Utrecht University

Master Thesis in Game and Media Technology

Narrative in Game Interventions for Training Social Emotional Skills

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Contents

Abstract

Social emotional skills are very important in children. The lack of these skills can lead to negative developmental outcomes. A good way to improve these skills in children is by using behavioral game interventions. However, getting a high learning gain and motivation in a child is challenging. Narrative could be a possible solution, as adding a story to a game can help with motivation, immersion, empathy, and even learning gain. This study looks at the possibility of using narrative as a way to improve the learning gain in a game intervention for training social emotional skills. This was done using an experiment where participants played a version of a game with a story or a version of a game without a story. Before and after the game the participants filled in a questionnaire so that the motivation and learning gain could be measured. Even though the results were not significant, the results still showed a trend that adding narrative to a game could still improve the motivation of the player. For the learning gain more testing has to be done. It was expected to see positive learning gains after playing the game, but this was not the case. The results showed negative learning gains for most of the participants. The data showed some significant positive correlations between motivational data, which is reason for future research. More research has to be done to see if narrative can help participants improve their learning gain in a game intervention for training social emotional skills.

1 Introduction

There are many definitions for social emotional skills. Payton et al. [27] describe social emotional skills as the skills to: recognize and manage their emotions, set and achieve positive goals, demonstrate caring and concern for others, establish and maintain positive relationships, make responsible decisions, and handle interpersonal situations effectively. They describe these skills as important as they help children to manage emotions, make friends and clear up disagreements. Studies have shown that usually these skills are linked to having a greater life experience, and a better school performance. Not having these skills, can lead to a variety of personal, social, or academic difficulties [10] [21] [8]. Lacking social emotional skills can be devastating and can lead to negative developmental outcomes [16]. Without social emotional skills a person can become an outcast, as making friends becomes more easy when having social emotional skills [16]. This can cause them to be lonely or even develop mental illnesses, such as depression or anxiety [15]. Children are supposed to learn these emotional skills needed for understanding emotions as they grow up. Whenever a child plays a game with other children or friends, they learn more about socialising and emotions step by step. They will learn that for example breaking rules in games does not make their friends happy and that this can lead to their own unhappiness. Playing with peers provides children with a safe environment to learn more about these social interactions without any possible 'real punishment' [13]. Children with a chronic illness do not always have an equal opportunity to participate in play and other social activities with their peers. Children with chronic illnesses can have frequent visits to the doctor, a strict treatment regimen and other illness-specific difficulties that take away time that could be spend with friends and peers in order to socialise. A recent study by Alexandridis et al. mentions an interview conducted with children from a children's hospital, the Wilhelmina Kinderziekenhuis (2017/2018, unpublished data). This interview shows that children with chronic illnesses had a desire to go to school and play, meet with friends, and play a sport [1]. Essentially, they want to feel connected and to be part of everyday activities with friends. The lack of socialising gives them a disadvantage at learning social emotional skills and possibly leads to feelings of loneliness. As the lack of social emotional skills can cause many problems, there is a need to help children with chronic illnesses to improve their social emotional skills.

Teaching social emotional skills can be done using serious games, as it has been proven before that video games can help with mental health issues [11]. Serious games can also create a safe play environment for children to practice and learn in. It is important to note however, that behavioural interventions often require multiple sessions to have a long lasting effect. Although there is no golden standard, Byrne et al. found that around 12 sessions had a good effect [7], as you do not want too little or too many sessions. If children only play one or two sessions there is a big chance that the effects will only be short lasting, and if there are many sessions the child has a big chance of loosing interest and motivation.

Ruby's Mission by Alexandridis et al. is an applied game developed for the purpose of teaching social emotional skills to chronically ill children [1]. This serious game was specifically created to help children with chronic illnesses to improve their social emotional skills to prevent loneliness. However, as they mention in their research as well, the game is still lacking in some aspects. Currently the game only consists of one level. As mentioned before it is very important for a behavioural intervention that participants play multiple sessions to give a successful effect on the player [7]. Keeping the same motivation when starting a serious game until the last session is a difficult task. Therefore, if the motivation in the game is improved it would help Ruby's Mission substantially. Another aspect is the actual learning of the social emotional skills in the game. In the research of Ruby's Mission, it is already explained in great detail how they plan to improve the social emotional skills in the player. However, there is no limit of the learning gain that the player can get and this can always be improved.

A simple way to improve the effect of behavioural interventions, such as Ruby's Mission, is by adding narrative to a serious game [22] [5] [2] [18]. Narrative has been proven to help serious games in many ways, it can help with motivation, engagement, immersion, and even learning gain [25]. Adding narrative to Ruby's Mission would prove to be beneficial to their goal. By adding certain narrative techniques that would help with motivation, children would have an easier time to finish the complete sessions until the desired effect and a learning gain is reached. There are also certain narrative techniques that could help with empathy which would support the learning goal of teaching social emotional skills [17]. As narrative techniques could even help with the learning gain of serious games [24], there are many benefits of developing a good narrative for such serious games.

By adding narrative techniques and narrative to a game intervention for training social emotional

skills, this research expects to find a direct and indirect increase in the learning gain. As mentioned before, narrative can provide a means to practice with social emotional skills in a safe environment through story and in-game characters. As interventions require multiple sessions to become more effective [7], narrative might stimulate increased learning gain indirectly, through improving motivation over multiple sessions. This study will use the serious game, Ruby's Mission, designed by Alexandridis et al. [1], as its goals fit with what this study expects to find. It is expected to see an improvement in the learning gain with Ruby's Mission after adding a new narrative to the game.

1.1 Social Emotional skills

As mentioned before, there are many definitions for social emotional skills. This study will use the definition set up by Alexandridis et al. [1].
Social emotional skills are described in three ways by Alexandridis et al. [1]. (1) Recognizing emotions in one-self and in others, (2) understanding the meanings of emotions to guide thinking and doing, and (3) understanding the subjectivity of emotional experiences.
The first description, recognizing emotions in one-self and in others, is essential when using the social emotional skills in social situations. Without being able to identify an emotion in others (or in one-self), it is impossible to respond with the correct and fitting emotions. This is why it is very important to learn social emotional skills. The same goes for understanding emotions (2). When understanding emotions, they can be connected to a set of possible actions. This realisation might help someone navigate their way through social interactions with others. The last description about the subjectivity of emotions, might be the most important one. If for example someone with a lack of social emotional skills is very lonely, they might perceive a lot of emotions as negative and see them in only the way that they perceive it. It might help minimize the negative bias that gets formed in social interactions, by understanding that emotions are subjective and might be different from your own.

1.2 Ruby's Mission

Ruby's Mission is a game intervention created to reduce loneliness in chronically ill children by training social emotional skills. These skills are taught using mini games and teamwork in the game. In figure 1 the opening screen of Ruby's Mission can be seen. The game is played with approximately three peers that the child with a chronic illness is familiar with and feels comfortable with (e.g. friends, family or classmates). The goal of the game is to help a robot named Ruby to understand and learn emotions. The game itself revolves around cooperation and communication. Together the players have to communicate and work together to control Ruby to clear all the missions. The missions are centered around socialising and emotions. All players control the robot in the game cooperatively. Each player has their own important and specific task to control the robot. This way the game cannot be played when someone is not joining in. This makes sure that no one is left out and that they all play the game together. The players also have to discuss a lot of their answers together, which helps to improve their social emotional skills, as well as helps them socialise. There are three different roles in the game that get randomly assigned to the players. The first role is the controller who controls Ruby and drives him around in the game. The second role is the decision maker. This role decides on a final answer when all the players need to discuss answers for certain mini games. The last role can be played by two players and is the collector role. For one of the mini games the players need to collect texts sprayed on the walls around the city in the game. Two players need to collect these so called 'tags'.

Figure 1: The opening screen of the game Ruby's Mission.

There are three different mini games that are all repeated two or three times in the game. These mini games are centered around three emotions that are chosen for that specific session. The first mini game is the poster game, which is repeated three times for each emotion. This mini game is a poster with the explanation of an emotion (see Figure 2). After reading the poster, a player can fill in when it was the last time for them that they felt that certain emotion, and what they did at that time. After filling in their answers the players can choose to place their answers next to the posters in the game world. When doing so, all the players can read each other's answers and discuss what they read.
The second mini game is the situation game. This game is repeated twice in the game, one game with only one emotion, and one game with two emotions. In this situation game Ruby talks to an NPC (Non Player Character) who talks about a situation that they are struggling with that is centered around an emotion. First the players have to decide what they think the NPC is feeling. After this each individual player gets a possible response that Ruby could say to the NPC. The players have to discuss all the possibilities and decide on one answer. When chosen which answer to give, Ruby will say this to the NPC and a fitting answer is given in return by the NPC. This answer shows if the given answer was received positively or negatively by the NPC. An example of this is where the player tells the NPC to do a presentation that their nervous for about their hobby. The NPC responds that they are not sure if they have the courage to do that. Giving an option on what the presentation should be about is not helping the NPC with their nervousness, so they respond slightly negative.
The last mini game is the graffiti tag game (see Figure 3). As mentioned before, some players have to collect texts that are sprayed on the wall around the city in the game. These texts are sentences about an emotion. For example "I watched a horror movie at midnight" which is connected to the emotion being scared. This game is repeated three times for each emotion. The players have to collect five 'tags' for each emotion. When they have collected five tags, a mini game will start. Here Ruby will say that they have collected five tags concerning a certain emotion, but his data base only has room for three tags. The players have to discuss and decide with each other which three tags they believe fit the emotion the best and should stay in Ruby's database.

Figure 2: A screenshot of the game Ruby's Mission where a poster mini game is visible. In the back there is also a graffiti tag visible that can be collected for the graffiti tag mini game. As the game is created for dutch children, the texts are all in dutch.

Figure 3: A screenshot of the mini game with graffiti tags from the game Ruby's Mission. As the game is created for dutch children, the texts are all in dutch.

The game is designed to be played over the span of a few weeks, where each week the children get a different session with three new emotions. The game is planned to have six sessions in total, and be played at the home of a chronically ill child. Currently there is only one session available with eight small missions that the children have to clear. This first session includes the emotions: guilt, pride, and jealousy. Currently the game is only tested with healthy children. Development for the game is ongoing during this research study, which means more sessions might become available.
The present story of the game is very limited to non-existent. The current state is limited to an intro and an outro cut-scene. The overall story, which gets briefly explained in the beginning of the game, is about a robot named Ruby. Ruby was sent to earth to learn about emotions. The robot was supposed to meet four scientists that would help him, but they did not show up. This is why Ruby asks the four children playing the game to help him navigate through the world and teach him about emotions.
The play tests from the research declared that the game was perceived as fun and that children were looking forward to playing the game again. However, as they only played one session it is unclear if this is due to playing the game for the first time or that this motivation will stay after multiple sessions. As the game eventually has to be played six times, there could be a high possibility that this motivation will not last over the multiple sessions needed to improve the social emotional skills of the chronically ill children.
In the study of Alexandridis et al [1] the design guidelines for Ruby's Mission are completely described. The study also mentioned how Ruby's Mission was created and what decisions they made for the game to make sure that it would teach social emotional skills to children.

1.2.1 Goal of Ruby's Mission

As mentioned before, the goal of Ruby's Mission is to improve social emotional skills of children with chronic illnesses to reduce their loneliness. There are three main objectives that the game tries to achieve. They state the following: (1) Learn to recognize emotions in one-self and in others. (2) Learn about the meanings of emotions to facilitate thinking and doing. (3) Learn to understand that emotional experiences are subjective [1]. These three objectives are translated in the game via game interactions.
The first objective, 'Learn to recognize emotions in one-self and in others', is taught through four game interactions. The first two game interactions deal with recognizing emotions in one-self. This is done via the poster mini game where the player has to reflect on their own experiences of when they felt a specific emotion. The second game interaction is done by motivating the player to use their previous and real life experiences to make decisions in the game. These two interactions makes the player reflect and recognize emotions in one-self. To recognize emotions in others, there are two other game interactions. The first game interaction is displayed in the situation mini game where the players have to deduce the feelings of another game character from a social context. The second game interaction is done by showing the player multiple facial expressions and body languages associated with specific emotions. These game interactions bring the player in contact with emotions from other people, which will help them recognize the emotions later on.
The second objective, 'Learn about the meanings of emotions to facilitate thinking and doing', comes back in the situation mini game where the players have to interact with a character that is feeling certain emotions. To find the desired interaction with the character, the players first have to think about the emotional meaning of what the character is currently feeling. After interacting with the character, they will get a response showing how the character reacts to their decision. This game can lead to a better understanding of the emotional meaning and the consequence on behaviour.
The last objective, 'Learn to understand that emotional experiences are subjective', comes back in two game interactions. The first game interaction comes back in the poster mini game where the players have to share their personal experiences with the same emotions with each other. By showing that all the answers can be different, it shows the players the subjectivity of emotional experiences. The second game interaction comes back in the graffiti mini game where the players have to make a group decision on an emotion related topic. As the group decisions are rarely unanimous, a discussion has to be held to choose a final answer. This discussion shows the different opinions of different players. This again shows how emotional experiences are subjective.

