with split screen. It is a two-player game and has no single player option. It is a hugely popular game which has topped 7 million sales from its launch on March 26, 2021, to July 2022 and is an award-winning game which has won several prestigious awards. (Kerr, 2022). The game is released on multiple platforms: Microsoft Windows, Playstation 4, Playstation 5, Xbox One and Xbox Series X/S. I played my copy on Xbox One.

I have chosen this game because it is a couch co-op/ split screen co-op genre. In this game you share the same screen, and share all the information you get, so the goal is to overcome the challenges by figuring out of the challenges together as a team, often using each character's unique skills and abilities. The game mechanics changes throughout the game, and often features abilities that complement each other's. In order to gain general knowledge of the genre, a game with split screen that could be played locally needed to be included. Many collaborative games feature these elements, and so I chose *It Takes Two* to represent them, because of its popularity.

Playing a game together with a shared- or split screen requires a different form of communication than when you play the games with two different screens where separate information is conveyed to the specific players. For example, in the shared- or split screen games, the players need to agree on which path to take, in what order they need to do things and who does what. When the players are navigating in the same game space together, they need to process information about what their partner is doing at the same time as focusing on their own character.

Also, this game features a strong narrative, so the game is worth including for storytelling purposes as well. The players play together as a married couple, May and Cody, who are planning on getting a divorce. After they tell their daughter Rose of their plan, the couple suddenly find themselves trapped inside Rose's handmade dolls and has to work together to become themselves again. The story takes up a big part of the content of this game, and therefore it is a relevant game to study for this element of the research question.

2.3.2 Operation Tango

Operation Tango (Clever Plays, 2021) is a collaborative spy adventure game which can only be played online. There is no single player option, and it is not possible to play through couch co-op or split screen. The game has won several Best Multiplayer Game awards, as well as a Best Game Design award. This game is also released on multiple platforms: Steam (PC), Epic Games (PC), Playstation 4, Playstation 5, Xbox One and Xbox Series X/S. I played my copy on PC through Steam.

In this game the two players have different information on their screens and the two players are not supposed to look at each other's screens. Since the players have different information on their screens, they must explain what they see through voice communication to their partner, in order to understand what needs to be done. This is a common element of many collaborative video games and is one of the reasons this game was chosen for further analysis.

In *Operation Tango* the players must choose to play as either Agent or Hacker, with player two choosing the other role. The player's objective is to overcome challenges together to take down the cybercriminal Cypher. Hacker is a character that has the point of view from inside a digital system, being the one who sits on most of the information. Agent is the one who needs to put this information into action in order to complete the mission. She also needs to convey the obstacles she encounters in order for Hacker to find the correct solution to overcome said obstacles.

This means that in *Operation Tango* the players will experience different gameplay if they play as player one or player two. There are many of these types of collaborative games, and often these games feature a player one who has access to information that is hidden from the other player, but only player two has the ability to navigate and "complete missions" with the information gained from player one. *Operation Tango* was chosen because it had these typical elements of different gameplay between player one and player two, but also because it features a story, something that is lacking in some of the other games of this type. Since my research question feature the element of storytelling as well as gameplay, and the research object should be selected with the research question in mind, *Operation Tango* was better suited to being a research object than many other games with similar game mechanics.

2.3.3 The Past Within

The Past Within (Rusty Lake, 2022) is a cross-platform collaborative mystery adventure game, with cross-platform meaning that it is possible for one player to play the game on a different platform than their partner. I played my copy on PC through Steam, but the game is also available on Mac, iOS, Android and Nintendo Switch. This is a newly released game, with it being released in November 2022. As with *Operation Tango* the game conveys different information on the screens if you play as player one or as player two, so the players are not supposed to be able to look at each other's screens.

The reason for choosing this game as part of the selection is for the same reasons the other two games have been chosen. It shares game mechanics with other collaborative games, so studying this game can therefore help represent the genre as a whole. Many of the collaborative games found today feature this game's escape-room style and gameplay, so analysing this game will also represent similar games. In contrast to *Operation Tango* which is fast-paced and sometimes requires action within limited time, *The Past Within* and similar games are more slow-paced with an objective of having the players using their logical skills more and figuring out solution to different puzzles together.

This game feature a story about solving a mystery around a man called Albert Vanderboom. The players control the same character, his daughter Rose Vanderboom, but one of the players play Rose the past, and the other play Rose in the future. Together the players need to communicate between past and future in order to fulfil Albert's legacy. The fact that this game features a storyline, means that all the elements of the research question is present, and therefore is a relevant selection for an analysis.

In this game the players don't need to have an online connection in order to play together. The players only need to have a means of communication. They agree on who is player one and who is player two, and the gameplay will differ with the choices made. This also means that player one will not see the actions of the other player at all during gameplay, but progression on both sides requires information that only the other player has access to.

2.4 Player two

An important feature of the games I've chosen to analyse is that they are two-player games. That means I had to employ a player two in order to play these games. Since I am looking at the games themselves, at gameplay and storytelling, the significance of player two is less than if the thesis had been on how players use the game. However, the significance of player two cannot be completely disregarded. Particularly within the category of communication, the identity of player two can impact the problem solving. For example, playing *It Takes Two* with my husband required less communication because we have an inherent understanding of our roles. In places where we had to choose different pathways I would go left, and he would go right without us uttering a single word to each other. The fact that we take on some roles automatically with people we know means that there is a risk of overlooking some game elements that are designed for collective decision-making. To try to counter these effects, I have a) played the games with different people, strangers among them, b) applied repeated play, and done close readings of different sections of the game to map out the places where cooperation is needed.

Although I have played through the games with different people, the repeated play intended for close reading was done with people close to me. This is because close reading of the games required sometimes stopping game progression to look closer at problems, taking notes, screenshots and spending time analysing parts of the game. Therefore, my player two needed to know and understand my research project, and in these repeated plays player two's main goal was to help me with research for my thesis rather than make continuous progress in the game. My main player twos for this purpose have been my husband; a casual gamer in his early forties, and a close friend through 20 years; an experienced gamer in her mid-thirties.

As I am studying game elements like what kind of problems players face through gameplay, where and why communication is needed, and how storytelling through gameplay impacts collective problem solving, the close relationship player two has with me is not a problem since these elements would be the same no matter who I played the game with. However, if the topic of study was the quality of communication, how fast the players could express a problem or a solution to each other, or what the *effects* of playing together were, another method should be chosen, since the results of these topics of study can rely heavily on the initial relationship of the players.

It should also be noted that these types of games are very linear. These games do not feature optional ways of solving problems or have multiple pathways for progressing, optional side quest etc. That means that the game presents a particular problem, you solve the problem, and you win. That means that I could have played these games with anyone, and the problems encountered would be the same no matter who the player two was. This seems to be the standard of all the games I have played in this genre to date. However, non-linear two-player problem solving games might also exist, or become more common in the future, and then the question of the identity of player two will become increasingly significant, for example if you need to choose which problems to solve, or which pathways to take, or how to solve the problem if there are different options of how to solve it. Then the initial relationship between players is more significant, as is their age and prior game experience. For these types of games, however, the players do not have these choices.

Also, there are two sides to every story. Since two players are required to play these games, the character's abilities, qualities, skills, equipment, information received etc. may differ whether you play player one or player two. To properly analyse these games, I would need to have a thorough understanding of both perspectives and to ensure this, I have played through the games both as player one, and as player two.

3. Theory

This chapter's purpose is to define terminology used and clarify delimitations of the thesis. As I explained in the previous chapter, there are different methods of analysis of video games, deriving from many different fields of study. It is therefore important to thoroughly explain different terminology used and describe theories that has created a basis for how I interpret the games, in order to prevent misunderstandings and to ensure validity and reliability. I will therefore go through terms that are necessary to define in order to understand my research question, both terms used for video games in general, and more specific for collaborative games.

3.1 What is a video game?

In order to fully understand what is meant by the term "video game", an understanding of the term "game" is necessary. I will not discuss the history of the term "game" in regards to analogue games, focusing instead on video game scholars and the two definitions listed in *Understanding Video Games* (Egenfeldt-Nielsen et al., 2016, p. 47) as particularly useful definitions:

The first definition is from *Rules of Play* and states that:" A game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome." (Salen & Zimmerman, 2004, p. 80) This definition emphasizes the idea that a game is a structured activity that involves players interacting with each other or with an artificial system in order to achieve a specific goal or outcome. It also highlights the role of rules in defining the boundaries and parameters of the game, as well as the fact that games often involve a sense of competition or conflict.

Jesper Juul has similar elements in his definition, though omitting the conflict: "A game is a rule-based formal system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels attached to the outcome, and the consequences of the activity are optional and negotiable." (Juul, 2010, p. 255)

Although Egenfeldt-Nielsen et al. criticises Juuls definition because it does not account for the fact that some games may not have quantifiable outcomes or may not involve the player trying to exert much effort (Egenfeldt-Nielsen et al., 2016, p. 47) this definition is widely

recognized in the game studies community, so Juul's definition will represent my understanding of the term.

Having defined what a "game" is, it is possible to then define a "video game". Although I could also use the term "computer game", which I consider to be a synonym to "video game", the term "video game" is "more accurate in regard to what kinds of games are meant when the term is used in common parlance" (Perron & Wolf, 2003, s. 21), so I will be using the term video game mostly out of common practice.

As for what constitutes a video game, I will turn to Håvard Vibeto's dissertation (2022), where he explains that while video games are games that are maintained by algorithms in a digital system that is realised through the audio-visual surface on a screen, they also feature the important characteristics of *interactivity* and *gameplay*. (Vibeto, 2022, p. 29)

My understanding of a video game can therefore be summed up as a game that requires computer processing power and are maintained by algorithms in a digital system, which is realised through a visual surface such as a screen, and features characteristics such as interactivity and gameplay.

3.2 Collaborative games

Having defined what a video game is, it is now possible to define the genre of my games of study. A crucial term I use in my research question is *collaborative games*, and therefore it is important to explain what I mean by this in order to prevent any misunderstandings.

I will be defining this term with a basis in the definition described by Zagal, Rick and Hsi (2006) as a third category you can divide multiplayer games into, the other two being "competitive" and "cooperative".

In competitive games you play against each other, and one has to lose in order for the other to win, or as Zagal, Rick and Hsi puts it: "The goals of the players are diametrically opposed" (2006, p. 25) and lists Chess and Checkers as examples of these types of games. In cooperative games, however, the goal is to work together to achieve a desirable outcome for all cooperating players. This can be said for collaborative games too, but there is an important difference. In a collaborative game, all players share the same outcome, while this is not necessarily true for cooperative games.

> "In a *collaborative* game, all the participants work together as a team, sharing the payoffs and outcomes; if the team wins or loses, everyone wins or loses. A *team* is an organization in which the kind of information each person has can differ, but the interests and beliefs are the same[…] *Collaboration* differs from *cooperation* among individuals in that cooperative players may have different goals and payoffs where collaborative players have only one goal and share in the rewards or penalties of their decisions." (Zagal et al., 2006, p. 25).

While this definition is good for emphasising the importance of the term *team*, and that you cannot win the game as an individual player in collaborative games, it still presents some problems.

The first issue with this definition is that the distinction between the two types of games is not always clear-cut. Some games may have elements of both cooperation and collaboration. Also, this definition of collaboration opens up for different interpretations of what it means for players to work together towards a common goal. For example, the game Raft (Redbeet Interactive, 2022) is a game where the players start on a small raft in the middle of the ocean and the main goal is to survive by gathering resources and using these to improve their chances of surviving. Here, the players share the same resources and the common goal of surviving. This would put the game into the collaborative category. However, the goal of surviving might not be the only goal, and the other goals and interests might differ between players. One player might want to make the best raft possible, while another player might

want to focus on travel and explore all the islands and their secrets. The element of having a common main goal makes this game a collaborative one, but the opposing other goals, which might be equally important for the players, makes it a cooperative game.

Also, another problem is that the definition does not capture the nuances of how players interact in the different types of games, which is important for studies on earlier mentioned possible social effects on players. An important aspect of what makes a collaborative game different from a cooperative one is the dependency on all the team members, and the necessity for them to interact with each other and be active participants in order to solve problems.

To prove that this is an important part of collaborative games, I turn to theory about collective problem solving and collective learning in general. When looking at distinctions between collaborative and cooperative problem solving in general, there is a wide agreement that the term collaborative includes mutual engagement where the parties are dependent on each other to solve a task together, while cooperations means that the team can delegate different pieces of the task to different team members, to be worked on independently. (Bang & Dalsgaard, 2005, p. 2; Heilesen, 2002, p. 80; Roschelle & Teasley, 1995, p. 70). To further clarify the term collaborative games, this definition of dependence should be applied to them.

Based on this, I have formulated my own interpretation of collaborative games:

A game where you work together as a team to achieve one common goal, while sharing the same interests and beliefs. The team shares the payoffs and outcomes; if the team wins or loses, everyone wins or loses. The team require mutual engagement and the players are mutually dependent on each other.

When this definition is applied, Raft can no longer be seen as a collaborative game, since the players are not dependent on each other. This definition still doesn't account for the fact that some games feature both cooperative and collaborative elements, or that a common goal can be interpreted differently, but it does consider the importance of interdependence and interpersonal interaction between players, which significance I will come back to in my analysis in chapter 4.

3.3 Gameplay

Another term I use in my research question is *gameplay*, so it is important to define what I mean when using this term.

According to game designer Richard Rouse, gameplay is what makes video games as an art form unique. He explains that gameplay is the game's "degree and nature of interactivity" and elaborates by further explaining gameplay as "how players are able to interact with the game-world and how that game-world reacts to the choices players make." (2005, p. xx). This is good definition, but it is quite broad. However, so are many other definitions, and many of them are quite similar to Rouse's, but since they all have small variations, it can be difficult to understand *exactly* what is meant by the term. Nonetheless, with the help of other definitions we can narrow the term down to something more precise.
The term interactivity is also used together with gameplay in the definition by Salen and Zimmerman who defines gameplay as a "formalized interaction that occurs when players follow the rules of a game and experience its system through play"(2004, p. 303). In this definition they have narrowed the definition down to a meeting between the players and the rules.

In the book *Understanding Video games*, Egenfeldt-Nielsen, Smith and Tosca writes that the term gameplay is ambiguous and goes on to explain the term as "the total effect of all active game elements. Refers to the holistic game experience and the ability of the game to command the attention of the player." (Egenfeldt-Nielsen et al., 2016, p. 13), which is another broad definition, but later in the book they refer to gameplay as "how it feels to play a game" and goes on to define the term as "the game dynamics emerging from the interplay between rules and game geography" (2016, p. 127). This latter definition is more precise and provides more clarity as to what gameplay is.

From these definitions I have gained the following understanding of gameplay:
Gameplay refers to the act of playing a video game, including all the actions and interactions that a player performs while playing the game, and refers to the game dynamics emerging from the interplay between rules and game geography. It is what gives a game its unique identity and sets it apart from other forms of entertainment, and can take many forms, depending on the genre and style of the game.

3.4 Game mechanics

Defining "game mechanics" is important when analysing gameplay as it allows for a clear understanding of the specific rules and systems that govern player interaction within a game. By identifying and examining these mechanics, researchers and designers can gain insight into how players engage with the game, as well as identify potential areas for improvement or innovation. By defining game mechanics, it is possible to draw comparisons between different games and understand how these mechanics contribute to the overall player experience. The process of defining game mechanics allows for a more detailed and in-depth examination of gameplay, which can ultimately lead to a better understanding of player engagement and the design of more effective and engaging games.

In *Understanding Video Games,* Egenfeldt-Nielsen, Smith and Tosca defines game mechanics as an “Ambiguous term often referring to events or actions that the game design allows for; for instance, driving, regaining health, or shooting. May be thought of as the “verbs” of a game, i.e. what the player can do” (Egenfeldt-Nielsen et al., 2016, p. 10). These mechanics can include things like the way a player's character moves, the way they interact with the game world and other characters, and the way they progress through the game or include actions such as rolling dice, drawing cards, making moves on a game board, and using game pieces to achieve a specific goal.

Later in the book they have a more technical definition of game mechanics:

> “Mechanics are the rules and basic code of a game. It is not what we see or hear while we play a game. Rather, “mechanics” refers to the vast amount of information that goes into constructing the world of the game—the series of algorithms, for example, that determine the reaction pattern of a computer-controlled character”. (Egenfeldt-Nielsen et al., 2016, p. 51)

In other words, game mechanics are the rules and systems that govern the gameplay of a video game or board game, and they define the actions allowed that impacts how a game is played.

3.4.1 Game mechanics in collaborative games

When analysing gameplay in collaborative games, I need to explore what kind of game mechanics players experience that promotes and facilitate teamwork. To do this I will be using descriptions from the paper “Game Mechanics for Cooperative Games” (Rocha et al., 2008) as a basis. This article by Rocha, Mascarenhas and Prada lists different types of game design patterns and challenges found in cooperative games, but since my analysis is of collaborative games, I will explain these elements in regard to collaborative games instead, and only include elements that are applicable for these games.

Rocha et al. states that one of the most commonly used design patterns is *complementarity*, which implies that players play different character roles to complement each other's activities within the game. For example, in *Operation Tango,* the players take on different roles of a spy team, one being a hacker, and the other an agent, and must work together to solve cases. The roles complement each other, and both is needed in order to win the game.

Synergies between abilities is listed as another important pattern in collaborative games. This design pattern allows one character type to assist or change the abilities of another. At one point in the game *It takes Two,* players get two different weapons. Cody gets a sap gun, while May gets a rocket launcher. If Cody shoots sap on something before May shoots it with her rocket launcher, the effect is greater than if May had shot it without the sap.

A third example of a collaborative game design pattern are *abilities that can only be used on another player*. In the game *Keep Talking and Nobody Explodes* (Steel Crate Games, 2015) one player must defuse a bomb while the other players must give instructions on how to do it. The player defusing the bomb cannot see the instructions and the other players cannot see the bomb, so they must rely on each other to complete the task. This design pattern promotes and facilitates collaboration by creating a situation where players have to rely on each other to complete the task.

Shared goal is a design pattern that forces players to collaborate together through synchronized goals and is a design pattern that is absolutely required in collaborative games. All collaborative games must have a shared goal, where you win or lose the game as a team.

Lastly, the design pattern *special rules* are used to enforce cooperation within teams. For example, designers can encode rules to denote specific effects to actions within the game

when performed on a friendly player. In the spy game *Hacktag* (Piece of Cake studios, 2018) the other player can rescue their teammate if the teammate has been captured by the surveillance system. This design pattern promotes and facilitates collaboration by creating a situation where players must rely on each other to survive and complete the task.

In addition to these game mechanics, Seif el Nasr et al. has expanded upon Rocha et al.'s work in their conference paper "Understanding and evaluating cooperative games" (Seif El-Nasr et al., 2010) and added some more design patterns to the list. I will include the ones that extend to collaborative games as well.

Camera Setting is a design pattern that is important in shared screen collaborative games. There are three design choices for developing a successful camera in a shared screen co-op games - split screen horizontally or vertically, one character in focus, all characters are in focus (the screen doesn't move unless all characters are near each other).

