



Norwegian University of
Science and Technology

Tappetina's Empathy

A Study of Serious Games Facilitating
Empathy with Storytelling

Sindre Berntsen Skaraas

Master of Science in Informatics

Submission date: June 2018

Supervisor: Maria Letizia Jaccheri, IDI

Norwegian University of Science and Technology
Department of Computer Science

Summary

Background: Empathy is the ability for people to understand other people's motivations, positions, and emotions. This is an important way for people to relate to each other and much research has been done to find out how serious games affects empathy. Much of it has, however, been focusing on negative impacts, which encourage anti-social behavior and reduce empathy. There is still a notable potential for games to have a positive impact on pro-social behavior by encouraging and building empathy.

Objective: This thesis investigates how a serious game can affect players in such a way, through the use of storytelling. First part of this objective is to do a literature review, which lays out discussions, reports and game projects on the topic of serious games, empathy and storytelling. The second part of the objective is to design and develop a storytelling game. By having players collaborate on telling a story, the game aims to exercise their empathic abilities. Each player uses a smartphone which displays the story structure and grants new cues for building the story together.

Method: The research performed here is design and creation, in which the main results is the design discussion and the game artifact (including the digital solution, and the flow of the physical activity). The game is then evaluated with a second research strategy, a quasi-experiment. This took place in a workshop trial with 12 participants.

Results: Contributions include the game activity, and the results of the literature review and the evaluation: Participants responded positively and enjoyed playing the game. The participants showed different abilities to build a story, and various reactions that suggested links to empathy.

Limitations: The game is still in an early stage and the quasi-experiment was too small to accurately generalize. A more streamlined game needs to be systematically evaluated to a larger audience.

Conclusion: The evaluation showed enough potential to use this approach to empathy through storytelling. Two scientific papers were written, one of which was published and the game will be presented at the IDC conference [1]. The project has also been further developed and researched based on the process and design outlined in this thesis, to better facilitate empathic responses.

Sammendrag

Bakgrunn: Empati er evnen til folk først andres motivasjoner, perspektiver og flelser. Dette er en viktig mte for folk forholde seg til hverandre, og mye forskning har blitt gjort for finne ut hvordan serise spill pvirker empati. Mye har imidlertid vrt fokusert p negative konsekvenser som oppmuntrer til anti-sosial atferd og reduserer empati. Det er fortsatt et bemerkelsesverdig potensial for spill ha en positiv innvirkning p pro-sosial atferd ved oppmuntre og bygge empati.

Ml: Denne oppgaven undersker hvordan et serist spill kan pvirke spillerne p en slik mte, ved bruk av fortellinger. Frste del av dette mlet er lage en litteraturvurdering, som omhandler diskusjoner, rapporter og spillprosjekter om temaet serise spill, empati og historiefortelling. Den andre delen av mlet er designe og utvikle et fortellingsspill. Ved f spillere til samarbeide med fortelle en historie, utver de sine empatiske evner. Hver spiller bruker en smarttelefon som viser fortellingens struktur og gir nye hendelser for bygge historien i lag.

Metode: Forskningen som utfres her er design og skaping (desing-and-creation), hvor hovedresultatene er designdiskusjonen og spillartifakten (inkluderer den digitale lsningen og den fysiske aktiviteten). Spillet blir deretter evaluert med forskningsstrategien kvasi-eksperiment. Dette ble gjort i en workshop med 12 deltakere.

Resultat: Bidragene inkluderer spillaktiviteten, og resultatene av litteraturvurderingen og evalueringen: Deltakerne reagerte positivt og syntes spillet var morsomt spille. De viste forskjellige evner til bygge en historie, og ulike reaksjoner som foreslo koblinger til empati.

Begrensninger: Spillet er fortsatt i et tidlig stadium, og kvasi-eksperimentet var for lite til generaliseres skikkelig. Et mer strmlinjeformet spill m systematisk evalueres til et strre publikum.

Konklusjon: Evalueringen viste nok potensial til utnytte denne tilnrmingen til empati ved hjelp av fortellinger. To vitenskapelige papirer ble skrevet, hvorav en ble publisert, og spillet vil bli presentert p IDC konferansen [1]. Prosjektet har ogs blitt videreutviklet og forsket basert p prosessen og utformingen som er vist i denne oppgaven, for bedre fremstille en empatisk respons.

Acknowledgements

The author of this master thesis would like to thank the supervisor, Letizia Jaccheri for her continual contribution to keep this project on the right track, as well as the Norwegian University of Science and Technology (NTNU).

Further thanks to other people who helped the master thesis: Alexandra Angeletaki for organizing the international experiment workshop at the Gunnerus library of NTNU. Javier Gomez Escribano and Kshitij Sharma for aiding with the research, analysis and design of the game, as well as taking on the responsibility of leading further research into the potential of the game Tappetina's Empathy. Alf Inge Wang for his assistance in giving consultation and resources for the project. And all the people taking part at the Gunnerus workshop event for helping evaluate the game and for giving their reactions and feedback to the benefit of this thesis.

The project has been recommended by the Data Protection Official for Research, Norwegian Social Science Data Services (NSD). For the development of the game, the Unity Engine and Editor was utilized, as created by Unity Technologies.

Table of Contents

Summary	i
Acknowledgements	iii
Table of Contents	viii
List of Tables	ix
List of Figures	xii
1 Introduction	1
1.1 Motivation	1
1.2 Project Description	2
1.3 Project Context	2
1.4 Research Questions and Methodology	3
1.5 Thesis Outline	4

2	State of the Art	7
2.1	Serious Educational Games	8
2.2	Categories of Serious Games	9
2.3	Storytelling and Empathy	10
2.4	Games for Storytelling and Empathy	12
3	Development	15
3.1	Ideation of Game Concepts	16
3.1.1	Concept 1: Novel Translated into Game	17
3.1.2	Concept 2: Investigate Crisis	17
3.1.3	Concept 3: Programming and Explanation	17
3.1.4	Concept 4 (selected for development): Empathy through Storytelling	18
3.2	Prototyping	19
3.2.1	Initial Story Structure	19
3.2.2	Low-Fidelity Prototype	20
3.3	Implementation	23
3.3.1	Choice of Technology	23
3.3.2	Implementation and Testing Process	25
4	Description of Tappetina’s Empathy	27
4.1	About the Game	27
4.2	Story Structure	28

4.3	Gameplay	29
4.3.1	Start Screen	29
4.3.2	Story Tags	32
4.3.3	Solutions	33
4.4	Requirements	33
4.4.1	Functional Requirements	34
4.4.2	Non-functional Requirements	36
4.5	Use Cases	36
5	Evaluation	39
5.1	Research Strategy	39
5.2	Data Collection Methods	41
5.3	Planning the evaluation	44
5.4	Participants and Event	45
5.5	Results	47
6	Discussion and Conclusion	51
6.1	Discussion	51
6.1.1	Validation of Research	51
6.1.2	Validation of Requirements	54
6.1.3	Validation of Technology	57
6.2	Conclusion	58

6.3 Taking the Game Further	60
Bibliography	63
Appendix	69

List of Tables

- 2.1 (Next page) a list of games that were looked at for inspiration and guidelines to this game project. 13

- 4.1 Use Case 1 37
- 4.2 Use Case 2 37
- 4.3 Use Case 3 38
- 4.4 Use Case 4 38

List of Figures

- 3.1 The development process 16
- 3.2 The player is put into a group 20
- 3.3 The character selection screens in the prototype 21
- 3.4 The story building screens in the prototype 21
- 3.5 Next player adds something to the story 22
- 3.6 The group presents their story 22

- 4.1 Story Tag Select screen - So far, having a wife with special needs has led Toby to accidentally hurt someone. It is up to the player to narrate the specifics. 28
- 4.2 The start screen of the game which handles connection setup. 29
- 4.3 Character Selection 30
- 4.4 The screens which display information about the Character and instruct the player to present the Character 30
- 4.5 Selecting a new Story Tag 31

4.6	Link the Story Tag to the story. This creates a cause and context for the new event.	31
4.7	Presentation of the Story Tag event. Note the player has made a link to the third trait, showing this is the reason for why the new Story Tag event happened.	32
4.8	The solution screen, from which every player decides on their own resolution to the story.	32
4.9	Presentation of the different solutions to each other. After this, the players decide on the best solution and the game ends.	33
5.1	A picture of the workshop where the game was played in a closed room by the different participants, each using a separate mobile phone.	46
5.2	Graph of the enjoyment levels as rated by the participants.	47
5.3	Graph of the empathy levels that the participants rated themselves with.	49

Chapter 1

Introduction

1.1 Motivation

One of the most common qualifiers to how we deal with the world is through understanding other people. As children will grow up, their opinions and perspectives will be formed largely based on their ability to understand other people's motives, emotions and views. This is empathy, and is an essential part to the process of which people interact with each other [2]. Storytelling is a natural and reoccurring way for humans to develop such empathy [3]. In fact, novels are one of the main forms of communication cultures have had to share different perspectives and to build empathy in their population. Despite this, the role of empathy in video games is a topic that has often received more negative attention than positive [4; 5]. In the research field of serious games, there is a need to focus more on what pro-social effects a game can make on its players. Furthermore, serious game research must try to learn not simply if there is such a positive impact, but also how one can accomplish this when making serious games [6]. This project aims to provide an activity that will positively affect empathy by emulating a storytelling experience. This activity will consist of a group of people that will collaborate on telling a story. By making each player understand and add to the story, they are forced to put themselves into the story and to have an empathic response to the character [7]. This is done in a way of collaborative learning, which is found to be more interesting to the players and to promote

critical thinking [8]. The development is directed by certain guidelines for educational games, as presented by Annetta et al., [9] to make sure the users can achieve heightened engagement and affective learning. To summarize, Annetta et al. advises how engagement can be increased by giving the player presence and agency in the game. Learning is then facilitated by properly adapting the difficulty and instruction, all while ensuring the teaching goal is made apparent, helping the player reflect on what they should learn.

1.2 Project Description

This master thesis presents a design/creation research process on the topic of serious games. The problem description of the project is to find a way to adapt the efforts of the Tappetina ecosystem (www.tappetina.com) into a game. This context is further outline in section 1.3 below. The game presented is in an early stage of development, with focus on determining whether it can form a connection to the players' empathic abilities. The research question is whether such a relation exists between the game experience and the players' empathy. The game uses storytelling as a way to exercise the ability to form an empathic understanding of an imagined situation. The players then show that they can interpret the story, build on it, and explain it to the group. In this stage, the study takes an informal approach. The aim is to explore the possibilities of the game with a real audience and to gather feedback to take the concept further. So because of that preliminary form, the game study exists mainly as a proof-of-concept. It is a combination of a digital system and a real-world activity of oral storytelling. The digital aspect is simply a conduit that provides communication tools and a structure to the play. The "game" in its true sense is determined when the players interact other and decide how they will develop the story. Because of this reliance on the group dynamic, there is an element of uncertainty to the game design. This is why the study also takes an exploratory approach, seeking the aid of the players to further develop the prototype.

1.3 Project Context

The study reported in this thesis is part of a larger ecosystem of projects. This ecosystem is formed under the novel of "The Little Doormaid: Tap-

petina” [10]. This novel also lends its name to the game in this study. The theme and goal of the game has ties to a story by the name of The Little Doormaid. This story is authored by Letizia Jaccheri, who also serves as this master projects supervisor. When asked why she wrote this story, Letizia answered that she hoped it could inspire girls who read it to be more interested in technology. The story would not only try to combat stereotypes of girls in tech, but also create an emotional impact that creates interest in and even romanticizes technological concepts. In essence, it aims to build enthusiasm in kids to tech, and is thus used in IT workshops for learning IT and programming. The ecosystem that came out of this is an initiative to encourage nuanced views of people. It is formed under to combat the stigma surround women entering male-associated fields such as technology. This master thesis begun with the possible goal of translating or interpreting this story of the novel into a digital game. Since then, this project has evolved into being a collaborative storytelling platform. Using the exploits of the novel’s protagonists, Tappetina, the novel is determined on inspiring confidence and self-reliance. Tappetina continues on into this project, where she serves as the game’s mascot, all while guiding the players along to tell their story.

1.4 Research Questions and Methodology

There are two objectives to this research: 1. To explore the research area around serious games to find the basis and inspiration necessary to create the game; and 2. to focus more on a single category of serious games by developing a game and finding out how feasible it is for creating an impact on the player’s sense of empathy.

Hence, the research questions will be:

1. RQ1: What categories, concepts and potential learning impacts exist to design a serious educational game?
2. RQ2: How can a collaborative storytelling game make an impact on one’s empathic ability?

The first RQ follows an exploratory approach, building on the literature review that represents the background in this thesis. The result of this

search is displayed in Chapter 2 State of the Art. The second research question picks up after that, implying the decision on developing a collaborative storytelling game that tries to make a connection between its gameplay activity and the player's empathy abilities. The strategy for this question is to follow the design and creation process of the game as well as an exploratory method. The aim is to find if and how this approach can be feasible as a foundation for a fully fledged "empathy game". This involves the development, testing and analyzing of the game, followed by experiments with a user group. For data collection, the research uses observation, questionnaires and documents (notes and game data). The result and contribution of this research is an and new insight into how serious educational games can be designed, using the perspective of an empathy-focused, storytelling approach, which is its own contribution in the form of a game research project. In addition to these elements, two scientific papers are attached to this project, one which is published. These provide another joint contribution to the research questions. The papers can be found in Appendix B and C and are further described at the end, in section 6.2.

The specific methodologies are described in more detail in the beginning of Chapter 2 State of the Art (game/literature review) and in Chapter 5 Evaluation (research strategy / data collection).

1.5 Thesis Outline

There are 6 different chapters in this thesis: Chapter 1 is the introduction, where the project is outlined, along with its motivation, method and context. Chapter 2 goes over the state of the art of serious games, storytelling games, and empathy games. It looks both at actual games which serves as inspiration and guidelines, but also finds literature that describes the role of games, their design and potential effects. This is where the elements of the first question are described. The first element, categories of serious games, is answered by section 2.2 and more focused in 2.3, on storytelling and empathy. The element of concepts is mainly described in the game review of section 2.4, but is also touched upon in section 2.1. And the potential learning impacts are outlined primarily in section 2.2, but also further discussed in 2.3 and through the games in section 2.4. Then, Chapter 3 offers a time line of how the game was created. This takes us from the early concept-making stage, through prototyping, and to the actual development in the

Unity Engine. Next is Chapter 4, a description of the game itself, showing how the resulting game is designed and structured. It also goes through some requirements, uses cases and architecture documentation to give insight into different aspects of how the game was organized as a project. In Chapter 5, there's the evaluation of the game in terms of the requirements and research questions. At the end is Chapter 6, which discusses the project, its contribution, a possible future, and finally concludes with a summary of how well the project satisfied its goals.

Chapter 2

State of the Art

The research starts with a literature review, as spurred on by research question 1 (*What categories, concepts and potential learning impacts exist to design a serious educational game?*). The answer to this is divided into two parts and is then extended by a look at different games and related work. The first part of the literature review looks at a wide area of research for exploration and figuring out where the potential for a game concept lies. The second search begins once a theme is chosen – in this case, storytelling and empathy. This is not only to aid the development, but also to provide the material needed to argue for the contribution of this project. Different articles and books were chosen based on recommendations, citations of other literature, and a manual search through literature sites such as Google Scholar. Keywords used in this search were first mostly to explore the wider opportunities, for example serious game, game impacts, and "serious game design opportunities". The next set of keywords were then to go deeper into the subject matters that appeared to be especially relevant or interesting, for example: "affective learning, serious game narrative, "empathy game, affective education, storytelling empathy". Selection criteria were mostly citation count, but also finding authors and journals which were well-known and trustworthy.

For the outline of this chapter: First is section 2.1 *Serious Educational Games*, a general overview of serious, educational games and what the research area looks like. Then there is section 2.2 *Storytelling and Empathy*,

an investigation into what role storytelling and empathy can play in games, and how they may be handled in designing a game. The last part, section 2.3 *Games for Storytelling and Empathy*, looks at how storytelling and empathy are implemented in actual games. This outlining is used to show how this game project can learn from existing attempts and improve on them to better study the game's relation to empathy.

2.1 Serious Educational Games

A serious game is defined in many ways, but the overview performed by Susi et al. [11] reveals a commonly agreed-upon understanding: Serious games are digital games that have some purpose other than to simply entertain. There are numerous application areas for such games; these are education, health care, military and science, to name a few. One of the most usual forms of serious games is that of an instructional game, which teaches or trains the player in place of traditional education. A literature review by Connolly et al. [12] shows the emergence of the serious game field, where serious games have been shown to be a more effective way of learning in certain situations. Games allow one to simulate and learn in environments or situations that would be infeasible in real life. Though what makes them especially interesting are their inherent ability to motivate learners to keep playing by mixing fun and increasing engagement into the learning process. This is what Garris et al. [13] calls the Game Cycle in their Input-Process-Outcome game model. Through a recurring process of providing feedback as the user makes judgments and acts in the game, the game play is inherently engaging. The goal is, then, to exploit this process to make the players learn while being self-directed and self-motivated, both because the activity is interesting in itself and because achieving the outcome is important. Another model that helps with this goal is the Game Flow model by Sweetser et al. [14]. This takes on the challenge of figuring out how player enjoyment of games work. Basing itself on the widely-accepted general enjoyment model of Flow, it identifies eight elements contributing to enjoyment in games. This can be used both as design criteria, and to aid in the evaluation, to observe whether any of the elements are not fulfilled. To summarize the eight elements, the game must have clear goals and skill development, require concentration and challenge, while giving the player proper control, immersion, in-game feedback, and even social interaction. Some notable elements to look at for a social storytelling game would be clear goals, feedback and

control, plus social interaction and skill-mastery to contribute to enjoyment and facilitating empathy.

There has been a fair amount of studies that set out to prove the effectiveness of game-based learning. Smiley [6] suggests how the research field is now beyond simply asking if game-based learning can be effective. He shows how several application areas exist where instructional games are proven to be more effective than normal instruction, something echoed by a more recent literature overview by Susi et al. [15]. So instead, Van Eck [6] argues studies should look more at why they are effective, and how – which is to say, when, with whom, and under what conditions. This is where the core motivation for this research proposal lies – to further explore how the to-be developed game can drive learning. Key to the research is uncovering the landscape of ideas that seem promising and that are grounded in theory. This is also what this literature review aims to do, to support the ideation of the game.