Figure 4: A screenshot of the game Ruby's Mission.

1.3 Research Question

The research question of this thesis states the following:

- **Can narrative enhance learning gains in a game intervention for training social emotional skills?**

As mentioned before, having social emotional skills is very important. These skills are learned and developed during childhood. A deficit in these skills can have a dreadful effect later in life, such as loneliness, and mental illnesses such as depression and anxiety [15][16]. This is why it is very important that each child learns these social emotional skills. An intervention is necessary in order for the child to train their social emotional skills. One way to accomplish this is through serious gaming. Nevertheless, creating a successful game intervention is difficult. This is due to the fact that behavioural interventions often need multiple sessions to have an effect on the player [7]. As there is always a limit to the amount of sessions due to time constraints, the sessions that can be played should be as effective in improving the skills as possible.
This could be achieved by adding narrative to these types of serious games. Adding certain narrative techniques could help the game elicit motivation and a learning gain. Some narrative techniques that will improve the game will be discussed in the next section. This study expects to improve serious games that train social emotional skills by adding a narrative that uses multiple narrative techniques to enhance the player experience. This study will then find out if the added narrative effectively improves the social emotional skills of the player.

1.3.1 Sub-Research Questions

To find an answer on the main research question presented above, this study will investigate the following sub-questions:

- **Does the inclusion of narrative in a 'game intervention for training social emotional skills' increase player motivation?**
- **Does the inclusion of narrative support the learning gains of social emotional skills of players of a 'game intervention for training social emotional skills'?**

As mentioned previously, behavioural interventions often need multiple sessions to result in a successful effect on the player [7]. This is why it is very important for a serious game focused on training social emotional skills to be motivating enough for the player to keep going. This is why the first sub research question focuses on motivation. There are a lot of narrative techniques that have been shown to improve motivation in games. By adding narrative to a serious game this study expects to see a spike in motivation in the current session. Keeping the motivation high will result in a successful and enhanced learning gain [20].

The second sub research question focuses on supporting and improving the learning gain. It is important that in each session of a behavioural intervention the learning gain is as high as possible. The goal of a behavioural intervention is to teach the player as much as possible, meaning a high learning gain is beneficial. As narrative has already been proven to enhance the player experience [25], this study expects to use it in a successful way. By adding certain narrative techniques to a serious game it is expected to see an improvement of the learning gain. By seeing if narrative actually supports the learning gain it is expected to be able to conclude that narrative is beneficial to improving social emotional skills.

2 Related Work

There has been a lot of research on different narrative techniques to improve motivation, immersion, empathy and learning. In this section the different narrative techniques will be discussed.

2.1 Narrative

Narrative is an effective way of improving games in many ways. By using narrative techniques it is possible to enhance motivation, empathy, immersion and even learning in serious games and

commercial games. This section will show all the possibilities for narrative, may it be in games, serious games or even counseling.
For example, Baceviciute et al. [3] discuss the use of interactive narrative tools in child counseling. In their research they used a tool in which a child could form and create their own story so that it could be better discussed with a counselor or therapist. They discovered that using such an interactive narrative tool did indeed help both the child and the counselor. Using the tool the child could explain their story better which led to the counselor understanding the story better as well. The tool helped to explore problems, form strategies, and create solutions to overcome the problems. In short, this study showed that adding narrative can also help with communication [3].
The research from Ware et al. [32] shows the difficulty of designing a story. Their research talks about the creation of a narrative planner named Sabre. The narrative planner creates a narrative that keeps the authors goal in mind but does allow theory of mind for all the characters in the story to create realistic characters. Theory of mind refers to the capacity to understand others' perspectives and to show empathy [12]. Ware et al. [32] describes the many small rules to create a clean and good narrative. Adding theory of mind to the characters creates dimensional characters that do not become flat and boring. This makes the narrative more realistic and immersive. The narrative planner Sabre takes this all in consideration when creating a story. An example of a created story with theory of mind is the following:

When a guard sees a bandit with a sword and a traveler with no sword and money, the guard will realise that the bandit would want to get the money and that the traveler has no means to protect themselves. The guard will draw a conclusion that he needs to help the traveler and attack the bandit as the guard does have a sword.

Without theory of mind the guard would not be able to draw this conclusion and would not help the traveler. Using theory of mind, the guard can predict and empathise with emotions of others, even when these emotions are not in line with his own.
The research from Bormann et al. [6] also showed the benefits of adding narrative to a game. They did research with three games. One with a story, one with a simple basic story where the participants were asked to ignore the story, and one game without a story. The results showed that the participants playing the game with story felt most immersed into the game. They showed evidence that narrative elements in video games may have a positive impact on the player.

2.1.1 Motivation using Narrative

There has been extended research on how to create motivation in serious games using narrative. Research distinguishes two broad categories of motivation: intrinsic motivation and extrinsic motivation [4]. Intrinsic motivation comes from your own interests, while extrinsic motivation comes from an external force, such as avoiding punishment or receiving a reward [4]. As intrinsic motivation comes from self interest it is far more effective than extrinsic motivation, and intrinsic motivation has been associated with quality learning and creativity [31]. This is why using intrinsic motivation techniques in narrative is a good way to increase the motivation of a player.
Rowe et al. [30] talks about the 4 basic steps to create intrinsic motivation. The four main motivators from intrinsic motivation are Challenge, Curiosity, Control and Fantasy.
The first motivator, challenge, can be explained easily. If a task is not challenging enough a user would easily lose interest. The same goes for a challenge that is too difficult. Finding a good balance between the difficulty can create a good challenge for a player in a way that he wants to try and beat the task to test his skills. Challenge can be easily added to a narrative. This can be done by adding certain goals to the story. A pedagogical and narrative goal are practical to add to a narrative-centered learning environment [30]. A pedagogical goal includes tasks that reveal information to be learned or give experience with this learned information. The player will be able to use such information or experience after the game, not necessarily during the game. Think of a serious game about subtractions in math for example. A pedagogical goal for this game is that you want the player to understand and be able to do subtractions afterwards. A narrative goal involves tasks that advance the plot of the story. An easy example of a narrative goal is "Find the legendary sword", where the sword can be used to safe the lost princess. Without this goal the narrative would not progress. In addition, there are also fixed and emergent goals. Fixed goals are specific and always happen in each game, while emergent goals only arise with some narrative path that the player has chosen. An example of a fixed goal would be "Go save the princess", while a emergent goal might be a side quest saying "Take the route through the forest (instead of the mountain)". These types of goals can give the player a sense of challenge. Adding uncertainty can

increase this feeling even more. When a player is uncertain if they can carry out a certain goal, it may give them a desire to test their own abilities [30].
The second intrinsic motivator is curiosity. Curiosity drives the player to explore and discover unknown subjects. For example, a mystery in a story will drive the player to look for the answer and keep playing. Rowe et al. distinguishes two types of curiosity: sensory curiosity and cognitive curiosity. Sensory curiosity is triggered through the environment itself with colors, lights and sounds. When an environment in a serious game is interesting and unknown, the player will want to explore and look around to learn more about that environment. Cognitive curiosity is triggered by things as incompleteness and inconsistency. A player will pursue a goal to try and remove the incompleteness and inconsistency from their understanding.
The third intrinsic motivator is control. When a player has no control in the game, they will quickly loose interest. Think of a game where the player is not informed of the rules. The player does not have control of the game and will easily get frustrated and stop the game. Adding control gives the player some security and is an easy way of giving intrinsic motivation. Giving the player the feeling they have control over the story will motivate them to keep playing. This can be done by making the story responsive (e.g. giving feedback when the player is not doing well) and giving the player choice (e.g. an interactive story) [30]. By changing the story this way the player will feel a sense of control while playing the game. The player will become an actual player, instead of a simple observer of, for example, a movie.
The last intrinsic motivator is fantasy. This motivator especially is very important for positively influencing the motivation of elementary school students [30]. Fantasy can be created in the environment and characters of the story. Creating a story filled with a new and imaginative world creates a whole new experience for the player. There are two ways of adding fantasy to a story. On the one hand, there is endogenous fantasy, which combines the goal of a game with the fantasy. On the other hand, there is exogenous fantasy, where the goal and the fantasy are not related. Endogenous fantasy makes sure that you cannot remove the fantasy from the story without removing the goal of the game and vice versa. This is a very effective way of creating motivation for not only the game but also the learning goal of the game itself [30].

Wouters et al. [33] came up with a similar narrative technique to stimulate motivation. They came up with surprise and curiosity, which is similar to curiosity from the four intrinsic motivators from Rowe et al. [30]. By adding curiosity-triggering events and surprises to the story, the player becomes motivated to keep playing to see the outcome of the story. Revealing the outcome of the story at the beginning of a game (foreshadowing), makes the player curious on how the story will unfold to get to this outcome. This way the player becomes more attentive to the story. By adding an unexpected event to the story as a surprise (such as a plot twist), the player will wonder why this event has happened and will also become more focused on the story.
Both these narrative techniques have something in common. They both deal with an information gap. The player is missing information to understand the whole story. Closing this information gap is a strong motivator for the player to keep playing. The player also deals with an inner conflict, as their expectations of the game no longer match the game itself. After a curiosity or surprise event, the player has to rethink their whole representation of the story to fill in the information gap. This makes the player think more about the story and makes them get more motivated to find out the ending as well [33].

Naul et al. [25] designed four narrative features that improve the narrative to create more motivation. These four features are: distributed narrative, intrinsic integration, empathic characters, and adaptive storytelling.
Distributed narrative means that the narrative is not located in one place. The narrative is scattered throughout the whole game by means of environmental storytelling. The story is told as usual, but the player also gets information from NPCs (non-player characters), and background art such as posters and objects. By distributing the narrative the cognitive load on a player is reduced, as they no longer have to read large amounts of text. This easier way of taking in information keeps the player motivated and attentive.
The second narrative feature is endogenous fantasy and intrinsic integration. Earlier, intrinsic motivation and endogenous fantasy have already been discussed. Intrinsic motivation, meaning that the motivation comes from the player itself, and endogenous fantasy, where fantasy is completely integrated into the story and goal of the game and not removable. Naul et al. [25] talks about completely combining these two into intrinsic integration. When merging the fantasy story with the goal, the player automatically becomes motivated to clear or learn the goal of the game when

they get motivated by the fantasy story. In their study they mention a research about a serious game to teach math. In the intrinsic integrated version of the game, the player has to solve math problems in order to attack zombies. If they would not solve the problems they wouldn't be able to successfully attack the zombies. This type of integration gives a lot of motivation to the player to not only play the game but also learn from the goal of the serious game.
The third narrative feature is empathic characters and virtual agents. By carefully designing the characters in a serious game, the player can get pulled into the story and get more immersed. Making these characters empathic also has a lot of benefits. Think of a princess character that is trapped in a tower. When this empathic character is correctly designed, the player would feel sorry for them and would want to free them from their confinements. This gives the player motivation to clear the game. A virtual agent can also help the player in their journey. By adding a virtual agent the player has someone to help them along the way. This connection motivates the player to keep playing as this would also help the virtual agent.
The last narrative feature is adaptive and responsive storytelling. This feature has a lot to do with the earlier mentioned intrinsic motivation called control. By giving the player control over the story the player becomes more motivated to play. This can be done by making the story adaptive so it can change for each player and by making the story responsive distinguishes the game from a book or a movie. Alongside control there is another benefit to using adaptive storytelling. Naul et al. [25] also found that adaptive storytelling made the characters more interesting and believable. This again helps with immersion, which motivates the player to keep playing.