Interacting with the same object is another pattern that provides interactive objects that can be manipulated by characters' abilities. For example, in *A Way Out* (Hazelight, 2018), players work together to solve puzzles by manipulating objects together, such as opening a door that is too heavy for one player alone.

Shared Puzzles are another pattern that falls under this general category for all collaborative design puzzles where both players encounter a shared challenge or obstacle. This pattern is seen in games like *The Past Within* where players work together to solve puzzles and progress through the game.

Vocalization is another pattern that embeds automatic vocal expressions on player characters that alert players of different challenging events. It, thus, encourages players to play close together and support each other. This pattern is seen in for example *It Takes Two* where the characters communicate with each other in different instances.

All of these patterns are designed to promote and facilitate teamwork among players, which is why I will be using them in my analysis. These patterns create situations where players must rely on each other to survive and complete the task presented, but in addition to these design patterns, Rocha et al. (2008, pp. 75–78) also describes different challenges in these games that promotes collective problem solving.

One of the most prevalent types of challenges in collaborative games are pure challenges. These challenges can be grouped into several categories, including physical challenges,

coordination, reflex/reaction, and spatial-awareness challenges, as well as challenges related to logic, inference, lateral-thinking, memory, intelligence, knowledge-based, and pattern-recognition.

Physical challenges in cooperative games involve real-life physical effort. These challenges can take various forms, such as physically demanding activities or tasks that require players to exert themselves to achieve a goal. Coordination, reflex/reaction and spatial-awareness challenges are closely related to one another and often involve coordinating a team of players to complete a task. These challenges require players to work together and react quickly to changing conditions in the game, as well as to coordinate their movements and actions to achieve a common goal.

Other types of pure challenges include logic and inference, lateral-thinking, memory, intelligence, knowledge-based and pattern-recognition. Logic and inference challenges require players to use their critical thinking skills to solve problems, while lateral-thinking challenges require players to think creatively and come up with new solutions to problems. Memory challenges require players to recall information from the game, while intelligence challenges test players' ability to understand and analyse information. Knowledge-based challenges test players' knowledge of a particular subject, and pattern-recognition challenges require players to identify patterns and make connections between different elements of the game.

In addition to pure challenges, collaborative games also present applied challenges. These challenges are often more specific and can include races, in which players must complete a task before a timer expires, exploration challenges, in which players must navigate through obstacles like opening locked doors, traps, and platforms, conflict challenges, in which players must face enemies stronger than one player, and economic challenges, which involve resource management. These challenges require players to use their skills and knowledge from the pure challenges in order to overcome them and achieve the common goal.

It's worth mentioning that some collaborative games also present moral challenges, which require players to make choices that may have ethical implications and can be seen as a subcategory of pattern-recognition challenges. However, these challenges are not particularly suited to promote collaboration between players (Rocha et al., 2008, p. 76), and will therefore not be explored further in this thesis.

3.5 Communication in video games

Communication plays an important part in video games in general, but it is crucial for collaborative games since the players are required to coordinate, strategize, and share information with one another to be able to progress. By communication, I mean the exchange of opinions, perceptions, thoughts, and emotions that occur between people, which is a fundamental requirement for all social life. (Levin & Rolfsen, 2015, p. 115). When I write about communication in regard to collective problem solving in collaborative video games, I mean the interpersonal interaction between players, not how players interact with the system or other types of interaction. In other words, I use the term communication in the sense of how meaning is conveyed from one player to another.

In his introductory book on communication theory and discourse analysis, Jan Svennevig (2020, p. 72) explains that the definition of communication differs whether you look at it from a pragmatic point of view, or a semiotic one. Communication in a pragmatic sense claim that for something to be communication, the person must intend to convey something, in other words – communication is an intentional action. In contrast, in a semiotic sense, intention is not necessary for something to be communication as meaning can be interpreted regardless, for example seeing that a person is nervous during a presentation (Svennevig, 2020, p. 72). Earlier in this paper, I have explained that I use the definition of text in a semiotic sense, and I will also be using communication in a semiotic sense. I will interpret both intentional and unintentional actions as communication, as long as the actions convey meaning to the recipient.

For example, in *Operation Tango*, the hacker can sometimes see the agent through surveillance cameras and is able to interpret meaning from seeing what the agent is doing. If the agent is walking towards a locked door, the hacker comes to the conclusion that he will need to open the door without the agent even knowing that the door in front of her is locked yet. Meaning has therefore been transferred from the agent to the hacker due to the hacker's observation of the agent's action, and I consider this to be an act of communication.

Having defined what communication is, I will explain different types of communication in video games. In *Rules of Play* (2004, pp. 462–464), Salen and Zimmerman differs between *internally* and *externally* derived social interaction. The internally derived interaction emerges from the game's rules, for example the action of marking an X or an O on empty squares in Tic-Tac-Toe. In contrast, externally derived interaction comes from outside the game itself, and Salen and Zimmerman uses pre-existing friendships and rivalries that affect in-game strategic choices as an example of this type of interaction. (Salen & Zimmerman, 2004, p. 463).

However, in regard to collaborative games, the interpersonal communication exists at the intersection of internally and externally derived social interaction, especially in regard to language-based communication such as voice chat. While the rules of the game provide a framework for social interaction within the game, communication in collaborative games is also affected by social roles brought in from outside the game. The mutual dependence of each other in order to progress in these types of games means that the communication is facilitated by the games' rules but is not entirely limited to them.

According to Salen and Zimmerman, since the internally derived social interaction is determined by the rules it means that the rules are "limiting what players can do and say to each other" (Salen & Zimmerman, 2004, p. 463), but the very nature of language-based communication does not have these kind of limitations as it is possible to speak about things outside of the games' rules as well.

Therefore, the communication is also influenced by the personalities and social dynamics of the players involved, and so the interaction types in these games falls somewhere in between these two categories. A more detailed description of types of communication in regard to collaborative games is therefore necessary in order to understand the significance of communication in regard to collective problem solving.

3.5.1 Communication and player interaction in collaborative games

In his dissertation titled “Rich interaction model for game and virtual environment design” (Manninen, 2004), Tony Manninen provides an in-depth analysis of interaction forms that can be utilised in multiplayer computer games and “Collaborative Virtual Environments” (CVEs). He explores both user to user interaction as well as user to environment interactions and he provides a number of different categories of interaction types as shown below:

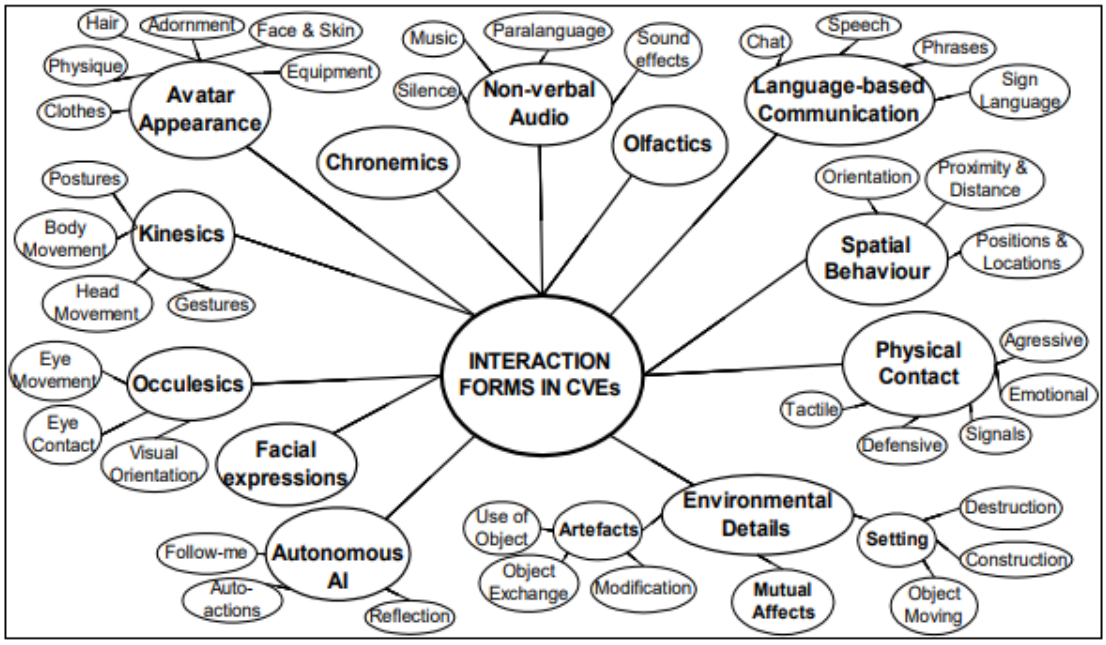

Figure 1: Interaction forms in CVE's (Manninen, 2004, p.111)

From the model, it is possible to see that Manninen has divided interaction forms into twelve main categories. One of these is language-based communication, and the other eleven is non-verbal communication types. Manninen explains that this model is made to be a tool for analysis, not a hardcoding of the categories, and that there might be difficult to distinguish borders of individual concepts. (Manninen, 2004, p. 110) There are a lot of concepts that might overlap, such as the possibility to use speech-to-chat functions.

The model is supposed to give a holistic overview of the structure of interaction forms available in multiplayer games and CVE’s in the time of writing, and their main characteristics. There are two levels present in the model, with the main twelve categories being the first level, and these are again divided into a second sublevel, for example language-based communication which is divided into chat, speech, phrases and sign language. Manninen explains that further sublevels exists, for example maybe chat can be divided into further subcategories, but these levels are omitted for conceptual clarity.(Manninen, 2004, p.

111). However, the levels illustrated in this model is enough for the purpose of giving an overview on what types of interpersonal communications can be found in collaborative games, so the model will suffice for the analysis of my games.

Since this model was made roughly 20 years ago, there are more to be said about interaction forms today, especially in the field of Autonomous AI where a lot has happened the last couple of years. Technologies such as VR (virtual reality), AR (augmented reality) and XR (extended reality) have also made significant progress in recent times. Although it would be an interesting topic of study how these interaction forms have evolved in the last two decades, this falls beyond the scope of this thesis. The interaction forms I study is that of interpersonal communication and not the interaction between players and the system, and I have found that the interaction forms in the games of analysis are forms described in Manninen's model, so I consider the model a sufficient and useful tool to use as a basis for my purposes. However, had the games featured interaction types specific to "newer" technology, the model would have been to be examined closer before utilization.

Given the scope limitation of this thesis, it would be impractical to explore all of these interaction forms in my analysis, Instead, Manninen's model will be used as a framework to provide an overview of interaction forms, where I will, in chapter 4.2, focus on those that are present in collaborative games, and which fosters interpersonal communication.

3.6 Narrative in video games

To understand the different forms of narrative in video games, it is useful to look at Katie Salen and Eric Zimmerman's (2004) classification of embedded and emergent narratives.

Embedded narrative is a term used to describe a narrative that is integrated into a game or other interactive experience. The narrative is pre-determined by the game designers and the player has no direct control over the outcome of the story: “Embedded narrative elements can take a variety of forms and be reached through a variety of means, but regardless of how they are experienced, embedded narrative elements are fixed and predetermined units of narrative content” (Salen & Zimmerman, 2004, p. 383). It is a type of storytelling that occurs within the context of the game and is often used to add depth and meaning to the gameplay experience. Embedded narratives can take many forms, such as cutscenes or in-game dialogue that reveal the story or character motivations. They can also be conveyed through gameplay mechanics or level design, which can create a sense of progression or reveal information about the game world.

Embedded narratives are an important element of many games, as they can help to immerse players in the game world and make the gameplay experience more engaging and meaningful. They can also help to drive the gameplay forward and give players a sense of purpose or motivation for their actions.

The other type of narrative is the emergent narrative. This refers to a type of narrative that arises from the interactions and choices of the player within the game world. Rather than following a predetermined plot, emergent narrative is generated based on the actions and decisions of the player, resulting in a unique story for each player. (Salen & Zimmerman, 2004, p. 383)

An example of emergent narrative can be found in games that have open-world environments, in which the player has a great deal of freedom to explore and interact with the game world. The player's actions and choices within the game can influence the story and shape the outcome of the game. For example, a player's decisions in a role-playing game may affect the relationships they have with non-player characters, or their actions in a strategy game may affect the outcome of a battle.

Emergent narrative can add an element of unpredictability and replayability to a game, as the player's experience will be unique to them. It can also allow for a more immersive and

dynamic gameplay experience, as the player feels like their actions have a direct impact on the story and the world around them.

Having established important definitions, the analysis of collaborative games can now be pursued.

4. Collective problem solving in three games

This chapter focuses on the analysis of three collaborative video games - *It Takes Two*, *Operation Tango*, and *The Past Within*. The primary goal of this analysis is to answer the research question of how gameplay and narrative encourage collective problem solving in collaborative games. To achieve this, the chapter is divided into three parts, with the first two parts focusing on gameplay and the final part exploring narrative. Since I have previously defined gameplay to include all actions and interactions that a player performs while playing the game, and the game dynamics emerging from the interplay between rules and game geography, I have chosen to divide gameplay into the categories of game mechanics and communication. In order to understand the actions of a player, and the interplay with rules and game geography, the rules and possible actions needs to be defined and explored. Also, since the games are meant to be collaborative, the actions and interactions that the player performs includes communicating with the other player.

Chapter 4.1 will therefore provide an in-depth analysis of the game mechanics present in the three games and how they contribute to collective problem solving. The chapter will explore the concepts of complementarity and interdependence, and how encountering game mechanics via gameplay encourages players to work together by looking at the players' different roles and abilities, the different puzzles and challenges encountered in these games, as well as the linearity of these games.

Chapter 4.2 is dedicated to the exploration of communication in these games in the context of gameplay. The communication I focus on has to be bound to the act of playing the game, focusing on the way communication is needed to ensure collective problem solving. Since this thesis focus is on the games, and not the players, this chapter will be on what type of communication is needed to progress in the game, who needs to convey what information in order to progress, and how the game is designed to ensure different types of communication, rather on what explicitly is being said.

Last but not least, chapter 4.3 delves into the role of how the narrative can contribute to encouraging collective problem solving. The chapter examines the embedded and emergent narratives of each game and how they contribute to the players' motivation and engagement in the problem solving.

4.1 Gameplay: Encountering game mechanics

In chapter 3.4, I went over the game mechanics defined by Rocha et al. (2008) and Seif El-Nasr et al. (2010) that could be used in collaborative games to encourage collaboration. In this chapter I will explore what happens when the player encounters these game mechanics through gameplay.

Also, in chapter 3.2, I added to Zagal et al.'s definition of collaborative games (2006, s. 25) with a claim that collaborative games also needed mutual engagement and the players was mutually dependent on each other. To support this claim, I will look at the degree of interdependence in these games, while at the same time seeing how interdependence can contribute to collective problem solving.

In the first subchapter I will therefore focus on complementarity and interdependence, I will look into how game mechanics facilitates the need for collaboration through having to rely on each other because of the difference in unique roles, abilities or access to information.

In addition to this, the second subchapter on linearity will explore how the game mechanics guide players towards a specific outcome or goal, and to what degree linearity is necessary for collective problem solving.

4.1.1 Complementarity and interdependence

Complementarity and *interdependence* are significant terms when it comes to collaborative video games. As I explained in chapter 3.4.1, complementarity is a widely used design pattern in cooperative games where different characters possess roles or abilities that complement each other. (Rocha et al., 2008, p. 74). This chapter will demonstrate that not only roles and abilities, but other elements in collaborative games also exhibit complementarity.

Interdependence, on the other hand, is the degree to which players are influenced by and dependent on another player's actions to reach the games goal. (Emmerich, 2021, p. 21). I previously expanded the definition of collaborative games to include mutual dependence, implying that some level of interdependence is required for a game to be considered collaborative. This expansion of the definition derives from general learning theory, which might not be transferable to video games, so this chapter will also serve the purpose of proving why interdependence is important for collaboration and collective problem solving in video games.

Roles and abilities

In traditional learning theory, there are two recurring issues in regard to team participation in collaborative teamwork. (Johnson et al., 2001, p. 41). Issue one is that a person might be unwilling to participate in a team and would rather do everything themselves (being selfish), and issue two is that there are those who don't understand how they can contribute to a team, maybe because of low self-confidence and thinking that they do not contribute anything valuable to a team. (Johnson et al., 2001, p. 41). Playing a collaborative video game might help address these issues by allocating different roles and abilities as it allows players to specialize in certain tasks and contribute to the team in unique ways. These unique roles and abilities shape the level of interdependence between players (Emmerich, 2021, p. 22) and a high interdependence has been found to foster players' interaction and group forming (Ducheneaut & Moore, 2004).

A common denominator in the games of analysis is that the players must choose one of two unique roles before starting gameplay. One of the first things players have to do is agree upon who takes on which role, and they cannot inhabit the same role. This requirement encourages players to communicate and collaborate from the outset, as they must work together to allocate roles that best fit each player's strengths and weaknesses. Before starting the game *It Takes Two* the players have to choose between the husband Cody, or the wife May. Each time

the game is started, the players return to the last checkpoint they passed, and they have to choose roles again, so switching roles is available at these checkpoints in the game. However, players do not get the choice of choosing again while in gameplay. You have to go out of the game to do so. In *Operation Tango* they have to choose between the role of hacker or agent, and the game is made up by different missions. The players have to play their chosen role throughout the chosen mission, but they have the option of switching roles between missions, so that a player can take on the hacker role in one level, and switch to the agent in the next. In contrast, *The Past Within* presents the players with the choice of either being Rose in the future and the past. In this game the players play the same character, just in different points in time, but they are to be considered as different roles since the information the players are presented with is not the same, and the players have different responsibilities. In this game, players do not have the opportunity to switch roles at any point throughout the game, and a role-change would require restarting the game from the beginning.

The allocation of different roles in these games is of significance because they support different play styles, thereby satisfying several player preferences. (Emmerich, 2021, p. 23). The roles seen in context with their different abilities, which I will come back to soon, creates a high level of interdependence which is necessary to address the issues stated above, and encouraging collective problem solving. However, first I want to address the possibility to switch roles.

There are different advantages and disadvantages to the possibility of changing roles throughout the game. For example, if the players are stuck in *It Takes Two*, they can switch roles and maybe the other player will overcome the challenge the first player could not. This could help game progression and preventing the game to be seen as boring due to continued failure on one of the parts. However, it could also mean that roles could be switched up every time they encountered anything that is experienced as more difficult for one of the roles, making one of the players carry a heavier load than the other, which in turn can leave the other player feeling more inadequate and promote unequal participation. Regarding the two issues stated above, this would be negative for collaboration as one player might feel the urge to “take over” a task, and someone with lower confidence might shy away from the task. Also, players may feel like they are not able to fully immerse themselves in a particular role or task if they are constantly switching back and forth.