Finally, to aid the game designing, we will look for practical guidelines in literature for creating serious games. A report by Hays [16] reveals some shortcomings of instructional games, which are sometimes ineffective at driving learning if used as a stand-alone activity. Recommendations for including instructional games are to ensure there is included debriefing and feedback after playing the game. This is to ensure proper learning takes place and to make sure the players understand how the experience is related to the learning objective. This same fact is also argued in a paper by Annetta et al. [9], who presents 6 elements in a framework for designing instructional games. These 6 elements are as follows: Identity (giving the player an identity in the environment), Immersion (feeling present in the environment), Interactivity (being able to act in the environment), Increasing Complexity (making the game increasingly demanding cognitively), Informed Teaching (as described above [16]), and Instructional (adaptive instruction to player's ability/development). Using these lessons, the game design may find help in principles that are grounded in theory.

2.2 Categories of Serious Games

In order to go on a hunt to find and consider different genres of serious games, one needs some way of classifying or grouping them. This is what

Ratan et al. [17] seeks to accomplish in their article called *Classifying Serious Games*. By analyzing over 600 serious games, they uncover some dimensions of characterization. These are Primary Educational Content, Primary Learning Principle, Target Age Group, and Game Platform. Dominating these categories are serious games focusing on replacing school with academic education as Primary Educational Content and skill practice as their Primary Learning Principle. Interestingly, Ratan et al. reports that education games taking this approach has no more induced motivation than normal teaching content, failing to fulfill the true potential of serious games. The ideal is to blend entertainment and education in parallel experiences. They conclude this could best be done with games that are open to exploration and requiring complex reasoning.

To look more closely at the different educational contents games may have, there is again the literature overview by Connolly et al. [12]. Here, they analyze different (positive) impacts of games, which include different learning outcomes. The learning outcomes they found to be most popular were affective learning, knowledge acquisition, perceptual/cognitive skills and behavior change, to name the top ones. The first one, affective learning, is concerned with changing the players belief and emotions. While nothing is decided yet, this category has the potential to be a great inspiration and focus for this research thesis. This is because the goal of changing beliefs and emotions is what the story *The Little Doormaid* intends to do. A game constructed using this outcome as research theme will have the added benefit of using a narrative that already seeks to drive this kind of learning. If this project goes in this direction, the article by Dormann et al. [18] on this topic will be useful. Here, they discuss and show some guidelines for how to design games for affective learning. They also provide an “affective walkthrough” for analyzing and identifying affective learning in a game. This can be used to better ensure affective learning in ones own game design, but also in evaluating other games to better understand how a game can accomplish affective learning.

2.3 Storytelling and Empathy

Since a narrative is central to the game development of this project it would be useful to find how stories are related to games in general. The basis for that discussion is found in an article by Jenkins [19] that clears up the ques-

tion of what the role between games and narrative really is. The work connects games and movies in that game narratives are not linear nor essential thing in games as it is in cinema. It's also showed here how the game designers are not storytellers, but narrative architects. This is because their real role is creating game spaces that facilitate narrative experiences, or spatial stories. Four approaches to such environmental storytelling is suggested by Jenkins [19]: These are (1) making spaces that evoke narratives the player is already familiar with, (2) enacting the narrative at certain spots of the game, (3) revealing the plot by embedding bits of info in the environment, or (4) letting narratives emerge spontaneously within the game. While only approaches 2 and 3 deal with telling a pre-planned story in the game, all approaches have potential use in designing the game for this thesis. As an example to how this can be used in learning, we have a study by Dickey et al. [20]. Here they used a game that both embedded and evoked a narrative using the environment, resulting in sustained motivation and curiosity while learning writing skills. For the final game concept in this thesis, the fourth approach (emergent narrative) ended up serving as a conceptual baseline.

The new question was then to find how emergent storytelling can be facilitated in the game. This can be helped by looking at emergent game design in general. Sweetser et al. [21] makes a comparison between Emergence – game design ruled by unplanned behavior and interactions with reusable elements – and Scripting – making pre-planned activities with predictable behaviors and low-level entities. In basic, Emergence entails having an environment which responds to the players, while in Scripting the designer decides before-hand on the player's experience without thinking about any sort of consistent world simulation. Sweetser et al. makes some relevant considerations for the design of this game: Clearly, emergence means more uncertainty and creative control, as one cannot expect exactly what will happen. Since the players may interact with the system in unpredictable ways, the experience will be harder to foolproof and to measure feedback on. Emergent systems need considerable planning and design of the structure and elements so that their relationships and interactions work as intended. The resulting design and implementation of the emergent storytelling is outlined in the 4.2 Story Structure section.

In [4], Anderson et al. describes how much research has been dedicated to making a link between violent video games and decreased pro-social behavior. Recently, more research has been going in the opposite direction, to investigate the positive effect of games on empathy. So-called pro-social

games are shown by Greitemeyer et al. in [5] to increase empathy along with a reduction in being pleased at someone else's misfortune, or *schadenfreude*. Greitemeyer et al. then shows support for the positive aspects of the General Learning Model (GLM) of Buckley et al. [22]. The GLM is an generalized version of the General Aggression Model (GAM), which was solely used to just look at the negative effects of violent games. With the GLM, games are portrayed as a media that when exposed to, one's mental state can be affected, leading to possible reactions in behavior. In [23], Belman et al. makes an overview of different efforts to promote empathy in social sciences, and recommends how to extend these studies to creating "games for good" that try to promote certain ethical values. Of note, two dimensions are identified in these studies. Firstly, Dispositional vs Induced Empathy, where studies may look behavior affected by empathy vs how empathy can itself be changed. The second dimension is Low- vs High-Involvement. In a game, this would determine how much the player is immersed in terms of time, engagement and building relationships in a player community.

2.4 Games for Storytelling and Empathy

Certain inspiration can be found in several other studies that look at games as a tool for letting the player build a story. One early example is KidPad [24]. In this game, kids can collaborate to tell a story using hyperlinks and drawing in one two-dimensional space using a PC. Effort is made to make the interaction easier using real-world metaphors such as crayons. In addition, it demonstrates the importance of simultaneous communication and every player seeing the same story in a zoom-able interface. *Façade* [25] is an interesting game that has the player participate in an interactive marriage drama. Using natural language processing and AI, the player takes a story design role by interacting with the non-player actors. This shows how an emergent narrative can be structured to support the player as narrative designer. On the educational side, *Murder on Grimm Isle* [20] is a serious game study that combines storytelling with writing lessons. Players are asked to design and argue for a crime story based on clues they can find by exploring a 3D environment. In terms of learning benefits, the results showed more sustained motivation and curiosity in the pupils. This has showed how part of the narrative can be embedded in the game while giving the player enough control to come up with the actual story.

As for popular entertainment games, there exists those that use different forms of storytelling and empathy in their mechanics: An older game genre that features collaborative storytelling is tabletop role-playing games, such as Dungeons and Dragons [26]. In this game, the story is created by a central narrator as each players take on a character and role dice to determine results. Other games will have all players contribute equally to creating the story, such as Once Upon a Time [27] by Atlas Games, which combines fairy tales and more traditional, competitive card playing. These games and others serve as inspiration to design the digital game and associated activity. Empathy games, on the other hand, take several forms: Some may deal with exploring one’s identity (Who Am I? Race Awareness Game [28]) or to simulate social interaction (Hall of Heroes [29] – helps teens adapt to middle school). Games that combine storytelling and empathy do so often by teaching problem-solving (Four Little Corners – An interactive storybook app about friendship [30]), but may be too inflated to be properly studied in terms of the exact relationship to empathy. This space is where this game wishes to fill. By simplifying the story structure, it may give the players the reins to exercise their empathic abilities.

Table 2.1: (Next page) a list of games that were looked at for inspiration and guidelines to this game project.

Name	About	Genre	Primary Edu. Content	Primary Learning Principle	Platform
A Force More Powerful [31]	Solving social conflicts non-violently	Strategy	Social Change	Social Problem Solving	PC
Darfur is Dying [32]	Educates by placing the player in the middle of the crisis in Darfur	Newsgame	Social Change	Exploration	Browser
Peacemaker [33]	Simulates the Israel-Palestine conflict	Simulation, Strategy	Social Change	Cognitive Problem Solving	PC
World Without Oil [34]	Collaborative storytelling in a world with no oil	Alternate Reality Game	Social Change	Social Problem Solving	Browser, Social Media
Dragon Dad [35]	Promotes environmentally healthy daily practices through minigames	Physical game	Social Change	Skills Practicing	PC
3rd World Farmer [36]	Endure hardships as a poor farmer in Africa	Strategy, Simulation	Social Change	Cognitive Problem Solving	Browser
Microsoft Flight Simulator [37]	Flight simulation tutorial	Simulation	Academic	Skills Practicing	PC
Fold It [38]	Solve protein puzzles, helping real-world medicinal research	Puzzle game	-	-	PC
Icra [39]	Presents Japanese culture and landmarks to raise cultural interest	Exploration	Culture	Exploration	PC
Its a Deal! [40]	Spanish-English communication in business	Social simulation	Academic	Social Problem Solving	PC
Global Conflicts: Palestine [41]	Report on the conflict while befriending the locals	Adventure	Culture	Exploration	PC
Façade [25]	Emergent drama with AI characters	Interactive drama/fiction	-	-	PC

Chapter 3

Development

This chapter shows the development process of the game, starting from the problem description. The general strategy is visualized in figure 3.1. First, the project starts with the problem description of the master thesis, which then goes into the ideation process (section 3.1) to find a game concept. This game concept was used in the next phase, called prototyping (section 3.2), where the general functionality and visuals were decided. Using this prototype, the game itself could be fully implemented (section 3.3). This was done in an iterative process where the game was implemented piece by piece according to the requirements in section 4.4. This game was tested and re-implemented in a cycle, until the finished product emerged. The development used agile development methods, as this is a process which allows for constant feedback and renewal of the solution and design specifications [42]. Thanks to that, the game could be developed iteratively while simultaneously considering and checking which elements were needed for realizing the end research goal.

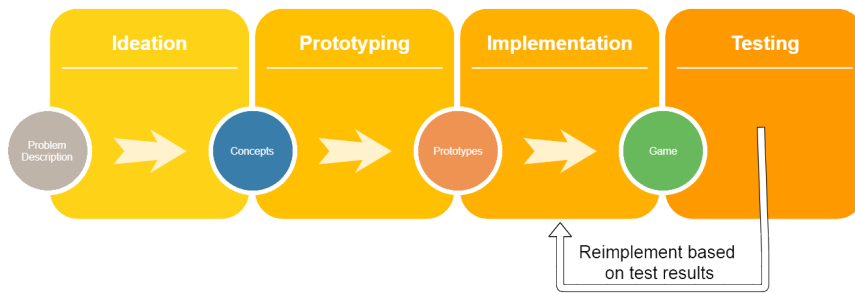


Figure 3.1: The development process

3.1 Ideation of Game Concepts

Once the review of the literature and serious games were done, the ideation started. This took the form of mapping different ideas and concepts based on earlier inspirations, and then discussing, changing and adding to it until a viable concept emerged. The problem description at this stage was very open. The only requirement was that the game had to be related to *The Little Doormaid* in some way. It was discussed that this could take the form of translating the story into a game narrative, or simply by extending the effect and aim of the novel into a game. In other words, the game could push the same ideals and attempt to create social change in the same way the novel does. As mentioned earlier, the novel was written by Letizia Jaccheri. When she began writing, she was motivated by her desire to increase self-confidence in women and to defeat stigmas of girls in technology. This showed some possible “hooks” to which the game concept could attach itself to: First, it could perform an affective effort to promote societal views or health. Alternatively, the game could take on a more focused approach on girls in different circumstances, on promoting technology education, or a combination of the two. Another interesting inspiration existed in the way Letizia created this story to express her views and to help other people to gain a perspective in a field she was interested in. This created an angle for a potential concept that uses storytelling for people to help relate to each other.

3.1.1 Concept 1: Novel Translated into Game

This looks directly at the categories presented by Jenkins [19] in Chapter 2 (section 2.3). A possible concept was to simply make an exploratory effort to figure out how these narrative structures could be used to translate the story into a game. Specifically, the categories of enacting and embedding would be most interesting here.

3.1.2 Concept 2: Investigate Crisis

Inspired by games such as *Global Conflicts: Palestine* [41] and *Murder on Grimm Isle* [20], this concept would try to replicate a narrative like the one in *The Little Doormaid*. This time, however, the player is in control and must investigate and solve a crisis with numerous people in conflict. Similar to *Global Conflicts*, the game would then use affective learning to have players better understand and empathize with people in similar, real-world conflicts.

3.1.3 Concept 3: Programming and Explanation

This concept merges programming with social games such as *Dungeons and Dragons* [26] and *Once Upon a Time* [27]. Here, pupils not only learn programming, but they must then explain what they learned to another person, to help them solve their task. An entire classroom plays this game on their phones while standing up. The game will encourage them to go into random pairs, then solve a puzzle together. One way to realize this could have been to learn and use programming concepts as tools in the game, then hand the tool as an in-game object to the partner and explain what it does. To make it more engaging, proximity beacons (such as *iBeacons* [43]) can be placed in the classrooms. The players can go to a location in the room and pair dynamically with a person there that has the tool needed.

3.1.4 Concept 4 (selected for development): Empathy through Storytelling

The concept that was finally selected is a game that attempts to build empathy using collaborative storytelling. This was especially inspired by empathy games that puts the player into the story to understand a difficult situation (Darfur is Dying, Peacemaker, 3rd World Farmer), and by some story-building games (Kidpad, World Without Oil). Façade was also useful for showing the degrees to which a player can help narrate in an emergent, yet dramatic story. In the initial version of this concept, people were supposed to be grouped randomly and given story elements to create their own full story in unison. The group then present the story to the other participants in other groups, who can vote and reward stories that they liked. To take it further and make sure empathy was in the center, it could explore different potentials: Fore example, it could involve stories which intrinsically help build perspective, players could solve different social problems, or it could build empathy to people in specific situations and problems. It eventually evolved into a game that trains people to better see real social issues by playing with make-believe characters with their own issues. People could play verbally while within each other's physical presence. It could then possibly be extended to be online, or even via text messages. The target user group would be anyone from kids to adults, but with especial focus on kids and teens.

Related to this, there were some other ideas for potential concepts and extensions. One extension involved taking a more instructional approach: The game could be tailored to a specific educational program. This could be done by having the players tell stories about people in a set historic or sociological theme. The players can then learn by exploring how issues have multiple sides, and how conflicts can arise between groups. Another idea was to make the storytelling happen backwards. in other words, the game presents the outcome of a serious conflict, and the players then go backwards to make up a possible cause for the conflicts. This can go on until they eventually find the root cause of the conflict. Then, the group presents the story to the other groups in forwards order, from cause to effect. This makes the players learn by involving themselves in the story and building perspectives about conflicts through discussion. None of these extra ideas made the cut, however. Instead, the concept went in a more natural direction to become a general storytelling tool.

After deliberation, two main challenges appeared when taking this concept to the prototype stage: 1. How the game will represent and store the story as an in-game structure, and 2. how the process would facilitate story building among the players. A secondary goal in this project was after all originally to make it so *The Little Doormaid* could be theoretically contained within the game. This is partly why the story structure received some extra priority in development.

3.2 Prototyping

For the prototyping stage, it was decided to first do what is called a low-fidelity prototype. A low-fidelity prototype is simply an early version of what the concept looks like that is made with lower standards towards true representation of the final product. This is to quickly design and test the visual and basic mechanics of the system, and allows for a fast, low-effort overview of the solution. This follows the same principles as those in the rapid prototyping stage of Design Thinking [44]. Design thinking is a solution-focused approach that encourages finding solutions in a practical and creative way. In addition to the mentioned benefits, a low-fidelity prototype will both encourage and foster such Design Thinking [45]. To make this prototype, the developer used a combination of drawing in Paint.net [46] and presenting them in PowerPoint [47] slides. Paint.net is a raster graphics editor which the author had some experience with, and PowerPoint allowed the most basic of functionality for displaying the prototype pictures sequentially. This granted the prototyping the brevity that was needed for quick design and development. After this prototype was developed, a more functional high-fidelity prototype could be considered. This ended up being merged into the actual development process (section 3.3). The reason for this is that was easy enough to simply create the different screens in the Unity development platform without much overhead.

3.2.1 Initial Story Structure

By now the structure of the game would be slowly coming into place. A single person would be the center point of the story, as main character. Other characters would come and go, but only as part of something new happen-

ing in the story. To give the player to an idea of the person’s personality, there are some different descriptions of that person, called traits. In order to continually add new, unexpected events to the story, the idea of Story Tags was introduced. A Story Tag is a piece of the story which describes something happening. It’s up to the player to actually present it however, so they must use their imagination and figure out what actually happens, and what the character decides to do. Since the focus at this point was to build up an issue, each new event would have to introduce something bad, such as a conflict with another person. At the end of it all, a final Story Tag would act as a “solution”, to wrap things up. This way, the players could build up a problem together and have a chance to fell the increasing desperation in the main character, before finally helping them. In addition to the effect of making an empathic connection to the in-game story (discussed in section 2.3), the group could even make an attempt at social innovation. Better yet, if the story mimicked something happening in the real world, this could be applied to directly understand and solve different social problems as they are currently happening.

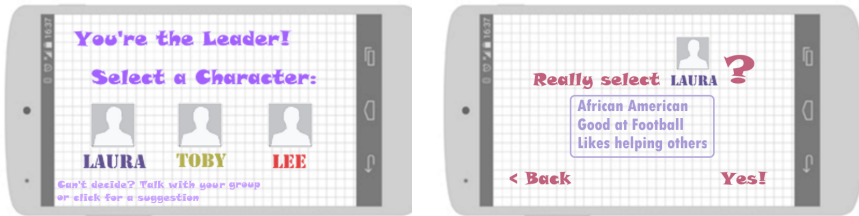
3.2.2 Low-Fidelity Prototype

Here are the PowerPoint slides that show the prototype images for the game concept. This also serves as a look into how the game process was envisioned this point in the project. Each player will have a mobile screen, while standing in a circle. They all start at the first screen (figure 3.2).



Figure 3.2: The player is put into a group

In the first phase, the game puts all the players in different groups. These groups could compete against each other, but the main reason is for them to present their stories to the other groups.