2.1.2 Empathy using Narrative

Multiple studies have discussed how to create empathy through games and how such a game influences a player. Greitemeyer et al. [14] proved that playing a pro social game already increases pro social behaviour and decreases antisocial affect. In their research they used a game where the player had to lead creatures to a safe exit without letting them die. After playing this game and filling in a survey, it showed that they had more pro social behaviour and increased interpersonal empathy compared to their test group which played an antisocial game where they had to kill all the creatures in the game.
Wu et al. [34] also proved with their study that playing an empathy game can improve the empathy of children. In their research they created a story-based tablet game in which children had to do small tasks where they had to (1) attend to and perceive emotionally important events in a story, (2) actively share the emotions of the characters identified, and (3) take others' perspectives and reason why a given emotion surfaces within the context [34]. Their game was made with four familiar themes (nursery, kindergarten, school, and home) so that the children could easily use their learned empathic abilities in real life situations. As the game was created for very young children each episode consisted of a very simple scene telling a story with an emotion as the middle point. The children were encouraged to 'notice' the emotion in the story themselves. They were encouraged by bright colors put around the main subject (e.g. a sad crying baby). By the simple scenes, no text, and the encouragement to find the emotions in the scene themselves, the children became more attentive to other people's feelings. The study also showed that children's empathic perception and their attention to others' distress was enhanced [34].

Pallavicini et al. [26] discussed two big commercial video games, 'Detroit: Become Human'[1] and 'The Walking Dead'[2], and how they induce empathy in the player using narrative. They believed this was caused in two ways: 'Perspective-taking and reflexive thinking' and 'empathic concern and emotion recognition'.
Perspective-taking and reflexive thinking is done in the following ways in both games. By making the player take the point of view of empathic game characters and control their actions and choices, the player is forced to try to put themselves in the shoes of the characters. The characters in 'The walking dead' are also purposefully designed to encourage the player to cognitively empathize with them. They are made ordinary and relatable to the player. Both games include in depth characters that stimulate empathy. The game 'Detroit: Become Human' also makes the player play with multiple characters throughout the game. By simultaneously playing these three characters, the player is forced to make decisions with the background and story of all the characters in mind. Both games also underline the complexity of the available options, making the player reflect on the impossibility of some of the choices. All these characteristics of the game promote the player to

[1] 'Detroit: Become Human' by Quantic Dream and Sony Interactive Media, 2018
[2] 'The Walking Dead: Season One' by Telltale and Skybound Games, 2012

take perspective of the characters and to reflect and think about the choices that they will make in the game.
Empathic concern and emotion recognition is again promoted in both games. Both games have constructed the graphics and narrative carefully to instigate intense emotions and empathy. In 'Detroit: Become Human' advanced animation was used. They also paid close attention to the animation of the eyes to make sure every emotion was well portrayed. 'The walking dead' also made use of colour theory and they framed facial expressions in such a way that they could not be ignored. The characters were also made likable and were all 'emotionally authentic', which was again encouraged by the emotional expressions of the characters. These techniques encourage the players to feel empathic towards the characters and recognize the emotions that the characters feel.

In the research of Kral et al. [17], they created a serious game that would teach the player certain emotions. While playing they would learn to recognize 6 basic emotions (anger, fear, happiness, surprise, disgust, and sadness). They would also be able to see the different intensities of each emotion by using a slider tool that could increase or decrease the intensity of a chosen emotion. In their research they tested if a video game that trains empathy could actually improve the empathic accuracy, empathy-related brain activation and connectivity of brain networks relevant for empathic processing in adolescents. Using MRIs, they looked at the brain of the participants to see the differences after playing their game. The results showed that participants who engaged more with the serious game had an increased empathic accuracy. It also showed that playing the game trained the player to more effectively recruit a region of the brain involved in perspective taking. This could be due to the fact that in the game the player often has to take the avatars' perspectives into account to clear the game. Overall, the results provided evidence that an empathy game could be used to improve empathy-related brain functions and connectivity in adolescents, especially the perspective-taking and emotion regulation.

2.1.3 Immersion using Narrative

Another way to enhance the players experience, is by improving the immersion in games. Narrative is a powerful tool that can help to achieve immersion when done well. McMahon et al. [23] did some research on this topic to improve immersion in games. When talking about narrative, they state that narrative elements make players willingly suspend disbelief. Meaning that a good narrative can help with immersion. They mention some easy structures to create a good narrative. Some of these structures are 'the hero's journey', 'the Aristotelian three-act structure', and the 'monomyth'. The first structure, 'the hero's journey', is a typical storyline where the main character goes on a trip or adventure to reach a certain goal. The structure can be seen as a metaphor for life or overcoming any challenge in life. The character starts from the beginning and slowly grows to be able to overcome the challenge. The second structure, the 'Aristotelian three-act structure', was created by Aristotle who said that each narrative needs a single cause to drive the story. This cause needs to have the structure of a 'living organism' and should have a beginning, middle and end section. By giving the story a structure of life (being born, mature, and die), it is easily perceived as familiar and pleasant. The third structure, 'monomyth', is based on three acts that consist of a total of 17 sub-scenes. It is similar to the 'Aristotelian three-act structure', but uses departure, initiation and return in the structure to give it form. [23].

Rowe et al. [29] also talked about how narrative can help presence in games. Presence, a part of immersion, is the sense of existing in the game. They distinguished three groups of factors that influences narrative presence and immersion. These groups are narrative-centric factors, user-centric factors, and interpersonal factors. The first group, narrative-centric, includes four factors to influence narrative presence. These are consistency, plot coherence, drama, and predictability. The first factor, consistency, states that after setting an expectation for the player, it is necessary to keep that expectation to prevent disrupting the narrative presence. This means that setting, plot, and characters should remain consistent to keep the narrative believable. The second factor, plot coherence, requires that the plot stays coherent. However the plot should also not become too superficial or oversimplified. This means that events comprising a narrative's plot should happen in a logical and causal order, or the event should be explainable through rational means. The third factor, drama, tells that the narrative should include a setup, conflict, and resolution needed to make an engaging and interesting plot. The last factor, predictability, states that some form of predictability in the narrative is necessary. This is to strengthen the expectations of the player

and mimic real world cause and effect.
The next group, user-centric factors, include again four factors: affect, motivation, efficacy, and control. The first factor, affect, states that narrative that stimulates the player's emotions may increase the presence in the story. The second factor, motivation, expresses that interesting narratives encourage active participation and progression through the whole story. Especially intrinsic motivation, discussed in previous sections, really help with creating an interesting narrative to encourage presence and immersion. The third factor, efficacy, talks about the fact that if a player does not feel capable of clearing a narrative problem, then they will quickly feel disengaged. By making sure the narrative creates a self-efficacy feeling towards the player, the player will stay engaged and immersed into the game. The last factor, control, is simple. By offering control and freedom in the story, the player becomes an active participant instead of a passive observer. This feeling promotes a sense of being part of the narrative.
The third group, interpersonal factors, includes five factors: identification, narrative load, character believability, empathy, and involvement. The first factor, identification, is important for the player itself. If the narrative and characters are relevant and identifiable to the player they are likely to get more interested and enhance the presence of the player. For the second factor, narrative load, it is necessary to look at the target audience. Some players may highly enjoy fantasy stories, whereas others may only like realistic stories. Carefully looking at the target audience to decide on the narrative load can assist with the presence of the players. The third factor, character believability, states that creating convincing characters with complexity and depth gives believability for the player which is crucial for the sense of narrative presence. The fourth factor, empathy, is again important for the believability. By making characters show empathy towards the player and other characters it may affect the sensation of narrative presence. The last factor, involvement, is very important for narrative in games. By being part of the story, by for example resolving conflict, the player becomes more involved in the story to go after the conclusion. Active participation and attention towards the story results in narrative presence. By following all these narrative factors the presence for a game can be greatly improved [29].

McQuiggan et al. [24] also tested presence in their serious game by giving a presence questionnaire to the participants after playing. Their serious game that teaches science subjects to children was originally created to look at the learning gain when narrative was added. However, they also tested the presence of their game compared to the test games without narrative. The narrative used in the game was focused on fantasy and combining this with the learning goal present in the game. This is similar to the technique called endogenous fantasy by Rowe et al. [30]. The results showed that narrative had a significant effect on the players presence, as a higher presence was reported in the game with narrative. The results also showed that when a higher level of presence was reported, the self-efficacy was also announced higher.

The studies from Naul et al. [25] and Bormann et al. [6], that have been mentioned before in this thesis, all also state that their findings improved immersion. Naul et al. [25] mentions that their design strategy (distributed narrative, intrinsic integration, empathic characters, and adaptive storytelling) also create a greater sense of immersion. Especially empathic characters and virtual agents. Strong created characters can pull the player into the story by way of immersion. Bormann et al. [6] used a questionnaire to look at the immersion in games during their research. The results again showed that narrative elements in video games improve the immersion of a player.

2.1.4 Learning gain using Narrative

Adding narrative to a serious game also has positive effects on the learning gain. McQuiggan et al. [24] did some research showing this positive effect. In their research they created a narrative mystery game that would teach microbiology. They used the earlier mentioned technique called endogenous fantasy [30], where they added fantasy to the game in such a way that it would support and be one with the learning goal. After letting participants play the game and fill in a questionnaire, they found out that playing the narrative game had a significant learning gain. It also became clear that the narrative version of the game reported a higher level of presence by the participants than the other versions. This is also a promising result for motivation. However, more tests need to be done on this subject, as one of their tests groups where students learned from a PowerPoint actually showed a higher learning gain [24]. This could be caused by many things in their research, but they suspect it has to do with the short-term experiments. As they let the

participants only play the game for a short amount of time and did a questionnaire and test right after they were finished. In later research with the same game, they did discover that adding the narrative-centered learning aspect of the game did not distract learning but rather supported the learning of the science content [19].

In previous mentioned literature for motivation, it was also mentioned that the steps to create motivation can also lead to a learning gain. Wouters et al. [33] also discusses the learning gain that the earlier mentioned curiosity and surprise can cause in their study. The learning gap created by curiosity and surprise form a good base for an enhanced learning gain, especially problem solving. This is caused by the fact that the player has to alter and reassess their mental model created for the game after a curiosity or surprise event. The player has to review the whole story again and will be more active and focused on next parts of the story to try and see these type of events coming. This is an easy way for the player to passively review the learned goals of the game.

Naul et al. [25] also discusses how narrative techniques can enhance the learning gain. Just as the game from McQuiggan et al. [24] used fantasy in their narrative, Naul et al. [25] also mentions that fantasy in narrative increases the learning gain. They show that a game with fantasy has a significantly greater learning gain than a game without fantasy. They also show that a virtual agent, which is one of their proposed narrative design strategies, can also support a player with the learning goals. By giving the player a virtual agent that helps them learn, they do not have to go through the learning process alone. As mentioned in earlier sections, these narrative techniques also help with motivation. The research from Naul et al. [25] also shows that enhancing the player's experience with narrative techniques for motivation, engagement, and immersion likely gives an increased learning gain. Meaning that all the narrative techniques mentioned before could also improve the learning gain as they all improve the player's experience.

3 Method

This section will explain how the research questions will be answered. This will be done by choosing the final narrative techniques used in the narrative. After this the progress of creating the new narrative with the chosen narrative techniques will be handled. Afterwards the game, the experiment and data collection will be discussed.

To be able to answer the first sub research question: "Does the inclusion of narrative in a 'game intervention for training social emotional skills' increase player motivation?" a lot of narrative techniques concerning motivation will be added to the story, which will be discussed in the next session. To test the motivation of the player it is preferable to do multiple play sessions with the game to see if the motivation stays higher during multiple sessions. However, that is not in the scope of this thesis. This is why only one session will be created for the experiment of this study. By focusing on one session and placing all the narrative techniques into this session, the experiment only needs to be one day. By only creating one session it also becomes easy to compare the motivation in one session with narrative to a session without narrative, without the experiment becoming too long. It is expected to see more motivation in a game session with narrative than without. If this is the case it is possible to speculate that the motivation will also stay higher over multiple sessions [20]. To measure this motivation the players fill in a questionnaire about how they perceived the game after playing.
To be able to answer the second research question, "Does narrative support the learning gains of social emotional skills of players of a 'game intervention for training social emotional skills'?", this study will look at the learning gain of the player. Again certain narrative techniques are selected to improve the learning gain. As the goal of the game and this research is improving social emotional skills it is not easy to measure the learning gain, as it is not as easy as filling in a quiz before and after the game. To try and see if the player has a better understanding of emotions they will first fill in a base questionnaire about emotions. This questionnaire is from Rieffe et al. [28] and can be found in the appendix. After playing the game the participants will fill in another questionnaire about the emotions in the game. This questionnaire can also be found in the appendix. By comparing the answers on these questionnaires it is expected to see an improved understanding of emotions with the participants that played the game with narrative.

3.1 Narrative

3.1.1 Chosen Narrative Techniques

In related work different narrative techniques have been discussed. This section discusses which techniques are most suitable for this research question. The focus is on creating more motivation and increasing the learning gain. While creating the story for the game, these chosen techniques were kept in mind to make sure that a fitting story was created for this research.