On the other hand, the opportunity to switch could also be seen as a tool to understanding the players own strength and weaknesses, as well as their partner's and thus seeing their own contribution of a part of a whole. For example, "you are better than me at shooting, while I'm better than you at driving, let's switch roles for this one" signifies an understanding of oneself and one's strength and weaknesses, while acknowledging their partner's strengths and weaknesses. The ability to switch roles can thus provide players with a greater sense of flexibility, allowing them to better handle different challenges and situations that they may encounter throughout the game. This can in turn lead to a more engaging gaming experience, as players feel more in control and empowered to overcome obstacles. The lack of opportunity to do this in *The Past Within* can make the players frustrated if they know their partner is good at solving a particular puzzle-type, but they are unable to switch. Yet, it might be that forcing the player to complete the task themselves leads to discoveries of unknown talents and overcoming the challenge can increase self-confidence and thereby encourage more problem solving of that kind.

Also, as explained, the games do not let players switch roles at will. By limiting the role-switching to between missions in *Operation Tango*, the player will need to play their part throughout the mission. The necessity to go out of the game to switch roles in *It Takes Two* might discourage the players to switch too often since it disrupts the gameplay, possibly limiting the role switch to situations where the players feel the absolute need to do so.

Proceeding to the matter of interdependence and complementarity, the choice of role in these games are closely linked to a specific set of abilities. In many cases, these abilities are specifically designed to complement and support the abilities of the other role, encouraging players to work together to overcome various challenges and obstacles. Understanding the different abilities and how they interact with one another is important to collective problem solving in collaborative games, since it allows players to effectively allocate tasks and responsibilities based on each other's strengths, and to work together more efficiently towards shared objectives. According to Zagal, Rick and Hsi a collaborative game should strive to give players different roles and abilities in order to "encourage team members to make selfless decisions" (Zagal et al., 2006, s. 31), which addresses the first issue of collaboration stated above, that of people not wanting to participate in collaboration. These different roles and abilities are made in a way that make the player unable to do the tasks by themselves, making them interdependent on each other.

The scope of different abilities of each role differs between the games but that they are complementary and interdependent is mutual for all. In *Operation Tango* the unique abilities of the players are so distinct that it creates two vastly different gameplay experiences. The hacker has the ability to manipulate computer systems, while the agent has the ability to manipulate things out in the field. While the hacker mainly has a stationary role, interacting solely within the computer system, the agent is free to walk, run, jump and interact with physical objects in the physical game world such as picking up items, moving objects and opening doors. The hacker's remote access and control over electronic devices in the game world allows him to do things like hacking into security cameras, unlocking doors and disabling alarms, which in turn is necessary to help the agent in making progress toward the objective out in the field.

Figure 2: Screenshot of Operation Tango. Different abilities between hacker (left) and agent (right). While hacker is able to manipulate things inside the computer system, the agent can move in the physical world.

This means that in *Operation Tango,* the players are separated into distinct player areas, each suited to their different abilities. This can lead to high interdependence since the players must perform actions with abilities only that player has, within an area only they have access to, to make the game proceed for both players. (Emmerich, 2021, p. 26). This makes the players' contribution to the team apparent for both themselves, and their partner. For example, the agent's ability to interact with physical objects in the game world and complete physical challenges, such as navigating through buildings and locating specific people, can complement the hacker's ability to remotely access and control electronic devices in the game world by finding the electronic devices on specific people, and giving the necessary information to the hacker.

Similarly, complementary abilities are seen a lot in *It Takes Two,* and the apparent nature of the way the roles' different abilities complements each other can be seen as a mechanic that is closely connected to the story of the game, which I will come back to in chapter 4.3, which features storytelling and narrative. The abilities are often something that belongs together as a

pair, fitting with the overall theme of the game. For example, Cody has an ability to use a nail gun to shoot nails and create platforms or activate switches, while May has the ability to use a hammer to smash objects or create a spring-like effect. A hammer and nail are two items that are obviously meant to be used together and this can create opportunities for coordination and teamwork, as players need to coordinate their movements and actions in order to progress through the game, for example to reach certain areas or solve puzzles. Cody may need to use his nail gun to create platforms for May to jump on, while May needs to use her hammer to smash objects and clear the way for Cody. These types of complementary abilities are also seen with other abilities, such as May's flaming sword and Cody's ice magic (fire and ice) and Cody and May's different half of a magnet, with opposite colours, having different abilities of pushing or pulling items towards them (repel and attract).

As opposed to *symmetric* game design, where players have the same opportunities and can perform the same actions (Emmerich, 2021), *Operation Tango* and *It Takes Two* feature *asymmetric* game design where the opposite is true. This means that the gameplay induces direct interdependence by featuring complementarity, and letting the players be "one half of a whole". As well as the roles and abilities prevents one player from taking the lead and deciding for the team (Zagal et al., 2006), the interdependence also provides a clear perspective on individual contributions through the distinct abilities. This is particularly valuable for players who may struggle to recognize their own value within a team in other contexts, as the game ensures that progress is only possible through active participation from all team members through their unique roles and abilities. Therefore, the two issues I explained in the beginning of this chapter, is both addressed through the asymmetric game design of these games, ensuring that both members actively contribute to the team and experience their own contribution as both valuable and necessary.

In addition to complementary abilities, *It Takes Two* features *synergy between abilities* (Rocha et al., 2008, p. 74) which allows one character to "assist or change the abilities of another" (Seif El-Nasr et al., 2010, p. 255). Inside a tree, Cody gets a sap gun, while May gets a rocket launcher. Although the weapons work by themselves, they are often not powerful enough to beat the obstacles on their own. Therefore, the player with Cody needs to shoot sap on something before May shoots it with her rocket launcher, which makes the sap explode, dealing a lot more damage than if the weapons had been used by themselves. The combined use of these abilities requires coordination and communication between players, as they must time their actions and work together to achieve their goal. By using each character's unique

abilities, players can create solutions to challenges that they would not have been able to overcome individually, for example by clearing a path through a blocked area with the explosion from the combined sap and rocket or defeating strong enemies (Emmerich, 2021, p. 22).

Figure 3: Screenshot of synergy between abilities in It Takes Two. Cody and May creating an explosion with Cody (right) shooting sap, then May (left) igniting it with her rocket launcher.

All in all, by having players specialize in different roles and abilities, the players can work together more efficiently as a team. Each player can focus on their specific tasks and use their abilities to complement the rest of the team. Additionally, players with different roles and abilities can often cover each other's weaknesses, creating a more well-rounded team. Players need to coordinate their actions and strategies to succeed, which requires effective collaboration. Players with different roles and abilities may have different perspectives on the game and its challenges, which can lead to more diverse and creative problem-solving approaches. Synergy between abilities can create solutions to challenges that would have been impossible to overcome individually, thereby showing the players the greater effect of teamwork. Also, the unique abilities create interdependence between the players, thereby encouraging collaboration by ensuring mutual participation. In summary, having different roles and abilities in cooperative video games can help with collective problem solving by allowing players to specialize in certain tasks, complement each other's strengths and weaknesses, and promote communication and teamwork. Also, by having different roles and

abilities, it is easier for the player to see their own contribution to the teamwork since their abilities are unique, and the other player is unable to do the things the first player is able to do.

Complementary information

Instead of complementary abilities, *The Past Within* offers player roles with abilities that are quite similar, as both players can do mostly the same things and can navigate in the game world the same way using point-and-click. What encourages collective problem solving in this game is not the roles' particular abilities, but rather the access to different information. Björk and Holopainen (2005) calls this feature *asymmetric information,* and it means that players have private information available to them, which is hidden from the other player (Björk & Holopainen, 2005, pp. 135–136). Björk and Holopainen lists several different ways of using asymmetric information, but none of them reflects the type of asymmetric information that exist in collaborative games, where the players have access to information that their partner needs and vice versa.

When Rocha et al. writes about game mechanics in "Game Mechanics for Cooperative Games" (2008) and Seif El-Nasr et al. expands upon this in "Understanding and Evaluating Cooperative Games" (2010), they write about *complementarity* and do so mainly in regard to roles and abilities. By combining the term complementarity with the type of asymmetric information that is featured in collaborative games I get the term *complementary information*.

What I mean with complementary information is that the player has access to information the other player needs in order to proceed, and vice versa. This makes the players interdependent on each other for access to information they need in order to solve a problem. In *The Past Within,* complementary information is combined with shared puzzles (Seif El-Nasr et al., 2010) and interacting with the same object (Seif El-Nasr et al., 2010) to create a high level of interdependence. The similar roles and abilities of *The Past Within* helps encourage the credibility of the idea that the players are playing the same character, and interacting with the same object can promote a sense of shared ownership which can be particularly useful in a game where the players play the same character.

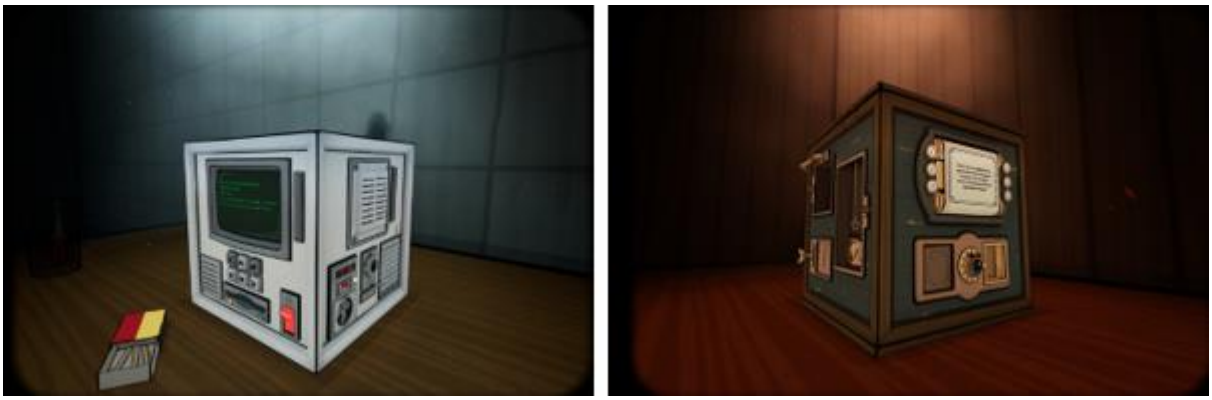

Figure 4: Screenshot of interacting with the same object in The Past Within. This is the same "device" in the past (right) and in the future (left), which requires both players' interaction with it to solve its secrets.

In *The Past Within*, shared puzzles are at the heart of the gameplay, requiring players to work together to solve a series of challenging puzzles. The game centres around a mysterious box called the “device”, which is filled with puzzles that the players must solve together. This device requires both players to interact with it, providing information that have to be passed from one player to the other. The receiving player then has to input the information in his version of the device, in other to solve the puzzles and progress in the game.

In one example, from the beginning of chapter 2, the player in the future receives a note with a code that needs to be communicated to the player in the past, to input in the device in the past. As the code is entered, the device in the past changes and provides instructions for another type of code that needs to be inserted into a panel in the future. When the player in the future inserts the code in the panel, a clock with three different coloured arms is shown. The position of these arms needs to be communicated to the player in the past for him to insert into a lens in the device in the past for a secret compartment to open and so on. This process continues as the players work together to solve all the puzzles that together reveal more about the game's story and objectives. Throughout the game, shared puzzles are used in combination with complementary information to convey information to the players bit by bit and help them progress through the story. This way, the game's use of shared puzzles creates a sense of collaboration and teamwork, as players must rely on each other's skills and access to information in order to progress.

Figure 5: Screenshot from The Past Within. The position of the arms of the clock in the panel in the future (left) needs to be communicated to the past, for the player in the past to configure the lens (right).

In *The Past Within* the abilities are similar, but the information is not. The players are often presented with each half of the story or half the solution to a puzzle and needs to communicate this to their partner in order to get to know the whole picture. However, since their abilities are the same, the other player can help by suggesting solution like “try to click that button on the device”, or “try to go to the room with the mirror, because my part of the solution was in there.” In contrast, in *It Takes Two* the information given to the players are the same, but their abilities are different. Both players get to know the objectives of the level they are in, and what kind of abilities their partner has. That means that if one player is stuck, the other is able to help by looking at the environment and are able to envision ways their partner could use their abilities to overcome obstacles. In *Operation Tango* the game features both complementary abilities and complementary information, which creates a high degree of interdependence. This makes it challenging for the players to know what their partner can and cannot do, as well as what their partner knows or do not know without communicating everything to each other or playing both sides.

These differences in complementarity can mean a lot for the difficulty of the game in regard to solving problems together as a team and is closely linked to communicating needs, which I will come back to in chapter 4.2. Of the three games, *It Takes Two* is regarded as the easiest in terms of understanding what needs to be done in order to progress. This is because both players have the same access to information and can envision what their partner can do. *The Past Within* comes second, since both players has some idea of what the other player can or cannot do in regard to abilities, so the difficulty comes down to the puzzle in itself. *Operation Tango* is the most difficult in terms of understanding what their partner needs, and how they can help the team, since both abilities and information differ.

Timed challenges and urgency

The collaborative gameplay in *Operation Tango* involves a variety of puzzles and challenges that require teamwork and coordination to solve. These challenges include navigating through security systems, hacking into electronic devices, overcoming physical obstacles, and synchronizing movements to progress through the game. A prevalent type of challenge are time-sensitive challenges like disarming bombs or avoiding detection by patrolling guards. These are applied challenges which goes under Rocha et al.'s category of a *race*, where players must complete a task before a timer expires. (Rocha et al., 2008, p. 76). At one point in *Operation Tango*, the players have to prevent a train crash by applying the emergency brakes and has five minutes to do so. This requires fast coordination by the two players, since the agent needs to navigate through the train and explain everything she sees to the hacker to know what buttons to press, learn how to tune different instruments etc., while the hacker has the manual for what needs to be done in different situations but can't see which of these situations applies without feedback from the agent.

These types of challenges that are created to give a sense of urgency are a mechanic used in several collaborative games. As with other genres of games, this timer means that players experience a greater urgency to the problem-solving process, but since collaborative games features a team, it means that timed challenges require the whole team to understand and identify the problem quickly, and to communicate clearly with their partner within the given time frame, which I will come back to in the related topic "timed communication" in chapter 4.2. For example, in the puzzle game *Keep Talking and Nobody Explodes* (Steel Crate Games, 2015) one player has the task of disarming a bomb within a set time, with the other player(s) having the manual of how to do so. In the stealth hacking game *Hacktag* (Piece of Cake studios, 2018), one player is able to turn security cameras or alarms off for a short period of time, creating a short window of opportunity for their partner to reach a previously obstructed area. According to Rocha et al. (2008, p. 76), these types of timed challenges usually causes teams of players to focus and work together more tightly due to the additional pressure created by the time limit. It can also create grounds for exciting emergent narrative for the players to experience together, which I will explore in more depth in chapter 4.3.

Often overlapping with timed challenges are coordination, or reaction, challenges. These types of challenges require precise timing, teamwork, and communication to successfully complete. (Rocha et al., 2008, p. 75). Coordination challenges can take many forms, such as

synchronizing movements, timing button presses, or coordinating attacks. At one point in *Operation Tango* the agent gets to a server access map, which is to be used to help the hacker gain access to a server. This takes form of a minigame where the agent has to create tiles for the hacker to step on in order to progress towards the server. However, the agent only has a given number of tiles to place, before having to demolish the first ones she made. Also, there are enemies called “digital sentinels” that sweeps the floor of tiles when they pass, and these enemies can only be seen by the hacker. This means that the placement of the tiles needs to be placed using synchronized movements, with the agent placing tiles at the same time as the hacker moving on to them and timed so that the enemies don’t destroy the tiles until the hacker has passed them.

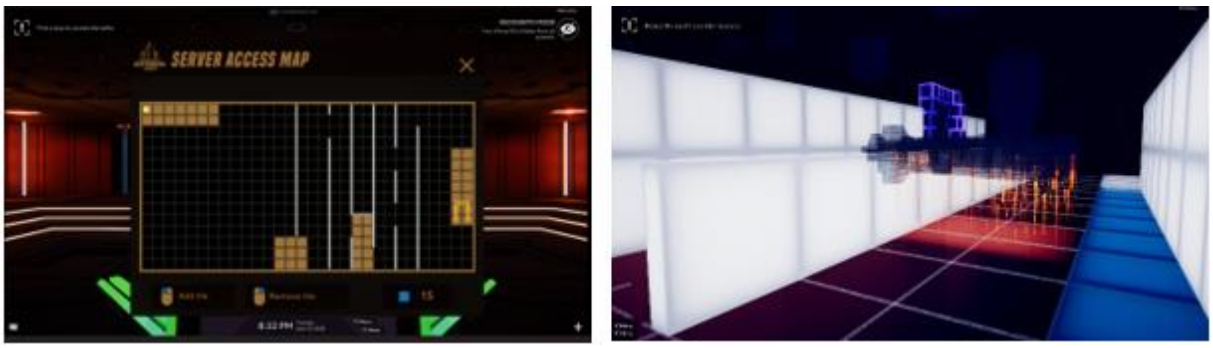

Figure 6: Screenshot of agent's point of view (left) and hacker's point of view (right) in Operation Tango. The agent has to time placement of tiles just right but is unable to see the enemies herself.

These types of challenges can be particularly challenging and encourage collective problem solving as they require players to anticipate their partner's actions, adjust their own movements accordingly, and communicate effectively to avoid mistakes. The timed element in this coordination challenge forces the player playing hacker to trust the agent in her placement of the tiles, since hesitation to move will lead to the sentinels reaching the area before the hacker has reached his destination, destroying his tiles and sending him into the digital void. This can be seen in context with the need for interdependence and the two issues of team participation. If a player hesitates to act because they do not believe in themselves or in their partner, the team will fail this challenge. However, by succeeding in this challenge, the players can see that they are able to depend on each other, building trust for future challenges.

Coordination challenges are often used in combination with shared puzzles in *It Takes Two.* Inside the cuckoo clock level May gets the ability to clone herself, while Cody gets the ability to turn back time for a short while. The objective of the chapter is to get two people-figurines on railroad tracks to reach their destination, but there are obstacles in the way. To make the

figurines move, the players need to clear the path for them, and that requires both players using their individual abilities in order to solve their shared puzzles. At one point, Cody needs to turn back time for a two-story elevator to ascend to the top, while May needs to be on the elevator, then leaving a clone when the elevator reaches on the top. Cody must then let go of his time-rewind, allowing the elevator to decent again with May descending with the elevator, but her clone still remaining at the top. When descended, May can warp to the top again by joining together with her clone, thereby allowing her to reach the top story, and Cody again needs to rewind time, reascending the elevator, allowing May to reach higher than before, and giving her the opportunity to reach a lever to open the door for the figurines to travel through.

Figure 7: Screenshot of elevator puzzle in It Takes Two, where both players need to collaborate in order to proceed.

Through the shared puzzles and timed coordination in these two games, players develop a high sense of interdependence and shared responsibility, encouraging them to think creatively and work together to find solutions to their puzzles.

Similar to the synchronized movements is the timed button challenge, which requires the players to press a button at the same time, and this challenge is commonly used in all three of the games of analysis. Sometimes the timed button presses fit well into the gameplay and story, but many times this type of challenge seems to be designed mainly to ensure that the players are at the same place in the game before allowing them to progress. For example, at the end of the previously mentioned train challenge in *Operation Tango,* the last thing the players have to do is press a button at the same time. In *The Past Within*, the players have to hold a button in for the same amount of time before they are presented with a new set of

challenges, and in *It Takes Two* the players encounter levers that are too heavy for one player to pull down on their own.