(a) Select a character

(b) Confirm character selection

Figure 3.3: The character selection screens in the prototype

The first player picks a main character, out of a selection of different names and pictures (a - 2.1). Tapping one will reveal their traits (b - 2.2), which can give the player an idea of what kind of person it is. In this scenario, the player selects Laura. Once confirmed, a new player gets the following screen (figure 3.4a):



(a) Add a new Story Tag event to the story (b) Link the Story Tag event to the story

Figure 3.4: The story building screens in the prototype

The players in the group will now take turns building to the story. First they get a set of possible new Story Tag events to the story (a - 3.1). Note the text on the bottom left, which is clickable. This text can be clicked by players who can't come up with a story. In which case, the game will suggest a completely described event for the player to use. Selecting one of the Story Tags will prompt the player to link it to the story (b - 3.2). The traits in the box at the top will now start floating around, showing the player that they must click one of them.



Figure 3.5: Next player adds something to the story

This is what the next player will see after the previous player has selected the event “She hurts someone by accident” and linked it to the trait “Good at Football”. This link means that the event is somehow related to the fact that Laura is good at football. A possible way to build this part of the story could be something like this: “Laura likes playing football every Friday. One day, she shoots the ball too high and accidentally hits someone on the sidewalk.”



Figure 3.6: The group presents their story

At the end, all the players in each group will be finished building their story. It is now up to the group to present their story to the others. In the order they added events, the players will tell their story verbally. Once each player is done with their part, they will click on the “Next Person” button, which signals the next player to start. After this, although not pictured in the prototype, a possible voting stage would take place. This was to add a competitive aspect between the groups, motivating each to make as good of a story as they could.

3.3 Implementation

As soon as the low-fidelity prototype was done, several changes were made to the original concept. The most major one was in the general activity. Instead of delegating the players into groups, the game would simply be reduced to that of a single group playing at once. This meant no inter-group competition nor any presentation in unison. Instead, the storytelling presentation were to happen at the same time as the player built the story. Other changes included the information visualization, which now needed its own GUI implementation.

3.3.1 Choice of Technology

When the project reached the development stage, a development platform had to be chosen for realizing the prototype into something closer to the final visuals, and then to add new functionality as needed. The platform had to be quick and easy to use so that the project could get started immediately with the design. Since the game mainly uses simple GUI mechanics and networking, the platform should have some GUI framework in place already. This was so that the project wouldn't need much time on "re-inventing the wheel" in terms of mechanics that have already been made. A benefit would also be that the networking had a simple solution, such that it could be tried and tested early. One consideration for technology was to use HTML5 and Javascript. This would allow for keeping the game entirely within a website, accessible to any compatible browser, mobile or PC. No downloads would be needed, and the networking would be inherent in the existing client-server architecture of the HTTP protocol. However, looking for more support for coding and planning the system, the spotlight turned elsewhere. Corona [48] is a free, cross-platform game engine which uses Lua. This was highly recommended by other programmers as an easy and powerful tool to create 2D video games. Still, it lacked a visual GUI editor, being more focused on games with movement and physics. The student looked elsewhere, considering platform that were more familiar. LibGdx [49] was one such platform. This was an environment the student had some experience in. There was also a visual editor that could be used, but the last experience with this had been slow and bug-prone. Next, Unreal Engine [50] was considered. This has a built-in visual way of programming, and allows one to drag-and-drop UI elements into the screen. But this platform

wasn't chosen either in the end, mostly because it couldn't stand up to the Unity Engine [51], with its superior documentation (official and on online forums) and familiarity with the student. It was also not perfectly stable on the main development computer, having experienced crashes more than once due to GPU errors.

In summary, the Unity Engine and Editor [51] was chosen because the student had a fair deal of experience with the platform and its C#-based programming language (called UnityScript). Benefits of using it includes having a big, established framework which lends itself to adding new functionality easily. In addition, there is ample support for building to several platforms without changing the code, including PC, Mac, Android and iPhone. Another big pull was the visual way that Unity organizes and lets you control your game elements. These elements can be drag-and-dropped around on the screen for easy and immediate-response design. Every screen is saved as a Scene, and reoccurring objects are saved as Prefabs. Unity also includes its own framework for building GUIs. Finally, Unity provides a large amount of documentation and tutorials, as well as several forum posts and answered questions around the internet, making learning a breeze.

The other piece of technology to be considered was networking, as Unity was compatible with different types. Besides the default solution (UNET), there was Photon Bolt, which was highly praised by other programmers as being more reliable than UNET, more features and better fine-tuned networking configuration. In addition, Photon Bolt is open-source, although it wasn't free. In the end, the student decide to go with the default networking library UNET that comes with Unity. This was because the networking system was envisioned only ever envisioned to be of a simple design. Thus it was not deemed necessary to build something low-level or paid-for. UNET grants matchmaking by setting up rooms online which the players can create or join. A room is a way for the networking aspect of the game to keep track of the different players. Each player connects to this room in order to play with each other. It is hosted by the player that creates it, meaning network quality will be dependent on this units connectivity. If more reliable connection is preferred, one would have to implement client prediction. That is, methods to make the negative effects of a bad connections less noticeable.

3.3.2 Implementation and Testing Process

The first priority after the prototyping was to remake all the major screens. This was done directly in Unity, which allowed for tying the look to what was actually possible in the framework¹. Some changes made because of technical reasons include the story view, which is visible in figures 3.4-3.5. This became more of a simple line between the Traits and the Story Tags, instead of spending a lot of effort on a curvy line that gracefully and dynamically reacts to line breaks. Also, the story structure was simplified in that the Story Tags would only ever contain text, not new Characters. This was partly because the events were re-imagined to be actual abstract events, and partly because of the architectural demands, which was a workload that could be left for later.

Now the game would be made with the basic mechanics in place. This meant developing a version that was offline and with only one player. At this stage, the player can go through the game, select a Character (with its 3 Traits), then attach a few Story Tags² to the story. Each Story Tag can be linked to another, or to one of the characters Traits. This all culminates into a saved Story data object³ which is visualized as the progress of what has been added to the story⁴. Next, the networking was to be added with UNET. When the players now start the game, they will try to join in a set room on the UNET network. Then, the flow of the game must be communicated over the network, with the players taking turns adding something to the story. But the story itself also needed to be communicated. This is done by broadcasting the ID of the character or StoryTag that was added, and then updating that locally. Since a Story Tag also needs to be linked to something else, a Story Link is also sent over the network, which represents a link between the story tag and a target, which is either a trait ID or a Story Tag ID.

Finally, a proper end to the game was added in the form of solutions. This let the players come together to pick a way for the story to end. As the Story Tags up to this point were designed to build up an escalating problem for the main character, this solution would now be the thing to solve it. The solutions are saved in the same way as Story Tags, with a simple

¹List of the screens in Unity: <https://git.io/vhGet>

²Story Tag script: <https://git.io/vhGe9>

³Story and other data objects: <https://git.io/vhGvU>

⁴Story view script: <https://git.io/vhGvs>

boolean attribute to tell them apart. In the game process, the solution stage is implemented so that all players can see the screen at the same time. Each player gets a different, random set of solutions shown to them. Once all have picked a solution, the group votes and talks by themselves which solution they want, ending the game.

A small set of preliminary tests were now performed. The feedback from these tests lead to several improvement ideas for the design. One of these in the way the linking of Story Tags is explained to the player. This was made more intuitive by creating a visual metaphor for a dangling rope that represents the link to the Story Tag (shown in figure 4.6). Noticing that the networking created some problems with unstable connections, a mitigation attempt was made by configuring some parameters with latency and ports. Another big issue which plagued the entire development process was a difficulty in shutting down a room with UNET once all players had exited their game. Upon exiting, the system is unable to disconnect properly, leading UNET believing the player is still joined. The result is having to wait for the 20-30 second timeout period for the room to be unlisted before being able to start playing. Several tries were made to fix this, including forcing creating a new room, or halting shutdown long enough for the user to leave the room. While somewhat avoidable because of its predictability, the issue would never fully go away until a switch or upgrade is made on the networking service used.

In the later stages of the project, the networking functionality would be made more robust to increase the dependability of the game⁵. And while the networking was made more robust, it was also made more complicated. This led to an unexpectedly large workload spent on implementing these network changes. Now the start screen will give info about which room they are connected to. An admin can use a secret button to create a new room if the current one isn't working. The game will also allow for a player to drop out and be reconnected. Now, the game may continue without all the other players being stuck waiting for the player to respond.

⁵Networking is tied between the main Game Manager (<https://git.io/vhGfw>), the Network Manager (<https://git.io/vhGfo>), and the Network Player objects (<https://git.io/vhGf6>) that all must communicate among each other.

Chapter 4

Description of Tappetina’s Empathy

4.1 About the Game

“Tappetina’s Empathy” places around 3-5 players in a group, each with a smartphone. The goal is to build and present a story to each other. This is done by making use of story cues that the game gives them. Each player takes turns to select a cue. As part of this, they must verbally tell the rest of the group what happens. Since all the player has is an incomplete story cue, they have to elaborate the details. This is one part the story details that the group has already established, and another part details from their own fantasy, all to produce a new event in the story.

By constructing a game with such collaborative storytelling, the players get an opportunity to put themselves into the position of the Character in the story. The game is designed in such a way as to build up a problem which may resemble real-world issues and challenges faced by real people. As Smiley [3] states, as a player continually puts themselves into the shoes of fictional people in such different positions, it develops their empathic ability and open up their view of the world. This allows them to better understand the motivation and background leading into real-world situations of the same nature. The game also gives each player the agency to shape the

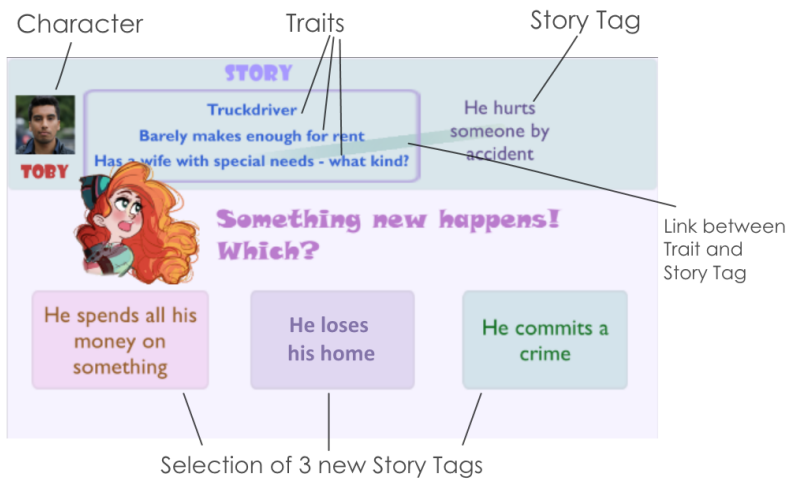


Figure 4.1: Story Tag Select screen - So far, having a wife with special needs has led Toby to accidentally hurt someone. It is up to the player to narrate the specifics.

story when presenting it. The desired outcome of is to facilitate introspection and exercise empathy alongside storytelling.

4.2 Story Structure

This section will describe the final information structure of the in-game story. This structure is how the story will be represented in the game, as seen in figure 4.1 below. At the core of the story, there is a single main Character. This Character is then attached to 3 Traits, which act as short descriptions of the Character. The main content of the story is represented by a variable set of Story Tags. Each of these act as a separate event that moves the story forward. This event may be something that suddenly affects the Character or an action the Character performs. Each Story Tag is linked to a cause. In other words, there must be something that yields this Story Tag event as a consequence. This cause could be another Story Tag, or it could be one of the Traits within the Character.

This structure is based on the suggestion and discussion by Louchart et al. [52] about models for emergent stories in video games. The proposed model involves time-separated “episodes” similar to improvised the-

ater. Each such episode is presented without going into detail about the specific execution of the event (which is up to the gameplay to decide). The Story Tags must then be abstracted such that only the overall goal and the story’s background are described. These elements and connections are also designed in the same way as a narrative planning problem [53]. That is, each event in the narrative must be connected by a believable Character action that advances the story by transforming the world.

4.3 Gameplay

The game follows a round-robin style format with the players going in turns. In the first turn, the player will select the Character for the story. Subsequent turns will take the form of a player selecting a Story Tag, linking it to the story, and presenting it verbally. Once everyone has had their turn, the solution round starts. Everyone picks one solution, presents it, and agrees in unison whose solution was best.

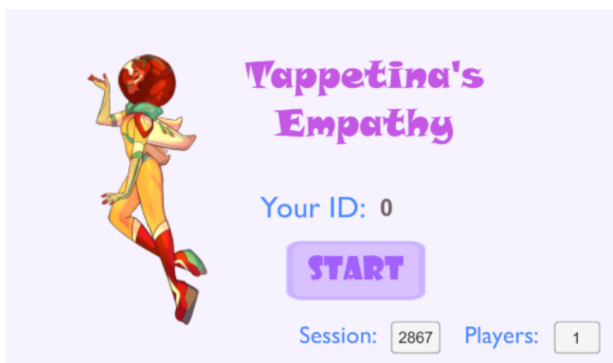


Figure 4.2: The start screen of the game which handles connection setup.

4.3.1 Start Screen

The first screen deals with connection setup and waiting for other players to join the network room, which is where the different players connect to each other online. When the game is launched, it will immediately bring the player to this screen and start searching for a room on the UNET network. If a room is not found, it will attempt to create one by itself, and join that. The ID of the player (designated by “Your ID:”) shows the player their server ID.

This can be used for testing and analysis, such as seeing who joined after whom, and which player added what to the story at what time. The Session box shows the room ID. This is called Session as a way to identify the group of players for later, and to know if you are connected to the same room as everyone else. This box also serves as a hidden button for administrator use. If clicked, the game will leave the room and instead try to find another, possibly creating a new room. Lastly, the Players box shows how many are currently in the room, so that the player can confirm that everyone is inside before starting.

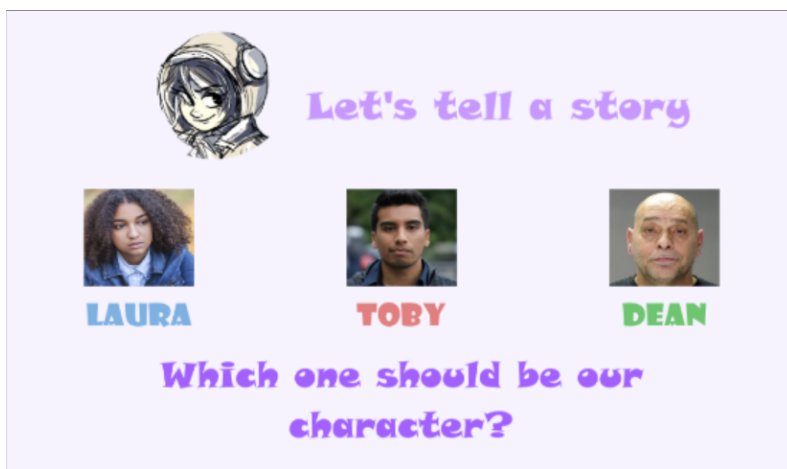
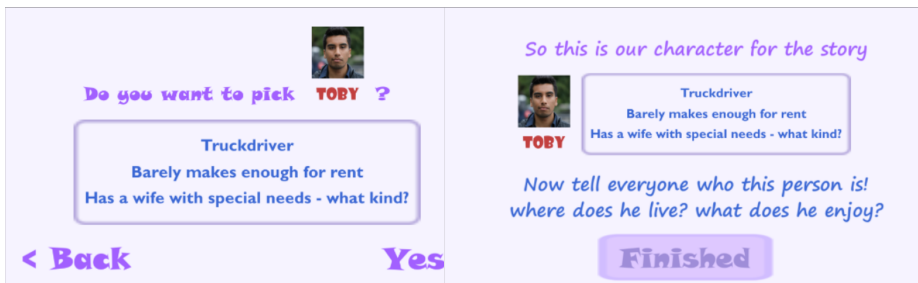


Figure 4.3: Character Selection



(a) Information about the Character

(b) Presentation of the Character

Figure 4.4: The screens which display information about the Character and instruct the player to present the Character

1. Character

When the first player picks the Character for the story, they are given a choice of 3 different Characters. After picking one, the player is asked to present the Character to the rest of the group. This includes describing him or her in name, and fleshing out the given Trait descriptions. They are also encouraged to come up with details outside of the game's established structure.



Figure 4.5: Selecting a new Story Tag

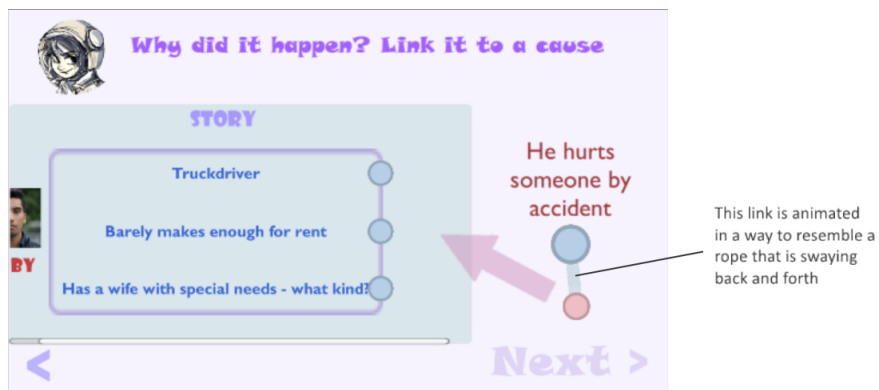


Figure 4.6: Link the Story Tag to the story. This creates a cause and context for the new event.



Figure 4.7: Presentation of the Story Tag event. Note the player has made a link to the third trait, showing this is the reason for why the new Story Tag event happened.

4.3.2 Story Tags

After the Character is established, each player gets to add a Story Tag. This is the next event that happens in the story. Likewise with the Character, the player must make up the specifics on their own, and present it verbally to the rest of the group. After the Story Tag is selected, the player is sent to a new screen where it must be linked. This is where to a cause, to add to the line of events that make up the story. This preceding cause may be one of the Character's Traits, or a different Story Tag.



Figure 4.8: The solution screen, from which every player decides on their own resolution to the story.



Figure 4.9: Presentation of the different solutions to each other. After this, the players decide on the best solution and the game ends.