The techniques distributed narrative and intrinsic integration (also known as intrinsic motivation and integrated fantasy) from Naul et al.[25] are used for the story. These two techniques improve immersion, motivation and give a higher learning gain. They also make sure that the learning goal of the game is completely integrated into the story of the game. By altering the world and mini games to fit the story, the narrative can be easily distributed. These two techniques help to bind the whole story together and make it inseparable from the learning goal in the game.
Another technique that will greatly benefit the story is the four intrinsic motivation techniques from Rowe et al., Challenge, Curiosity, Control, and Fantasy [30]. These four intrinsic motivations help enhance the motivation of the game. The techniques also give an easy check to make sure that the game stays interesting for the player.
The technique curiosity is also backed up by Wouter et al.[33] who showed that it can also help improve motivation and learning. Adding a bit of mystery to the story is an easy way to create such a feeling of curiosity for the player, which is proven to help with the learning gain.
The last intrinsic motivation, Fantasy, is also shown to add to learning [19] and give extra motivation [24]. Adding fantasy is a good way to bind the story to the learning goal. This narrative technique is also not difficult to add to the story, as the original story already includes a robot.

These narrative techniques were chosen as they fit with the goal of creating more motivation and an increased learning gain. These narrative techniques are also easy to add to one story as they often overlap with each other. This eased the process of creating a complete story with all the narrative techniques included. An overview of the narrative techniques and how they are weaved into the story, which is also explained in a later section, can be seen in Table 1.
The narrative was created in cooperation with the serious gaming studio IJsfontein[3]. This studio also helped during the development of the base game of Ruby's Mission. By discussing the story in close collaboration with the studio a detailed story was created with all the narrative techniques included. This created narrative was added upon the game Ruby's Mission in Unity so it could be used for the experiments. More information on how the base game Ruby's Mission was created can be read in the study by Alexandridis et al. [1].

3.1.2 Narrative Journey

The narrative went through many changes. In this section the journey of how the finished narrative came to be will be discussed. The story would be created for six sessions in the game, with each session having three emotions that are learned by the player. Each session needs its own drive of motivation for the player to keep playing, but it should also not be too complicated as these sessions are meant to last around 25 minutes.

The first story for the game was created by the author of this study. In this story Ruby the robot was made into an outer space spy. He needed to stop other robots from his planet from stealing emotions from planet earth, as they believed that emotions were redundant. This story included another evil 'vacuum cleaner' robot that was stealing away all the emotions from people (see Figure 5). In the story, with the help of four children, Ruby helps people, learns more about emotions, and learns more about the evil 'vacuum cleaner' robot (that turns out to be just jealous that other people have emotions). Each session had its own separate goal and side story, so that the player would stay motivated. However, this turned out to be the downfall of this story, as it was too packed for the small amount of time that each session was supposed to last. It was also expected that with a minimum of a week between each session, the story would become too confusing as a lot would happen in between sessions. A dutch presentation of the story board for this first story can be found in the appendix.

[3]IJsfontein, a serious gaming studio located in Amsterdam, The Netherlands. https://www.ijsfontein.nl/en/

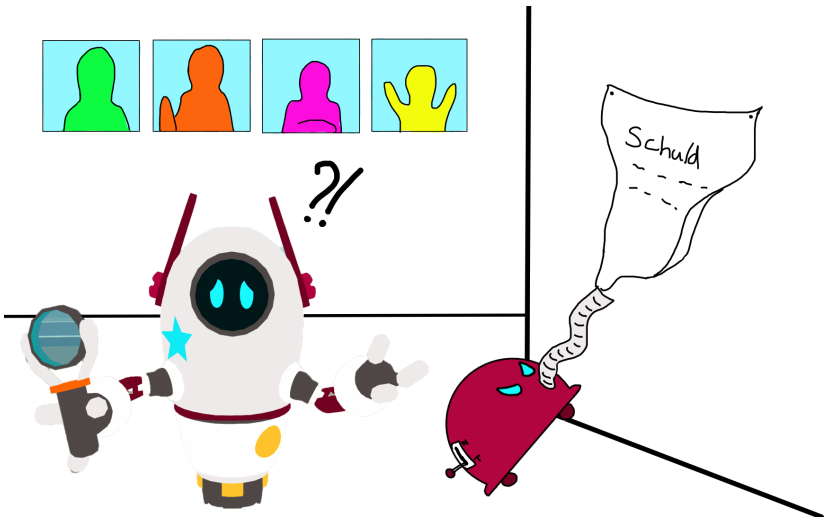

Figure 5: An image of the story board for the first version of the story of the game Ruby's Mission by Roos Boekelman. The image shows Ruby being upset as the evil vacuum cleaner robot Hettie steals all the emotions and posters in the game. On the top of the image the four players of the game are visualised.

After establishing that the first story idea was too complicated for the age group and length of the individual game session, a brainstorm session was held with the serious gaming studio IJsfontein to create a new story. In this session it was also made sure that the narrative techniques would become integrated into the story. Succeeding this brainstorm session the serious gaming studio took the new story idea and worked out all the details.

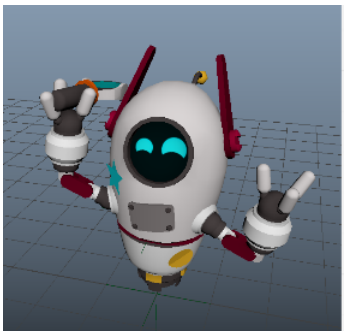

Figure 6: The character Ruby from the game Ruby's Mission. Art by the serious gaming studio IJsfontein.

The final story that ended up in the game changed completely. Ruby the robot no longer came from space, but was actually created on Earth (see Figure 6). Ruby became a robot created with emotions to be best friends with children. However, in the game Ruby does not remember anything anymore and he does not know where he is from. With 4 children Ruby will try to find out where he is from and re-learn all his knowledge of emotions. This story contains two side characters that show up in later sessions (see Figure 7). The first character is "Spray" the spray can robot that was jealous of Ruby and his emotions. He decided to steal Ruby's hard drive with his emotions, however he doesn't really understand how to actually use it. This is why he keeps spraying random texts about emotions around in the city, which Ruby collects in the graffiti mini game. The second side character is Lena. Lena used to be Ruby's friend before he lost his memory. She secretly tries to help Ruby learn about emotions again by hanging up posters around the city that talk about emotions. The story resolves around Ruby finding back his emotions, understanding the mystery of what happened to him, and defeating the spray can robot. This story is worked out over 6 sessions.

Figure 7: The side characters for the game Ruby's Mission. On the left is Spray, the evil robot that steals the main characters database. On the right is Lena, the friend of the main character who tries to help him by hanging up posters around the city. Art by the serious gaming studio IJsfontein.

In the first session, which is used in the experiment, Ruby starts with explaining to the players that he woke up at a dump and that he doesn't remember anything. He asks the players to help him find out who he is. After driving around the city Ruby encounters an advertisement column with a poster. The poster shows a similar robot as Ruby with emotions. Seeing this poster, Ruby realises that he also used to have emotions, but that he lost all knowledge of them. After learning about three emotions, Fear, Nervousness, and Amazement, an outro scene starts where Ruby declares that he is happy learning about emotions and that he remembers who he was, a robot with emotions. Ruby does state his curiosity about the 'wound' on his belly and how he got that.

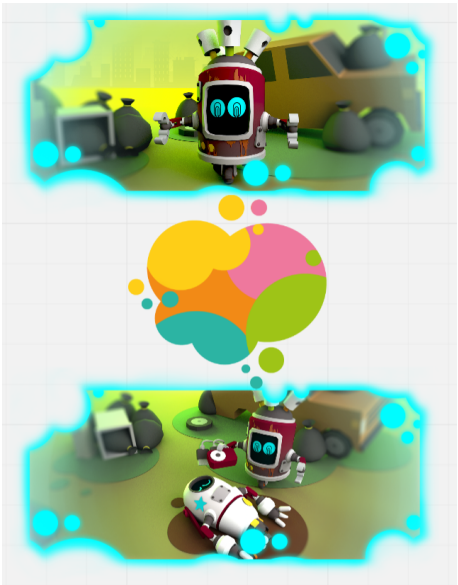

Figure 8: The character Spray stealing the database from the main character Ruby at the beginning of the game Ruby's Mission. Story board art by the serious gaming studio IJsfontein.

The second session is centered around jealousy, guild and pride. The session starts with Ruby explaining that he dreamt about a mysterious spray can robot that was repairing him. Later in the game he encounters a graffiti text on the wall with 'Spray'. Reading the name Spray, Ruby remembers that that was the robot he dreamt about. Spray stole his emotion database because he was jealous of Ruby having emotions (see Figure 8). However, to understand the emotion database you also need a chip, but Spray did not know this. The game ends with an outro scene where Ruby explains that he will be turning off all his signals so that Spray cannot find him and steal his database again.
The third session is centered around satisfaction, hope and enthusiasm. The session starts with Ruby saying that he dreamt about something nice but that he does not remember what it was about. Later in the game he encounters children who are playing hide and seek. Seeing the children play makes Ruby remember that he used to play as well. He remembers that he once was playing

hide and seek but that he fell of the stairs and that is how he broke and ended up on the dump. Afterwards Ruby drives past the advertisement column again and he sees some small letters on the poster talking about a possibility to link robots with each other. This makes him remember that he was linked to another robot called Lena. He thinks of the fun time he used to have with her, and hopes that Lena can maybe receive his signals so that she can find him. The game ends with Ruby saying that he is happy that he remembers Lena again. He is assured that if his database is filled again with emotions he will be able to find Lena again.
The fourth session is centered around anger, sadness, and disgust. Ruby is sad and tells the players that Spray stole his database again because Ruby forgot to turn of his signals. They start with looking for a database, which they quickly find after a kid offers to give Ruby a database after seeing how sad Ruby looks. At the end of the game Ruby feels less down and he tells the players that he is going to think of a plan to get his old database back from Spray.
The fifth session is centered around loneliness, disappointment, and joyful. Ruby tells the players that he came up with a plan to bait Spray into stealing an old database so that he can trap him and get his database back. At the end Ruby tells the players that he collected equipment for his trap and that he is excited to get his database back as this means that he will see Lena again.

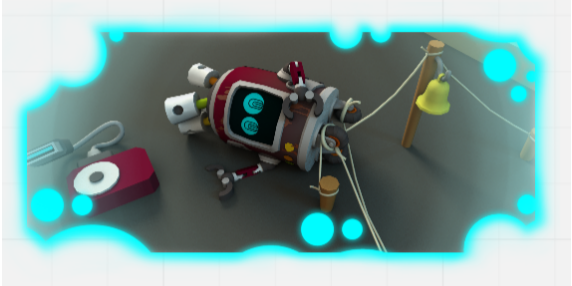

Figure 9: The character Spray being caught by the trap created by Ruby to get his database back in the game Ruby's Mission. Story board art by the serious gaming studio IJsfontein.

The sixth and last session is centered around shyness, shame, and happiness. The game starts with Ruby saying that his plan worked and that he got his database back (see Figure 9). He now only needs to learn three more emotions to see Lena again. After some time Ruby encounters Spray who is sitting on the sidewalk with a frown. Spray tells Ruby that he is sorry for stealing the database and that he feels ashamed for saying it so late. He tells Ruby that he also wants to learn about emotions. Ruby tells Spray that he will help him after he has found Lena again. At the end of the game Ruby finds Lena. They are happy together and Lena tells that she felt Ruby's signal but that it was too weak. It turns out that she was the one who put posters up all around the city (see Figure 10). This was done to help Ruby learn more about emotions, making his signal become stronger. The game ends with them being happy and thanking the players.
Due to copyright reasons the storyboard from the final story cannot be added to the appendix.

Figure 10: The character Lena hanging up posters around the city to try and help Ruby understand emotions in the game Ruby's Mission. Story board art by the serious gaming studio IJsfontein.

3.1.3 Techniques in the Narrative

As this experiment will only use the first session, all the narrative techniques will be put into the story of the first session. For future work and when later sessions are created it is practical to make sure that the narrative techniques are present in all the different sessions. Despite the initial

aim, not all narrative techniques ended up as strong in the first session as expected. This section discusses how the narrative techniques come back into the final story of the first session and why they might be less present or not. An overview of this can be seen in Table 1.