Zagal et al. (2006) lists three different pitfalls that designers need to overcome when designing collaborative games, and they are that the game should not allow for one player to make decision for the team, the players need to care about the outcome and should have a satisfying result, and that the experience needs to be different each time, and the challenge needs to evolve. (Zagal et al., 2006, pp. 32–34). For the button press challenges, the games often fall into all three pitfalls. This type of challenge requires a minimal amount of coordination and is not very collaborative since one player can take the lead and decide when to step on the button. The experience is often the same and has the same outcome, which quickly become disengaging, and this makes the teamwork appear forced and unnecessary. In other words, these types of challenges create a superficial collaboration. This is negative for collaboration, because it can possibly encourage negative views people might have on collaboration. A player who would rather do everything themselves, will fail to see the worth of the other team member's contribution, and would be perceive them more as a burden that hinders progression, and a player which struggle to see her own value to a team will feel the same because of the minimal effort required to do the challenge, and it becomes difficult for individuals to recognize the true benefits of teamwork and develop a sense of appreciation for their teammates. The synchronized movements challenge feels much more encouraging towards solving problems collectively, since it is more natural that one player creates a window of opportunity for the other to do something within a time limit, than having to press a button at the same time because the buttons were too far away from each other to be pressed by one player, or that they were too heavy to be pushed by one player. Game designers should therefore be wary of these types of challenges, since they can be perceived as *negative* interdependence, where the teamwork is seen as unnecessary, as opposed to the *positive* interdependence I have written about earlier, which helps the team members see their own and their team members contribution to the team.

Summary of complementarity and interdependence

Considering complementarity and interdependence is important when choosing a game that features collective problem solving, and the end goal of collaboration should be taken into account, as some games may prioritize communication over individual skill, while others may require a balance of both. By examining the types of complementarities and interdependence present in a game, we can better understand how they impact communication, teamwork, and other social factors. Emmerich highlights the importance of complementarity and high interdependence, and sums up that various research has found that both "asymmetry and high interdependence were preferred by participants and led to higher ratings of social presence, connectedness, immersion, and behavioral engagement." (Emmerich, 2021, p. 24).

As I have shown, all games of analysis feature complementarity and interdependence of a high degree, but *Operation Tango* was the one with the highest level of interdependence, due to the fact that this game features both complementary roles and abilities, and complementary information. However, the complementary information used in *The Past Within* creates a high level of interdependence in regard to communication. Similarly, the complementary roles and abilities in *It Takes Two* creates a high interdependence in regard to solving puzzles together, and the fact that the game lets the players navigate the game space together makes it easier to see one's own contribution to the team, as well as their partner. This high level of interdependence makes it easier to see what each player brings to the team, and that one cannot win without actively participating.

Complementary abilities and information can have different effects on social dynamics within a game. In games with complementary abilities, players may rely more heavily on individual skill and coordination. On the other hand, games with complementary information may require more communication and teamwork, fostering a more collaborative environment. The social effects of these subcategories can also depend on the type of game and the goals of the players. For example, in a game where the goal is to complete objectives quickly such as *It Takes Two* or *Operation Tango*, complementarity of abilities may be more effective, while in a game where the goal is to solve complex puzzles, such as *The Past Within*, complementarity of information may be more beneficial.

In general, the different types of complementarities and interdependence found in collaborative video games can promote collective problem solving in a number of ways. Timed challenges, for example, can help players improve their reflexes and joint decision-

making abilities under pressure. Coordination challenges require players to practice effective communication and develop their ability to work collaboratively. Shared puzzles can promote thinking as a team and the use their shared analytical skills to find solutions to complex challenges.

Furthermore, the use of complementary information in collaborative video games can improve use of information sharing among players. When players have access to complementary information, they must work together to piece together the information they need to solve a puzzle or challenge. This can foster a sense of interdependence and shared responsibility among players, encouraging them to communicate more effectively and work together to find solutions.

Overall, the findings signify the importance of complementarity and interdependence to foster a collaborative environment and encourage the players to work together as a team when solving problems.

4.1.2 Linearity

The level design of all three games can be said to be linear, as in that they have a structured progression that must be followed, and few choices with regard to different way of solving puzzles or overcoming challenges. Richard Rouse uses the mathematical example of a straight line from A to B as an example of linearity: “There are no choices to be made; one simply must navigate all of the points between A and B.” (Rouse, 2005, p. 119). This is opposed to more non-linear games where players are free to explore and make choices between multiple paths on how to progress in the game, either by having multiple solutions to puzzles, picking the order in which the players perform challenges or picking which challenges they want to overcome (Rouse, 2005, p. 120).

Of the three games, *It Takes Two* is the game that offers the most freedom for the players, and as such the most non-linear game of the three. The levels allow for some exploration and experimentation, as the game feature game objects that can be interacted with without them being necessary for game progression, such as finding a button that shoots fireworks at top of a tower. It also features mini games that are not directly tied to the main story, and is optional to participate in. These diversions can provide additional opportunities for players to collaborate and experiment with different aspects of the game and enjoy more freedom to choose what to do. Also, at one point in the game, the players have to go through several portals, solving a puzzle in each, in order to progress. Here, the players are free to choose what order they do the portal challenges in, as long as they do them all. As such *It Takes Two* are less linear than *Operation Tango* and *The Past Within* which both feature fixed sequences in obstacles and has less room for exploration and side activities.

However, compared to other types of games, such as open-world games like *The Elder Scrolls V: Skyrim* (Bethesda Game Studios, 2011), or sandbox games like *Minecraft* (Mojang Studios, 2011), *It Takes Two* can be regarded as a linear game since it has a set story progression and a series of levels that players must complete in a fixed order. The levels themselves also have a relatively linear structure, with clear objectives and a defined path to follow. In addition, the game features puzzles and obstacles that are designed to be solved in a specific way, which can limit the player's freedom to experiment.

Although Rouse claims that non-linearity is the interesting aspect of gameplay and that more non-linearity makes the games better (Rouse, 2005, p. 119), this depends on what the end goal of the game is. A game might not be made purely for enjoyment but might serve a purpose of

being educational as well. According to James Gee, there are cultural models one learns from school about learning as something linear with a “right” way of doing something, that the final goal is important and defines the learning, and that “good learners move towards it without being distracted by other things.” (Gee, 2007, pp. 173–174) He goes on to explain that video games are different in that they stress both non-linear movement as well as linear movement. The fact that collaborative games has so little focus on non-linear movement, and there is little room for variety in terms of how to reach the correct solution, therefore signalises that these games have a mission to teach something rather than just be for enjoyment. Since many game researchers and designers has discussed possible benefits of non-linearity and player agency for many years (Calleja, 2011; Domsch, 2013; Rouse, 2005; Salen & Zimmerman, 2004), I would deem it unlikely that games in the collaborative genre all suffers from lazy game design. This means that the restrictions are there for a reason, and the most likely reason is to remove possible distractions from the act of collaboration and collective problem solving.

Linear collaborative games, due to their structured and focused gameplay design, can serve as an effective starting point for players to learn the basics on how to work together as a team. The linear nature of these games encourages close communication and coordination between players, which can help to develop essential teamwork skills such as clear communication, shared decision-making, and coordinated action. As players gain experience and become more comfortable working together, they can gradually progress to more non-linear cooperative games, which offer greater freedom and creativity but also require more advanced teamwork skills. Therefore, it the end goal of the gameplay is to learn how to work together as a team in order to solve problems collectively, it is my recommendation that players start with linear collaborative games to establish a foundation of teamwork before moving on to more complex game designs.

In conclusion, linearity plays an important role in encouraging collective problem solving in collaborative games. By creating levels that require close communication and coordination between players, and providing unique environments, challenges, and obstacles to overcome, game designers can enhance the gameplay experience and thus encourage effective teamwork. However, the linearity of collaborative games can also limit players' freedom and creativity, potentially hindering effective teamwork because the gameplay feels more constricted, and the collaboration more forced. While linearity can be beneficial for establishing a foundation

of teamwork- and communication skills, progressing to more non-linear games may be necessary to fully develop and utilize these skills.

4.2 Gameplay: Communication as player actions

Communication is fundamental for both establishing and developing a team. Without exchanging information, it will not be possible to get a team to solve tasks collectively. (Hjertaker, 1988, p. 68; Levin & Rolfsen, 2015, p. 115). This applies for all social settings where a team is involved, but in a collaborative game, effective communication plays a crucial role as players need to synchronize their actions and strategies.

According to the article "Collaborative games: Lessons learned from board games" (Zagal et al., 2006), the nature of computer facilitated communication allow for altering the mode of communication, which can significantly impact how players collaborate. Additionally, limiting certain forms of communication while promoting others can be a powerful tool in shaping the nature of collaboration in games (Zagal et al., 2006, p. 35) which is why it is important to look at the different types of communication in these types of games.

Therefore, this chapter aims to investigate the significance of communication in collaborative video games specifically from a gameplay perspective. The focus of this study is on communication that is facilitated by the rules of the game and is conveyed through player actions.

In chapter 3.5 I explained Salen and Zimmermans distinction between internally and externally derived social interaction, where internal social interaction is facilitated and limited by the game's rules, and external is pre-existing roles and friendships (Salen & Zimmerman, 2004, pp. 462–464). Since I am analysing the games, and not the players themselves, the communication I explore in this chapter must be internally derived, since the communication is facilitated by the rules. However, the communication is not necessarily *limited* by the rules since the communication used is most often language-based communication, which does not have that type of limitation. So, although the communication must derive from the rules, the communication is not entirely internal, but a mixture of internally and externally derived interaction.

However, since I am focusing on *collective* problem solving, it is the interpersonal communication that arises from player actions I am interested in. I do not include an analysis of communication that is pre-scripted by the game, such as communication in cut-scenes or pre-scripted dialogue that is triggered at certain places. The combination of the fact that these things are pre-scripted, and the linear nature of these games means that these elements fall more into the category of embedded narrative and will be explored further in chapter 4.3.

The goal for this chapter is to investigate where and how the game facilitates for players to communicate with each other through gameplay to solve problems collaboratively. By analysing the various forms of communication that players engage in, this part of the thesis seeks to provide insight into how collaborative video games facilitate and enhance communication between players.

In order to provide a comprehensive analysis of the communication in collaborative video games, I have relied on Tony Manninen's model of interaction forms which I have presented in chapter 3.5, and which offers a valuable framework for identifying and categorizing different types of communication. Through my analysis, I have found that four main types of communication are prominent in collaborative video games. Of these communication types, three of them are non-verbal communication forms. These include spatial behaviour, which refers to the movement and positioning of players in the game world; kinesics, which involves the use of body language and facial expressions to communicate; and environmental details, which include the use of visual and audio cues in the game world to convey information and create atmosphere. (Manninen, 2004). The last communication type found is language-based communication, which involves the use of spoken or written language to convey information and ideas. This form of communication is also the most prevalent one in these games.

4.2.1 The significance of language-based communication

In collaborative games, language-based communication is the primary mode of communication, enabling players to share information and collaborate effectively. Language-based communication is a dominant form of communication in most collaborative video games, with some games, like *It Takes Two*, relying less heavily on it than others. Nonetheless, it remains an important communication form and is present in all of these games.

Tony Manninen's categorization of language-based communication includes "speech", "chat", "sign language", and "phrases". However, in this chapter, I will focus specifically on the role of speech as the primary mode of communication in the collaborative video games I have played. In my experience, the other forms of language-based communication, such as in-game chat, sign language, and pre-defined phrases, have not been facilitated in the games I have played. While in-game chat is a common feature in many multiplayer games, it may not be practical in collaborative games due to the need for constant real-time communication and the potential for time constraints. Furthermore, pre-defined phrases may be unnecessary when players are connected via voice-chat, as they can freely communicate with each other.

Speech, on the other hand, remains the most important form of language-based communication in collaborative video games. Through speech, players can quickly and efficiently share information, observations, and strategies, which is essential for effective collaboration and problem-solving. Speech allows players to exchange information in real-time and to build on each other's ideas. It enables players to discuss different perspectives, brainstorm solutions, and make decisions together. This type of communication facilitates collective problem solving by ensuring that all players have a shared understanding of the problem they are trying to solve and the best way to approach it. Through speech, players can also ask for help or provide support to each other when needed.

In *Operation Tango* and *The Past Within*, players have access to different information on their screens, and they must communicate this information to their partner to progress through the game. This type of collaborative gameplay relies heavily on effective communication, and this might even be the main purpose for these types of games (Emmerich, 2021, p. 25). This notion is further encouraged by the fact that there is so few other methods of communication available in these games.

In these games players are prompted to find a way to communicate with their partner via voice-chat before the game starts. While *Operation Tango* features its own in-game voice chat that can be used, *The Past Within* prompts the user with an on-screen message to find a way to communicate at the very start of the game. This ensures that players can establish a connection with their partner, making it possible to work together to achieve their objectives.

In *The Past Within* voice-chat is the only way of communicating with your partner, when disregarding pre-scripted communication types, such as the player in the future seeing the other person's avatar through a camera lens to the past. The reason for this is that the two gameplay perspectives are not really connected to each other. In *Operation Tango* players need to connect to each other's game worlds by inputting a code, to enable the two characters to inhabit the same game world. There is no such thing in *The Past Within.* The players have to agree who goes to the past and who goes to the future in order to get all the information needed to solve the puzzles, but if they wanted to, they could both go to the past. They wouldn't, however, be able to progress in the game without a partner providing them with information from the future. The fact that the game worlds are not really connected to each other means that the players have no means of experiencing what their partner is doing in-game without voice-chat. There are no visual or audible cues that does not come from the player themselves. In fact, if player two had all the information player one needed on a piece of paper, player two wouldn't need to be in the game, but could have just read the answers out loud. This type of unconnected game worlds can be seen in several collaborative games, such as *Keep Talking and Nobody Explodes* (Steel Crate Games, 2015) and *Tick Tock: A Tale for Two* (Other Tales Interactive, 2019).This means that gameplay is not affected on the other player's in-game action but rather on the information given through voice chat, making this the most important communication form of this game.

The use of speech as the only mode of communication in collaborative video games can have both advantages and disadvantages. One of the advantages is that it allows players to focus on honing their speech skills. When players are limited to communicating solely through speech, they are forced to rely on their verbal communication skills to convey their thoughts and ideas. This can be especially useful for players who struggle with public speaking or who are not accustomed to communicating in a clear and concise manner, since the games makes them practice these specific skills. By training these skills these types of games can improve players' confidence and comfort level with speaking, which in turn can make them better collaborators in other aspects of life. As players become more comfortable with using speech

as their primary mode of communication, they may find that they are more at ease when speaking in other social or professional settings.

However, there are also potential disadvantages to relying solely on speech as a means of communication in video games. For example, players who are not fluent in the language used in the game may struggle to communicate effectively with their partner. Additionally, players who have difficulty expressing themselves verbally may find it scary or challenging to convey their thoughts and ideas to their partner through speech, especially at the start, or with a partner they don't know well, which can hinder effective collaboration.

Speech through voice chat is the most important communication form in *Operation Tango* as well. In contrast to *The Past Within,* players inhabit the same game world in *Operation Tango,* making it possible to sometimes see what your partner is doing through seeing their avatar, for example the hacker seeing the agent through a surveillance camera, or the agent seeing the effects of the hacker's action such as a locked door opening. Therefore, *Operation Tango* feature both language-based communication and non-verbal communication forms. However, the players are most often unable to see what their partner is seeing on their screen, making relying entirely on non-verbal communication near impossible and making voice communication an absolute necessity, which further strengthens the belief that the collaborative games that feature complementary information has communication as a main purpose.

The combination of language-based communication and non-verbal communication is also seen in *It Takes Two.* Because both players share information on their screen, and navigate the game world together, the need for speech is less necessary than in the other games. Other means of communication can be sufficient to convey meaning, which I will elaborate further in the next subchapter, chapter 4.2.2, which is about non-verbal communication. Speech, however, plays an important role in *It Takes Two* as well. This is especially true for time sensitive challenges where a vocal prompt can help coordinate an action. For example, when May uses her hammer head to swing herself from nail to nail, and Cody is in charge of retrieving and placing the limited nails, a prompt of "I am letting go of 3, 2, 1, NOW!" can help with the timing of the placement of the next nail. Although it is possible to overcome the challenge by the player playing Cody observing the actions of May, the task would be more difficult as he would never know exactly when May made her move forward.

Speech is therefore an important element in in all of the games analysed as it enables players to share information and collaborate more efficiently. The degree of importance differs whether it's the only means of communication or not, but in most collaborative games, speech is the most important communication form. In games which provides different information to the players, the ability to speak to each other is an absolute necessity. This, combined with the lack of other language-based communication methods makes these games suited to be a training tool for practising speech skill, which in turn can help with the ability to work in a team which is necessary for collective problem solving.

Alternating communication vs a more natural flow of conversation

Focusing on the speech skill, there are two different types of facilitating speech in collaborative video games. One I have called alternating communication, or turn based communication, and the other is a more open communication type.

The term alternating communication is based on Jan Svennevig's description of turn based conversation, where he explains that one can't talk whenever one wants but have to wait their turn. (Svennevig, 2020, p. 121). Normally it is the participants themselves that decides who can talk when, and this can change from moment to moment (Svennevig, 2020, p. 121). However, within the context of video games, this can be decided by the game rather than the participants.

Alternating communication is closely related to the game mechanics shared puzzles and complementary information where one player doesn't have the means of solving the puzzle on their own but needs their partners information to be able to progress. This means that players must create a common knowledge base needed for coordinating their actions. (Emmerich, 2021, p. 25). Because of the design of these puzzles, where the players need to give and receive information back and forth, players need to alternate between speaking and listening, depending on if they need to convey information to their partner or receive it. This way of communicating is common in collaborative games with complementary information such as *Operation Tango* and *The Past Within*.

For example, in *The Past Within*, the player in the past is at one point given a music key which reveals a small piano. Above this piano is a number. This number needs to be conveyed to the player in the future, and this player needs to recognise the number as a frequency to be inputted into their radio. Tuning into the correct frequency, a number of letters appear in sync with the music. These letters need to be communicated from the player in the future to the

player in the past, in order for the player in the past to recognise the letters as musical notes to be played on the piano. In return, the player in the past gets a new frequency and so on. This type of back-and-forth communication needs to continue until something new is revealed.

Similarly, in *Operation Tango* the players need to collaborate on hacking passwords in order to access cell phones. This happens by the agent trying a random code, then the hacker is able to see how many digits are correct and how many are wrong. The agent therefore needs to explain which number she tries, and the agent needs to answer with how many of the digits were correct. This needs to happen back and forth until a pattern is found, and it is possible to reveal the password.

In essence, alternating communication is a type of communication in which the participants take turns speaking and listening, ensuring that both parties have equal participation in the conversation. This approach can be useful in situations where both parties have valuable input to contribute, such as in games with different access to information, and it can help to prevent one person from dominating the conversation. By alternating between speaking and listening, both parties can develop their active listening skills and speaking skills. When a player is listening, they are learning to focus on what the other person is saying and respond appropriately, and when a player is speaking, they are practicing how to express themselves effectively and clearly. This can help in learning the dynamics of teamwork, which is necessary when solving problems collaboratively.