4.3.3 Solutions

Finally, once everyone has added an event to the story, players must come up with an ending. They do so in unison, each picking their own solution and presenting it. The group decides on a single solution that they like the most. This completes the story.

4.4 Requirements

These are the requirements which were initially put forth to guide the development of the game. They also serve as documentation of the state of the project, in terms of what was planned, and what was actually completed. Each functional requirement is prioritized from high to low. A high score indicated that this requirement is an utmost necessity for the game for be considered satisfactory. Medium (written as “med”) are important details which will heavily affect the results if not included, but are not essential to the core of the game. Low priority requirements are those that would benefit the game project overall, but are neither fully necessary nor a big influence on the end goal of the thesis.

The creation of requirements is quite different from that of figuring out the design and concept (as seen in section 3.1). From this point on, one must consider what can be implemented and how. This process is discussed by

Callele et al. [54] as an extension to traditional requirements engineering to support the creative process in creating video games. Unlike most normal software systems, a game is made by thinking and designing creatively. This leads to a different sort of transition from pre-production to actual production where one has to use domain-specific knowledge to find “implications” of certain design choices. That is, what does the implementation need to do in order to accomplish that? Three levels implications are revealed, dependent on where knowledge are derived from. These have guided the requirements in this thesis: First are the implications directly from the design, such as R6, which comes from directly from the concept of what a Story Tag is. Second are the implications from domain-knowledge, where the domain is usually the game genre mechanics and structure. Here, the domain is storytelling with a GUI (Graphical User Interface)-heavy game. Take for example R5, which comes from the knowledge that games need a storage to keep track of elements presented in the design. The third level are the implications that come from knowledge of the actual implementation, such as the architecture used. This is where the most unforeseen implications can occur, sometimes leading to overly complex structures or feedback to change the design. R6.5 can be seen as a good example of this, as it makes the implication that Problems and Solutions can be represented both as a Story Tag data object, saving hassle of implementing them separately in the architecture.

The implementation strategy were to go through the requirements one by one as separate tasks, focusing on the high-priority requirements, and secondly the medium ones. Then, if enough time and resources were available, the low priority requirements would be implemented, if they still appeared to be enough of benefit to be worth it. For the non-functional requirements, these were selected to guide the quality validation of the final game. The important part isn't to create a highly optimized game, but one that is functional enough to accomplish the design objectives and to not be a distraction when playing. So, as such quality requirements were never a large part of the thesis' final goal, this section is relatively sparse.

4.4.1 Functional Requirements

- R1. (high)** The game is played by multiple players, each on a separate smart-phone
- R2. (high)** The gameplay will involve constructing a story out of Story Tags and

Characters

- R2.1. (low)** The data to each finished story should be saved as analytics data
- R3. (high)** The players go through several game phases in a play session:
- R3.1. (med)** Setting up the connection - a player hosts, while the others connect using a keyword
- After R3.1, the game cycle goes:
- R3.2. (high)** Selecting Characters/Story Tags - repeated for each player until they are ready to present the story (see R6)
- R3.3. (high)** Presenting the story with the guide of the game, the players verbally present the story
- R3.4. (low)** Giving points to the best story - the performance and quality of each story is scored by the players in the end
- R3.5. (med)** Finish - after all groups are finished, the results are presented to the players
- R4. (high)** The game should connect players standing in the same physical room using the internet
- R4.1. (med)** The connection will be peer-to-peer, with one player acting as host
- R5. (high)** The game must keep a storage of content that will help build the story: Story Tags and Characters
- R5.1. (med)** The Story Tags will be mainly textual, and each is linked to another Story Tag or to the Character
- R5.2. (low)** The Story Tags may also contain a new Character or an image for additional inspiration to the story
- R5.3. (high)** The Character will have a portrait image and several Traits (textual descriptors) to display their personality
- R6. (high)** Constructing a story (R3.3): The Story Tags will represent a chain of events in the story that lead to an outcome.
- R6.1. (high)** As part of the game cycle (R3), the game will iterate through each player, instructing them to select a Story Tag and use this to carry the story on
- R6.2. (med)** The first player to be selected will pick the main Character of the story
- R6.3. (med)** When selecting a Story Tags, the player must pick an existing element (previous Story Tag or a Character Trait) to base this off.

-
- R6.4. (low)** If the player can't come up with a story, they may click a button to have the game attempt to give a suggestion or hint to help imagine the story
 - R6.5. (med)** Story tags can switch between being a Problem which escalates the conflict/issue or a Solution that helps resolve it.
 - R6.6. (med)** A selection of solutions will be shown at the end of the game's turns, which finishes the story building

4.4.2 Non-functional Requirements

- R8.** The game must be well usable by the players, with >90% of players finding it easy to navigate without previous experience
- R9.** Constructing a story should be easy - no player (<1%) should experience being stuck with no ability or inspiration to keep the story going when playing a round
- R10.** The game must be accessible to >95% of Android smartphone users
- R11.** For establishing the first-time connection, the game should always (>99% of cases) be able to find and play with to the other players, as long as there is an internet connection

4.5 Use Cases

These Use Cases were created from the functional requirements to get a better idea of the flow of the game. This aided development by planning out the different states and which buttons would be needed to go from one to the other. All 4 Uses Cases are considered successfully implemented in the game, with some changes. UC1 (Set up connection) no longer requires step 2, as the keywords are no longer part of the game flow. And UC4 (Finding a solution to the story) has changed step 1 in that all players get a set of solutions to pick from. Also, step 4 and 5 are replaced by a discussion among all players about which solution to accept, then an end screen which displays the final story. These changes are further discussed in section 6.1.2 Validation of Requirements below.

Name	Set up connection
ID	UC1
Description	The host sets up a room before the game starts
Actors	Host player Other player(s)
Triggers	Host boots up the game and clicks "Host Game"
Preconditions	2+ players
Main Course	<ol style="list-style-type: none"> 1. The game sets up a room online, displaying the keyword for that room 2. The other players connects to the room using the keyword 3. The game puts everyone in the same online room 4. The Host hits "Start Game", which takes the game to UC2
Alternate Courses	

Table 4.1: Use Case 1

Name	Game start
ID	UC2
Description	The story is set up and a character is chosen by the player
Actors	Host player Other player(s)
Triggers	End of UC1
Preconditions	2+ players
Main Course	<ol style="list-style-type: none"> 1. The game creates a Story object which is constantly synced to every player's device 2. A player is given the objective of selecting a Character from a set of three, each with its own 3 Traits which describe their personality 3. The player selects a Character, which is added to the beginning of the story 4. The player narrates and describes the Character, which is recorded in the game 5. The game begins building the story (UC3)

Table 4.2: Use Case 2

Name	Building the story
ID	UC3
Description	Every turn a new player gets to add to the story by choosing a Story Tag
Actors	A randomly chosen player (selected round-ribbon style) Other player(s)
Triggers	End of UC2 or UC3
Preconditions	2+ players
Main Course	<ol style="list-style-type: none"> 1. A new player is prompted to click "Next Player", starting their turn 2. The game shows set of new Story Tags, which the player can add to the story 3. The player links it to one of the Traits in the Character or a previously added Story Tag 4. The player narrates what happens in the story, using the Story Tag and the link as inspiration 5. The Story Tag is added to everyone's visible Story

Table 4.3: Use Case 3

Name	Finding a solution to the story
ID	UC4
Description	A solution is picked to resolve and end the story
Actors	A randomly chosen player Other player(s)
Triggers	After all turns are finished in UC3
Preconditions	2+ players
Main Course	<ol style="list-style-type: none"> 1. The game selects a player and presents a set of Solution Story Tags 2. The player picks one Solution, then narrates how it solves the Story's problem and helps the Character 3. All players gets a choice of whether the problem was really solved, or if they want another solution (see AC1) 4. Once the solution is confirmed the game ends and the story (along with recorded narrations) is saved 5. All players are sent to the start screen

Table 4.4: Use Case 4

Chapter 5

Evaluation

5.1 Research Strategy

Different empirical strategies are described by BJ Oates [55]. To figure out how to conduct the research in this thesis, several different strategies were considered. To give a synopsis, Oates describes 6 possible strategies in a standard research process: survey, design and creation, experiment, case study, action research, and ethnography. The strategy is the overall way of obtaining the knowledge desired. It defines the plan of action, the structure of the data collection, and argues for the purpose of it all. Finding the strategy is a direct answer on how to answer the research questions. Now, for a look at the different strategies:

A **survey** is a way to get a large amount of data from a group of people in a systematic way. This is to then look at the collection of data for patterns and generalizations. Data collection for such a strategy may use polls and questionnaires, but could also be structured interviews that are performed repeatedly. For this project, a survey would mean having to figure out in advance exactly the types of data needed. A survey falls short in that it doesn't allow for enough depth and unexpected sources of information. The goal of research question 2 isn't to find some generalizable measure of the quality of the game effect. Instead, it wishes to discover ways that the game relates to empathy. For this, a more direct approach is desired, which can

query the reactions of a select few participants.

Design and creation is a strategy where the research process involves the actual development of an information system. This means the system itself is part of the contribution. This can be part of a collection of strategies used in a research process. First, one may design the system, then decide to test how users actually react to the system using, for example, a survey. Part of the goal for doing this strategy is to learn while making the system. Five steps are involved in this, as a problem-solving approach, which is quite similar to how software systems are generally made. The five steps are these: Awareness (acknowledging the problem), suggestion (proposing a possible solution), development (implementing the solution), evaluation (measuring how well it solves the problem), and conclusion (discussing and deciding on the overall benefit). This approach seems to fit well with the problem description of this thesis. The game will constitute part of the main knowledge contribution as an innovative tool. And, the added goal of learning while designing can now allow the discussion during the design process to be an additional source of contributed knowledge.

An **experiment** is an approach to collect data in as controlled environment as possible. Often placed in a laboratory, it is a very well-established scientific practice which has some of the strictest requirements in order to show the facts of, say a hypothesis. This makes it the only research strategy which can truly show a cause-and-effect relationship in a system. If the research goal for this thesis was to find such an undeniable proof of empathic improvement, this would certainly be the way to go. Unfortunately, the situation of this game is much too uncertain to properly warrant a proper experiment. Not only is the expected reactions and data not clear, but the environment is difficult to predict and control. A general downside to experiments is also that they may show a too artificial situation that fails to properly mimic how the phenomenon happens in real life. In this evaluation, an important priority is to make a sincere connection to the participants. At best, this would make it a quasi-experiment. This means that the evaluation will be planned and performed with a set of non-randomly selected participants. This introduces possibly threats to validity in terms of selection bias and external confounding influences. These are outlined in section

A **case study** goes in the opposite direction of an experiment: While an experiment is all about limiting external influences, a case study welcomes them in. Instead of a laboratory trial, this prefers the real-life context, in-

cluding all the factors and relationships which help determine how the situation plays out. This means depth is key, with only of a few select cases investigated and analyzed at a time. One drawback for this project is that a case study puts the environment into focus, much more than is desired. In addition, while survey provides not enough depth, this may very well encourage too much. The important element of the evaluation is to figure out in what way the participants react when playing how they may use their empathic and storytelling abilities to interact with the game and each other. It is too early and not relevant enough to see how the game would play out in an actual everyday setting, as all the distractions may take away from the performance of the core game concept.

Those are the main strategies considered, but one can still take a quick look at the remaining two strategies that Oates underlined: **Action research** is a way to suggest and evaluate how groups work to solve more immediate problems. This is outside the scope of this project, as it focuses on a change situation, such as a work place, to find better strategies and courses of action. An **ethnography** is a study of a group's culture. This is often to explore and represent the knowledge and behaviour of that group in certain social situations.

So, the chosen strategies are design and creation, plus a quasi-experimental strategy. This represents the project's focus on the game as a research artifact, constituting its own contribution, and the way it will be evaluated. By having two different strategies, they can be used to validate each other through so-called strategy triangulation. This is performed by having two different ways of finding knowledge, and comparing the two. In this case, one source is through the design process of the game, which argues for how the game correlates to empathy by using several principles and frameworks. The other is the end evaluation, which can attempt to show that same correlation through player behavior in the game trials.

5.2 Data Collection Methods

Next in the research process, Oates [55] shows 4 different methods for collecting data. These are: Interviews, observation, questionnaire, and documents. In order to pick a method, one has to consider the plan as defined by the research strategies. For the design and creation, there wouldn't be any

evaluation with users, as this part simply focuses on the design process. But, if any methods were to be considered, it had to be one that could argue for why the game could work. This could be done by either analyzing the game in retrospect, or by ensuring beforehand that it uses the necessary principles. For the quasi-experiment, one would need the data collection methods that allowed for some depth, yet also flexibility. This is so that the evaluation can investigate where the participants react in a way that is most interesting, and then “drill down” on these points of interest, without having to plan it out from before.

An **interview** is a good way to elicit information from an individual or a group. It usually involves asking questions, but can also just be a planned discussion with a set topic in mind. As such, it can have varying levels of structure. If it is a structured interview, all questions are planned in advance, similar to a questionnaire, with little room to explore new topics. In a semi-structured interview, there is space for more unplanned discussion to take place, by leaving certain questions open and instead relying on a set of themes to explore. An unstructured interview has no requirement for planning questions. Similar to normal conversation, new ideas and topics can be brought up in a free-flowing way. No interviews were planned for this evaluation, although it could have been a useful source of info. This was mainly due to the structure of the workshop event, which didn’t leave room for a lot of question-asking after the game was played. Still, one may consider the resulting chatter to be an set of small, unstructured interviews. These represents opportunities for the players to talk about how they enjoyed the game, a topic which could continue as the players are in and out of the game.

Observation doesn’t involve querying the research participants for information. Instead, the researcher stands on the sideline, simply taking note of how the situation plays out. This may give a completely different insight into the social situation, figuring out how everything plays out in unison, as opposed to hearing how participants describe it later. The researcher do need to immerse themselves in the environment in order to properly observe what is happening. Generally, observation can be performed over a long time, and the researcher is usually participating enough that the primary data may be affected. Similarly to interviews, observation can be structured, planning out when and what will be taken note of, or it can be unstructured, without any planned variables or schedule. For this evaluation, the observation will be key to analyzing the people playing the game. Since the range of possible variables of interest is still uncertain at this point, the observation would do

best to be mostly unstructured in terms of expected data, although the time scheduling will still be defined by the quasi-experiment time slot.

A **questionnaire** is a pre-planned set of questions that the participants are expected to answer. Like a structured interview, there is little room for changes once it is put into action, but the data will be much more easily analyzed in large group. This is why surveys often use questionnaires for data collection. For other strategies, such as an experiment, a questionnaire can still be beneficial by providing a quick and simple way for people to give their response individually. Questions can be designed to require a formulated response, called open questions, or they may be fixed to certain types of responses, such as yes or no, called closed questions. A downside to the pre-determined nature may be the lack of quality control and explanation should the questions be hard to understand or unfit for the type of response the participant may wish to give. For this evaluation, a questionnaire is just the thing needed to ask more personal questions in an economic manner and to triangulate certain results from the observation. For the evaluation trial, the questionnaire was only made with a few questions, all of the closed. This was because the questionnaire would be paired with a researcher present and open to more detailed feedback from the players.

Using **documents** as a data-collection method means using documents such as data reports or literature to find the information that is wanted. These documents can be previously created, which is a “Found Documents” approach. They could alternatively be created as part of the research process, such as scribbled notes or development diagrams, making it a “Researcher-Generated Documents” approach. Such documents can make up a big part of the argument, often serving as a way to chronicle other empirical methods, or to argue for a certain design process. The first research question can be largely considered to be answered in this way, by searching for and referencing secondary literature. Such literature might not always be as trustworthy or objective as it first seems, however. Not to mention, they are rarely made with the same research question in mind. So, one need to make sure to consider how the documents help one’s research goal, and how well they can be trusted to do this. A strategy to ensure this is to look for more esteemed authors and documents which are often referenced by peers. This goes for the game review, as well. Additionally, the quasi-experiment and the design and creation both make use of documents in their research. The evaluation uses note-taking and a certain degree of pictures, while the design process uses literature as basis and its own generated documents, such

as the prototypes.

5.3 Planning the evaluation

This section offers a look-back at the considerations and rationale that were made during the time of planning the evaluation. At the beginning, it was deemed that instead of formal experimental data collection, that having a researcher involved in and observing the activity would grant the most insight. This way the engagement can be evaluated by interacting with participants. This gives rise to investigating feedback and being able to examine different players and their behavior. The main form of getting feedback was observation and having the participants talk aloud about their experiences and difficulties. A questionnaire could be used to later compare to these observations. It was only natural to mainly perform qualitative analysis of the data. This is because of the qualitative nature of the research goal. Instead of requiring a numeric answer or one that can be inferred statistically, it asks for arguing and interpretation of the situation, which is what qualitative analysis is about. Some quantitative (i.e. numeric or statistical) analysis is still possible with the questionnaire, although the conclusion that is drawn from this must still be made qualitatively.

In total, the data collection methods were: Observation, recording audio of the activity, a short questionnaire, plus the game data - the complete constructed story and their individual solutions. These data results will then allow one to look back on the trial and effectively reconstruct the interaction and story building process. By having an audio recording, the researcher could better focus on observing and talking to the participants. It also allowed for later analyzing to catch details about the players' behavior that weren't noticed before. The questionnaire was then added on top of this both as a way to get direct feedback and to find light correlations between their performance and their characteristics of age, gender, etc. An added benefit was to triangulate the observation and audio recording with the questionnaire data. Triangulation is a technique where multiple data collection methods can be used for the same data point, allowing better validation from multiple perspectives [55]. The questions given in the questionnaire were similarly short and informal, asking the participants to rate their experience in a 1-5 score system. As seen in figures 5.2 and 5.3, the players were asked to score their own enjoyment of the game and their

empathy ability. The questionnaire also had a question about how well the players considered their storytelling ability to be. There were several reasons for the questionnaire being constructed in this way: In addition to the uncertain nature of the workshop time, the end goal was only ever to investigate any potential correlations between the player's performances and their characteristics. Furthermore, this was accomplished mainly through the observation and audio recording.

Since the researcher participates in the game, there were some fears of the resulting data being affected by the researcher's presence. This would be most noticeable afterwards, when the game data and the general group performance was analyzed. Neither of these were the main focus of the research, however. The main analysis would be done during play, when observing the individuals' playing styles. BJ Oates writes about how participants may act differently than normal when they feel like they are being observed overtly [55]. By having everyone in the room as part of the game, it contributed to lowering this inhibition and making everyone more at ease. At certain times, the participants were to be informed of the goals of the game and given some guidance on how to play, when needed.