The first technique, distributed narrative, is added into the story by adding an advertisement column in the city of the game. This advertisement column has a poster on it with information about robots with emotions, and this tells Ruby that he used to have emotions. When the game starts the player is positioned in such a way that it is difficult to miss the advertisement column. When the player is close to the advertisement column, Ruby will speak up and tell the player that he must have also had emotions. The player can see this advertisement column in the city during the whole game. This column is also hidden in the no story version of the game, as this column only contributes to the story.
The integrated fantasy technique did not show up as strongly into the game. It was expected to change the mini games in such a way that the story would flow through these games as well. One mini game has a little bit of integrated fantasy in it. This is the graffiti game, where the players have to collect graffiti texts on the wall. In later sessions, it turns out that these tags are created by the evil robot Spray and that these tags could lead Ruby to Spray himself. However, this is not yet clear in the first session.

Next there are the four motivation techniques, Challenge, Curiosity, Control, and Fantasy.
Starting with challenge, this technique is only slightly present in the story. A small challenge for the players is understanding where to go and figuring out how the mini games work. Some instructions are given at the beginning of the game, but each player has to also learn how everything works separately. It was expected to add small goals into the game to give the player even more challenge, however this was not possible in the time frame of this study.
The next motivation technique is curiosity. This technique can be found back into the mystery of the story. The game starts out with Ruby barely knowing anything. The player has to figure out how Ruby lost his emotions and memory and where he is from.
Next we have the narrative technique, control. Control can be added into a story in multiple ways. It can be added by giving the player complete control over the story, and have them be able to change and guide the story in how ever way they want. This is a difficult way of adding the technique, as multiple story lines have to be made. However, there is also an easier way of adding control to the story. It can be done with responsiveness, choice, and power [30]. When a player moves Ruby towards a mini game this mini game will start, and when the players give Ruby a response in one of the mini games an NPC (Non Player Character) will respond accordingly. The game will respond to the players actions in clear and observable ways. These simple actions give the player a sense of responsiveness and power. The player is also free to choose how to navigate the world and in which order to do the mini games. This flexibility provides the player with a strong sense of choice, which again helps the feeling of empowerment and motivation.
Lastly there is the narrative technique, fantasy. As mentioned before, this technique was already present with Ruby the robot being in the game. This fantasy is expanded by making Ruby a possible friend to the player. Ruby also has friends and enemies in the game, making the fantasy story complete. An overview of all the techniques and how they ended up into the story can be seen in Table 1.

Narrative Technique	Integrated into Story
Distributed narrative	An advertisement column with more information that stands in the game world.
Intrinsic Integration	The graffiti game is caused by the evil robot Spray.
Challenge	Learning how the game works, and understanding their individual roles.
Curiosity	The mystery of where Ruby came from and how he lost his memories.
Control	The game responds to the players choices and gives power and choice to the player on how to complete the game.
Fantasy	Different robots being perceived as normal in the game world.

Table 1: All the chosen narrative techniques and how they ended up in the final story.

3.2 The Game

As mentioned before the original game of Ruby's Mission was used as a base. By adding on to the game it was easy to create a story version of the game. The story version of the game was created first. After this version would be finished, all the story elements would be deleted so that the games are as similar to each other as possible. It was decided to change the three base emotions that would be learned in the first session of the game to fit the story better. Now the first level of the game the players learned more about Fear, Nervousness, and Amazement. This is linked back to how Ruby is feeling at the beginning in the story of the game.
As mentioned in the introduction, the game has three types of mini games. These mini games were slightly altered so that they all had the correct emotions. Except for the situation in the situation mini game, the rest of the mini games were barely changed. The situation game received a new situation that fitted the new emotion better (see Figure 11 and 12). In the original game there were eight mini games. For the experiment some games were removed so that the experiment would not take too long. All the mini games were also put closely together on the game map so that the final session would take only 15 minutes instead of 25. By making the experiment shorter it was possible to get as many participants playing the game on the testing days as possible. The final mini games in the experiment concluded in two poster games with the emotions Fear and Amazement, one graffiti game with the emotion Nervousness, and two scenario games with the emotions Nervousness and one with Amazement and Anger combined.

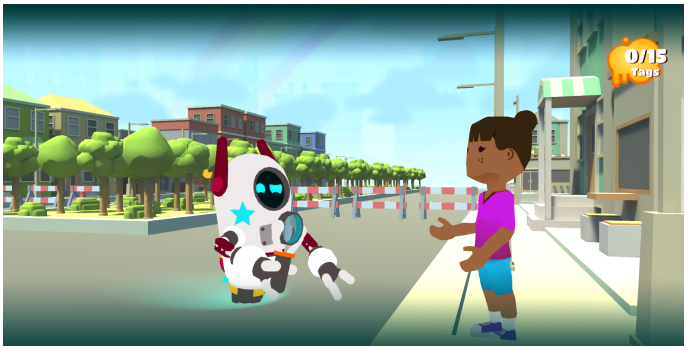

Figure 11: A screenshot of the game Ruby's Mission where the situation mini game is visible. Ruby talks to an NPC (Non Player Character) that has some troubles and that wants some advice from Ruby. As the game is created for dutch children, the texts are all in dutch.

Figure 12: A screenshot of the game Ruby's Mission from the situation mini game. A NPC (Non Player Character) explains there troubles to Ruby. The player has to decide on how the NPC is feeling.

The story elements consisted of an elaborated introduction at the beginning of the game, some comments by Ruby after certain games, an advertisement column which triggered some comments from Ruby, and an outro at the end of the game.
When the players start the game, the first thing they walk into is a big advertisement column (see Figure 13). When walking towards this column a cut-scene is triggered, moving the players to the column. On this advertisement column hangs a poster about robots with emotions (see Figure 14). Ruby states that the robot is the same as him, and that he must have had emotions. He is curious on how he lost his emotions. The players can then fill in on how they think Ruby lost his emotions and if they would want such a robot with emotions.

Figure 13: A screenshot of the game Ruby's Mission where the advertisement column is visible that has the poster on it that tells Ruby that he used to have emotions. As the game is created for dutch children, the texts are all in dutch.

After each poster game Ruby mentions a moment when he felt that same kind of emotion that was just learned from the poster (e.g., "I also felt fear when I was lost before I found you guys!"). In the no story version of the game Ruby just thanks the players for giving him information about the emotion learned from the poster.
At the end of the game Ruby states his happiness about learning more about himself and emotions. Ruby then talks about the mysterious wound on his belly and that he is curious how he got the wound, giving the player something to be curious about. In the no story version of the game, Ruby just thanks the players for teaching him about emotions.

Figure 14: The poster on the advertisement column in the game Ruby's Mission that tells Ruby that he used to have emotions before losing his memories. As the game is created for dutch children, the texts are all in dutch. Art by the serious gaming studio IJsfontein.

3.3 Experiment

The experiment started with a base questionnaire that would measure the level of understanding of emotions of the children [28]. Afterwards the participants would be randomly divided into two groups. One group would play the Ruby's Mission game with no story, and the other group would play the Ruby's Mission game with the added story. After playing the game the participants immediately received a second questionnaire. The questionnaires each took around 5 to 10 minutes, and playing the game took around 15 to 20 minutes. During the experiment the children would sit in a separate room to prevent distractions from other groups.

3.3.1 Participants

Ruby's Mission was created for children from age 8 to 12, therefore the goal was to get this target audience for the experiments as well. As this study only looks at the motivation and learning gain of the player, the participants did not have to be chronically ill or have problems with social emotional skills. Every child can show a learning gain or motivation, meaning that experiments can be held on any school. However, there were some problems with finding good locations for the experiment. This was due to the fact that during the planned time of the experiment, elementary schools with the children from the target audience had to do final exams. This exam is the dutch 'CITO'-test, which is taken at the end of elementary school to decide to which high school the child will go to. Therefore a lot of schools did not have time to participate in an experiment.
As most elementary schools did not have time, this study expanded the age group so that more possibilities for experiment locations would be available. It was decided to also look for older participants. It was expected that older children would understand and still enjoy the game as opposed to younger participants who might have trouble understanding the game. This study was also curious to see if older children would enjoy the game more or less than the target audience formed by Ruby's Mission.
The final experiment was performed on two different locations. The first experiment was on a dutch elementary school with children aged 9 to 12 (from the 7th grade in elementary school) and consisted of 16 participants. The second experiment took place on a dutch high school with children aged 12 to 14 (from the 1st and 2nd class of high school) and consisted of 24 participants. The groups of participants were divided up into groups of three or four, so that all the different roles in the game were present and played by at least one participant in each session.
There were two participants that had unusable data due to wrongly filled in questionnaires or missing answers. The final participant group consisted of 38 participants with usable data. From this group 55% was male, 42% female, and 3% filled in other for gender (see Figure 15). The ages of all the participants had a mean age of 12.08 and a standard deviation of 1.459 (see Table 2 and Figure 16). From the usable data, 19 participants played the game with a story and 19 participants

played the game without a story.

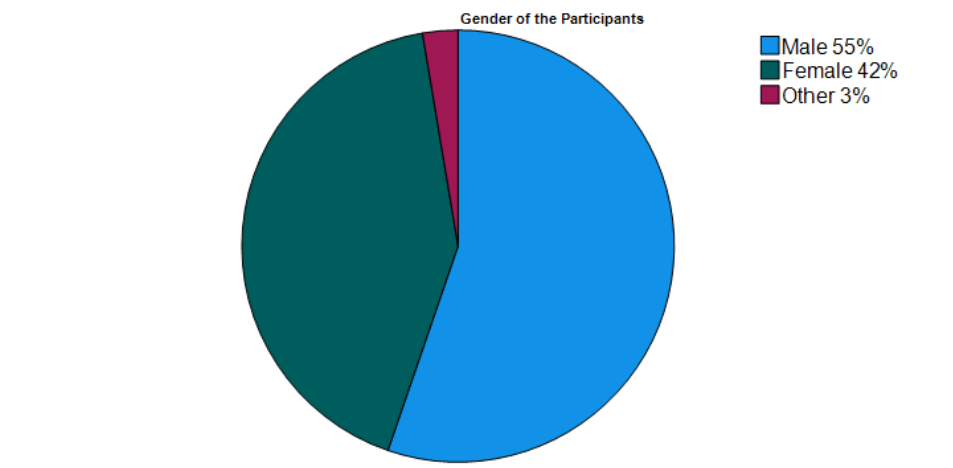

Figure 15: A Pie chart of the frequency of the participants' gender. NTotal = 38, NMale = 21, NFemale= 16, NOther=1

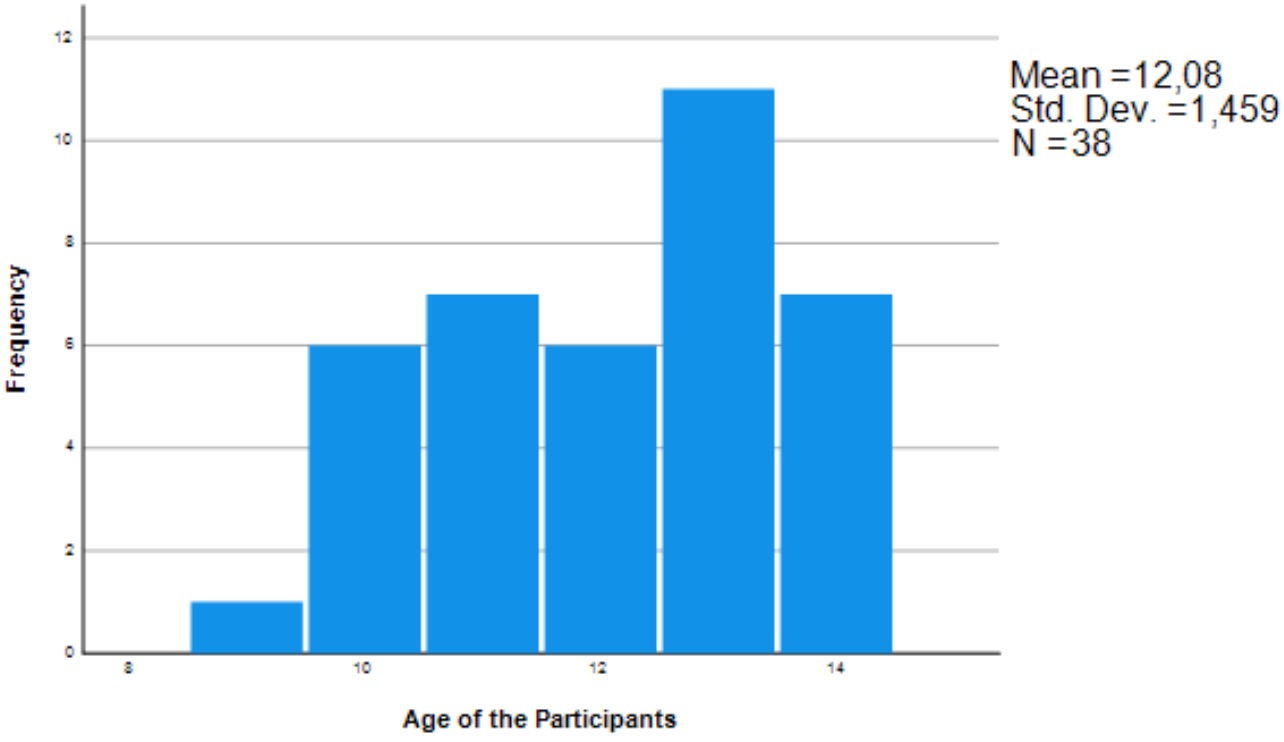

Figure 16: A Histogram of the frequency of the participants' age.