However, it is important to note that alternating communication is not necessarily a natural way of communicating. In more natural social settings, interrupting or speaking over others may be common, and there are individual differences in how talkative a person is. This structure of alternating communication is rarely met in real life, as conversation is usually more spontaneous and free-flowing, and people rarely have access to exactly one half of the information that is needed. Experiencing the unnaturalness of this type of communication can make the communication feel forced and predictive and might make these types of games boring over time.

Despite these challenges, alternating communication can be a useful tool in promoting equal participation and effective communication between individuals. This type of communication can be particularly useful in the starting process of learning how to communicate as a team since it requires equal effort from everyone involved. By practicing active listening and clear communication, individuals can develop stronger relationships, and learn the dynamics of

teamwork where one has to both contribute and be able to listen to others. This can foster a sense of mutual respect and encourage everyone to contribute equally to the team's success. Over time, practicing alternating communication can lead to stronger relationships between team members, as everyone becomes more comfortable with each other's communication styles and preferences. As soon as this is achieved the team members could benefit from games with a more natural flow of communication, to experience a more realistic dynamic on how communication is done in other settings. A more natural flow of communication can be found in *It Takes Two*, where both players receive the same information simultaneously. They are both aware of the objectives of the game, the challenges they face, and the tools at their disposal. In contrast to alternating communication, a more natural flow of communication allows for a more dynamic and spontaneous conversation to take place. The players can bounce ideas off each other, make split-second decisions, and react quickly to changing situations without having to wait for their turn to speak. This makes the communication feel less forced and more natural than the alternating communication type.

While the natural flow of communication in *It Takes Two* can be more dynamic and engaging, it may also lead to unequal participation between the players. Without the structure of alternating communication, one player may dominate the conversation and decision-making, leaving the other player feeling left out or undervalued. This can be problematic, especially in situations where the goal is to promote equal participation in communication in order to learn teamwork. If one player is consistently making decisions and taking the lead, the other player may not have the opportunity to contribute their ideas or perspectives, which can hinder the development of their communication and teamwork skills.

However, it is also important to consider that learning about each other's personalities and communication styles can be a benefit in collective problem-solving. Some individuals may be more natural leaders, while others may be more comfortable following and executing tasks. By playing a collaborative video game like *It Takes Two*, team members can identify their strengths and weaknesses and work together to leverage everyone's unique skills.

When engaging in alternating communication or having a more natural flow of communication, it is important that both participants are able to understand and respond to each other effectively. The very nature of solving problems collectively means that the participants need to be able to explain what problems they are facing, or possible solutions to them. Clear and concise communication can help ensure that both individuals are on the same page and working towards the same goal.

Learning to express oneself clearly

An essential aspect of effective teamwork is the ability to communicate effectively and make oneself understood by others. To ensure effective communication. the receiver must be able to understand the sender's behaviour. It is not enough to know when it's one's turn to speak or know what to talk about. One also has to consider *how* the information needs to be conveyed so that the other person understands what you are saying. The language used is important because the receiver must be able to attribute the same meaning to the linguistic expressions as the sender.(Levin & Rolfsen, 2015, p. 117) This is particularly important when it comes to problem solving, as team members must be able to describe their observations and experiences in a way that others can understand.

Good communication between two people occurs when the receiver perceives and interprets the message from the sender in the way that the sender intended, without adding or subtracting anything. This requires both clear and unambiguous sending and concentrated attention from the receiver. (Hjertaker, 1988, p. 68). These are some reasons why learning how to express oneself clearly is important, and collaborative video games can be a tool for this purpose. There are several instances in collaborative video games which requires the players to express themselves clearly in order to be understood by their partner.

In *Operation Tango* and *The Past Within*, each player has different information on their screen, which requires them to communicate what they see in order to solve the challenges they encounter. By providing detailed descriptions of what they are seeing and experiencing, players can help their teammates understand what is happening and work together to find solutions. In contrast, games like *It Takes Two* where both players can see the same information simultaneously, does not have the same need of describing things is as the players navigate through the game world together.

To provide effective descriptions, players must consider the perspective of others and use clear and concise language. Verbal communication is often taken for granted, and that often leads to misunderstanding (Levin & Rolfsen, 2015, p. 118). People often address this by supplementing verbal communication with non-verbal communication to emphasise their point(Levin & Rolfsen, 2015, p. 119), but in video games like *Operation Tango* and *The Past Within* the possibilities of non-verbal communication is very limited since the players have different information on their screens, and most often is unable to see the other player's avatar. This means that there is even more focus on verbal communication and the need to

express oneself clearly. Having to explain the need for information can enhance players' problem-solving skills by encouraging them to think more critically and strategically about their needs and the needs of their partners. By practicing effective communication in these games, players can develop the skills needed to describe problems in detail and work together to find solutions. The nature of video games is that they provide direct feedback from the system, so the players immediately understands if their communication was clear enough or not. If they fail to convey the information in a matter that their partner understands, they will both be unable to progress in the game and will need to try again. This will provide them with valuable feedback that they will need to re-evaluate their communication. This can be a valuable skill in real-world situations where effective communication and problem solving are required.

Moreover, by practicing effective communication in collaborative games, players can develop stronger relationships and improve their ability to work together as a team. When players have to explain their needs for information to their partners, it can encourage active listening, which is a form of listening that involves full concentration on the sender's message. (Hjertaker, 1988, p. 75). Active listening allows individuals to gain a better understanding of their partner's perspective, thoughts, and ideas. This can lead to more effective problem solving as both parties have a deeper understanding of the issue at hand. Active listening can also help to prevent misunderstandings and ensure that all parties are on the same page when working towards a solution.

However, there are also some possible disadvantages to the necessity of needing to describe and explain ones needs. Some players may find the need for clear descriptions to be frustrating or challenging, especially if they are not accustomed to communicating in this way. This can lead to tension or conflict between players, which can negatively impact the overall gaming experience and negatively impact the will to solve problems together with others.

Despite these possible limitations, the act of practicing communication skills through gameplay can still be beneficial as collaborative games offer a unique opportunity to learn how to communicate clearly in a fun and engaging way. Also, the problems encountered in these games are concrete and objective, which is a safe start to expressing oneself clearly, before moving on to more difficult topics like emotions and abstract ideas and thoughts (Levin & Rolfsen, 2015, p. 120). By working together and practicing communicating, players can develop their ability to express themselves clearly and concisely, as well as interpret and

understand the communication of their partners. These skills can translate into real-life situations, making collaborative games not only a source of entertainment but also a tool for learning important social and communication skills.

One way to further explore the importance of clear communication in collaborative games is to consider how time pressure can affect communication. In the following pages, I will examine the role of timed communication in collaborative games, and how it can both facilitate and hinder effective collaboration.

Timed communication

With timed communication I mean the type of communication required when players encounter the applied challenge of what can be defined as a race, in that it is a challenge that needs to be completed before a timer runs out. (Rocha et al., 2008, p. 76). The fact that these challenges require players to complete a task or overcome an obstacle within a certain time frame, makes fast and concise communication essential for success.

In many collaborative games, timed challenges are a common feature, and can be seen in games like *Hacktag* (Piece of Cake studios, 2018), *Keep Talking and Nobody Explodes* (Steel Crate Games, 2015), *Codename:Terranova* (ACGames, 2020) and *Operation Tango*. For example, in mission 4 in *Operation Tango*, the hacker is trying to access a server on the dark net, which is visualized as a type of race track the hacker moves along. On the track in front of him, there is a series of obstacles that must be avoided by changing lane before the hacker impacts them. At the same time, he is being chased by so-called “tracers”, which the agent can see on her screen. The agent must therefore communicate the location of the tracer to the hacker, who must then quickly and accurately move accordingly to avoid being detected.

Another example of timed communication in *Operation Tango* is in the previously mentioned train mission, where the hacker and agent must work together to stop a speeding train. In this mission, there is a timer that counts down to when the brakes overheat, and stopping the train will be impossible.

In *It Takes Two*, timed communication is also important for success in certain challenges. For example, in the tree-level, players are sliding down the tree trunk while being attacked by wasps. Here, the players need to coordinate quickly in order to shoot down walls of wasps, which is most effectively done when Cody shoots sap first, then May igniting the sap with her rocket launcher.

These types of timed communication in video games can be a great way to practice and develop effective communication skills. Players must learn to convey information quickly and concisely, listen actively to their teammates, and make split-second decisions to succeed. However, there are some disadvantages too.

Timed communication can create stress and anxiety among players because of the perceived sense of urgency. This can lead to mistakes or poor decision making, which can hinder effective problem solving. When players are under time pressure, they may not have enough time to communicate all of their ideas or to consider all of the perspectives and insights of their partners. This can limit the effectiveness of communication. The players might also feel rushed or pressured to make decisions quickly which can lead to hasty decisions or actions, which in turn can hinder effective problem solving. This means that timed communication may not be suitable for all players, particularly those who require more time to process information or who may feel overwhelmed by time pressure. This can create frustration or discomfort, which can hinder effective communication and collaboration.

On the other hand, when players have a limited amount of time to communicate and make decisions, they may be more focused and efficient in their communication. This can help to ensure that players are using their time effectively and that they are making progress towards solving the problem. Since timed communication can also promote a sense of urgency among players, it can help to keep them motivated and engaged.

When players have a limited amount of time to communicate, they may be forced to prioritize their ideas and strategies more effectively. This can help to ensure that the group is focusing on the most important aspects of the problem and working towards a solution more efficiently. Timed communication can thereby enhance players' problem-solving skills by forcing them to think quickly and make decisions under pressure. This can be a valuable skill in real-world situations where quick decision-making is required.

While spoken communication is the most prevalent communication form in collaborative games, it is not the only form of communication at play. There are also non-verbal communication forms present. In the following subchapter, I will explore the different forms of non-verbal communication found in collaborative games and how they contribute to successful problem solving with a partner.

4.2.2 The (forgotten?) importance of non-verbal communication

Looking at Tony Manninen's model over interaction forms, language-based communication is just one of twelve main interaction forms. The rest is non-verbal communication forms, which in simple terms can be explained as "all messages other than those expressed in oral or written words." (Rayudu, 2009, p. 189). In his book on communication, C.S. Rayudu emphasises the importance of non-verbal communication:

> The importance of non-verbal medium of communication cannot be overemphasised. It is necessary that every listener should get himself acquinted with skills of non-verbal communication to observe and understand effectively. Every speaker when talking to us, uses and gives non-verbal signals.(Rayudu, 2009, p. 191)

Since collaborative games focuses on human-to-human interaction, this applies to communication in collaborative games as well. According to Manninen, interactivity is greatly increased in multiplayer games due to the human participants(Manninen, 2004, p. 24).

Manninen argues that multiple interaction forms should be used in collaborative virtual environments for several reasons. Firstly, having a range of interaction mechanisms available allows participants to choose the mechanisms that are most effective for their purposes. (Manninen, 2004, p. 24) For example, some participants may be more comfortable communicating through non-verbal cues, while others may prefer to use verbal or written communication.

Secondly, the "combination of different communication channels enables the enhancement of messages or the execution of contradicting behaviours".(Manninen, 2004, p. 24). By using multiple forms of communication, participants can convey more nuanced or complex messages, or even convey seemingly contradictory messages that are complementary when taken together.

Finally, Manninen suggests that participants can convey information or knowledge through their actions or behaviour, even if they are not explicitly communicating it through words or other forms of communication (Manninen, 2004, p. 24). In other words, there are many reasons why non-verbal communication forms should be incorporated in video games.

The importance of non-verbal communication in collaborative games is thus well established, yet many collaborative games fail to incorporate these interaction forms into their gameplay. This is particularly surprising given the potential benefits of using non-verbal communication, such as providing important contextual information and enhancing communication between

players. As previously mentioned, many collaborative games such as *The Past Within*, *Keep Talking and Nobody Explodes,* and *Tick Tock: A Tale for Two* only facilitate speech as a communication form. While these games can still be effective in promoting verbal-based interaction and social training, they may not provide a natural or realistic communication experience.

However, there are games that have successfully incorporated other communication forms, such as *The Timeless Child*, a mystery puzzle game similar to *The Past Within*. In this game, the actions of the player in the past affected the world of the player in the future, and players could also "ping" each other with a sound to get their attention to a particular location. These additional communication forms not only enriched the gameplay experience overall but also provided a more natural and realistic communication experience.

It is likely that designers of many collaborative games omit non-verbal communication forms in order to focus on verbal-based interaction in order to prioritize social training and active listening skills. However, incorporating some additional interaction forms could still prioritize social training while at the same time providing a natural communication experience and enhance the overall gameplay. As such, it is important for game designers to consider the potential benefits of non-verbal communication and explore ways to incorporate these interaction forms into collaborative games. Utilising several interaction forms will mean that the players have the means of communicating what they mean clearly, and this ability is a crucial component of successful collaborative problem solving. When players are able to express themselves effectively, they are better equipped to work together and solve problems more effectively.

While some of the communication forms in Manninen's model has natural reasons for being absent, such as olfactics, meaning the user representation's scents and odours (Manninen, 2004, p. 115), which is absent due to technological limitations, and occulesics, meaning the representational movements of the eyes (Manninen, 2004, p. 115), which might be better suited to a VR environment, there are other communication types that are surprising to see omitted because they are so common in other types of games – those of avatar appearance and facial expression.

None of the games I have played in the genre of collaborative games has had an option of customising the avatar. The avatars have been pre-defined, with the only choice being which of the two roles the players want to play. This might not be of crucial importance to collective

problem solving, but customisation could help with encouraging a sense of ownership to the character and allowing for a more immersive experience, which in turn could help with the motivation of solving problems together with a partner. Also, a customisation option could help with expressing a personality to their partner, which could lead to a better understanding of one another and thus lead to better collaboration.

When writing that the games do not feature the communication form facial expressions, I mean that the players do not have the means to manipulate these. The characters do have facial expressions, but they are pre-scripted in the game. The incorporation of the ability of manipulating facial expressions can enhance the communication experience without removing the need for verbal communication. For example, players could use different emoticons or facial expressions to convey their moods or reactions to different situations in the game. This can help to provide additional context and nuance to communication, which can improve understanding and collaboration. In a game like *The Past Within* it would be unnatural to have the option of manipulating facial expressions or sending emoticons, as the perspective is first person, and the only time they see their character is when looking in a mirror, and they are also unable to see their partner. But in games like *Operation Tango* and *It Takes Two* an incorporation of facial expression might be beneficial to enhance the communication experience.

Although many communication forms are missing from collaborative games, there are some that is present as well. Of the games that have been analysed, *It Takes Two* stands out as a game that incorporates the most diverse range of communication forms beyond language-based communication. However, these same forms of communication can also be found in *Operation Tango,* but to a lesser extent. These communication forms include kinesics, spatial behaviour and environmental details. The use of non-verbal communication forms seems closely related to how often players are able to see each other's avatar. In *It Takes Two,* the players see each other's avatar all the time, while in *Operation Tango,* the players only see their partners avatar occasionally. The degree of visibility of other players' avatars can therefore affect the types of non-verbal communication forms that are available for use in collaborative games. Kinesics is one such non-verbal communication form that can be used to enhance communication and collaboration between players.

Kinesics, also known as body language, is a form of non-verbal communication that involves bodily movements, gestures, and postures. (Manninen, 2004, p. 52). This type of communication can provide important context and nuance to language-based communication,

allowing players to better understand each other's intentions, or kinetics can be used to convey meaning in itself, without the help of language-based communication.

In collaborative video games, kinesics can be used in a variety of ways to enhance communication and teamwork. Players may use head nods to indicate agreement or understanding, or postures to convey confidence or uncertainty. Gestures, such as pointing or waving, can be used to draw attention to important objects or areas in the game.

For example, in *Operation Tango* the hacker sometimes has a choice of many different screens to view, each representing a different surveillance camera. These cameras have a limited range of view of the area, and the screens are small and in black and white, so in order to locate the agent, a description of the place might not be enough. Instead, the agent can use different body language to convey where she is. A continuous jumping action from the agent or running back and forth on a small area can create movement on one of the screens, which can be easier to identify than a vocal description. This means that in some situations, using kinetics is a more effective way of communicating than speech.

In addition to draw attention to things, kinesics can also be used as a way of expressing mental state and mood. One instance of this can be found in *It Takes Two,* when players need to collaborate on pushing a button or pulling a lever in order to progress in the game. These actions require players to coordinate their movements and actions, and to be in the same place at the same time. In these situations, players may use kinesics to convey their impatience or frustration with the other player without necessarily saying anything.

For example, often while playing with my husband and exploring my surroundings, I noticed my husband jumping up and down next to the button or lever, expressing his impatience to move on without having to say anything. These non-verbal cues can provide important context and nuance to communication, helping players to understand each other's mental states and emotions. Another form of communication that can be used to provide important context is spatial behaviour.

Spatial behaviour refers to the various ways in which individuals interact with their physical environment. This can include behaviours related to proximity, orientation, territorial behaviour, and locomotion. (Manninen, 2004, p. 52). Proximity, for example, refers to the distance maintained between individuals when communicating or interacting with one another. Orientation, on the other hand, refers to the direction in which individuals face when interacting with others or with objects in their environment. Territorial behaviour refers to how individuals mark and protect their personal space or territory, while locomotion refers to how individuals move within their physical surroundings (Manninen, 2004, p. 61). Proxemics, which is a subcategory of spatial behaviour, specifically relates to actions taken with respect to personal space (Manninen, 2004, p. 109). This can include actions such as standing closer or further away from another person or adjusting one's posture in relation to the other person.

In collaborative video games, spatial behaviour can play an important role in how players solve problems collectively. For example, when encountering the boss “the Wasp Queen” in *It Takes Two,* having a distance between the players can help ensure survival of both players. The queen sometimes swings a hammer of wasps down towards one of the players. By having the players stand far away from each other, the hammer can only hit one of the players at a time, and since both players need to die for it to be game over, this means that if one player should be hit, the other player can stay alive for the other to be able to resurrect, thus ensuring survival of them both. To ensure this, both players need to be observing the movement, orientation and proximity of the other, so they can move farther away from each other if they get too close.

Spatial behaviour can also be found in *Operation Tango.* The hacker can sometimes see the agent’s location through his access to computers, and as such is able to move accordingly. In mission 3, the agent is on a train, and the hacker is able to see the agent’s movements on an electronic map. By seeing the agent’s location and movements the hacker is able to provide relevant information for that area.

By paying attention to their own and their partner's spatial orientation, distance, and movements, players can increase their awareness of each other and coordinate their actions more effectively. This can improve overall communication and teamwork in the game, and is as such a useful form of communication in collaborative games, in that it can be used both to encourage teamwork, and as a tool to solve problems together.

The last communication form to be found in collaborative games is environmental details. “Environmental details define the appearance of surroundings providing contextual cues. E.g., artefacts, manipulating the physical setting.” (Manninen, 2004, p. 52). This communication form can therefore be seen as similar to the game mechanic of interacting with the same object (Seif El-Nasr et al., 2010, p. 255). However, when used as a form of communication, players can manipulate environmental details in order to convey important information to their partner. This could include leaving clues or hints for the partner to find or doing something specific to an object to communicate a message. The ability to manipulate the environment in this way adds another layer to the communication experience in collaborative games, allowing players to solve challenges together in a more immersive and engaging way.