To cite an example study which provided inspiration by employing similar methods, we have a report by Chen et al. [56]. This is also a quasi-experiment which tests the performance and effect of a game that is designed using certain principles. Very little effort is made to strictly control the environment and the subjects, who are kids learning mathematics. Just like in this evaluation, the kids are first instructed on how the game works, then the gameplay is recorded, and at the end set to fill out a questionnaire. Also similar is the fact that the study was only meant for a short-term schedule, relying on further investigation to increase validity.

5.4 Participants and Event

The evaluation was held during the workshop "Games, culture and science for boys and girls". This event took place at the Gunnerus Library (Trondheim, Norway). It was conducted by NTNU researchers and aimed at teenagers. The objective of the workshop was to introduce teenagers to research and the current games developed at the University. The presentation language was English, accommodating both the local Norwegian and



Figure 5.1: A picture of the workshop where the game was played in a closed room by the different participants, each using a separate mobile phone.

international players or presenters. Having this workshop as the context of the evaluation made it less of a typical laboratory research environment. Instead, everyone was open to comment, share their experience, and play however they liked. Participants joined the workshop both as teenagers and their parents. “Tappetina’s Empathy” was among several games to be presented here. Around 30 people in total were present to play the games. Teenagers were also brought in to help organize the activities as well as participate themselves. This led to a relaxed and jovial atmosphere, which was further contributed to by encouraging the participants to pick the games they wanted to try out. Before the activities, each game project got to present their goal and agenda, informing everyone about what the game would be like. The first batch of players would be pre-determined, followed by a period of walking around to the games that each found interesting. In addition to the game trials, there were art installations and brief history lessons, as this was hosted in an old library.

The trial was prepared with a mobile phone for each player (see figure 5.1), all connected to the library WiFi network. Because of the number of workshops and time constraints, only a part of the 30 participants were able to play. In total, 12 players played the game activity in groups of 4 people. Most of them were teens of age 13 or older, some joined by their parents. Their point of initiative was mixed between being lead to the game by the organizers and electing to play this game over others after hearing the presentation. Similarly to the other games, “Tappetina’s Empathy” received its own isolated room for the players to sit in a circle. Here, the players could speak and focus without distractions.

5.5 Results

How much did you enjoy the game? (where 5 is enjoyed it a lot)

11 answers

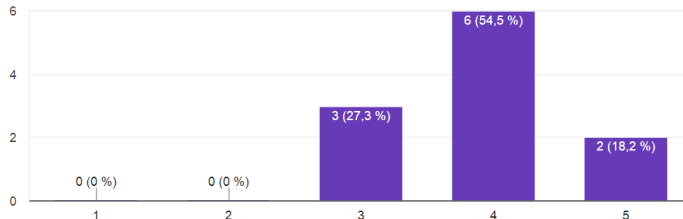


Figure 5.2: Graph of the enjoyment levels as rated by the participants.

One of the data points observed is enjoyment. That is, how much fun the experience was for the players. Looking at the questionnaire data, there were varying amounts of engagement: When asked how much they enjoyed playing the game, most players answered 4 out of 5 stars, seen in figure 5.2. Going by the observations and the audio recording, players displayed different emotional reactions and level of focus. A couple of younger kids were naturally more boisterous with friends or siblings present, showing great willingness to build onto the story with numerous details. Others were reserved and silent, but could eventually offer a constructive story addition.

Female 13-year-old: *“He gets the power a fly, so he flies into a bank and steals their money. Then he makes a castle on his old house, and lives happily ever after!”*

Using the Game Flow model [14] discussed in section 2.1, further inferences on the players’ enjoyment can be made. In general, players had little trouble being immersed, concentrated, and challenged. There were also plenty of social interaction outside what was required by the game, although mostly by those that knew each other before hand. What created more disruption was the lack of proper control and feedback at times, where the game wouldn’t respond due to lack of internet connection. There was also some confusion around the specific goals of how one was supposed to build the story by linking Story Tags as causal events. The observation had a hard time deciding if the game supported proper increasing challenge and

skill mastery, as the session was too short to make any conclusion. Notably, the players did all show increased control and agency over the game flow after one round had passed, since they now had knowledge of how the game was supposed to be played. This implies that the game should have a more external guidance or an initial tutorial to make it easier to play for the first time. Either that, or the game should present the linking and storytelling differently, by hinting earlier at the causal links between Story Tags.

Players had also different ways of interacting with the story and the game tools. The most timid could at times do nothing but repeat the cue they selected. Others would go at length to describe what they had in mind, sometimes before even reaching the linking stage of the Story Tag Selection (see 3.2 *Gameplay: Story Tags*). The majority of participants showed an innate ability to use their fantasy to build onto the story. Some would even put elements of their own life into the character and story, displaying a desire to form real-world, empathic connections to the fiction. Players showed differences in their comprehension of the game structure. This can be interpreted through time spent selecting and how they expressed that the choices were difficult. There did seem to be a hint of relation between this comprehension and the player's age and self-rated empathy (fig 5.3). When it comes to the correlation to empathy, some hints were gathered about a possible relationship here. In the question form, the players were asked to rate their empathy ability (figure 5.3). Looking at all the answers for this, and comparing them to their respective answers for enjoyment (figure 5.2), we see a 0.73 average distance. While this is hardly enough for a proof in its own terms, it does grant an indication that further research can look at. To be adapted, the game's design would need to focus even more on requiring the player to form an emotional understanding to succeed and have fun. As it is, there is not enough agency in the player's hands to properly shape the story. This may be because of an overly simplistic structure, or that the Story Tag events themselves are too descriptive.

Some challenges presented themselves during the workshop trials that may have affected the results. Disruptions ranged from network problems and difficult language for some younger players, which led to delays and lessened quantity of participants. The data collection would also prove a little difficult because of the fast movement of the start and end of a session. The audio logs were sometimes started a while after starting. And, only 11 out of the 12 people would actually respond to the questionnaire. But this was not of great harm to the study: The aim of this project is not

How empathetic (good at understanding people) are you as a person?

11 answers

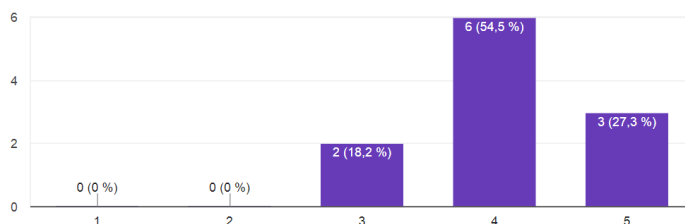


Figure 5.3: Graph of the empathy levels that the participants rated themselves with.

to bring a comprehensive or strictly experimental data set of the game in action. Rather, it is to show a proof of the potential of the game project. The data collected is largely used to highlight points of interesting research value and see if the experience hints towards the correlations to empathy or engagement. Enough such potential was found that a decision was made to develop the project further.

The most disruptive influence was the network, which would at times be unstable enough for some mobile phones to lose connection. Since the networking framework the game employed was not robust enough, the respective participant would no longer be part of the game. Either that, or the activity would be restarted anew. Still, the trials had plenty of allocated time, and every group got to play their session out to the fullest. Another complication arose from the language comprehension of certain teenage players. Several of the younger Norwegian participants would need help from older siblings or guardians to properly understand all the English words being said or displayed. Even so, this swap between different languages in the middle of playing demonstrated some of the adaptability the game format could bring.

Discussion and Conclusion

6.1 Discussion

6.1.1 Validation of Research

Research question 1 stated “*What categories, concepts and potential learning impacts exist to design a serious educational game?*”. The answer and contribution to this was the literature review (Chapter 2) which was used for the game conceptualization in Chapter 3. Research question 2 stated “*How can a collaborative storytelling game make an impact on ones empathic ability?*”. This was answered with a contribution of the game concept, design and implementation (Chapter 3 and 4) as a design-and-creation strategy, as well as its evaluation in a quasi-experiment (Chapter 5). These research strategies were performed as specified by BJ Oates [55], and the inspiration of a similar game study [56].

The serious game itself uses different literature for its design and concept. As a concept, it took inspiration from different collaborative storytelling games such as A World Without Oil [34] and empathy games such as Global Conflicts: Palestine [41]. In terms of originality, the concept manages to stand on its own as an innovation on the previous ideas that inspired it. For the design, it made good use of literature for figuring out the story structure, such as the emergent story framework discussed by Louchart et

al. [52]. This approach worked quite well for the research objective, since it made it easier to tailor the story construction for an empathy reaction. Still, the project could have used more literature on how to elicit and measure empathic responses with storytelling. Luckily, the game research has only just begun: More projects have been attached to the game, which can address this more closely. One way to measure empathy which was not used is the Empathy Quotient scale, as presented and proven valid by Lawrence et al. [57]. This is a self-report scale which was considered for the evaluation. The results from this would have been a much more reliable way of finding empathic abilities. In the end, it was deemed to be too large for the otherwise succinct questionnaire and short quasi-experiment performed at Gunnerus. Having a more exact measure of empathy, while useful, was not an important enough quality to bog down the flow of the workshop.

From the start, it was apparent that rigorously measuring an actual improvement in empathy would be too difficult with the concept being made from scratch. This is because the field of measuring positive empathy impacts in games is relatively new [4], and the fact that a lot of resources in this thesis was spent on the exploration and ideation phase in research question 1. One way to make the empathy theme easier to handle would be to narrow it down, such that it focuses on spreading awareness or informing perspectives about a specific issue or demographic. Instead, it was decided to turn this project into more of a preliminary proof-of-concept that future development can build on. As such, it was only strictly necessary to find the potential and feasibility of the concept. Still, the methodology for doing this could have been more extensive and better planned. The workshop results did show certain correlations to empathy. More importantly, the results were enough to give an impression that the participants had fun playing the game and found the idea to be interesting. Looking back at the workshop trials, there ended up being more time than previously realized that could have been spent on a semi-structured interview or a longer questionnaire. This would have given better triangulation on figuring out the level of engagement and how much empathic connections played a role. There is also the issue of results not being comprehensive, and participant IDs not being properly set. This could have been avoided with a stricter plan that emphasized making sure all questionnaires were correctly filled in.

Threats to validity

There is also the question of any threats to the validity of the results and experience. DT Campbell et al. [58] grants us the base for this discussion, with their 12 identified threats to validity in experimental design, separated into the categories of internal and external validity. Internal validity refers to the core of the experiment, whether the proposed solution or condition actual has the effect wanted on the subjects. External validity is the quality of which one can generalize that interpretation of the internal events to a larger audience, so that it's actually meaningful as general research. In other words, do both the experiment situation represent real-world situations, and do the participants represent real-life people?

Because of the quasi-experimental nature of the evaluation, the participants were not randomly selected. This leads to what Campbell et al. calls selection bias, and is a threat not only to internal validity (threat no. 6), but can also intrude on external validity (threat no. 10). The participants were not controlled and may have shared a number of similar characteristics that influence their result, such as relationship to each other, video game experience, and social skills. The participants were still observed to be of varying backgrounds. The participant group was small and followed the whims of the player's interests, leading mainly to a threat to generalizability, or external validity.

Another possible threat to external validity is sometimes called the observer effect, or Hawthorne effect. Campbell et al. uses the expression *Reactive effects of experimental arrangements* (threat no. 11) to describe this. In short, this means that the behaviors of the players, being observed in an experimental environment, could have been different to a real play session. By knowingly being part of a research trial, people may change their behavior to appear or perform in a certain way [55]. The execution of the experiment and event was heavily focused on mitigating this. The players were observed to have the impression that the main goal of the event was for them to be able to try out new games, and not to be in a laboratory setting, which made them feel at home and relaxed. And the participation of the researcher in the games, even if it is a potential threat to the results' validity, aimed to contribute to this atmosphere.

Ethics in the Research

Another quality of the research which is important to uphold, is the ethical side. After all, this does involve people taking part in a quasi-experiment and having data stored about them. The first thing to make sure was that the participants would all be properly informed. In other words, it had to be made clear that this was in fact a research trial on an game which existed as part of a Master Thesis. Next, they were told about the game, and how the trial would be performed. Every data collection method were detailed and explained. It's also important to make the distinction between personally identifiable information. It can either be directly identifiable, such as full name, or indirectly, such as their age, school, and where they live. Thankfully this project didn't need any directly identifiable info, but some indirect info were still recorded, such as gender. Participants were all assured that no such info would be published in a way that might be traced to them. And after the project ends, all such data will be anonymized. All this info goes under the recommendation of the Data Protection Official for Research in Norway, namely the Norwegian Social Science Data Services (NSD). They provide the template for a consent form template which can be used to inform the participants and to collect their written consent. Since the workshop also included children, the consent form also has a line for a parent/guardian to provide their consent. The English version of this consent form can be found in Appendix A. Finally, the evaluation plan and consent form was sent in to NSD to apply for permission to perform the research. Once this application was accepted, the evaluation was ready to begin.

6.1.2 Validation of Requirements

Following a development iteration, the game was tested by validating the requirements specified in Chapter 2 (section 4.4). This helps one keep track of the quality and the implementation of the functionality, to see whether the game performs as it should as the code is changed. This section shows the final state of the game's requirements, going through which were found to be fully, partially, or not at all implemented. This validation was performed by going through the flow of the game as specified in section 4.3 Gameplay and section 4.5. Each requirement was one by one noted to be either in working order, partially completed or not implemented.

The completed game was found to fully support all high-priority functional requirements, 6 out of 8 medium-priority requirements, and none of the 4 low-priority requirements. For starters, the game did manage to house multiple players with a smartphone each (**R1**). All players can play by connecting to each other via the internet (**R4**). The gameplay makes use of story construction with Story Tags and Characters (**R2**), which are added in various sequential phases (**R3**). Only some of these phases worked in the same way as the requirement envisioned. They do have phases for selecting Characters and Story Tags (**R3.2**) along with presentation of these elements individually (**R3.3**). There is also a final phase for finishing where the resulting story is displayed (**R3.5**). But the other phases in R3.1 and R3.4 were either partially or not implemented (discussed below). For the storage of the Story Tags and Characters, this was performed successfully as in-game data objects (**R5**). These are in fact mainly textual, and all Story Tags were able to be linked to the Character's Traits or to other Story Tags in the story (**R5.1**). And, the Character is built as its requirement specifies, with Traits and a portrait image (**R5.3**). The requirements for the details of the story construction also worked as planned, being a chain of events with a final outcome (**R6**). Most of the sub-requirements for this was also in line with the planning: All the players each add a Story Tag (**R6.1**), where the first player is selecting to add a Character (**R6.2**). Each new Story Tag is correctly required to be linked to something (Trait or Story Tag) before being added (**R6.3**). The solution system also works; certain Story Tags acting as Problems or Solutions (**R6.5**), and in the end, the players get a selection of Solution Story Tags to finish the story with (**R6.6**).

Some functional requirement were only partially implemented. These were: **R3.1** and **R4.1**. Incidentally, all of these are of medium priority. This is because they were all deemed to be worthy of being implemented as an idea, but during development ended up being changed in one way or another. While the connection screen described in **R3.1** was indeed created, the player's can't connect to another room by specifying a keyword. This is mostly because the game never needed any more than that one room active at a time. Still, there is a room ID visible on this screen (figure 4.2). It also still supports additional rooms by hitting the hidden button described in 4.3 Gameplay, Start Screen. **R4.1** suggested a peer-to-peer (p2p) solution with a single player acting as host. This is considered to be partially implemented, as the networking only takes a pseudo-p2p implementation. A peer-to-peer architecture is one where every unit in a network (called a peer) is connected to the other units, without any acting as a singular server. This means every-

one can be responsible for sending data and handling connections. Since the technology is UNET, the networking instead uses rooms hosted on a server online. The players still look at each other in a sense as peers, and that is how the game is currently implemented, but they still depend on this server for communication. For a discussion of how well this technology worked for the project, see section 6.1.3 Validation of Technology.

The following functional requirements were not implemented: **R2.1**, **R3.4**, **R5.2**, and **R6.4**. All of these are low priority, so they were simply not considered important enough at the end to warrant development time. **R2.1** wanted extra analytics data to be stored. This was not worked on, as the game flow could be easily enough reconstructed by looking at the final story and using the audio recordings, from which one can infer who picked what and when. Still, this was made a priority for a next version of the game, which were planned to be involved in large-scale data collections with many participants. In that case, the automatic and quantitative nature of the game analytics would be much more useful. For **R3.4**, the point score system was not implemented because having such a competitive element didn't seem to be a natural requirement for the collaborative nature of the game. Further experimentation with this could be fruitful however, especially if the idea of having different groups is reconsidered. No extra Characters or images were attached to Story Tags, as **R5.2** said. This was not only because the text seemed to be sufficient in creating inspiration, but having more info could risk hurting the dependence on imagination when players narrate the Story Tag, as mentioned in Story Structure [52]. **R6.3** proposed a button to help players that aren't able to properly imagine a new event related to the Story Tag. In hindsight, this idea seemed worse than initially imagined: Constructing a story that is somehow related to what the other players imagined is too unfeasible of an approach. Not to mention, the game should instead be designed as to avoid this situation in the first place. As the nonfunctional requirement R9 says: The game should be easy, so that the gameplay can continue even if a player isn't feeling particularly imaginative.

For the non-functional requirements, not all could be validated as strongly as the precise percentages in the descriptions might suggest:

No formal usability tests were done to measure **R8** (*The game must be well usable by the players, with >90% of players finding it easy to navigate without previous experience*). But, general testing and evaluation did show that certain screens and concepts were difficult for some kids to un-

derstand. In terms of just navigation, though, the flow was simple enough that everyone could figure it out in time, leading to a partial completion of R8.

The next one, **R9**. (*Constructing a story should be easy - no player (<1%) should experience being stuck with no ability or inspiration to keep the story going when playing a round*), can also only refer to previous observations. In the evaluation, a couple players would take a longer time than usual to pick a Story Tag and present it. Whether this constitutes “being stuck” is a case for debate, but they all did eventually manage to come up with a story. Thus, R9 is also considered to be completed, tentatively.