	N	Min	Max	Mean	Std. Deviation
Age	38	9	14	12.08	1.459

Table 2: Descriptive Statistics: Age of all participants

3.4 Data Collection

To gather data in the experiment there are two questionnaires. The first questionnaire is about emotions and is meant as a base line to see what the level of understanding of emotions is from the participants. It consists of 30 small questions where the participants can answer: not true, sometimes, and often true. The questionnaire is simple and quick to fill in, making it perfect for an experiment where you do not want to lose the focus of children. This questionnaire is from Rieffe et al. [28], and was used as they already created an emotion questionnaire with questions that were checked by professionals. All the questions are ranked in categories. This way it is easy to see on which part of emotions a participant had previous experience with. The categories are: Differentiating emotions, Verbal sharing of emotions, Not hiding emotions, Bodily awareness, Analyses of emotions, Attending to others' emotions. For the experiment a dutch version of the questionnaire was used, in the appendix an English version of the questionnaire can be read.
The second questionnaire is created to get data usable to answer the sub research questions. The questions are about the game and how the participants perceived the emotions in the game. It contains 17 questions in total, which has 3 questions about general data (ID number, age, gender), 7 questions about motivation, 4 questions about emotions and possible learning gain, and 3 question for possible remarks made by the participants and extra data about teamwork. All the categories for questions consist of a mix of a 5 Point Likert Scale questions and open questions. It was chosen to use 5 Point Likert scale questions as these questions are easy to answer for the participants and easy to analyse. These questions always had a scale of 1 being negative and the lowest score, and 5 being positive and the highest score. For the motivation questions, three questions consisted of 5 Point Likert Scale questions. The data from these questions can be easily compared in graphs. These questions are: "What did you think of the game?", "Are you curious how the story continues in the game?", "How badly would you like to play again?". The remaining questions are open, and are only looked at for possible remarks as this data is difficult to compare between participants. The specific questions can be found in an English form in the appendix.
The questions about emotions and learning gain are all open, except for one. A scoring system is created for this data, more about this can be read in the next section. The specific questions that will be used for data comparison are: "Q10. How do you think Ruby felt at the beginning of the game?", "Q11. And how do you think Ruby felt at the end of the game?", "Q14. Why do you think Anouk was surprised when Tobi's brother destroyed the hut that they build in the game?", and "Q13. How badly do you want Ruby to learn more about emotions?". Question 13 is a 5 Point Likert Scale question, and the other three questions are open. The first three open questions will be compared to multiple categories from the first questionnaire. These three questions are combined as they all talk about analysing emotions and other people's emotion. The last question, question 13, is compared to the categories separately. This is because it has a different scoring system, and because this question specifically asks about if participants care if Ruby knows emotions or not.
All the questions of the first and second questionnaire can be found, in translated English form, in the appendix.

It was decided not to collect data automatically through in-game interactions. The original researchers that created Ruby's Mission are still in the validation process of connecting in-game interactions to the learning outcomes [1]. Therefore, these interactions say little about the research goals described in this thesis.

3.5 Analysis

For the analysis of the data IBM SPSS Statistics for Windows, Version 28.0.1.0 was used. To interpret the data it was chosen to use an independent sampled T-Test. Looking at the data from this research, a T-Test might not sound logical. The data from the questionnaire mostly consists of 5 Point Likert Scale answers, which is a discrete data instead of the preferred continuous data. However, Winter et al. [9] describe the practical use of a T-Test on Likert data. In their study they show that it is possible to use a T-Test on Likert data. They also mention that using the Likert data in other ways, such as combining the total score and finding the average which is done in this study, creates a more normal distribution for the data, which works in favor of the T-Test. The questions that do not consist of a 5 Point Likert Scale get their own scoring system, making the data similar to Likert data. As this data is combined to create an average, the T-Test can still be used. This is the reason why a T-Test was chosen. The data also consists of two non paired groups, so a normal independent sampled T-Test can be used. The T-Tests are performed using

an α of 0.05, and [CI] of 95%. There was also no need to check for homogeneity across groups, as sample sizes were equal (Group that played the game with story N=19, Group that played the game without story N=19). The correlations checked between data is done with a Spearmans Correlation, as the variables are ordinal. When participants filled in 'wrong' numerical data, for example a comma number on the 5 Point Likert Scale such as 3.5, this data was rounded down.

3.5.1 Scoring system

To use the data from the first questionnaire a scoring system was created. This questionnaire from Rieffe et al. does not have an official scoring system [28]. Rieffe et al. do however mention what positive or negative answers are. As mentioned before, the questionnaire consists of three options on each question: not true, sometimes, often true. Some questions are marked 'reverse'. This means that it is positive to answer 'not true' on these questions. With other questions it is positive to answer 'often true'. With this knowledge a new scoring system was created. When participants answer a positive answer they receive 1 point, when answering a negative answer they receive minus 1, answering sometimes is 0 points. Rieffe et al. also categorised the questions [28]. For each category an average is calculated. This average can then be compared to other averages or other participants. This way it is possible to say something about the emotional understanding of the participants and if this improves or not.

To use the open text data from the second questionnaire another scoring system was created. As mentioned before, this was only done for three questions, as these could be compared to the first questionnaire to look at a possible learning gain from the participants. These questions were: "Q10. How do you think Ruby felt at the beginning of the game?", "Q11. And how do you think Ruby felt at the end of the game?", and "Q14. Why do you think Anouk was surprised when Tobi's brother destroyed the hut that they build in the game?". For each of these questions a scoring system was created, and with this scoring system all the answers were analysed to give a correct score. The scoring system was made to look similar as the scoring system from the first questionnaire. This way a correct average can be calculated. These scoring systems are the following: For the first question (Question 10), 1 point was given if the participant mentioned an emotion, 0 points were given if the participant did not mention any emotion or when they described a feeling (e.g., forgetful, stressed, confidence), -1 points were given when the participant would answer unknown (doesn't know/no answer) or when they also do not describe a feeling (e.g., saying Ruby has no feelings). As this question focuses on emotions a positive score is given to an answer with any emotion. The same goes for the second question (Question 11). However, some participants might give negative emotions as answers due to the fact that Ruby learns about negative emotions in the game. This means that not all emotions can be given a positive point, as the answer should be about how Ruby feels at that moment, and not how he might feel because of past learned emotions. This ended in the following scoring system for question 11: 1 point for positive emotions, 0 points for no emotions (the same as the scoring system in question 10), and -1 points for negative emotions, no feelings or unknown answers.
The last question (Question 14) is about a situation in the game. In the situation a girl is surprised and angry as her hut was destroyed when she was gone. Being angry at this situation is easy to understand, but why the girl is surprised could be more difficult to explain. An answer to explain why the girl was surprised should be something concerning the unexpected. Participants should not mention that the girl is surprised because she is angry, or try to describe the situation again as this does not actually explain why the girl is surprised. This is why the scoring system looks like the following: 1 point for mentioning that the situation is unexpected, 0 points for describing the situation and not adding anything new, -1 point for mentioning angry or another answer that does not actually explain the emotion surprise, or an unknown answer. See Table 3 for an overview of the scoring systems.

With all the above scoring systems the average is calculated by dividing the scores by the amount of questions. This delivers a scale of the score between -1 and 1. This way comparisons between the different data can be easily made.

To fit this same scale of -1 to 1 on the scores, one other question from questionnaire 2 had to be changed. Question 13, "How much do you want Ruby to learn more about emotions?", consists of answers on the 5 Point Likert Scale. This means that the answers range from 1 to 5. To compare these answers with the scores from questionnaire 1, the range has to be scaled down. To change

the range from 1 to 5 to a range of -1 to 1, an equation was applied to the given scores. As the wanted range can be seen as 0 to 2, the score is first subtracted by 1. This makes the range 0 to 4. After this the score is divided by 2, making the range 0 to 2. Lastly the score is again subtracted by 1, giving the wanted range of -1 to 1. All these steps lead to the following equation:
$((Score - 1)/2) - 1$
Now the data from Question 13 can be correctly compared to the data from Questionnaire 1.

Scoring system	**score -1**	**score 0**	**score 1**
"*Q10. How do you think Ruby felt at the beginning of the game?*"	unknown/no feeling	no emotion	any emotion
"*Q11. And how do you think Ruby felt at the end of the game?*"	unknown/no feeling/negative emotion	no emotion	positive emotion
"*Q14. Why do you think Anouk was surprised when Tobi's brother destroyed the hut that they build in the game?*"	unknown/anger/ other emotion	description of situation/ adding nothing new	unexpected

Table 3: Question 10/11/14 from Questionnaire 2 with their scoring system.

4 Results

4.1 Results of Motivation

For the results of the first sub research question about motivation, only the data from questionnaire 2 is used, as discussed in the Method section. First, an analysis was performed on the data from the question that asks about the opinion of the game, "What did you think of the game?", which the participants could answer on a 5 Point Likert Scale. An independent samples T-Test was performed to compare the score given to the game between participants that played the game with a story (M=4.00, SD=.745) and participants that played the game without a story (M=3.58, SD=.838) (see Table 4). There was no significant difference between these two groups, t(36)=1.637, one-sided p=.055, despite the score on average being 0.421 higher for the participants that played with a story (see Table 5).

Score given to the game	**Story or No Story**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
	Story	19	4.00	.745	.171
	No Story	19	3.58	.838	.192

Table 4: Descriptive Statistics: Score given to the game by the participants on a 5 Point Likert Scale.

	Mean Diff.	**Std. Error Diff.**	**Lower**	**Upper**	**t**	**df**	**Sig. (One-Sided p)**
"*What score do you give the game?*"	.421	.257	-.101	.943	1.637	36	.055

Table 5: Independent Samples T-test: comparing the score given to the game by the participants between the game with a story and without a story.

The data for the second question, "Are you curious how the story continues in the game?", consisted again of answers on a 5 Point Likert Scale. Again an independent samples T-Test was performed to compare the curiosity of the continued story in the game between participants that played the game with a story (M=3.84, SD=.898) and participants that played the game without a story (M=3.37, SD=1.212) (see Table 6). There was no significant difference between these two groups, t(36)=1.369, one-sided p=.090. Nevertheless, the average score given for curiosity towards the continuing of the story is 0.474 higher for participants that played the game with a story (see Table 7).

Curiosity towards the story	**Story or No Story**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
	Story	19	3.84	.898	.206
	No Story	19	3.37	1.212	.278

Table 6: Descriptive Statistics: The curiosity on how the story in the game continues, given by the participants on a 5 Point Likert Scale.

	Mean Diff.	**Std. Error Diff.**	**Lower**	**Upper**	**t**	**df**	**Sig. (One-Sided p)**
"*Are you curious how the story continues?*"	.474	.346	-.228	1.175	1.369	36	.090

Table 7: Independent Samples T-test: comparing the curiosity on how the story continues from the participants between the game with a story and without a story.

The last data looked at for motivation was the question, "How much would you like to play again?", which again consisted of answers on a 5 Point Likert Scale. Once more, an independent samples T-Test was performed to compare the motivation to replay the game between participants that played the game with a story (M=3.68, SD=1.003) and participants that played the game without a story (M=3.42, SD=1.261) (see Table 8). There was no significant difference between these two groups, t(36)=.712, one-sided p=.241. Even so, the average motivation to replay the game was 0.263 higher for participants who played the game with a story (see Table 9).

The want to replay the game	**Story or No Story**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
	Story	19	3.68	1.003	.230
	No Story	19	3.42	1.261	.289

Table 8: Descriptive Statistics: The motivation to replay the game, given by the participants on a 5 Point Likert Scale.

	Mean Diff.	**Std. Error Diff.**	**Lower**	**Upper**	**t**	**df**	**Sig. (One-Sided p)**
"*Do you want to replay the game?*"	.263	.370	-.487	1.013	.712	36	.241

Table 9: Independent Samples T-test: comparing the motivation to replay the game from the participants between the game with a story and without a story.