An example of use of environmental details as communication can be found in various locks that needs to be opened together in *Operation Tango.* These locks have several pins in them with different colours, the colour indicating which of the players can move them. By one player moving one of their pins, the other can see which pin was moved, and can move their own pins accordingly. This demonstrates how environmental details can provide contextual cues that guide players towards the correct solution.

Similarly, in *It Takes Two*, players encounter a puzzle in a cuckoo clock that requires them to work together to progress. Initially, Cody needs to turn back time to make a bridge appear for May to cross. After that, May has to step on different buttons to trigger platforms for Cody to use. Through observing the other player's manipulation of environmental details, such as the movement of the bridge and the appearance of platforms, players can understand their role and work together accordingly.

This use of environmental details as a means of communication highlights how collaborative games can incorporate various forms of communication beyond verbal and written communication. It allows players to use the game's environment as a tool to communicate and solve problems together, creating a more immersive and engaging experience through more choices of means of communication. Also, the observation of changing environmental details can make the players they feel like they are discovering the solution themselves rather than simply following instructions. When players feel like they have discovered the solution themselves, it creates a sense of ownership and accomplishment that can motivate them to continue collaborating and problem-solving together.

4.2.3 Summary of communication

In summary, the analysis of collaborative video games with a basis in Tony Manninen's communication form model has revealed four distinct types of communication. Although not all communication forms are relevant for these types of games, there are still many communication forms that could have been utilised for a more enriched communication experience.

Of communication forms found, the first is language-based communication, which involves the use of spoken language to convey information and ideas. Language-based communication does also include text, but text chat has been shown to be absent in this kind of games which might indicate that the game designers want the games to be focused on speech. Speech is by far the most dominant form of communication in collaborative video games, and the lack of many of the other communication types makes them ideal for training players in expressing themselves verbally. There are many ways these games encourage speech training, such as by prompting players to describe things clearly in order to hone both their speaking skill and listening skill, having players speak in turn to ensure equal participation, and creating the necessity to communicate quickly within a given time frame in order to prioritize ideas. By practicing and improving their vocal communication skills, players can become better collaborators and problem-solvers in both virtual and real-life situations.

The other three types of communication forms identified includes kinesics, which involves the use of body language to communicate. This type of communication proved effective at things like revealing a player's position or expressing a mood. The second type of non-verbal communication is spatial behaviour, which relates to the movement and positioning of players in the game world. This type of communication can contribute to encouraging players to observe the other player's movement and proximity. Learning how to interpret their partners movement can help in more effective problem solving. Finally, the third type of non-verbal communication, and the fourth communication type of all is environmental details, which define the appearance of surroundings providing contextual cues. This type of communication can prevent the feeling of having to follow instructions all the time, by creating a sense of discovering the solution to a problem by observing the changes in the environment. This can lead to a greater sense of accomplishment which in turn encourages collective problem solving.

4.3 The effect of a good story

> If players do not care about the outcome, then they are not motivated enough to help each other or improve on their performance. If players find the outcome to be unsatisfying (either boring or random), they are unlikely to learn anything, understand the consequences of their actions, or want to play it again. Games require a good narrative and flow to be entertaining to the players (Zagal et al. p.33)

So far, I have discussed how collaborative games encourages collective problem solving by looking at gameplay, which provides players with immediate feedback on their joint efforts. However, there are additional features in these games that support collective problem solving in more subtle ways, such as narrative. This chapter will therefore delve into the significance of narrative in collaborative video games in relation to collective problem solving and will explore the intricate interplay between embedded and emergent narrative structures.

In the process of selecting video games for the present research, I examined multiple collaborative games, two of which were *Codename: Terranova* (ACGames, 2020) and *Keep Talking and Nobody Explodes* (Steel Crate Games, 2015). These games offered intriguing gameplay elements, including complex puzzles, distinct roles and abilities, and the necessity for effective communication with a partner much similar to *Operation Tango* and *The Past Within*. Despite these attributes, I did not complete the two games first mentioned, due to a perceived lack of engagement. This disinterest can be attributed to two primary factors: the repetitive nature of the level design and the absence of a story to provide context and motivation for the tasks at hand.

The presence of a story is therefore a factor to be considered for prolonged gameplay. It should be noted, however, that the games without a story provided much of the same game mechanics and communication forms as those I've already mentioned, making these games fully capable of providing the players with the same training in collaborative skills as the games of analysis and could be used for these purposes in shorter sessions. This chapter on narrative will therefore be of a more general nature, of how narrative encourages both players to stay motivated over time, which in turn gives more opportunities for practicing the collaborative skills needed for collective problem solving.

The first subchapter provides an overview of embedded narrative, a pre-generated narrative structure that exists prior to a player's interaction with the game and acts as the backbone of the game's story. (Salen & Zimmerman, 2004, p. 383). I will discuss the role of embedded narrative in shaping player experiences, guiding their choices, and establishing a context for

problem solving. The chapter also highlights the importance of cutscenes, strong character development, meaningful dialogues, and engaging plotlines in fostering player motivation and collaboration.

Emergent narrative refers to the spontaneous, player-driven stories that arise through gameplay interactions.(Salen & Zimmerman, 2004, p. 383). In subchapter 4.3.2, I delve into the nuances of emergent narrative, exploring the ways in which it contributes to a dynamic gaming experience and enhances player agency in collaborative video games. The chapter investigates how emergent narratives can influence collective problem-solving strategies and foster unity between team members.

Striking the right balance between embedded and emergent narratives is crucial for creating immersive and captivating collaborative gaming experiences. Therefore, I will also examine this balance, offering insights into the advantages and disadvantages of both narrative approaches. I will discuss the importance of flexibility in game design, allowing for player agency and unexpected developments while maintaining a coherent and engaging storyline.

4.3.1 Creating meaningful action through embedded narrative

The use of embedded narrative serves to provide context for problem solving and motivate players. By engaging with the game's narrative, players can gain a deeper understanding of the challenges they face and the stakes involved. (Salen & Zimmerman, 2004, p. 383) This understanding can inform their problem-solving strategies and help them make more informed decisions in the game.

Collaborative video games utilize a variety of techniques to present embedded narrative which I will explore in this subchapter. Cutscenes, for instance, are non-interactive sequences that provide a break in gameplay and feature cinematic storytelling, and are used in all games of analysis, but particularly in *It Takes Two*. In this section I want to see the effect of using cutscenes, and how they encourage or discourage collective problem solving.

Furthermore, this exploration will investigate how different types of embedded narratives impact collective problem solving. One such technique is level design, which can facilitate embedded narrative in collaborative video games by establishing a sense of progression and context. Other techniques include textual narratives and event triggers, and I will look at the role of these techniques in regard to collaboration.

Additionally, the players' characters in collaborative games play a vital role in developing the game's narrative. Pre-scripted dialogue and the ability to identify with a character can create a sense of ownership and agency, leading to social impact. This exploration will also delve into the roles of non-playable characters (NPCs) and their significance in collaborative video games.

Lastly, I will examine the feature of a split narrative in collaborative games and see if these can either encourage or discourage collective problem solving.

The role of cutscenes in collaborative games

A cutscene is a cinematic sequence that is used to relay information to the player, and are used to create narrative in a variety of ways (Egenfeldt-Nielsen et al., 2016, p. 206). In *Understanding Video Games,* Egenfeldt-Nielsen, Smith and Tosca lists five reasons for using cutscenes (2016, pp. 207–208) which I will use as a basis to understand the role of cutscenes in collaborative games:

1. To introduce a central narrative tension.
2. To shape the narrative in a certain direction.
3. To compensate for missing game narrative.
4. To associate the game with contemporary cinema aesthetics.
5. To provide the player with information.

An important driving force in any game is the goal of the game, which can be seen as the first reason listed. Goals are important because they give the players a reason for doing something. "Goals not only help players judge their progress through a game (how close are they to winning), but also guide players in understanding the significance of their actions within a narrative context" (Salen & Zimmerman, 2004, p. 385). A requirement for a game to be a collaborative game is that the players have a *common* goal, therefore, in order for a collaborative game to be successful, it is crucial that the players have a clear and common understanding of the goal they are working towards. This is commonly done through an opening cutscene.

Both *It Takes Two* and *Operation Tango* use opening cutscenes to define goals. In *Operation Tango,* the game's narrative establishes a futuristic world in which an evil organization poses a significant threat, and the players must collaborate to save humanity. By embedding the narrative into a cutscene, *Operation Tango* effectively sets the stage for players to understand the significance of their objectives, thus motivating them to collaborate and strategize effectively from the start. This shared understanding of the story and the common goal of foiling the antagonist's plans establishes a sense of understanding between the agent and the hacker, fostering teamwork and collective problem solving even before the gameplay has started.

In *It Takes Two,* the introductory cutscene sets the stage for the game's central theme of collective problem solving. The game revolves around the story of Cody and May, a couple planning to divorce, who are magically transformed into dolls. They are guided by Dr. Hakim,

an anthropomorphic relationship therapy book, who explains that they must work together to overcome various challenges and ultimately mend their relationship. Similar to *Operation Tango* this cutscene also presents the goal, which acts as a driving force for the players. The opening cutscenes also introduce players to the main characters, and hints at the unique game mechanics the players will encounter, setting the stage and preparing the players for their unique roles and abilities. This gives them an understanding of what they need to do, as well as their partner's role, which fosters an environment for collective problem solving.

This kind of introductory cutscene is so common that it comes as a surprise when *The Past Within,* is lacking this kind of opening. Here, the players are thrown into gameplay without any explanation of their roles or their goals, except for their initial choice of being in the past or in the future. Although cutscenes are used in *The Past Within* they don't appear before much later in the game, and even then, they are scarce and short. This has to do with the fact that *The Past Within* is a mystery game, where it is up to the players to find out what and why they are doing something. The lack of a cutscene in a narrative game can therefore also set the tone of the game. While *Operation Tango* and *It Takes Two*'s cutscenes set up an environment for collaboration where the players had an introduction to their roles and objectives, *The Past Within* leaves their players in the dark, encouraging collaboration in a different way – that of trying to find out what they are doing. This is often done through game mechanics such as interactive objects which provides textual narratives, which I will come back to shortly.

The reasons of shaping a narrative in a certain direction and providing the player with information are often used in tandem in cutscenes in *It Takes Two* and *Operation Tango.* Throughout the game, cutscenes can serve as a tool for building consensus and helping players align their understanding of the goals and strategies. Cutscenes can provide the players with a shared understanding of the game world and its challenges. This shared understanding can help players develop a shared strategy for solving problems together. Cutscenes can also be used to highlight the strengths and weaknesses of each player's character, which can help players make strategic decisions that complement each other. For instance, in *It Takes Two*, a cutscene is usually shown at the end of each chapter, where players get an insight to how the relationship between Cody and May has progressed, and at the same time they get introduced to their new abilities, which will need to be deployed in the following chapter. Although many types of games use cutscenes for these purposes, they are particularly important for collaborative games since both players needs to understand their

own and their partner's role in the team, and their joint strengths and weaknesses in order to come up with strategies to solve problems together,

Although cutscenes can set up an environment for collaboration, it does not mean that cutscenes are exclusively positive for collective problem solving. One disadvantage is that cutscenes can disrupt the flow of gameplay and break players' immersion in the game world, and this is more likely the more players a game has because of their personal differences. Players may become disengaged if they have to sit through lengthy cutscenes, and especially if the players are hardcore gamers. Salen and Zimmerman writes that hardcore gamers often tend to ignore cutscenes, and rather want to dive right into the action: "As hardcore gamers, these impatient players have experienced enough games to have internalized the common uses of game setting and stories."(Salen & Zimmerman, 2004, p. 411). In *Operation Tango* cutscenes are used to compensate for missing game narrative in between missions, which is reason three listed. After a mission, the player's get a cutscene showing them short videos of the duo's celebration of success, and another short video before the next mission, showing that time has passed and setting the stage for the next mission, again preparing the players for how they need to collaborate. However, except from these very short cutscenes at the end and start of each mission, there are few disruptions in the gameplay in form of cutscenes, signalising that the game has a focus on the collaborative action through gameplay instead of a rich story. The cutscenes are mainly there to connect the missions to each other and ensure that the players have an overall goal for them to accomplish together.

In *It Takes Two*, the inclusion of numerous and occasionally protracted cutscenes, coupled with a relatively predictable narrative centred on rekindling the love between May and Cody to prevent their divorce, may lead to player disengagement, especially for experienced players. Players with a moderate familiarity with narratives may easily anticipate the storyline's progression, and if they are experienced gamers as well, they might not need the introduction for their new abilities as they can easily adapt to them through gameplay, thereby diminishing their investment in the cutscene and in the game. Consequently, this foreseeability in narrative can undermine collaborative efforts and the decision-making processes, as players' diminished interest in the game may result in decreased focus or distraction by unrelated activities. However, the different nature of the use of cutscenes in *It Takes Two* compared with other collaborative games might indicate that *It Takes Two* doesn't just focus on collaborative gameplay in order to encourage collaboration. Since the cutscenes and other story elements in this game is *about* collaboration, it most likely wants to convey a

message of the importance of collaboration through the story, as well as through the gameplay.

Another thing to consider about cutscenes in collaborative games is that they can limit players' freedom and agency. Players may feel like they are being led by the hand or forced down a particular path by the game's narrative and cutscenes, which can reduce their sense of ownership and investment in the game's challenges and objectives. This can lead to a lack of creativity and innovation in problem solving, as players may feel like they are simply following a predetermined script or set of rules. However, this isn't necessarily exclusively negative in a collaborative sense either, which I will come back to in chapter 4.3.3.

Overall, cutscenes can be an effective tool for fostering collaborative problem solving in games by providing players with a shared understanding of the game world, characters, and challenges, and helping them develop a consensus on how to approach and solve problems together, but game developers need to considered how long and how often these cutscenes should occur because the participants are not actively working together to solve problem while a cutscene is showing, but can help encourage collective problem solving through rewarding players for completing sections of a game or explaining further action.

Explaining action and moving the plot forward can also be done using other means throughout the game without necessarily interrupting gameplay and was found to be important aspects of keeping engagement alive in order to continue collaborating.

Providing level variation, context and revealing progression

According to Salen and Zimmerman, game levels "offers players access to specific areas of the narrative world, each level populated by unique events, objects, and characters that create a particular narrative tone and texture" (2004, p. 386) However, in *Codename: Terranova* and *Keep Talking and Nobody Explodes,* the variation between levels were small. The difficulty of the puzzles increased a bit, or the timer was reduced slightly, other than that the events, objects and characters were the same. This meant that even though *Operation Tango* and *The Past Within* featured a lot of the same type of puzzles and challenges, they were seen as more engaging because they featured level designs with more diverse events. These events were often connected to the overall goal or conflict. Even though *Codename: Terranova* and *Keep Talking and Nobody Explodes* both featured conflict (e.g., you have to diffuse this bomb, or you die), there were no apparent overall greater conflict or goal that drove the plot forward. A game conflict should motivate and contextualize player action (Salen & Zimmerman, 2004, p.

387), and while the beforementioned games did so for that particular level, they didn't provide an engaging enough reason for continuing through all the levels. Since the levels were so similar, the levels were predictable, and according to Salen and Zimmerman, it is the element of the unknown that infuses a game with dramatic tension (2004, p. 388), which meant that the tension evaporated after a few levels because the unknown had become known. This means that level design should be planned and there should be an overall goal to completing the levels and completing them should feel like progressing towards something bigger, provided one wants the players engaged over an extended amount of time. Salen and Zimmerman explains that level structures should allow players to feel the details of a story, while the game designer "maintains control of the larger narrative experience" (2004, p. 387). Only experiencing the details, without a larger narrative experience can thus lead to disengagement for one or both of the players and thereby reducing chances of meaningful collaboration. A well thought out level or mission structure, however, can be an effective way of encouraging collaboration. Usually the completion of a level provides a kind of resolution "usually preceded by a difficult 'boss fight' to give a greater sense of achievement."(Egenfeldt-Nielsen et al., 2016, p. 212). These boss fights are used in both *It Takes Two*, where the boss fight is exactly that – a fight with a powerful enemy, and in *Operation Tango,* in the form of a particularly challenging task. When defeating these challenges as an important step on the way to achieving the overall goal part fosters a shared sense of achievement and feeling of resolution which can both encourage collaboration and create a motivation to move forward.

Another way of providing context and revealing progression is through conveying information through *textual narratives*. Textual narratives are what Sebastian Domsch classifies as a passive form, a form that cannot be interacted with by the player and is therefore comparable to a cutscene. (Domsch, 2013, p. 31). However, he goes on to explain that "when passive forms like textual narratives are embedded into the game-world, and need to be actively found by the player in order to be experienced at all, they can heighten the non-unilinearity of the game's storytelling" (Domsch, 2013, p. 31). Even though these textual narratives are pre-scripted, the findings of these texts often gave a sense of accomplishment, especially when finding them in *The Past Within* where you often had to collaborate and solve several puzzles before revealing a text that provided a clue to the story. Textual narratives are also often used in *Operation Tango* where players have to work together to find a text clue for progressing in the mission, for example in the form of a text message in somebody's phone.

The objective is then for the agent to localise the correct person, with the help of the hacker, and when localised, the hacker can hack into the phone in order to convey the text and progress the story. This way of conveying pre-scripted narrative has the opportunity to foster collaboration through the information the narrative conveys, but also makes it feel like the players find a reward for their collaboration. However, there are some disadvantages to the usage of textual narratives as well, which I will cover later in this chapter, when I explain the concept of *split narrative*.

A way of presenting embedded narrative in *It Takes Two* is what Sebastian Domsch calls an *event trigger*: "An event trigger defines an action performed by a player that triggers a narratively relevant event that would not have occurred without this action, yet is not causally related to it in the storyworld." (Domsch, 2013, p. 41). The purpose of these triggers are to provide narrative information without removing agency from the players, and creating an impression that an event happens by chance. (Domsch, 2013, p. 41).

These triggers are only used in *It Takes Two* and the reason for this is most likely because the characters inhabit the same game space. A way event triggers are commonly used in this game is to start pre-scripted dialogue between Cody and May when they reach specific locations. These dialogues help the players in better understanding the relationship between the two characters, providing the players with the characters backstory as well as indicating a progression in the characters' relationship which gradually improves through their joint efforts. Through the use of event triggers, the belief that the game aims to promote collaboration not only through gameplay but also through the story is reinforced. This brings up the subject of the importance of identifying with the characters.

Understanding the characters

There is a significant difference between *It Takes Two* and *Operation Tango* and *The Past Within* in that the characters in *It Takes Two* is what Egenfeldt-Nielsen, Smith and Tosca calls "actors". Actors are characters that can be seen in third person view, have their own biography and are always part of a story. (Egenfeldt-Nielsen et al., 2016, p. 210). In contrast, the characters of *Operation Tango* and *The Past Within* falls in between the category of actors and avatars but leaning mostly towards avatars because they are non-intrusive characters that most often cannot be seen, and the game view is in first person. However, they do feature some actor-qualities in that they have names and a limited backstory.