R10 (*The game must be accessible to >95% of Android smartphone users*) can be easily validated by comparing the supported Android OS versions in the Unity System Requirements to how many registered Android devices which support that. These system requirements for Unity shows that they support everything from the Android OS 4.1 version and above [59]. The official Android distribution dashboard shows that 99.3 % of all Android devices that visited the Google Play Store runs version 4.1 or higher (as of May 7, 2018) [60], which means the R10 requirement is upheld.

R11 (*For establishing the first-time connection, the game should always (>99% of cases) be able to find and play with to the other players, as long as there is an internet connection*) is also easy to consider, since it is clear that this requirement couldn’t be met. The networking problems caused by UNET (described in the below section 6.1.3) created many cases where the connection couldn’t properly be made. While overall, one can take precautions to make sure 100% reliability, by definition this doesn’t cover all cases, such as when a “ghost” room exists on the network for around 30 seconds after disconnecting. R11 is not fulfilled, and the networking needs to be upgraded before it can be tested.

6.1.3 Validation of Technology

Looking back, there were some decisions about technology that could have been rethought. While Unity did prove to be easy to design in and to play around with visuals, it didn’t prove to be as extendable UI-wise as hoped. What this means is that the UI framework was set to be used mostly only a certain way. Attempts at breaking the mold and making new sorts of UI

mechanics would cause unexpected behavior and require re-implementation from scratch. An example of this is the link screen seen in figure 4.6 of Chapter 4. Here, the red link had to use more low-level cursor interaction mechanics to work. This conflicted with the blue box, which used the built-in UI element for a box with content that could be scrolled (or swiped from side to side). When these two elements overlapped, they would end up fighting for precedence of the cursor input, which could only go to one object. In this case, the result is that the red link couldn't be moved after being dropped inside the rectangle.

But Unity wasn't the only technology that could have been reconsidered. Over time, the UNET networking service showed itself to be less reliable than desired. Among the major problems was long connection times, "ghost" rooms that lock up clients trying to connect to them and unstable connection. Regarding the latter problem, UNET would too easily disconnect players who experience a moment of unstable internet connection, and then fail to reconnect them. Many hours were spent trying to configure the network and to building a more reliable system that could handle these issues.

6.2 Conclusion

The goal of this Master Thesis was to develop and evaluate a game which uses storytelling to make an impact on player's empathy ability. The problem description was to create a game which fits into and uses the project ecosystem of The Little Doormaid (<http://www.tappetina.com>). It does so by cooperating with the creator of the ecosystem and the eponymous novel, Letizia Jaccheri. In the start, it was considered that the problem description should be "translating the story into a digital game". This meant trying to directly incorporate the novel narrative in an interactive experience, in one way or another. This description was eventually reformulated to have the thesis adapt the effort, or the aim, of the novel as opposed to directly translating the story. This was mainly so that the game could more easily reach a research contribution on its own without having defined beforehand how it will be presented. This led to a process of interpreting the novel and discussing it with the author and thesis supervisor, Letizia Jaccheri. So, to accomplish the novel's goals of social change with technology. The selected theme for this sort of social change is through empathy. Now, instead

of evaluating the actual impact, this project goes one step earlier and instead wants to determine the feasibility and potential for this game to accomplish its goal. While the results aren't rigorous enough to be considered guarantees of empathy improvement, they do accomplish the main objective: Participants showed the indication of engagement and a willingness to use the game to build stories with each other. It also provided a suggestion that people with higher empathy tend to enjoy it more than others. For the contribution of the thesis as a research project, one must look at the research questions, and how they were accomplished:

Research question 1 asked: *What categories, concepts and potential learning impacts exist to design a serious educational game?* This was contributed to by the exploration into literature, games and related work in Chapter 2 State of the Art. Here, the search went first through a slew of literature on serious games and education, before honing in on Storytelling and Empathy. This revealed models for viewing games such as the Game Flow, as well as different categories of learning impacts. Several literature revealed a need to investigate and understand the positive impacts games can have and how they can be achieved. Of especial interest to this project, the chapter also took note of how pro-social games can be designed, and how such existing games already accomplish this goal. In addition, the search lead to a discovery of how storytelling can be the key to unlock the creation of a game with a learning impact that is rooted in empathy.

Research question 2 said: *How can a collaborative storytelling game make an impact on ones empathic ability?* While the literature review touched on this with the theory found on linking storytelling to the formation of empathy, it is the design-and-creation process and quasi-experiment evaluation that constitute the main contributions to this question. While the research methodology in this project has hardly been rigorous enough to provide a full and decisive answer to this question, it still offers what was promised from the get-go: A suggestion to how this can be accomplished. We've already seen how this suggestion does exist which links the designed serious educational game with empathy. While much has been said about "how" the game was developed, the question can be further answered by categorizing the game in frameworks established by Ratan et al. [17] and Connolly [12]: The game can be defined as a Serious Game with Primary Educational Content as Social Change, Primary Learning Principle as Exploration, and main Learning Outcome as Affective Learning.

The results of the game include not only the contribution of the game, literature review and evaluation, but also two conference papers. The first one was submitted to the 17th Interaction, Design and Children Conference (IDC) 2018 [1] in the category of “Demos and Art Installations”. For this, the paper was accepted and will be published. This paper can be found in Appendix B. It mainly shows the concept and is focused on describing the game to be exhibited. In other words, this paper covers mostly the second research question, detailing the design, implementation, and a little bit of the evaluation. As a result of this acceptance, the game will be presented at the IDC conference in June 2018. The second paper was submitted to the 2018 International Conference on Entertainment Computing (ICEC) [61] as a long paper. As of the time of writing, no decision has yet to be received about its acceptance. This paper presents the actual research in addition to describing the concept of the game. The paper can be found in Appendix C. The long form means this paper covers mostly the same content that this thesis does, with less focus on the process. That means the ICEC paper can be seen as a contribution to both research question 1, with its background discussion, and research question 2, where it goes into more detail about the workshop event and evaluation compared to the IDC paper.

In sum, the Master Thesis can be considered a success, although not without its faults. With a difficult theme, it was hard to find a proper “red line” which could tie everything neatly in one package, from literature review, to design and results. Instead, the project was characterized with exploration and some confusion, with this being somewhat uncharted waters for conducting research. Still, the game project showed such promise that it can be developed and researched further. In fact, the development is already underway and has been picked up for another master thesis project. By these criteria, the problem description and research objectives was solved in a satisfactory way.

6.3 Taking the Game Further

The trial was considered enough of a success that the game is to be further developed. The overall response from the players was positive, who were intrigued by the concept. A couple players even showed a desire to download the game and play it with their friends. The main goal was however to determine if it could be used to make a stronger connection to empathy.

This was also determined to be fulfilled enough to warrant a more focused approach. Specifically, some improvements and changes would be in order to better influence or be influenced by empathic abilities:

First, in terms of general usability, the game should be configured to respond better to the player's expectations and intuition. This is mainly in the GUI, which for example must encourage the Story Tag linking, make it clearer conceptually and easier to control. The activity and the goal can be made even more empathy-driven. As mentioned earlier, this could be accomplished by abstracting the story tags even more. Instead of small description of an event which may bring the character into an imagined emotional state, the story tag can be that emotion itself. In other words, the only info that the player receives is the goal emotion, with which they must come up with a story event themselves.

As of the time of this writing, a new set of experiments is currently in the works with a new version of the game. The researchers responsible for this new project are Javier Gomez and Kshitij Sharma. Building on the results from this master thesis, the new experiments goes on a much larger scale, with over 100 participants involved. To better adapt the game for repeated trials, some changes were performed, in line with the general improvement suggestions: First, the game should be more easily analyzable quantitatively. This means the game should automatically generate and store logs of the play, similar to the abandoned, low-priority requirement R2.1 (see section 4.4). This includes timing the interactions and recording the story decisions. The audio logs would also be automatized, starting and stopping when the player starts their turn and finish adding a new element (Story Tag or Character) to the story. Other changes involve redesigning the UI and flow to better focus on simple emotional states (e.g. anger, happiness). The solution stage is mostly taken out, and the Characters are made more unpersonal, leaving extra room for the players to come up with all the details themselves. This new version would be more difficult to figure out without an explanation. But, since the players are forced to explain an emotion through a story event, it may be much better suited for studying empathy in serious games.

Bibliography

- [1] A. for Computing Machinery, 17th Interaction, Design and Children Conference (IDC), <http://idc-2018.org/>, accessed: 2018-05-29 (2018).
- [2] B. J. Kalisch, What is empathy?, *The American journal of nursing* (1973) 1548–1552.
- [3] J. Smiley, *Thirteen Ways of Looking at the Novel*, Alfred a Knopf Incorporated, 2005, 608 pages.
- [4] C. A. Anderson, A. Shibuya, N. Ichori, E. L. Swing, B. J. Bushman, A. Sakamoto, H. R. Rothstein, M. Saleem, Violent Video Game Effects on Aggression, Empathy, and Prosocial Behavior in Eastern and Western Countries: A Meta-Analytic Review., *Psychological bulletin* 136 (2) (2010) 151.
- [5] T. Greitemeyer, S. Osswald, M. Brauer, Playing Prosocial Video Games Increases Empathy and Decreases Schadenfreude., *Emotion* 10 (6) (2010) 796.
- [6] R. Van Eck, Digital Game-Based Learning: It’s Not Just the Digital Natives who are Restless, *EDUCAUSE review* 41 (2) (2006) p. 1–16.
- [7] P. J. Manney, Empathy in the time of technology: How storytelling is the key to empathy, *Journal of Evolution and Technology* 19 (1) (2008) 51–61.
- [8] A. A. Gokhale, Collaborative learning enhances critical thinking, *Journal of Technology Education* 7 (1) (1995) 51–61.

-
- [9] L. A. Annetta, The “I’s” Have It: A Framework for Serious Educational Game Design, *Review of General Psychology* 14 (2) (2010) 105–112.
- [10] L. Jaccheri, *The Little Doormaid: Tappetina*, CreateSpace Independent Publishing Platform, 2016, 24 pages.
- [11] T. Susi, M. Johannesson, P. Backlund, *Serious Games: An Overview*, Tech. rep., Institutionen för kommunikation och information (2007).
- [12] T. M. Connolly, E. A. Boyle, E. MacArthur, T. Hainey, J. M. Boyle, A Systematic Literature Review of Empirical Evidence on Computer Games and Serious Games, *Computers & Education* 59 (2) (2012) 661–686.
- [13] R. Garris, R. Ahlers, J. E. Driskell, Games, motivation, and learning: A research and practice model, *Simulation & Gaming* 33 (4) (2002) 441–467.
- [14] P. Sweetser, P. Wyeth, Gameflow: a model for evaluating player enjoyment in games, *Computers in Entertainment (CIE)* 3 (3) (2005) 3–3.
- [15] P. Backlund, M. Hendrix, Educational Games – Are They Worth the Effort? A Literature Survey of the Effectiveness of Serious Games, in: *Games and virtual worlds for serious applications (VS-GAMES)*, 2013 5th international conference on, IEEE, 2013, pp. 1–8.
- [16] R. T. Hays, *The Effectiveness of Instructional Games: A Literature Review and Discussion*, Tech. rep., NAVAL AIR WARFARE CENTER TRAINING SYSTEMS DIV ORLANDO FL (2005).
- [17] R. Ratan, U. Ritterfeld, Classifying serious games, *Serious games: Mechanisms and effects* (2009) 10–24.
- [18] C. Dormann, R. Biddle, Understanding Game Design for Affective Learning, in: *Proceedings of the 2008 Conference on Future Play: Research, Play, Share*, ACM, 2008, pp. 41–48.
- [19] H. Jenkins, Game Design as Narrative, *Computer* 44 (2004) 53.
- [20] M. D. Dickey, Murder on Grimm Isle: The Impact of Game Narrative Design in an Educational Game-Based Learning Environment, *British Journal of Educational Technology* 42 (3) (2011) 456–469.

-
- [21] P. Sweetser, J. Wiles, Scripting versus emergence: issues for game developers and players in game environment design, *International Journal of Intelligent Games and Simulations* 4 (1) (2005) 1–9.
- [22] K. E. Buckley, C. A. Anderson, A Theoretical Model of the Effects and Consequences of Playing Video Games, *Book: Playing Video Games: Motives, Responses, and Consequences* (2006) 363–378.
- [23] J. Belman, M. Flanagan, Designing Games to Foster Empathy, *International Journal of Cognitive Technology* 15 (1) (2010) 11.
- [24] J. P. Hourcade, B. B. Bederson, A. Druin, G. Taxén, KidPad: Collaborative Storytelling for Children, in: *Conference for Human-Computer Interaction 2002 extended abstracts on Human factors in computing systems*, ACM, 2002, pp. 500–501.
- [25] M. Mateas, A. Stern, Façade: An Experiment in Building a Fully-Realized Interactive Drama, in: *Game developers conference*, Vol. 2, 2003, pp. 4–8.
- [26] G. Gygax, D. Arneson, *Dungeons and Dragons*, Vol. 19, *Tactical Studies Rules* Lake Geneva, WI, 1974.
- [27] R. Lamber, A. Rilstone, J. Wallis, *Once Upon a Time: The Storytelling Card Game* (2003).
- [28] P. Interactive, *Who Am I? Race Awareness Game* (2010).
- [29] Centervention, *Hall of Heroes game* (2016).
- [30] D. Company, *Four Little Corners - An Interactive Storybook App about Friendship* (2013).
- [31] B. Games, *A Force More Powerful game* (2006).
- [32] S. Ruiz, *Darfur is Dying game* (2006).
- [33] ImpactGames, *Peacemaker game* (2007).
- [34] K. Eklund, *World Without Oil game* (2007).
- [35] Tiltfactor, *Dragon Dad game* (2016).
- [36] F. Hermund, *3rd World Farmer game* (2005).
- [37] B. Artwick, *Microsoft Flight Simulator game* (1982).

-
- [38] U. of Washington, Fold It game (2008).
- [39] M. Mortara, C. E. Catalano, G. Fiucci, M. Derntl, Evaluating the effectiveness of serious games for cultural awareness: the icura user study, in: International Conference on Games and Learning Alliance, Springer, 2013, pp. 276–289.
- [40] V. Guillén-Nieto, M. Aleson-Carbonell, Serious games and learning effectiveness: The case of itsa deal!, Computers & Education 58 (1) (2012) 435–448.
- [41] S. G. Interactive, Global Conflicts: Palestine game (2007).
- [42] K. Beck, M. Beedle, A. Van Bennekum, A. Cockburn, W. Cunningham, M. Fowler, J. Grenning, J. Highsmith, A. Hunt, R. Jeffries, et al., Manifesto for agile software development.
- [43] A. Inc., iBeacon proximity beacons technology, <https://developer.apple.com/ibeacon/>, accessed: 2018-05-18.
- [44] T. I. D. Foundation, What is Design Thinking?, <https://www.interaction-design.org/literature/topics/design-thinking>, accessed: 2018-05-20.
- [45] S. T. Dam R, Stage 4 in the Design Thinking Process: Prototype, <https://www.interaction-design.org/literature/article/stage-4-in-the-design-thinking-process-prototype>, accessed: 2018-05-20.
- [46] L. dotPDN, Paint.NET raster graphics editor, <https://www.getpaint.net/index.html>, accessed: 2018-05-18.
- [47] Microsoft, Microsoft PowerPoint presentation program, <http://office.microsoft.com/PowerPoint>, accessed: 2018-05-18.
- [48] C. L. Inc., Corona software development kit, <http://www.coronalabs.com/>, accessed: 2018-05-29 (2009).
- [49] M. Zechner, libGDX game development application framework, <https://libgdx.badlogicgames.com>, accessed: 2018-05-29 (2014).

-
- [50] E. Games, Unreal game engine, <http://www.unrealengine.com/>, accessed: 2018-05-29 (1998).
- [51] U. Technologies, Unity game engine, <https://unity3d.com/>, accessed: 2018-05-29 (2005).
- [52] S. Louchart, R. Aylett, Narrative theory and emergent interactive narrative, *International Journal of Continuing Engineering Education and Life Long Learning* 14 (6) (2004) 506–518.
- [53] M. O. Riedl, R. M. Young, Narrative planning: Balancing plot and character, *Journal of Artificial Intelligence Research* 39 (2010) 217–268.
- [54] D. Callele, E. Neufeld, K. Schneider, Requirements engineering and the creative process in the video game industry, in: *Requirements Engineering, 2005. Proceedings. 13th IEEE International Conference on, IEEE, 2005*, pp. 240–250.
- [55] B. J. Oates, *Researching information systems and computing*, Sage, 2005, 341 pages.
- [56] Z.-H. Chen, C. C. Liao, H. N. Cheng, C. Y. Yeh, T.-W. Chan, Influence of game quests on pupils' enjoyment and goal-pursuing in math learning, *Journal of Educational Technology & Society* 15 (2) (2012) 317.
- [57] E. J. Lawrence, P. Shaw, D. Baker, S. Baron-Cohen, A. S. David, Measuring empathy: reliability and validity of the empathy quotient, *Psychological medicine* 34 (5) (2004) 911–920.
- [58] D. T. Campbell, J. C. Stanley, *Experimental and quasi-experimental designs for research*, Ravenio Books, 2015.
- [59] U. Technologies, Unity System Requirements, <https://unity3d.com/unity/system-requirements>, accessed: 2018-05-24.
- [60] G. LLC, Android Distribution dashboard, showing a percentage of devices running a certain Android OS version., <https://developer.android.com/about/dashboards/>, accessed: 2018-05-24.
-

-
- [61] I. F. for Information Processing, International Conference on Entertainment Computing (IFIP-ICEC'18), <http://www.ifip-icec.org/>, accessed: 2018-05-29 (2018).

Appendix

Appendix A: NSD Consent Form

(Starts next page)

Forespørsel om deltakelse i forskningsprosjektet

”Tappetinas Empati – En studie på seriøse spill med affektiv læring og historiefortelling”

Bakgrunn og formål

Denne studien er en masterstudie av Sindre Berntsen Skarås om hvordan et digitalt spill kan skape følelsesmessig læring hos brukere. Ordrett handler det om såkalt «affektiv» læring – endring av holdninger, livssyn og empati. Institusjonen dette gjøres igjennom er NTNU (Norges teknisk-naturvitenskapelige universitet) og veilederen til masterstudiet gjøres av Letizia Jaccheri, som er også oppdragsgiveren internt i NTNU.