4.2 Results of the Learning Gain

To get data for the learning gain result this study looks at the average of the score with the scoring system that was created, as described in the previous section. The average scores for each category in the questionnaire are looked at independently. First an independent samples T-Test was performed to compare the average score in each category from questionnaire 1 between the participants that played the game with a story, and participants that played the game without a story. The mean and standard deviation for each category can be seen in Table 10. As this first questionnaire is meant as a baseline, the two groups should not differ and there should be no significance. Looking at the results of the T-Test, it is visible that there were only three categories from the six with no significant difference. The t and p values can be seen in Table 11. Only the categories "Not Hiding Emotions", "Analyses of Emotions", and "Attending to Others' Emotions" had no significance, Two-Sided p¿.05. The three categories, "Differentiating Emotions", "Verbal Sharing of Emotions", and "Bodily Awareness" showed a significant difference. The categories that are significant are not used in future analysis in this study as they are not a good foundation

to compare to other data.

	Story or No Story	N	Mean	Std. Deviation	Std. Error Mean
Total of "Differentiating Emotions"	Story	19	.72180	.267150	.061288
	No Story	19	.39098	.409197	.093876
Total of "Verbal Sharing of Emotions"	Story	19	.21053	.443026	.101637
	No Story	19	-.27632	.506175	.116125
Total of "Not Hiding Emotions"	Story	19	-.01316	.412257	.094578
	No Story	19	-.14474	.458831	.105263
Total of "Bodily Awareness"	Story	19	.25263	.420804	.096539
	No Story	19	-.15789	.505872	.116055
Total of "Analyses of Emotions"	Story	19	-.15789	.343698	.078850
	No Story	19	-.05263	.515718	.118314
Total of "Attending to Others' Emotions"	Story	19	.47368	.354091	.081234
	No Story	19	.63158	.213574	.048997

Table 10: Descriptive Statistics: The average score on the emotion questionnaire (1) for each category filled in by the participants.

	Mean Diff.	Std. Error Diff.	Lower	Upper	t	df	Sig. (Two-Sided p)
Total of "Differentiating Emotions"	.330827	.112112	.103454	.558200	2.951	36	.006*
Total of "Verbal Sharing of Emotions"	.486842	.154321	.173864	.799820	3.155	36	.003*
Total of "Not Hiding Emotions"	.131579	.141511	-.155419	.418577	.930	36	.359
Total of "Bodily Awareness"	.410526	.150959	.104368	.716685	2.719	36	.010*
Total of "Analyses of Emotions"	-.105263	.142181	-.393620	.183093	-.740	36	.464
Total of "Attending to Others' Emotions"	-.157895	.094867	-.350293	.034504	-1.664	36	.105

Table 11: Independent Samples T-test: comparing the average score on the emotion questionnaire (1) per category from participants between the game with a story and without a story. *= significant with p<.05

Next the data from the second questionnaire was looked at. First the average of the score for the three questions, 10/11/14 about analysing and attending to others' emotions, as discussed in the previous section is looked at. An independent samples T-Test was performed to compare the average score of the combined questions between the participants that played the game with a story (M=.17544, SD=.513622) and participants that played the game without a story (M=.19298, SD=.631633) (see Table 12). There was no significant difference between the two groups, t(36)=-.094, one-sided p=.463. The data also shows that on average participants scored 0.017544 higher on the questions when they played the game without story (see Table 13).

Total Average of Questions 10/11/14	**Story or No Story**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
	Story	19	.17544	.513622	.117833
	No Story	19	.19298	.631633	.144907

Table 12: Descriptive Statistics: Total Average score of Questions 10(How do you think Ruby felt at the beginning of the game?)/11(And how do you think Ruby felt at the end of the game?)/14(Why do you think Anouk was surprised when Tobi's brother destroyed the hut that they build in the game?) from Questionnaire 2.

	Mean Diff.	**Std. Error Diff.**	**Lower**	**Upper**	**t**	**df**	**Sig. (One-Sided p)**
Total Average of Questions 10/11/14	-.017544	.186769	-.396328	.361241	-.094	36	.463

Table 13: Independent Samples T-test: comparing the total average score of Questions 10/11/14 from Questionnaire 2 from the participants between the game with a story and without a story.

Following the remaining data from the second questionnaire, the data from the question "How badly do you want Ruby to learn more about emotions?" is looked at. As mentioned in the previous section, this data has been scaled down to fit the data from questionnaire 1, so that a correct analysis can be made. An independent samples T-Test was performed to compare the average score of the question between the participants that played the game with a story (M=.2895, SD=.56065) and the participants that played the game without a story (M=.1053, SD=.54209) (see Table 14). There was no significant difference between the two groups, t(36)=1.030, one-sided p=.155. Nevertheless, the average motivation score to let Ruby learn about emotions is 0.07368 higher for participants that played the game with a story (see Table 15).

Total Average of Question 13	**Story or No Story**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
	Story	19	.2895	.56065	.12862
	No Story	19	.1053	.54209	.12436

Table 14: Descriptive Statistics: Total Average score of Question 13 from Questionnaire 2.

	Mean Diff.	**Std. Error Diff.**	**Lower**	**Upper**	**t**	**df**	**Sig. (One-Sided p)**
Total Average of Question 13	.18421	.17891	-.17864	.54706	1.030	36	.155

Table 15: Independent Samples T-test: comparing the total average score of Question 13 from Questionnaire 2 from the participants between the game with a story and without a story.

4.2.1 Learning Gain

After all the average scores of the participants were calculated, a difference between the second questionnaire scores and the first questionnaire scores were calculated to indicate a possible learning gain. When subtracting the two scores, it is expected to get a positive number as this indicates a learning gain in the participants. The learning gain is tested three times. Once between the category 'Attending to others' emotions' from questionnaire 1 and the three questions about analysing and attending to others' emotions (10/11/14) from questionnaire 2. The second learning gain is tested between the category 'Attending to others' emotions' from questionnaire 1 and the one question about attending to others' (13) from questionnaire 2. The last learning gain is tested between the category 'Analysis of emotions' from questionnaire 1 and the three questions about analysing and attending to others' emotions (10/11/14) from questionnaire 2. The learning gain is only tested with these three options, because of the available data that links to each other.

This study starts with looking at the possible learning gain between the category 'Attending to others' emotions' from questionnaire 1 and the three questions about analysing and attending to others' emotions (10/11/14) from questionnaire 2. After subtracting the average scores from each other, an independent sampled T-Test is performed. This is to compare the learning gain between the participants that played the game with a story (M=-.29825, SD=.651065) and the participants that played the game without a story (M=-.43860, SD=.744135) (see Table 16). There was no significant difference between the two groups, t(36)=.619, one-sided p=.270. The data also shows that both groups had a negative learning gain. Even though there was a negative learning gain, it is still visible that the participants with no story had a lower average of 0.140351 than the participants that played the game with a story (see Table 17).

Learning Gain: "Attending to Others' Emotions" & Question 10/11/14	**Story or No Story**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
	Story	19	-.29825	.651065	.149365
	No Story	19	-.43860	.744135	.170716

Table 16: Descriptive Statistics: Learning Gain between "Attending to Others' Emotions" category and Questions 10/11/14 from Questionnaire 2.

	Mean Diff.	**Std. Error Diff.**	**Lower**	**Upper**	**t**	**df**	**Sig. (One-Sided p)**
Learning Gain: "Attending to Others' Emotions" & Question 10/11/14	.140351	.226834	-.319690	.600392	.619	36	.270

Table 17: Independent Samples T-test: comparing the learning gain between "Attending to Others' Emotions" category and Questions 10/11/14 from Questionnaire 2 from the participants between the game with a story and without a story.

Next the learning gain between the category 'Analyses of Emotions' from questionnaire 1 and the three questions about analysing and attending to others' emotions (10/11/14) from questionnaire 2 are handled. After subtracting the average scores from each other, an independent sampled T-Test is performed. This was to compare the learning gain between the participants that played the game with a story (M=.3333, SD=.60041) and the participants that played the game without a story (M=.2456, SD=.78820) (see Table 18). This again showed no significant difference between the two groups, t(36)=.386, one-sided p=.351. However the data does show a positive learning gain, and the average learning gain is 0.08772 higher for participants that played with a story (see Table 19).

Learning Gain: "Analyses of Emotions" & Question 10/11/14	**Story or No Story**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
	Story	19	.3333	.60041	.13774
	No Story	19	.2456	.78820	.18083

Table 18: Descriptive Statistics: Learning Gain between "Analyses of Emotions" category and Question 10/11/14 from Questionnaire 2.

	Mean Diff.	Std. Error Diff.	Lower	Upper	t	df	Sig. (One-Sided p)
Learning Gain: "Analyses of Emotions" & Question 10/11/14	.08772	.22731	-.37329	.54873	.386	36	.351

Table 19: Independent Samples T-test: comparing the learning gain between "Analyses of Emotions" category and Questions 10/11/14 from Questionnaire 2 from the participants between the game with a story and without a story.

Lastly this study looks at the learning gain between the category 'Attending to others' emotions' from questionnaire 1 and the one question about attending to others' emotions (Q13) from questionnaire 2. After subtracting the average scores from each other, an independent sampled T-Test is performed. This was to compare the learning gain between the participants that played the game with a story (M=-.1842, SD=.65512) and the participants that played the game without a story (M=-.5263, SD=.49648) (see Table 20). This actually showed a significant difference between the two groups, t(36)=1.814, one-sided p=.039. The data shows a negative learning gain for both groups, but the average learning gain is 0.34211 higher for participants that played the game with a story (see Table 21).

Learning Gain: "Attending to Others' Emotions" & Question 13	Story or No Story	N	Mean	Std. Deviation	Std. Error Mean
	Story	19	-.1842	.65512	.15029
	No Story	19	-.5263	.49648	.11390

Table 20: Descriptive Statistics: Learning Gain between "Attending to Others' Emotions" category and Question 13 ("How badly do you want Ruby to learn more about emotions?" from Questionnaire 2.

	Mean Diff.	Std. Error Diff.	Lower	Upper	t	df	Sig. (One-Sided p)
Learning Gain: "Attending to Others' Emotions" & Question 13	.34211	.18858	-.04035	.72456	1.814	36	.039*

Table 21: Independent Samples T-test: comparing the learning gain between "Attending to Others' Emotions" category and Question 13 from Questionnaire 2 from the participants between the game with a story and without a story. *= significant with p<.05

4.3 Correlations and Remaining Results

In this section the correlations between data variables is discussed. Only the correlations that are higher than 0.5, and have a significant difference (p<.05) are discussed.

The grade given to the game had a positive correlation with the curiosity of the story (r(38)=.570), the want to replay the game (r(38)=.664), and if participants wanted Ruby to learn about emotions (r(38)=.542) (see Table 23). When given a higher grade to the game, there was more curiosity and motivation towards the story.
Next the curiosity on how the story continues also had a positive correlation with participants that wanted to replay the game (r(38)=.672) (see Table 23).
The next correlation is found between the date when participants joined the experiment and the curiosity for the story. The date variable consists of two possible dates, where the first option was on an elementary school and the second option being on a high school. This gives two age groups, as the participants from the elementary school were aged between 9 and 12 (M=10.53, SD=.743), and the participants from the high school were aged between 12 and 14 (M=13.09,

SD=.733) (see Table 22). With this data a negative correlation was found with the curiosity of the story (r(38)=-.500) and if participants wanted to replay the game (r(38)=-.772) (see Table 23). .

Age participants	**Place Experiment**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
	Elementary school	15	10.53	.743	.192
	High school	23	13.09	.733	.153

Table 22: Descriptive Statistics: Age participants on the experiments on an Elementary school and a High school.

		Curiosity Story	*Replay Game*	*Ruby learning Emotions*
Grade Game	**Correlation Coefficient**	.570	.664	.542
	Sig. (2-tailed)	<.001*	<.001*	<.001*
Curiosity Story	**Correlation Coefficient**		.672	
	Sig. (2-tailed)		<.001*	
Place Experiment	**Correlation Coefficient**	-.500	-.772	
	Sig. (2-tailed)	.001*	<.001*	

Table 23: Spearman's rho Correlations: Correlations between the grade given to the game and curiosity towards the story, the want to replay the game, and the want for Ruby to learn emotions. Correlation between the curiosity towards the story and the want to replay the game. Correlations between the place of the experiment and the curiosity towards the story and the want to replay the game. Empty spaces means that there was a correlation that was below .500 or no significant difference. All correlations are with N=38. *= significant with p<.05

As mentioned before there was extra data measured in the questionnaire. One question asked the participants how the teamwork went between their peers while playing the game. This answer was given on a 5 Point Likert Scale. This data is calculated with 3 less data points, as some participants did not fill in this question. To look at this data an independent samples T-Test was performed to compare the teamwork between participants that played the game with a story (M=4.34, SD=1.106) and participants that played the game without a story (M=3.94, SD=1.124) (see Table 24). There was no significant difference between these two groups, t(33)=1.070, one-sided p=.146. Nevertheless, the average score for teamwork is 0.405 higher between participants that played the game with a story (see Table 25).