The distinction between the presentation of avatars and characters with defined personalities and motivations, so-called actors, can have a significant impact on the overall gaming experience. In the case of *It Takes Two,* the characters Cody and May are integral to the gameplay and story, creating a deeper level of engagement for the players. Conversely, in games like *Operation Tango* and *The Past Within,* the focus is more on the abilities of the characters rather than their personalities, leading to less investment in the character's story. While collaboration is the main focus in all these games, the emphasis on character development and storytelling in *It Takes Two* makes it stand out as a more impactful experience and raise the question if it is the act of collaborating with a partner that is the focus of the game, or if it has a mission of teaching the players a lesson on relationships as well.

The dialogues that are being triggered in *It Takes Two* constantly let the players be updated on the dynamics of the relationship between Cody and May. The many dialogues combined with the cutscenes with Dr. Hakim makes the narrative at times feel instructive. This type of narrative can be regarded as an encouragement to collaboration or a discouragement, depending on the players' acceptance of being instructed.

In *Understanding Video Games,* Egenfeldt-Nielsen, Smith and Tosca questions the importance of players identifying with the characters. On one hand there's the belief that the stronger the personality of a character, the easier it is to feel alienated from it, and on the other hand there is the view that unless the characters have strong personalities, they are empty, making identification impossible. (Egenfeldt-Nielsen et al., 2016, p. 210) This is an interesting debate, especially with regard to *The Past Within* where the players are supposed to be the *same* character. Both players play the character Rose, just set in different time periods. Here, the developers have chosen to give the character only vague attributes, and only providing players with a tiny bit of backstory for Rose, giving the players the option of figuring out the character of Rose among themselves. However, by giving Rose so few attributes, combined with the first-person perspective, the character's importance is diminished. While playing as the same character could have been an opportunity to promote a sense of unity between players, the minimal significance of Rose ultimately detracts from this goal. This highlights an important consideration for game designers in terms of how much information to provide about the avatar and how that impacts player engagement and investment in the game's narrative.

On the other hand, giving the characters too much personality might alienate them. In *It Takes Two* I had difficulties of identifying with the character of May who is an engineer who was

working too much and was never at home, while Cody was the stay-at-home father who took care of their daughter. This was the opposite of the roles of me and my husband, where he is the engineer, and I was a stay-at-home mom while we had small children. For me, the swapping of roles was seen as a somewhat parodic attempt of the game narrative trying to be progressive in terms of gender norms and equality, and because of the differences I found it difficult to relate to the character of May. However, I could relate more to my husband's character, and the fact that I could sympathise more with the character of my partner fostered a sense of collaboration in wanting his character to succeed. Also, for my husband, he saw this swap in roles as an opportunity to learn the other side of his own perspective, so he found the story more engaging. So, where I found the strong personalities of the characters to be a hindrance to collaboration, he found it to be an encouragement. These are, of course, subjective opinions to one particular story, but it proves to show that a story can be a discouragement or encouragement to collaboration depending on the person who is subjected to it.

Regarding characters in collaborative games, it is intriguing to note the limited attention given to non-playable characters (NPCs) in these types of games. While single player games often provide meaningful interactions with NPCs, collaborative games tend to feature very few options for engaging with these characters. Although NPCs do exist in these games, the developers seem to have intentionally limited their role and significance. By placing limited focus on NPCs, developers create an environment in which players rely almost exclusively on their partners for information, strategies, and support and forcing the player's to only focus on each other. By removing NPCs as intermediaries, players are encouraged to collaborate directly with their partners without any distractions.

The limited attention given to NPCs in collaborative games may seem like a design constraint at first glance, but another way of looking at it is that it fosters an environment that promotes teamwork, communication, and collective problem solving by placing the emphasis on the partnership between players. In contrast to single player games, where interactions with NPCs can sometimes detract from the main storyline, collaborative games prioritize the relationship and communication between players. This enforces the theory that the main objective of these games is to bring players together to work together as a team.

In some games, like *The Past Within* the developers has even facilitated that access to the narrative also should be connected to collaborative actions. By linking access to the game's

story with collaborative gameplay, the developers have created an environment where players must work together to progress through the game and uncover the narrative.

Split narrative

One interesting approach to narrative in these types of games is by splitting the narrative in two, giving each player each half of the overall story, a feature that I have chosen to call ‘split narrative’ and is a technique that can be found in *The Past Within* as well as other collaborative mystery games. This technique can be seen as a similar category to the beforementioned complementarity in gameplay, where the players are dependent on each other because of their differences. By dividing the story among players, this approach encourages collaboration as players must work together to share their parts of the story, in order to piece together the entire narrative. This not only fosters teamwork, but also encourages players to communicate with one another. This can be seen as similar to what Henry Jenkins write about narrative being conveyed through multiple information channels, which can help motivate the players’ active examination of clues or exploration: “Such an embedded narrative doesn’t require a branching story structure but rather depends on scrambling the pieces of a linear story and allowing us to reconstruct the plot through our acts of detection, speculation, exploration and decryption.” (Jenkins, 2004, s. 127–128) While Jenkins description of this type of narrative was directed toward one-player games where the player has to find different pieces of information to piece together the whole narrative, the same can be applied for collaborative games, only with the added dimension of splitting the narrative between different players as well as information channels. Jenkins also assert that these types of narratives most often take the form of detective or conspiracy stories, which is true for collaborative games as well, since the structure of this kind of narrative has been found mostly in the collaborative mystery games that requires players to finding clues and explore in order to piece together what has happened.

One of the benefits of using this approach, besides motivating exploration and examination of clues, is that it allows players to experience a sense of ownership over their part of the story, while also promoting an understanding of the bigger picture. This can be particularly effective in games where the narrative is central to the gameplay, as it can add an additional layer of complexity and intrigue.

However, a disadvantage of the split narrative approach in collaborative games lies in its reliance on communicating the story among the players. If the players are unwilling or unable

to communicate their part of the story effectively, the story may remain incomplete, leading to a sense of frustration and dissatisfaction. As Gordon Calleja points out: “While some players skim the quest text to work out what they need to do to accomplish the quest, others engage specifically with the story aspects.” (Calleja, 2011, p. 121). This means that players may prioritise different aspects of the gameplay experience, with some preferring to delve deep into the game's narrative, while others may be more interested in the gameplay itself. For example, in *Tick Tock: A Tale for Two* (Other Tales Interactive, 2019), the players were often presented with the story in form of written text such as letters, newspapers, text from the radio etc. If both players were to experience the whole story, it required reading these written texts out loud to their partner, and there was a lot of them. Most often these texts had a clue to a puzzle in them as well as part of the story, encouraging the players to read the texts in order to find the clue. This would be an activity that fit some players, while others would feel having to read all the text out loud to be a chore, because they are more interested in getting on with the gameplay and less invested in the story. As a result, players' divergent engagement with the game's story can undermine the effectiveness of the split narrative, leading to potential discord among players. This, in turn, could discourage collaboration, especially if the divergent engagement becomes more frustrating than engaging. Therefore, it is important to consider players' engagement with the narrative and gameplay when implementing this approach, to ensure that all players remain invested in the game's overarching story.

The requirement for one player to read their information out loud also happens in *The Past Within*, but to a much lesser degree, which reduces the feeling of having to convey the story as a chore. Similar to *Tick Tock: A Tale for Two*, these texts also had a clue to a puzzle in them, encouraging the players to read them in order to find the clue. For example, in the past within, a number is required for one player, and this can be found in form of a date in the other player’s letter.

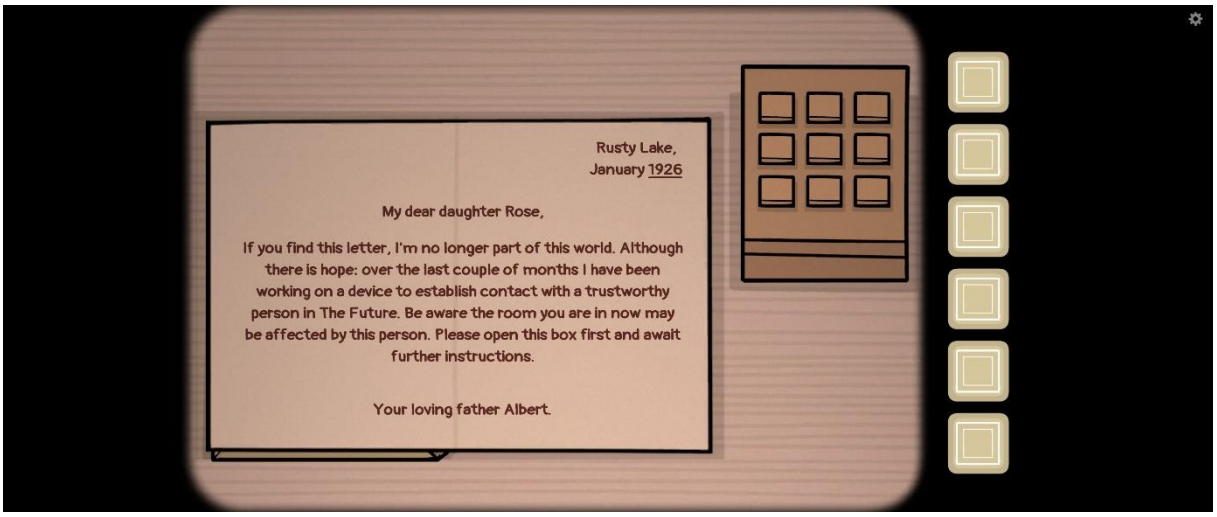

Figure 8: Screenshot of The Past Within. The narrative embedded in the letter is only accessible to the player in the past, where the text has a clue to the puzzle (the underlined number).

Overall, the use of two halves of a story in collaborative games is an innovative approach that can lead to engaging gameplay experiences, foster teamwork and communication, and create a sense of ownership and understanding among players but is a technique that has to be used with an understanding that players have varying degrees of investment in the story.

4.3.2 Emergent narrative in collaborative games

Embedded narrative in games provides a uniform narrative experience for all players, while emergent narrative offers a distinct experience for each player. This approach can be particularly effective in collaborative games as it creates a unique shared experience for each player, promoting collaboration and teamwork that is special for that particular team. By tailoring the game experience to the individual player, emergent narrative can create opportunities for players to bring their unique perspectives and problem-solving strategies to the game. This promotes collaboration by emphasizing the diversity of thought and experience among players. In contrast, embedded narrative may not provide the same level of individuality in the gaming experience, as all players are presented with the same narrative elements. While this approach can be effective in creating a cohesive game experience, it may not encourage collaboration in the same way as emergent narrative.

This subchapter aims to offer perspectives on the significance of emergent narrative in collaborative games, particularly with regard to player agency and teamwork. The emphasis will be on how emergent narratives arise from the collective effort of overcoming challenging obstacles and participating in enjoyable activities as a team. However, a common feature observed in the collaborative games I have played so far is their linear nature, which limits players' autonomy to act according to their own preferences. Both *The Past Within* and *Operation Tango* offers few options of player agency in their games, often providing only one way of completing puzzles or challenges in order to succeed with the objective.

The game with less limited emergent experience is *It Takes Two.* Even though the game features a lot of embedded narrative, the game space within each chapter is usually open for exploration and experimentation, providing players with multiple options for approaching challenges and puzzles. This freedom of exploration and experimentation encourages players to try out different strategies and solutions, leading to emergent narratives that are unique to each playthrough. Also, the nature of the alternating communication the players has to do in order to solve their puzzles can in themselves be a source of emergent narrative, which could arise from players’ actions and interactions with each other.

Overcoming challenges as a team

Emergent narratives arise from the unpredictable and player-generated experiences that occur during gameplay. These narratives can be created through the players' actions, decisions, and interactions with each other and the game environment. Communication about a problem could be the starting point for the creation of an emergent narrative if it leads to players developing creative solutions, making unexpected decisions, or engaging in unique interactions that are not pre-scripted or pre-determined by the game design. In these games, the puzzles often require players to work together and communicate effectively in order to progress. The process of solving these puzzles and overcoming obstacles can lead to emergent narratives that are unique to each playthrough, based on the players' decisions and actions.

In *Operation Tango*, the requirement for players to collaborate and complete timed objectives can give rise to emergent narratives that are formed by the players' communication and problem-solving abilities. The pressure of a ticking clock can create a sense of excitement and unpredictability, leading to emergent narratives that are unique to each playthrough. The uncertainty of the outcome can also generate dramatic tension, as noted by Salen and Zimmerman (2004, p. 388), resulting in player experiences such as narrowly avoiding failure with only seconds to spare. These emergent narratives contribute to the overall gameplay experience by creating memorable moments that the players can share and reflect upon, creating narratives like “Wow! We were nearly blown to bits! I can’t believe we did it with only two seconds left on the clock!” Kaye and Bryce (2012) found that playing games socially enhanced positive atmosphere and experience in social situations, increased feeling of social integration, and that in-game experiences could facilitate offline social interactions. (Kaye & Bryce, 2012, p. 31). Emergent narratives like the example above can facilitate these offline interactions. While these things do not have a direct impact on collective problem solving, they do help with facilitating a group mentality in players, and a social closeness that might help collective problem solving indirectly.

In *It Takes Two*, the open game space within each chapter, and diverse range of puzzles also provide opportunities for emergent narratives to arise from the players' communication and collaboration. The game design encourages players to work together and experiment with different strategies in order to progress through the levels, creating emergent narratives that are unique to each playthrough. For example, the game includes a variety of puzzles that require players to use their individual strengths and communicate effectively with each other in order to find solutions. These puzzles can be approached in different ways, giving players

the freedom to experiment and find the best strategy for their playstyle. This allows for emergent narratives to arise based on the players' individual decisions and actions, as well as their collaborative efforts.

Additionally, the open game space in It Takes Two allows players to explore and interact with the environment in creative ways, leading to emergent narratives that are shaped by the players' choices and actions. The game world is filled with hidden areas and secrets, providing incentives for players to explore and experiment with the game mechanics in order to discover new things. This encourages emergent narratives to arise from the players' curiosity and experimentation and creates enjoyable diversions for the players to bond over.

Enjoyable diversions

Although *It Takes Two* is a linear game, it features some elements that allows for interesting emergent narrative to happen outside of the main storyline. These comes in form of mini-games and references to other games.

The inclusion of mini games in It Takes Two provides an opportunity for players to take a break from the main storyline and playstyle, and for a while giving the opportunity to engage in competitive activities. These mini games, which span various genres and gameplay styles, encourage players to learn and adapt to new mechanics together. In this context, players are able to create emergent narratives around the unpredictability of the outcome and their shared experiences with the mini games, enhancing their engagement with the game world and strengthening their bond as a team.

Moreover, the integration of these mini-games and game references contributes to a playful and light-hearted atmosphere, which can have a positive effect on players' disposition and willingness to collaborate by balancing moments of tension and challenge in the main storyline with more relaxed and entertaining diversions. Nevertheless, in the case of highly competitive players, the mini games may exacerbate tension and animosity among players, reducing their willingness to continue collaborating. Fortunately, these mini games are optional and do not impact the primary storyline, allowing players to choose whether or not to participate.

Figure 9: Screenshot of a mini game in It Takes Two.

Another fun feature in *It Takes Two*, especially for experienced gamers, are the occasional references to other, classic video games. For example, during a fight with a squirrel the game mechanics suddenly changes to imitate that of the arcade game *Street Fighter II* (Capcom, 1991). When in the clock tower, the players can find pots with rupees in them, referencing to the *Legend of Zelda* (Nintendo, 1986) games. And towards of the end of the game, the players slides down a long colourful road, similar to the widely known 'Rainbow Road' in the *Mario Kart* (Nintendo, 1992) games.

Figure 10: Screenshot of reference to other games in It Takes Two. Street Fighter (above), Legend of Zelda (left) and Mario Kart (right).

The references to other games in *It Takes Two* can create emergent narrative by combining the experiences of the players' current gameplay with retelling game stories from the games that are being referenced. Salen and Zimmerman explains that retelling game stories are common, and that they can represent powerful experiences that players want to share and relive with others. (Salen & Zimmerman, 2004, p. 412). The references to other games in *It Takes Two* can also serve as a shared cultural touchstone for players, eliciting a sense of familiarity and nostalgia. By incorporating recognizable elements from popular games, players can more easily identify with the gameplay and engage with the challenges presented. These references also have the potential to initiate conversations between players, who may exchange thoughts and memories about the games being referenced, thereby fostering a sense of camaraderie and collaboration.

4.3.3 The balance between embedded and emergent narrative

As I have earlier explained, collaborative games are mostly linear, allowing for less emergent narratives than many other types of games. According to Egenfeldt-Nielsen, Smith and Tosca "The key to successful mechanics is to make players feel that they are contributing to creating a plot; the most successful narrative experiences happen in games where our actions have noticeable plot consequences." (2016, p. 212). However, success in collaborative games will depend on the intended outcome of the game session. Instead of viewing the linear nature of the game as a limitation on player freedom, it can be seen as a focused approach to teaching players how to collaborate as a team. By limiting possible distractions, collaborative games can focus on and encourage players to work together towards a common objective instead of providing distractions to do other things. Since so many of these game feature such a linear structure, the game developers must have collaborative problem solving as the main objective.

The linear nature of collaborative games can also facilitate a more straightforward approach to storytelling. This can allow players to better mutual understand the game's objectives and the consequences of the players' actions, which is crucial for both players to understand since they are working together towards a common goal. By providing a clear narrative structure, collaborative games can foster an environment that promotes teamwork and effective communication.

While collaborative games often have a linear structure, there is still an opportunity for emergent narrative to arise from player actions and choices, but due to linear nature the possibilities of emergent narratives are limited. However, emergent narrative can add an additional layer of engagement to the game, allowing players to feel as though their actions have a noticeable impact on the story and its outcome. While the linear nature of collaborative games may limit the degree of emergent narrative, it is still possible to create meaningful and engaging narrative experiences through a balance of linear and emergent storytelling. This can foster an environment that promotes effective communication and teamwork among players, while also allowing for a sense of agency and ownership over the story's outcome.

5. Conclusion

The objective of this study was to examine how collective challenges, communication, and narrative elements in collaborative games contribute to collective problem solving. The research question guiding the study was focused on how gameplay and narrative fostered collaboration among players. By exploring these factors, the study aimed to gain a deeper understanding of collaborative games and their potential applications.

The distinction between collaborative and cooperative games has been of importance for this thesis. I found the existing definition of the term collaborative games made by Zagal et al.(2006, p. 25) to be lacking and too difficult to separate from cooperative games. Therefore, I incorporated collaborative and cooperative learning theory to enhance the definition. I proposed that collaborative games necessitate mutual engagement and mutual dependence among players. Although this definition does not completely resolve the difficulties in distinguishing collaborative games from cooperative games, it highlights important aspects of the potential uses of these games.