Deltakeren blir bedt om å delta i denne studien fordi de inngår i målgruppen (barn rundt 14 år) som er utvalgt for å prøve spillet. Dette gjennomføres som en del av det større prosjektet Tappetina (Den lille dørfuren) av Letizia Jaccheri om å bryte usunne normer og stereotyper som finnes i teknologi, forskning og videre, spesielt for jenter.

Hva innebærer deltakelse i studien?

Studien vil innebære at deltakerne spiller videospillet sammen i en gruppe. Det vil handle om å bygge en fortelling sammen og å forstå hvordan dette kan lære oss noe om virkelige mennesker.

Underveis vil det foregå observasjon av aktiviteten. Deretter vil hver person fylle inn et spørreskjema og et kort, uformelt intervju. Spørsmålene for disse vil gjelde å finne om deltakernes holdninger eller evner har endret seg basert på opplevelsen. Temaet vil fokusere på problemer og konflikter som andre mennesker opplever i samfunnet, og hvordan spillerne kan empatisere (dele/forstå følelser) med folk i slike situasjoner. Data som lagres er notater, spørreskjemaene, pluss lydopptak under spillet og intervjuet.

Foreldrene vil ha ansvar for å gi samtykke for barnenes deltakelse. De vil også få tilgang til intervjuguide og spørreskjemaene etter forespørsel.

Hva skjer med informasjonen om deltakeren?

Alle personopplysninger vil bli behandlet konfidensielt, og vil bli lagret i en privat server som blir passord-beskyttet. Kun studentforsker og veileder vil ha tilgang til dette.

I publikasjonen vil det ikke være mulig å gjenkjenne identiteten til noen av deltakerne.

Prosjektet skal etter planen avsluttes 1.6.18. Ved prosjektslutt vil datamaterialet bli anonymisert, og all identifiserende info vil bli slettet. Denne anonymiserte dataen vil deretter forbli lagret mer åpent delelig og vil forbli lagret på den samme beskyttede mappen. Den anonymiserte dataen vil ikke forbli konfidensielt; enhver kan få tilgang etter de dataansvarliges (de som har tilgang) egen bedømmelse.

Frivillig deltakelse

Det er frivillig å delta i studien, og du kan når som helst trekke ditt samtykke uten å oppgi noen grunn. Hvis du trekker deg, vil alle opplysninger om deg bli anonymisert.

Dersom du ønsker å delta eller har spørsmål til studien, ta kontakt med:

Prosjektleder / studentforsker: Sindre Berntsen Skarås (sindrebs@stud.ntnu.no, tlf. 47370567)

Veileder: Letizia Jaccheri (letizia.jaccheri@ntnu.no).

Studien er meldt til Personvernombudet for forskning, NSD - Norsk senter for forskningsdata AS.

Samtykke til deltakelse i studien

Samtykke kan gis som signatur nedenfor, men du kan også gi den muntlig. Dersom du ikke ønsker at data skal lagres kan du gi samtykke uten dette, bare la oss vite det.

Jeg har mottatt informasjon om studien, og ønsker å delta

(Signert av barn / deltaker)

Foresattes / verges samtykke på vegne av barn

(Signert av foresatte til prosjektdeltaker, dato)

Appendix B: The accepted demo paper to the Interaction, Design and Children Conference (IDC) 2018 [1]

(Starts next page)

Tappetina's Empathy Game: A Playground of Storytelling and Emotional Understanding

Sindre B. Skaraas

Norwegian University of Science and Technology, Trondheim (Norway)
sindrebs@stud.ntnu.no

Letizia Jaccheri

Norwegian University of Science and Technology, Trondheim (Norway)
letizia.jaccheri@ntnu.no

Javier Gomez

Norwegian University of Science and Technology, Trondheim (Norway)
javier.escribano@ntnu.no

Abstract

In this paper we present a serious game about collaborative storytelling in an effort to promote and give an outlet for empathy. It uses smartphones to provide cues and to visualize a story structure. This way, players will invent a story together. They have to play by turns, so this facilitates the empathic response inherent in both hearing and telling stories.

Author Keywords

Serious games, affective learning; empathy; collaborative storytelling

ACM Classification Keywords

K.3.1 [COMPUTERS AND EDUCATION]: Computer Uses in Education - Collaborative learning

Introduction

One of the most common qualifiers to how we deal with the world is empathy. As children will grow up, their opinions and perspectives will be formed largely based on their ability to understand other people's motives, emotions and views.

In a historical account, Smiley argues how storytelling is a natural and reoccurring way for humans to develop empathy. And further, that it's one of the main ways that cultures have had to share different perspectives in their population

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s).

Copyright held by the owner/author(s).
JDC '18, June 19–22, 2018, Trondheim, Norway
ACM 978-1-4503-5152-2/18/06.
<https://doi.org/10.1145/3202185.3210765>

[7]. This project aims to emulate that by having a group of people collaborate on telling a story. By forcing the players to put themselves into the story, storytelling may induce an empathic response to the character [5]. This is done in a way of collaborative learning, which can be more interesting to the players while promoting critical thinking [2]. To be made effective, the development is directed by certain guidelines for educational games [1] to make sure the users can achieve heightened engagement and affective learning.

This project originally started as part of an ecosystems of games and installations around one novel [3], and has since evolved into this collaborative story telling platform.

Playing with Empathy

"Tappetina's Empathy" places around 3-5 players in a group, each with a smartphone. The goal is to build and present a story to each other, by using cues given by the game. Each player takes turns to select and verbally tell the rest of the group what happens. In doing so, they have to use their fantasy to produce an event in the story, based on the incomplete information given.

By constructing a game with such collaborative storytelling, the players get an opportunity to put themselves into the position of the character in the story. The game is designed in such a way as to build up a problem which may resemble real-world issues and challenges faced by real people. As [7] states, as a player continually puts themselves into the shoes of fictional people in such different positions, it may develop their empathic ability and open up their view of the world. They are encouraged to understand the motivations and background of real-world situations of the same nature. Each player has the agency to shape the story when presenting it. The ultimate desired outcome is to facilitate introspection and exercise empathy alongside storytelling.

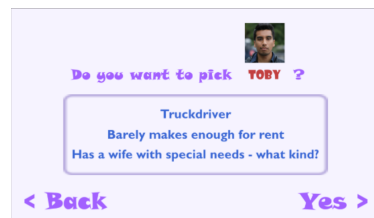


Figure 1: First, the story begins by selecting a character

Story Structure

The basic structure of the story is as follows: First, there is one main character who will be the center point for the story. This character is described with 3 textual descriptions, called Traits. A Trait seeks to bring more life and personality to the character. The main content of the story exists in the Story Tags. These function as textual cues, being a short description of the new event. This event will be something that suddenly affects the character or an action the character performs. Each Story Tag is connected to a cause that must yield this event as consequence. This structure is based on the suggestion and discussion by [4] about models for emergent stories in video games. The proposed model involves time-separated "episodes" similar to improvised theater. Each such episode is presented without going into detail about the specific execution of the event (which is up to the gameplay to decide). Only the overall goal and the story's background are described. The elements and connections are designed in the same way as a narrative planning problem [6]. That is, each event

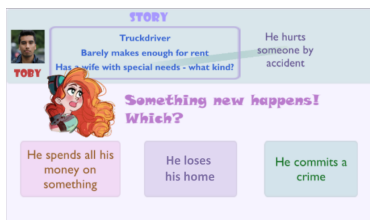


Figure 2: Story Tag Select screen - So far, having a wife with special needs has led Toby to accidentally hurt someone. It is up to the player to narrate the specifics.

in the narrative must be connected by a believable character action that advances the story by transforming the world.

Gameplay

The game starts with the first player selecting a character. Then the next turn starts. Each turn after this will take the form of a player selecting a story tag, linking it, and presenting it. Once everyone has gone once, the solution round starts. Everyone picks one solution, presents it, and agrees in unison whose solution was best.

1. Character

The first player picks the character for the story. Next, the player is asked to present the character to rest of the group. This includes describing them in name, and fleshing out the given Trait descriptions. They are also encouraged to come up with details outside of the game's established structure.



Figure 3: Pictured: players in the solution stage, discussing and agreeing on a unified ending to the story.

2. Story Tags

After the character is established, each player gets to add a Story Tag. This is the next event that happens in the story. Likewise with the character, the player must make up the specifics on their own, and present it verbally to the rest of the group. The Story Tag must also be linked to a cause, to add to the line of events that make up the story. This preceding cause may be one of the character's Traits, or a different Story Tag.

3. Solutions

Finally, once everyone has added an event to the story, players must come up with an ending. They do so in unison, each picking their own solution and presenting it. The group decides on a single solution that they like the most. This completes the story.

Evaluation

An evaluation was held during the workshop "Games, culture and science for boys and girls". This event took place at the Gunnerus Library (Trondheim, Norway). It was conducted by NTNU researchers and aimed at teenagers. The objective of the workshop was to introduce teenagers to research and the current games developed at the University.

Twelve players participated (teens of 13 years and older) and played in groups of 4 people. Each game took place in a separate room, so they felt more private and relaxed. There were varying amounts of engagement; most participants stated they had fun telling stories and playing the game. Some Norwegian children found parts of the English language difficult. The concept and GUI design of linking Story Tags also generated some sources of confusion. This was then mitigated by the group discussing and helping each other understand the instructions. The majority of participants showed an innate ability to use their fantasy to build onto the story. Some would even put elements of their own life into the character and story, displaying a desire to form real-world, empathic connections to the fiction.

Conclusion and Future Work

Initial experiments produced positive responses from the participants. Further development and examination are planned on a second version of the game. This will have more focus on creating stories based on explicit emotional states to grant more storytelling freedom and make the reliance on forming an empathic understanding clearer.

Practical Considerations

Running the game for a group requires 5 smartphones with stable internet connection. In addition, a space for a medium group (up to 6 people) to sit together without too much audio disturbance.

Acknowledgements

This work has been partially supported by NTNU ARTEC and by the ERCIM fellowship program. The authors would like to thank Alexandra Angeletaki for organizing the international experiment workshop at the Gunnerus library of NTNU. The project has been recommended by the Data Protection Official for Research, Norwegian Social Science Data Services (NSD). For the development of the game, the Unity Engine and editor was utilized, as developed by Unity Technologies.

REFERENCES

1. Leonard A Annetta. 2010. The "Is" have it: A framework for serious educational game design. *Review of General Psychology* 14, 2 (2010), 105.
2. Anuradha A Gokhale. 1995. Collaborative learning enhances critical thinking. (1995).
3. Letizia Jaccheri. 2016. *The Little Doormaid: Tappetina*. CreateSpace Independent Publishing Platform.
4. Sandy Louchart and Ruth Aylett. 2004. Narrative theory and emergent interactive narrative. *International Journal of Continuing Engineering Education and Life Long Learning* 14, 6 (2004), 506–518.
5. Patricia J Manney. 2008. Empathy in the time of technology: How storytelling is the key to empathy. *Journal of Evolution and Technology* 19, 1 (2008), 51–61.
6. Mark O Riedl and Robert Michael Young. 2010. Narrative planning: Balancing plot and character. *Journal of Artificial Intelligence Research* 39 (2010), 217–268.
7. Jane Smiley. 2005. *Thirteen ways of looking at the novel*. Alfred a Knopf Incorporated.

Appendix C: The submitted long paper to the 2018 International Conference on Entertainment Computing (IFIP-ICEC'18) [61]

(Starts next page)

Playing with Empathy through a Collaborative Storytelling Game

Sindre B. Skaraas, Javier Gomez, and Letizia Jaccheri

Department of Computer Science, NTNU, Trondheim, Norway
sibsen@live.com, {javier.escribano, letizia.jaccheri}@ntnu.no

Abstract. This study follows the early stages of a serious educational game about empathy. By having players collaborate on telling a story, it aims to exercise their empathic abilities. Each player uses a smartphone which displays the story structure and grants new cues for building the story together. This study shows the exploratory phase aimed at proving the game concept and identifying points to be further developed. The game was evaluated in a workshop trial with 12 participants. This evaluation showed enough potential to warrant development into a more focused version that facilitates empathic responses.

Keywords: Serious Games, Affective Learning, Empathy, Collaborative Storytelling.

1 Introduction

One of the most common qualifiers to how we deal with the world is empathy. As children will grow up, their opinions and perspectives will be formed largely based on their ability to understand other people's motives, emotions and views. Storytelling is a natural and reoccurring way for humans to develop empathy [23]. In fact, novels are one of the main forms of communication cultures have had to share different perspectives and to build empathy in their population. Despite this, the role of empathy in video games is a topic that has often received more negative attention than positive [1, 12]. This project aims to provide an activity that will positively affect empathy by emulating a storytelling and story creation experience. This activity will consist of a group of people that will collaborate on telling a story. By making each player understand and add to the story, they are forced to put themselves into the story and to have an empathic response to the character [20]. This is done in a way of collaborative learning, which is found to be more interesting to the players and to promote critical thinking [11]. The development is directed by certain guidelines for educational games, as presented by Annetta [2], to make sure the users can achieve heightened engagement and affective learning.

The game presented in this paper is in an early stage of development, with focus on determining whether it can form a connection to the players' empathic abilities. The research question is whether such a relation exists between the game experience and the players' empathy. The game uses storytelling as a

way to exercise the ability to form an empathic understanding to an imagined situation. The players then show that they can interpret the story, build on it, and explain it to the group. In this stage, the study takes an informal approach. The aim is to explore the possibilities of the game with a real audience and to gather feedback to take the concept further. So because of that preliminary form, the game study exists mainly as a proof-of-concept. It is a combination of a digital system and a real-world activity of oral storytelling. The digital aspect is simply a conduit that provides communication tools and a structure to the play. The “game” in its true sense is determined when the players interact with each other and decide how they will develop the story. Because of this reliance on the group dynamic, there is an element of uncertainty to the game design. This is why the study also takes an exploratory approach, seeking the aid of the players to further develop the prototype.

The study reported in this paper is part of a larger ecosystem of projects. This ecosystem is formed under the novel of “The Little Doormaid: Tappetina” [16]. This novel also lends its name to the game in this study. Starting as a way to interpret the story of the novel into a digital game, this project has since evolved into a collaborative storytelling platform. The ecosystem is an initiative to encourage nuanced views of people. It is formed under to combat the stigma that surrounds women entering male-associated fields such as technology. The novel was set to inspire confidence and self-reliance through the exploits of the novel’s protagonist, named Tappetina. Tappetina continues on into this project, where she serves as the game’s virtual avatar, all while guiding the players along to tell their story.

The structure of this paper is as follows: Section 2 *State of the Art* will look at a collection of papers and games which hold some relation to the process of this research project. Next is section 3 *Tappetina’s Empathy*, which describes the actual game design and gameplay. Section 4 *Evaluation* outlines the evaluation process and discussion of its results. And section 5 *Taking the Game Further* then talks about how the game will be developed for improvement and more focused research.

2 State of the Art

Here is a look at the literature and technology that surrounds the themes of this study. These themes were investigated to make clear the background of this project and to aid the design of the study. This can also shed some light on what angle the study can take to contribute to the field. First is section 2.1 *Serious Educational Games*, a general overview of serious, educational games and what the research area looks like. Then there is section 2.2 *Storytelling and Empathy*, an investigation into what role storytelling and empathy can play in games, and how they may be handled in designing a game. The last part, section 2.3 *Games for Storytelling and Empathy*, looks at how storytelling and empathy are implemented in actual games. This section is used to show how this game

project can learn from existing attempts and improve on them to better study the game's relation to empathy.

2.1 Serious Educational Games

A serious game is defined in many ways, but the overview performed by Susi et al. in [24] reveals a commonly agreed-upon understanding: Serious games are digital games that have some purpose other than to simply entertain. There are numerous application areas for such games such as education, health care, military or science, to name a few. One of the most usual forms of serious games is that of an instructional game, which teaches or trains the player in place of traditional education. A literature review by Connolly et al. [8] shows the emergence of the serious game field, where serious games have been shown to be a more effective way of learning in certain situations. Games allow one to simulate and learn in environments or situations that would be unfeasible in real life. Though what makes them especially interesting is their inherent ability to motivate learners to keep playing by mixing fun and increasing engagement into the learning process. This is what Garris et al. [10] calls the game cycle in their Input-Process-Outcome game model. Through a recurring process of providing feedback as the user makes judgments and acts in the game, the game play is inherently engaging. The goal is, then, to exploit this process to make the players learn while being self-directed and self-motivated, both because the activity is interesting in itself and because achieving the outcome is important.

There has been a fair amount of studies that set out to prove the effectiveness of game-based learning. Smiley [25] suggests how the research field is now beyond simply asking if game-based learning can be effective. He shows how several application areas exist where instructional games are proven to be more effective than ordinary instruction, something echoed by a more recent literature overview by Susi et al. [3]. So instead, Van Eck [25] argues studies should look more at why they are effective, and how which is to say, when, with whom, and under what conditions. This is where the core motivation for this research proposal lies to further explore how the to-be developed game can drive learning. Key to the research is uncovering the landscape of ideas that seems promising and that are grounded in theory. This is also what the literature review will revolve around, to support the ideation of the game. Regarding the educational content games may have, there is again the literature overview by Connolly et al. [8]. Here, they analyze different (positive) impacts of games, which include different learning outcomes. The most popular learning outcomes they found were: affective learning, knowledge acquisition, perceptual/cognitive skills and behavior change, to name the top ones.

2.2 Storytelling and Empathy

Since a narrative is central to the game development of this project it would be useful to find how stories are related to games in general. The basis for that discussion is found in an article by Jenkins [17] that clears up the question of

what the role between games and narrative really is. The work connects games and movies in that game narratives are not linear nor essential thing in games as it is in cinema. It's also showed here how the game designers are not storytellers, but narrative architects. This is because their real role is creating game spaces that facilitate narrative experiences, or spatial stories. Four approaches to such environmental storytelling is suggested by Jenkins [17]: These are (1) making spaces that evoke narratives the player is already familiar with, (2) enacting the narrative at certain spots of the game, (3) revealing the plot by embedding bits of info in the environment, and (4) letting narratives emerge spontaneously within the game. This fourth approach is what lead to coming up with the concept of the game activity in this study. The question that arose from this discovery was then to find literature that proposes how emergent storytelling can be facilitated.

In [1], Anderson et. al describes how much research has been dedicated to make a link between violent video games and decreased pro-social behavior. Recently, more research has been going in the opposite direction, to investigate the positive effect of games on empathy. So-called pro-social games are shown by Greitemeyer et al. in [12] to increase empathy along with a reduction in being pleased at someone else's misfortune, or *schadenfreude*. Greitemeyer et al. then shows support for the positive aspects of the General Learning Model (GLM) of Buckley et al. [5]. The GLM is an generalized version of the General Aggression Model (GAM), which was solely used to just look at the negative effects of violent games. With the GLM, games are portrayed as a media that when exposed to, one's mental state can be affected, leading to possible reactions in behavior. In [4], Belman et al. makes an overview of different efforts to promote empathy in social sciences, and recommends how to extend these studies to creating "games for good" that try to promote certain ethical values. Of note, two dimensions are identified in these studies. Firstly, Dispositional vs Induced Empathy, where studies may look behavior affected by empathy vs how empathy can itself be changed. The second dimension is Low- vs High-Involvement. In a game, this would determine how much the player is immersed in terms of time, engagement and building relationships in a player community.

2.3 Games for Storytelling and Empathy

Certain inspiration can be found in several other studies that look at games as a tool for letting the player build a story. One early example is KidPad [14]. In this game, kids can collaborate to tell a story using hyperlinks and drawing in one two-dimensional space using a PC. Effort is made to make the interaction easier using real-world metaphors such as crayons. In addition, it demonstrates the importance of simultaneous communication and every player seeing the same story in a zoom-able interface. Faade [21] is an interesting game that has the player participate in an interactive marriage drama. Using natural language processing and AI, the player takes a story design role by interacting with the non-player actors. This shows how an emergent narrative can be structured to support the player as narrative designer. On the educational side, Murder on Grimm Isle [9] is a serious game study that combines storytelling with writing

lessons. Players are asked to design and argue for a crime story based on clues they can find by exploring a 3D environment. In terms of learning benefits, the results showed more sustained motivation and curiosity in the pupils. This has showed how part of the narrative can be embedded in the game while giving the player enough control to come up with the actual story.

As for popular entertainment games, there exists those that use different forms of storytelling and empathy in their mechanics: An older game genre that features collaborative storytelling is tabletop role-playing games, such as Dungeons and Dragons [13]. In this game, the story is created by a central narrator as each players take on a character and role dice to determine results. Other games will have all players contribute equally to creating the story, such as Once Upon a Time [18] by Atlas Games, which combines fairy tales and more traditional, competitive card playing. These games and others serve as inspiration to design the digital game and associated activity. Empathy games, on the other hand, take several forms: Some may deal with exploring one's identity (Who Am I? Race Awareness Game [15]) or to simulate social interaction (Hall of Heroes [6] - helps teens adapt to middle school). Games that combine storytelling and empathy do so often by teaching problem-solving (Four Little Corners - An interactive storybook app about friendship [7]), but may be too inflated to be properly studied in terms of the exact relationship to empathy. This space is where this game wishes to fill. By simplifying the story structure, it may give the players the reins to exercise their empathic abilities.

3 Tappetina's Empathy

"Tappetina's Empathy" places around 3-5 players in a group, each with a smart-phone. The goal is to build and present a story to each other. This is done by making use of story cues that the game gives them. Each player takes turns to select a cue. As part of this, the must verbally tell the rest of the group what happens. Since all the players have an incomplete story cue, they have to elaborate the details. This is one part the story details that the group has already established, and another part details from their own fantasy, all to produce a new event in the story.

By constructing a game with such collaborative storytelling, the players get an opportunity to put themselves into the position of the character in the story. The game is designed in such a way as to build up a problem which may resemble real-world issues and challenges faced by real people. As Smiley [23] states, as a player continually puts themselves into the shoes of fictional people in such different positions, it develops their empathic ability and open up their view of the world. This allows them to better understand the motivation and background leading into real-world situations of the same nature. The game also gives each player the agency to shape the story when presenting it. The desired outcome of is to facilitate introspection and exercise empathy alongside storytelling.

3.1 Story Structure

This section will describe the static information structure of the story. This structure is how the story will be represented in the game, as seen in Figure 1. At the core of the story, there is a single main Character. This Character is then attached to 3 Traits, which act as short descriptions of the Character. The main content of the story is represented by a variable set of Story Tags. Each of these act as a separate event that moves the story forward. This event may be something that suddenly affects the character or an action the character performs. Each Story Tag is linked to a cause. In other words, there must be something that yields this Story Tag event as a consequence. This cause could be another Story Tag, or it could be one of the Traits within the Character.

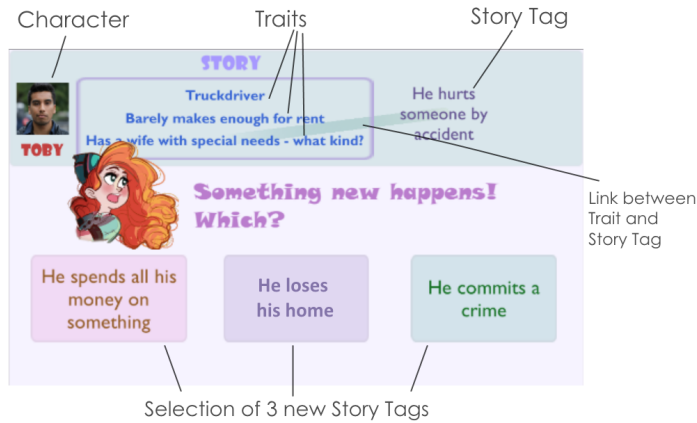


Fig. 1. Story Tag Select screen - So far, having a wife with special needs has led Toby to accidentally hurt someone. It is up to the player to narrate the specifics.

This structure is based on the suggestion and discussion by Louchart et al. [19] about models for emergent stories in video games. The proposed model involves time-separated “episodes” similar to improvised theater. Each such episode is presented without going into detail about the specific execution of the event (which is up to the gameplay to decide). The Story Tags must then be abstracted such that only the overall goal and the story’s background are described. These elements and connections are also designed in the same way as a narrative planning problem [22]. That is, each event in the narrative must be connected by a believable character action that advances the story by transforming the world.

3.2 Gameplay

The game follows a round-robin style format with the players going in turns. In the first turn, the player has to select the character for the story. Subsequent turns will take the form of a player selecting a Story Tag, linking it to the story, and presenting it verbally. Once everyone has had their turn, the solution round starts. Everyone picks one solution, presents it, and agrees in unison whose solution was best.

1. Character When the first player picks the character for the story, they are given a choice of 3 different Characters. After picking one, the player is asked to present the character to rest of the group. This includes describing them in name, and fleshing out the given Trait descriptions. They are also encouraged to come up with details outside of the game's established structure.

2. Story Tags After the character is established, each player gets to add a Story Tag. This is the next event that happens in the story. Likewise with the character, the player must make up the specifics on their own, and present it verbally to the rest of the group. After the Story Tag is selected, the player is sent to a new screen where it must be linked. This is where to a cause, to add to the line of events that make up the story. This preceding cause may be one of the character's Traits, or a different Story Tag.

3. Solutions Finally, once everyone has added an event to the story, players must come up with an ending. They do so in unison, each picking their own solution and presenting it. The group decides on a single solution that they like the most. This completes the story.

4 Evaluation

4.1 Method

Since the study at this stage was determined to not require a formal experiment, the methodology was loose and not very controlled. So, instead of formal data collection, it was deemed that having a researcher heavily involved in and observing the activity would grant the most insight. This way the feasibility can be evaluated by interacting with participants. This gives rise to investigating feedback and examining what points need improvement. The main form of getting feedback was observation and note-taking. The researcher played the game together with the participants. This means that while taking part in the story building, he could talk to the players and get an insight into how well they engage with the game. Since the researcher participated in the game, it was not a blind trial. The participants were to be informed of the goals of the game and given some guidance on how to play, when needed. Data collection methods included recording audio of the activity, a short questionnaire, plus the game data:

the complete constructed story and their individual solutions. The data results allowed one to look back on the trial and effectively reconstruct the interaction and story building process.

4.2 Participants and Event



Fig. 2. A picture of the workshop where the game was played in a closed room by the different participants, each using a separate mobile phone.

The evaluation was held during the workshop “Games, culture and science for boys and girls”. This event took place at the Gunnerus Library (Trondheim, Norway). It was conducted by NTNU researchers and aimed at teenagers. The objective of the workshop was to introduce teenagers to research and the current games developed at the University. The presentation language was English, accommodating both the local Norwegian and international players or presenters. Having this workshop as the context of the evaluation made it less of a typically controlled research environment. Instead, everyone was open to comment, share their experience, and play however they liked. “Tappetina’s Empathy” was among several games to be presented here. Around 30 people in total were present to play the games. Teenagers were also brought in to help organize the activities as well as participate themselves. This led to a relaxed and jovial atmosphere, which was further contributed to by encouraging the participants to pick the games they wanted to try out. Before the activities, each game project got to present their goal and agenda, informing everyone about what the game would be like. The first batch of players would be pre-determined, followed by a period of walking around to the games that each found interesting. In addition to the game trials, there were art installations and brief history lessons, as this was hosted in an old library.

The trial was prepared with a mobile phone for each player (see Figure 2), all connected to the library WiFi network. Because of the number of workshops and time constraints, only a part of the 30 participants were able to play. In total,

12 players played the game activity in groups of 4 people. Most of them were teens of age 13 or older, some joined by their parents. Their point of initiative was mixed between being lead to the game by the organizers and electing to play this game over others after hearing the presentation. Similarly to the other games, “Tappetina’s Empathy” received its own isolated room for the players to sit in a circle. Here, the players could speak and focus without distractions.

4.3 Results

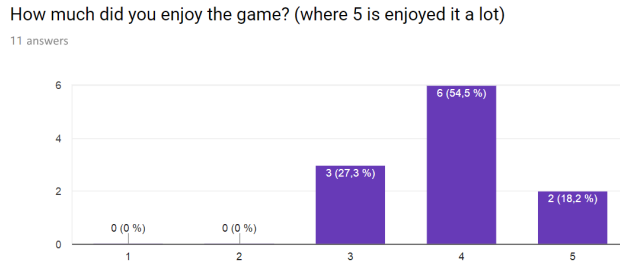


Fig. 3. Graph of the enjoyment levels as rated by the participants.

Among the data points observed is engagement. That is, how much fun the experience was for the players. Looking at the questionnaire data, there were varying amounts of engagement: When asked how much they enjoyed playing the game, most players answered 4 out of 5 stars, seen in Figure 3. Going by the observations and the audio recording, players displayed different emotional reactions and level of focus. A couple of younger kids were naturally more boisterous with friends or siblings present, showing great willingness to build onto the story with numerous details. Others were reserved and silent, but could eventually offer a constructive story addition.

Female 13-year-old: *“He gets the power to fly, so he flies into a bank and steals their money. Then he makes a castle on his old house, and lives happily ever after!”*

Players had also different ways of interacting with the story and the game tools. The most timid could at times do nothing but repeat the cue they selected. Others would go at length to describe what they had in mind, sometimes before even reaching the linking stage of the Story Tag Selection (see 3.2 *Gameplay*). The majority of participants showed an innate ability to use their fantasy to build onto the story. Some would even put elements of their own life into the character and story, displaying a desire to form real-world, empathic connections to the fiction. Players showed differences in their comprehension of the game

structure. This can be interpreted through time spent selecting and how they expressed that the choices were difficult. There did seem to be a hint of relation between this comprehension and the player's age and self-rated empathy (Figure 4). When it comes to the correlation to empathy, some hints were gathered about a possible relationship here. In the question form, the players were asked to rate their empathy ability (Figure 4). Looking at all the answers for this, and comparing them to their respective answers for enjoyment (Figure 3), we see a 0.73 average distance. While this is hardly enough for a proof in its own terms, it does grant an indication that further research can look at. To be adapted, the game's design would need to focus even more on requiring the player to form an emotional understanding to succeed and have fun. As it is, there is not enough agency in the player's hands to properly shape the story. This may be because of a overly simplistic structure, or that the Story Tag events themselves are too descriptive.

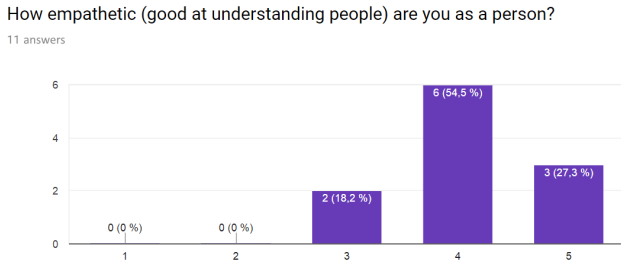


Fig. 4. Graph of the empathy levels that the participants rated themselves with.

Some challenges presented themselves during the workshop trials that may have affected the results. Disruptions ranged from network problems and difficult language for some younger players, which led to delays and lessened quantity of participants. The data collection would also prove a little difficult because of the fast movement of the start and end of a session. The audio logs were sometimes started a while after starting. And, only 11 out of the 12 people would actually respond to the questionnaire. But this was not of great harm to the study: The aim of this project is not to bring a comprehensive or strictly experimental data set of the game in action. Rather, it is to show a proof of the potential of the game project. The data collected is largely used to highlight points of interesting research value and see if the experience hints towards the correlations to empathy or engagement. Enough such potential was found that a decision was made to develop the project further.

5 Taking the Game Further

The trial was considered enough of a success that the game is to be further developed. The overall response from the players was positive, who were intrigued by the concept. A couple players even showed a desire to download the game and play it with their friends. The main goal was however to determine if it could be used to make a stronger connection to empathy. This was also determined to be fulfilled enough to warrant a more focused approach. Specifically, some improvements and changes would be in order to better influence or be influenced by empathic abilities:

First, in terms of general usability, the game should be configured to respond better to the player's expectations and intuition. This is mainly in the GUI, which for example must encourage the Story Tag linking, make it clearer conceptually and easier to control. The activity and the goal can be made even more empathy-driven. As mentioned earlier, this could be accomplished by abstracting the story tags even more: Instead of small description of an event which may bring the character into an imagined emotional state, the story tag can be that emotion itself. In other words, the only info that the player receives is the goal emotion, with which they must come up with a story event themselves.

Acknowledgment

This work has been partially supported by NTNU ARTEC and by the ERCIM fellowship program. The authors would like to thank Alexandra Angeletaki for organizing the international experiment workshop at the Gunnerus library of NTNU. The project has been recommended by the Data Protection Official for Research, Norwegian Social Science Data Services (NSD). For the development of the game, the Unity Engine and editor was utilized, as developed by Unity Technologies.

References

1. Anderson, C.A., Shibuya, A., Ihori, N., Swing, E.L., Bushman, B.J., Sakamoto, A., Rothstein, H.R., Saleem, M.: Violent video game effects on aggression, empathy, and prosocial behavior in eastern and western countries: A meta-analytic review. *Psychological bulletin* **136**(2), 151 (2010)
2. Annetta, L.A.: The "I's" have it: A framework for serious educational game design. *Review of General Psychology* **14**(2), 105 (2010)
3. Backlund, P., Hendrix, M.: Educational games-are they worth the effort? a literature survey of the effectiveness of serious games. In: Games and virtual worlds for serious applications (VS-GAMES), 2013 5th international conference on. pp. 1–8. IEEE (2013)
4. Belman, J., Flanagan, M.: Designing games to foster empathy. *International Journal of Cognitive Technology* **15**(1), 11 (2010)
5. Buckley, K.E., Anderson, C.A.: A theoretical model of the effects and consequences of playing video games. Book: *Playing Video Games: Motives, Responses, and Consequences* pp. 363–378 (2006)

6. Centervention: Hall of Heroes game (2016)
7. Company, D.: Four Little Corners - An interactive storybook app about friendship (2013)
8. Connolly, T.M., Boyle, E.A., MacArthur, E., Hainey, T., Boyle, J.M.: A systematic literature review of empirical evidence on computer games and serious games. *Computers & Education* **59**(2), 661–686 (2012)
9. Dickey, M.D.: Murder on Grimm Isle: The impact of game narrative design in an educational game-based learning environment. *British Journal of Educational Technology* **42**(3), 456–469 (2011)
10. Garris, R., Ahlers, R., Driskell, J.E.: Games, motivation, and learning: A research and practice model. *Simulation & Gaming* **33**(4), 441–467 (2002)
11. Gokhale, A.A.: Collaborative learning enhances critical thinking. *Journal of Technology Education* **7**(1) (1995)
12. Greitemeyer, T., Osswald, S., Brauer, M.: Playing prosocial video games increases empathy and decreases schadenfreude. *Emotion* **10**(6), 796 (2010)
13. Gygax, G., Arneson, D.: *Dungeons and Dragons*, vol. 19. Tactical Studies Rules Lake Geneva, WI (1974)
14. Hourcade, J.P., Bederson, B.B., Druin, A., Taxén, G.: Kidpad: Collaborative storytelling for children. In: *Conference for Human-Computer Interaction 2002 extended abstracts on Human factors in computing systems*. pp. 500–501. ACM (2002)
15. Interactive, P.: *Who Am I? Race Awareness Game* (2010)
16. Jaccheri, L.: *The Little Doormaid: Tappetina*. CreateSpace Independent Publishing Platform (2016)
17. Jenkins, H.: Game design as narrative. *Computer* **44**, 53 (2004)
18. Lamber, R., Rilstone, A., Wallis, J.: *Once Upon a Time: The Storytelling Card Game* (2003)
19. Louchart, S., Aylett, R.: Narrative theory and emergent interactive narrative. *International Journal of Continuing Engineering Education and Life Long Learning* **14**(6), 506–518 (2004)
20. Manney, P.J.: Empathy in the time of technology: How storytelling is the key to empathy. *Journal of Evolution and Technology* **19**(1), 51–61 (2008)
21. Mateas, M., Stern, A.: *Façade: An experiment in building a fully-realized interactive drama*. In: *Game developers conference*. vol. 2, pp. 4–8 (2003)
22. Riedl, M.O., Young, R.M.: Narrative planning: Balancing plot and character. *Journal of Artificial Intelligence Research* **39**, 217–268 (2010)
23. Smiley, J.: *Thirteen ways of looking at the novel*. Alfred a Knopf Incorporated (2005)
24. Susi, T., Johannesson, M., Backlund, P.: *Serious games: An overview* (2007)
25. Van Eck, R.: Digital game-based learning: It's not just the digital natives who are restless. *EDUCAUSE review* **41**(2), 16 (2006)