Through textual analysis, I examined three different collaborative games with different characteristics in order to find common denominators. I first made an analysis of game mechanics with a basis in game designs patterns described by Rocha et al. (2008) and Seif El-Nasr et al. (2010) that has been used for cooperative video games, and saw which of the patterns applied to collaborative games, and how they could encourage collective problem solving. I found that the games ensured *complementarity* and *interdependence* through game mechanics by providing the players with distinct roles and abilities and/or complementary information. These roles and abilities make the players have to consider both their own strength and weaknesses as well as their partner’s and consider how these roles and abilities can help them achieve their common goal. This makes the players need to consider the overall skills of the team, and creates a sense of collaboration and teamwork, with each player contributing to the game's success in a unique way. The roles, abilities and asymmetrical distribution of information also contribute to an equal participation in the problem solving, which stems from the interdependence the players have to each other, and this equal participation can help players appreciate the significance of their role in a team setting, as well as the contributions of their partners.

Secondly, I used Tony Manninen's *Rich Interaction Model for Game and Virtual Environment Design* (2004) as a basis for analysis of interpersonal communication in collaborative video games. I found that collaborative games mostly utilize speech as their main tool of communication and provided few other options. This is especially true for collaborative games that feature different information on the players' screens. With as many interaction forms that exist, this is not likely to have been omitted by chance. It is more likely that these games have a purpose of focusing on the collective problem solving through speech.

These games also feature the technique of alternating communication, where the game is designed in a way that makes the players take turn speaking, ensuring near equal participation in the communication. The games also required the players of these games to describe problems to each other only by using speech. This prompted the players to be aware of how they presented the information and necessitated clear communication between the players. Also, the added urgency of the occasional timed communication tested the players communicating skills by having them do the alternating and clear communication within a given timeframe. By communicating effectively, players are able to coordinate their efforts and achieve their goals, making them more likely to succeed.

This focus on verbal interaction suggests that the primary objective of these games is to promote the importance of communication in teamwork. The success of these games is reliant on the players' ability to communicate effectively with one another, requiring them to work together to overcome challenges and achieve their goals. This emphasis on teamwork and communication makes these games particularly well-suited for social training purposes. For instance, playing these games can help one player develop their communication skills by requiring them to formulate words and sentences that are clear and easily understood by their partner. At the same time, the other player can improve their listening and interpretation skills by actively listening to their partner's messages and understanding their point of view.

Third, I looked at narrative in these games with a basis in Salen and Zimmerman's (2004) terms of embedded and emergent narrative. Although all my games of analysis featured some degree of embedded narrative, I compared them with games without embedded narratives in order to experience the significance of storytelling. Here, I found that embedded narrative can help collective problem solving in that they provide the players with a mutual understanding of their goals, their characters and the game world.

Another important aspect of narrative in collaborative games is the use of split narrative in some of the mystery games, such as in *The Past Within*, where players are required to piece together the story between themselves. This adds an additional layer of collaboration, as players must work together to understand the plot and progress through the game. This approach, however, requires both players to be willing to participate in sharing their part of their story.

When it comes to emergent narrative, the collective experience of playing the game can result in an ongoing, evolving story if the players opt for it. However, for a shared emergent narrative to be encouraging it requires both players to have a mutual understanding of the game's mechanics and objectives, as well as a willingness to collaborate and communicate effectively. This can lead to a sense of shared ownership over the story that unfolds during gameplay, with each player contributing to the development of the narrative. Additionally, the emergence of new challenges and unexpected events during gameplay can add to the overall sense of immersion and engagement, further reinforcing the collaborative nature of the experience.

Another factor that promotes collective problem solving in collaborative games is reducing the focus on non-collaborative elements. For instance, minimizing the presence of non-playable characters and other disruptive elements such as reducing the number of interactable objects, besides the puzzles themselves, can help maintain a high level of engagement and collaboration among players by making them focus only on the collaborative problem. Also, the linear nature of these games can limit distractions from the overall objective, allowing players to focus on working together to overcome the challenges presented. By reducing distractions and maintaining a clear focus on the goal, collaborative games can encourage players to work together more effectively and enhance their collective problem-solving abilities. The exception to this is *It Takes Two*, which seem to have a different approach to promoting collective solving that focuses less on interpersonal communication than the two other games. The complementarity and interdependence of the characters in terms of game mechanics are similar to the other games, but in addition to these elements, *It Takes Two* use lengthy cutscenes and much embedded narrative to convey a message to the players, which proves that the game designers not only had a focus of collaboration in mind, but also one of instructing something through the narrative. It has an overall message of collaboration as a correct behaviour towards understanding each other, and the importance of teamwork.

Overall, collaborative games provide a unique opportunity for players to develop their problem-solving skills while also fostering important communication and interpersonal skills. As such, they have the potential to be a valuable tool for both personal and educational use. By playing collaborative games, individuals can improve their teamwork skills, their ability to communicate effectively, and their overall problem-solving abilities.

5.1 Further research

In chapter 1 of this thesis, I explained that several studies of social effects had been made on cooperative games. The problem, however, was that the researcher(s) most often did not make a difference between collaborative and cooperative games. I propose distinguishing between cooperative and collaborative games because I believe they may produce different social effects due to their distinct natures. This is a hypothesis that would require further investigation. My argument is that cooperative and collaborative games offer distinct gameplay experiences, with collaborative games being better suited for social training for beginners and for initial teambuilding training. Collaborative games, unlike cooperative games, minimise distractions and emphasise mutual engagement, interdependence, and a shared objective. It would therefore be interesting to study whether cooperative and collaborative games have different social outcomes.

In my opinion, the requirement for communication in games where players have access to different information on their screens, and are unable to see their partner's screen, presents a valuable opportunity to enhance communication skills. It would be intriguing to investigate whether these games could be utilized as a tool to improve communication abilities, particularly in the field of psychology, with individuals who experience difficulties in communication, for example individuals with conditions that might have difficulties expressing themselves clearly.

Additionally, exploring the use of these games as an educational tool could prove beneficial in enhancing collaborative problem solving, team building, and communication skills in students. By conducting studies on the use of collaborative games in educational settings, researchers can investigate the impact of these games on a range of outcomes, such as academic performance, teamwork skills, communication abilities, and engagement.

References

Aarseth, E. (2007). *I Fought the Law: Transgressive Play and The Implied Player*. DiGRA '07 - Proceedings of the 2007 DiGRA International Conference: Situated Play, The University of Tokyo. http://www.digra.org/wp-content/uploads/digital-library/07313.03489.pdf

Aarseth, E. (2012). Playing Research: Methodological approaches to game analysis. In B. Herzogenrath (Ed.), *Travels in Intermediality: ReBlurring the Boundaries* (pp. 175–191). Dartmouth College Press.

ACGames. (2020). *Codename: Terranova* [PC]. ACGames.

Bang, J., & Dalsgaard, C. (2005). Samarbejde—Kooperation eller kollaboration? *Tidsskrift for Universiteternes Efter- Og Videreuddannelse (UNEV)*, *3*(5). https://doi.org/10.7146/unev.v3i5.4953

Bethesda Game Studios. (2011). *The Elder Scrolls V: Skyrim* [PC]. Bethesda Softworks.

Bizzocchi, J., & Tanenbaum, T. J. (2011). Well read: Applying close reading techniques to gameplay experiences. In Well played 3.0: Video games, value and meaning (pp. 289–315). ETC Press.

Björk, S., & Holopainen, J. (2005). *Patterns in game design*. Charles River Media.

Calleja, G. (2011). *In-Game: From Immersion to Incorporation*. MIT Press. http://ebookcentral.proquest.com/lib/hilhmr-ebooks/detail.action?docID=3339299

Capcom. (1991). *Street Fighter II* [Arcade]. Capcom.

Clever Plays. (2021). *Operation Tango* [PC]. Clever Plays.

Dolgov, I., Graves, W. J., Nearents, M. R., Schwark, J. D., & Brooks Volkman, C. (2014). Effects of cooperative gaming and avatar customization on subsequent spontaneous helping behavior. *Computers in Human Behavior*, *33*, 49–55. https://doi.org/10.1016/j.chb.2013.12.028

Domsch, S. (2013). *Storyplaying: Agency and narrative in video games: Vol. Volume 4*. De Gruyter.

Ducheneaut, N., & Moore, R. J. (2004). The social side of gaming: A study of interaction patterns in a massively multiplayer online game. *Proceedings of the 2004 ACM Conference on Computer Supported Cooperative Work*, 360–369.

Egenfeldt-Nielsen, S., Smith, J. H., & Tosca, S. P. (2016). *Understanding Video Games: The Essential Introduction* (3rd edition). Routledge.

Embaugh, K. (2016, July 21). Local Co-Op is The Most Consistently Appealing Mode of Social Gaming Across Gender and Age. *Quantic Foundry*. https://quanticfoundry.com/2016/07/21/social-gaming/

Emmerich, K. (2021). Designing Player Interdependence to Enhance Players' Social Experience in Multiplayer Games. In R. Dillon (Ed.), *The Digital Gaming Handbook* (pp. 19–35). CRC Press.

Emmerich, K., & Masuch, M. (2013). Helping Friends or Fighting Foes: The Influence of Collaboration and Competition on Player Experience. *FDG*, 150–157.

Gee, J. P. (2007). *What video games have to teach us about learning and literacy*. Palgrave Macmillan.

Greitemeyer, T. (2013). Playing video games cooperatively increases empathic concern. *Social Psychology*, *44*(6), 408. https://doi.org/10.1027/1864-9335/a000154

Greitemeyer, T., & Cox, C. (2013). There's no "I" in team: Effects of cooperative video games on cooperative behavior. *European Journal of Social Psychology*, *43*(3), 224–228. https://doi.org/10.1002/ejsp.1940

Gripsrud, J. (1999). *Mediekultur, mediesamfunn*. Universitetsforl. https://urn.nb.no/URN:NBN:no-nb_digibok_2009031804131

Grønmo, S. (2016). *Samfunnsvitenskapelige metoder* (2. utg.). Fagbokforl. https://www.nb.no/search?q=oaiid:"oai:nb.bibsys.no:999919818099702202"&mediatype=bøker

Hanghøj, T., Lieberoth, A., & Misfeldt, M. (2018). Can cooperative video games encourage social and motivational inclusion of at-risk students? *British Journal of Educational Technology*, *49*(4), 775–799. https://doi.org/10.1111/bjet.12642

Hazelight. (2018). *A Way Out* [PC]. Electronic Arts.

Hazelight. (2021). *It Takes Two* [Xbox One]. Electronic Arts.

Heilesen, S. (2002). CSCW som grundlag for distribueret netbaseret undervisning og læring. *Uddannelse, Læring Og IT-26 Forskere Og Praktikere Gør Status På Området*, 79–86.

Hjertaker, E. (1988). *Læring gjennom samarbeid* (Vol. 9). https://urn.nb.no/URN:NBN:no-nb_digibok_2012061406011

Iser, W. (1974). *The Implied Reader: Patterns of Communication in Prose Fiction from Bunyan to Beckett*. Johns Hopkins University Press.

Jenkins, H. (2004). Game Design as Narrative Architecture. In N. Wardrip-Fruin & P. Harrigan (Eds.), *First Person: New Media as Story, Performance, and Game*. MIT Press.

Johnson, D. W., Johnson, R. T., Haugaløkken, O. Kr., & Aakervik, A. Osv. (2006). *Samarbeid i skolen: Pedagogisk utviklingsarbeid, samspill mellom mennesker* (4. rev. utg.). Pedagogisk psykologisk forl. https://urn.nb.no/URN:NBN:no-nb_digibok_2014040705012

Johnson, D. W., Johnson, R. T., & Holubec, E. J. (2001). *'Som hånd i hanske':en praktisk innføring i samarbeidslæring* (A. O. Aakervik, Trans.). Pedagogisk psykologisk forlag. https://www.nb.no/items/URN:NBN:no-nb_digibok_2009011404026

Jordheim, H., Rønning, A. B., Sandmo, E., & Skoie, M. (2008). *Humaniora: En innføring*. Universitetsforlaget.

Jørgensen, K. (2012). Players as Coresearchers: Expert Player Perspective as an Aid to Understanding Games. *Simulation & Gaming*, *43*(3), 374–390. https://doi.org/10.1177/1046878111422739

Juul, J. (2010). The Game, the Player, the World: Looking for a Heart of Gameness. *Plurais Revista Multidisciplinar*, *1*(2), Article 2. https://doi.org/10.29378/plurais.2447-9373.2010.v1.n2.%p

Kaye, L. K., & Bryce, J. (2012). Putting the fun factor into gaming: The influence of social contexts on the experiences of playing videogames. *International Journal of Internet Science*, *7*(1), 24–38.

Kerr, C. (2022). *It Takes Two has topped 7 million sales in under two years*. Game Developer. https://www.gamedeveloper.com/business/it-takes-two-has-now-sold-over-7-million-copies

Lankoski, P., & Björk, S. (2015). Formal analysis of gameplay. In *Game Research Methods* (pp. 23–35). ETC Press.

Lenhart, A., Kahne, J., Middaugh, E., Macgill, A. R., Evans, C., & Vitak, J. (2008). Teens, Video Games, and Civics: Teens' Gaming Experiences Are Diverse and Include Significant Social Interaction and Civic Engagement. *Pew Internet & American Life Project*. https://eric.ed.gov/?id=ED525058

Levin, M., & Rolfsen, M. (2015). *Arbeid i team: Læring og utvikling i team* (2. utg.). Fagbokforlaget. https://urn.nb.no/URN:NBN:no-nb_digibok_2018030648125

Manninen, T. (2004). *Rich interaction model for game and virtual environment design* [University of Oulu]. http://jultika.oulu.fi/Record/isbn951-42-7254-4

Mäyrä, F. (2008). *An Introduction to Game Studies: Games in Culture*. SAGE Publications Ltd. https://doi.org/10.4135/9781446214572

Medietilsynet. (2020). *Barn og medier 2020—Gaming og pengebruk i dataspill* (Delrapport 3). https://www.medietilsynet.no/globalassets/publikasjoner/barn-og-medier-undersokelser/2020/200402-delrapport-3-gaming-og-pengebruk-i-dataspill-barn-og-medier-2020.pdf

Mojang Studios. (2011). *Minecraft* [PC]. Mojang Studios.

Nintendo. (1986). *The Legend of Zelda* [Nintendo]. Nintendo.

Nintendo. (1992). *Mario Kart* [Nintendo]. Nintendo.

Norwegian Directorate for Education and Training. (2012). *Framework for Basic Skills*. https://www.udir.no/contentassets/fd2d6bfbf2364e1c98b73e030119bd38/framework_for_basic_skills.pdf

Other Tales Interactive. (2019). *Tick Tock: A Tale for Two* [PC]. Other Tales Interactive.

Piece of Cake studios. (2018). *Hacktag* [PC]. Piece of Cake studios.

Quandt, T., Chen, V., Mäyrä, F., & Van Looy, J. (2014). (Multiplayer) Gaming Around the Globe? A comparison of Gamer Surveys in Four Countries. In T. Quandt & S. Kröger (Eds.), *Multiplayer: The Social Aspects of Digital Gaming*. Routledge.

Rayudu, C. S. (2009). *Communication*. Global Media. http://ebookcentral.proquest.com/lib/hilhmr-ebooks/detail.action?docID=3011271

Redbeet Interactive. (2022). *Raft* [PC]. Axolot Games.

Reuter, C., Wendel, V., Göbel, S., & Steinmetz, R. (2014). Game Design Patterns for Collaborative Player Interactions. *DiGRA, 8*.

Rocha, J. B., Mascarenhas, S., & Prada, R. (2008). Game mechanics for cooperative games. *ZON Digital Games 2008*, 72–80.

Roschelle, J., & Teasley, S. D. (1995). The Construction of Shared Knowledge in Collaborative Problem Solving. In C. O'Malley (Ed.), *Computer Supported Collaborative Learning* (pp. 69–97). Springer. https://doi.org/10.1007/978-3-642-85098-1_5

Rouse, R. (2005). *Game design: Theory & practice* (2nd ed.). Wordware Publishing.

Rusty Lake. (2022). *The Past Within* [PC]. Rusty Lake.

Salen, K., & Zimmerman, E. (2004). *Rules of play: Game design fundamentals*. MIT Press.

Schell, J. (2008). *The art of game design: A book of lenses*. CRC.

Schmierbach, M. (2010). "Killing Spree": Exploring the Connection Between Competitive Game Play and Aggressive Cognition. *Communication Research*, *37*(2), 256–274. https://doi.org/10.1177/0093650209356394

Seif El-Nasr, M., Aghabeigi, B., Milam, D., Erfani, M., Lameman, B., Maygoli, H., & Mah, S. (2010). Understanding and evaluating cooperative games. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 253–262.

Skaug, J. H., Staaby, T., & Husøy, A. (2017). *Dataspill i skolen* (Notat No. 1). Senter for IKT i utdanningen. https://www.udir.no/globalassets/filer/spill_i_skolen_-_notat_-revidert_2018.pdf

Statped. (n.d.). *Spill i skolen*. Statped. Retrieved 4 September 2022, from https://www.statped.no/laringsressurser/teknologitema/spill-i-skolen/

Steel Crate Games. (2015). *Keep Talking and Nobody Explodes*. Steel Crate Games.

Stiff, C., & Bowen, T. (2016). Two-Player Game: Playing Casual Video Games with Outgroup Members Reduces Levels of Prejudice Toward That Outgroup. *International Journal of Human–Computer Interaction*, *32*(12), 912–920. https://doi.org/10.1080/10447318.2016.1212484

Svennevig, J. (2020). *Språklig samhandling: Innføring i kommunikasjonsteori og diskursanalyse* (3. utgave.). Cappelen Damm akademisk.

Taylor, D. W. (2013). Decision making and problem solving. In J. March (Ed.), *Handbook of organizations* (Vol. 20, pp. 48–86). Routledge New York.

Totilo, S. (2021, June 14). *Co-op video games are on the rise this year*. Axios. https://www.axios.com/2021/06/14/co-op-multiplayer-games-rise

Unity Technologies. (2022). *Unity 2022 Multiplayer Report*. https://images.response.unity3d.com/Web/Unity/%7B5a147e9d-3ac4-4ba4-a035-2c831b4ea020%7D_Multiplayer_Report_2022.pdf?elqTrackId=bf6eb87806e7469fa1d77a75221be548&elqaid=4386&elqat=2

Velez, J. A., Mahood, C., Ewoldsen, D. R., & Moyer-Gusé, E. (2014). Ingroup Versus Outgroup Conflict in the Context of Violent Video Game Play: The Effect of Cooperation on Increased Helping and Decreased Aggression. *Communication Research*, *41*(5), 607–626. https://doi.org/10.1177/0093650212456202

Vibeto, H. A. (2022). *Dataspillets spillverdener: En undersøkelse av audiovisuelle virkemidler som innganger til spillopplevelser: Vol. 2022:200*. Norges teknisk-naturvitenskapelige universitet, Det humanistiske fakultet, Institutt for kunst- og medievitenskap.

Zagal, J. P., Rick, J., & Hsi, I. (2006). Collaborative games: Lessons learned from board games. *Simulation & Gaming*, *37*(1), 24–40. https://doi.org/10.1177/1046878105282279

Østbye, H., Helland, K., Knapskog, K., & Larsen, L. O. (2013). *Metodebok for mediefag* (4. utg.). Fagbokforlaget.