Rated Teamwork between peers	**Story or No Story**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
	Story	19	4.34	1.106	.254
	No Story	16	3.94	1.124	.281

Table 24: Descriptive Statistics: The teamwork rated on a 5 Point Likert Scale by participants.

	Mean Diff.	**Std. Error Diff.**	**Lower**	**Upper**	**t**	**df**	**Sig. (One-Sided p)**
Rated Teamwork between peers	.405	.378	-.365	1.174	1.070	33	.146

Table 25: Independent Samples T-test: comparing the teamwork from the participants between the game with a story and without a story.

Another result from the data that popped out was how Ruby the robot was gendered by the participants. Ruby's gender isn't mentioned anywhere in the game, and the only hint to the gender Ruby might have is that the voice of Ruby could sound feminine to some. What is remarkable is that

from the 21 participants that used specific gendered pronouns for Ruby in the second questionnaire, 16 participants called Ruby by their own gender (see Table 26 and Figure 17). 10 participants that were male also called Ruby a male, and 6 female participants called Ruby a female by saying she or her in the questionnaire. The remaining 5 participants either called Ruby a he, they or she.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	*Same Gender*	16	42.1	76.2	76.2
	Different Gender	5	13.2	23.8	100.0
	Total	21	55.3	100.0	
Missing	*System*	17	44.7		
Total		38	100.0		

Table 26: Frequency Statistics: The Frequency of Participants calling Ruby the same gender or a different gender as themselves in the game.

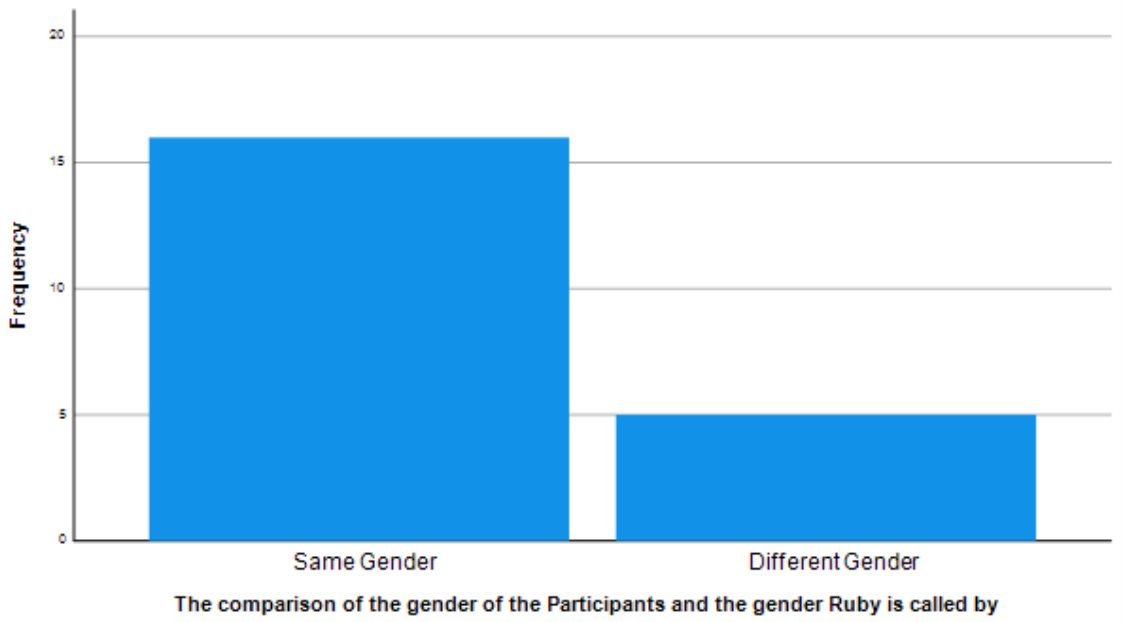

Figure 17: A Bar chart of the frequency that participants call Ruby by the same gender or a different gender as themselves in the game.

5 Discussion

"Does the inclusion of narrative in a 'game intervention for training social emotional skills' increase player motivation?"

When looking at the results about motivation it is visible that there is no significant data. This could be due to a too small participant group. However, a small trend in the data is visible. When comparing the score given to the game between the participants that played the game with and without a story, it is visible that the score is higher for the participants that played the game with a story. The difference between the scores is also relatively high, with a mean of 0.421.
The second measured variable looked at if the participants wanted to know more about the continuing story. There was no significant difference between participants that played the game with or without the story. In spite of that, a trend was again visible as the participants that played the game with a story did say that they were more curious about the story. The average mean difference was 0.474. This difference might have been even higher if the story was more present in the game, because currently the two versions of the game did not differ that much from each other.

Lastly there is measured data that looked at how much the participants wanted to replay the game. Again, there was no significant difference between participants that played the game with or without the story. Nonetheless, the score for participants that played the game with a story was higher with an average mean of 0.263. It is not clear if this low difference is caused by the fact that participants were told that if they joined the experiment they did not have to join their normal classes. Not having to join their own classes could have been a motivation for all the participants to play again. A few participants did mention this in their answers, meaning at least some participants were influenced by this. Other participants however mentioned that they wanted to play the game again because they were curious about the story or because they really enjoyed the multiplayer part of the game.
Some extra data that was measured was how the participants perceived the teamwork in their team. This data was measured to see if there would be better teamwork in the game with the story elements. It was expected that when participants perceive good teamwork the game would be played smoother, as there would not be any trouble during the discussions in the mini games. It was also expected that the story would give participants a more shared goal to achieve, which might not happen in the game without the story. The data did not show any significant difference between participants that played the game with or without a story. However, a trend was again visible as participants that played the game with a story perceived the teamwork to be better with an average mean of 0.405. This difference is quiet high and it could indicate that the story in the game gives a shared motivation for the participants. It is noticeable that participants did have trouble stating in the open questions what they have learned from the teamwork, as a lot of the answers were "I don't know" or "Nothing". This could be studied further.

A significant conclusion can not be made with the current available data about motivation. This could be due to a too small participant group, or the way the questions were asked. The data might also show more significant results when multiple sessions are tested. However, as the data does show a trend of the story having a positive effect, there is reason for future research to find a significant conclusion on if narrative can help the motivation of players of a game intervention for training social emotional skills.

"Does the inclusion of narrative support the learning gains of social emotional skills of players of a 'game intervention for training social emotional skills'?"

Most of the data on learning gain also does not show any significant difference for participants that played the game with or without a story. It was expected to find a positive learning gain or no learning gain at all. However, the data mostly showed a negative learning gain, meaning that the participants 'lost' knowledge about emotional skills after playing the game.
A reason for the results could be due to the fact that the base questionnaire already showed some significant difference between the two groups, before the participants even played the game. It was expected to prevent this by putting the participants randomly into groups, however this was not the case. As the questionnaire has been used for previous research it can be established that the questionnaire was not the problem during the experiment. There was probably some misfortune of the composition of the participant groups.
Another reason for the data could be due to the asked questions from the second questionnaire. These questions could have been stated more clearly or differently, so that they would fit the topic of the first questionnaire better. In future research the questions in the second questionnaire should be tweaked and altered to fit the first questionnaire more so that a learning gain can be measured properly.
Even though the data showed no significant difference between the two participant groups and there was a negative learning gain, the data still showed a small trend that participants that played the game with a story had slightly better results. When testing the learning gain for the category 'Attending to Others' Emotions' and Question 10/11/14 there was an average mean difference of 0.140351, as the participants that played the game with a story had a slightly lower negative learning gain value than the other participants. The same goes for the comparison between the category 'Attending to Others' Emotions' and Question 13, as again the participants that played the game with a story had a slightly lower negative learning gain value than the other participants with an average mean difference of 0.34211. This results even showed a significant difference between the two groups, p=.039. The last comparison actually did show a positive learning gain, but unfortunately there was no significant difference between the participants that played the game with or without a story. For the category 'Analyses of Emotions' and the questions 10/11/14, the

participants that played the game with a story had a higher positive learning gain with an average mean of 0.08772. This difference is very small. Even though this result showed a positive learning gain, not much can be said about the results.

With some of the unexpected results, it is difficult to draw a clear conclusion on the sub research question. It is necessary to do future research with more participants and perhaps different questions. With more research it is expected that narrative will show a more definite influence on the learning gain of the players of a game intervention for training social emotional skills.

As shown in the results, some extra data was found while looking at the answers of the questionnaire. It was noticeable that participants kept referring to Ruby with different pronouns. After analysing this data it was visible that the group was too small to draw a significant conclusion about participants that called Ruby by their own gender or with a different gender. However, the data does still show a trend, as more than halve of the participants that called Ruby by certain pronouns called Ruby by their own gender. Future research on this topic could be interesting. It might be beneficial to make a protagonist non-binary or ambiguous in a game so that players can fill in their own gender onto the main character, making the character more relatable.

The correlations between the data also showed some interesting insights. First of all there was a correlation between the grade given to the game and the curiosity of the story(.570), the want to replay the game(.664), and the want for Ruby to learn more about emotions(.542). All these correlation also showed a significant difference, $p<.05$. This was in line with expectations as it is preferable that the motivation data is correlated with each other to form more motivation. The curiosity towards the story also showed a correlation with the want to replay the game(.672), which again showed a significant difference, $p<.05$. This is also expected as the only way a player can know more about the story is by replaying the game.
The last correlation between data that had a significant difference, $p<.05$, was the correlation between the experiment location and the curiosity for the story(-.500) and the want to replay the game(-.772). The two locations for the experiment were an elementary school and a high school. The correlation shows that apparently the participants on the elementary school with a lower age were more curious on how the story would continue, and they wanted to replay the game more than participants from the high school. This is in line with the target group that was mentioned in the study from Ruby's Mission [1].

6 Conclusion

The goal of this study was to find if narrative could affect the learning gain in game interventions for training social emotional skills. To look into this matter some sub research questions were created. These sub research questions focused on whether motivation of the player could be effected with narrative and if narrative supports the learning gain. When motivation is improved it can be expected that the motivation will stay higher through multiple play sessions from a behavioural intervention. This will again lead to a higher learning gain.
To test this a user, study was conducted with a created story in a game intervention. This was done for the game intervention Ruby's Mission made by Alexandridis et al. [1]. Participants played either a version of the game with a story, or a version of the game without a story. The data was collected using two questionnaires.

As the results are mixed and do not show any significant difference between the test groups, a significant conclusion can not be made. Future research needs to be done to say if narrative actually enhances the learning gain in a game intervention for training social emotional skills. However, there is a definite reason for future research, as there was a small trend visible for narrative improving the motivation of the player in the game. The data for the learning gain did not show much significant difference between the groups or a big trend for participants that played the game with narrative. Future research should use a bigger participant group or alter the questions to measure the data.

This study did show some promising results with the correlations between the measured data that did show significant result. The correlations between the data confirmed that the target audience of Ruby's Mission was stated correctly by Alexandridis et al. [1]. It showed that participants that were older of age and were from a dutch high school, would find the story less interesting and did

not want to play the game again. The participants that were the target audience and from an elementary school were more curious about the story and had more motivation to play the game again. There were also multiple correlations found towards motivation. Numerous correlations showed that when participants graded the game higher, they were also more motivated to play the game. The same went for the curiosity towards the story. When this was scored higher by the participants, they also showed more motivation to play the game again.

The significant results from the correlations and the trends visible from the data give a good reason and encouragement for future research. It is expected that with a bigger participant group narrative can indeed show a positive influence on the learning gain of behavioural interventions for training social emotional skills.

7 Limitations & Future work

7.1 Limitations

The biggest limitation of this study is that it was not possible to do a longitudinal test. It was hoped to do multiple experiments with the same participants to see a clear learning gain and record a high motivation throughout multiple sessions. However, finding places where experiments were possible took longer than expected. This made it only possible to do a singular experiment and compare the learning and motivation to a version of the game with no story.

Another limitation of this study was the created story. Due to limited time the story had to be created quickly and implemented fast. Due to this time limit, there was no time to add certain narrative techniques more prominent into the story. For example, the integrated fantasy technique was hoped to be added in the story by changing the story of the mini games. However, this was not possible in the time frame of this study.
Another problem of the story was the fact that it was not as worked out as could be. The overall story was good when looking at all the different sessions. However, because the participants only played the first session and no more, the story that they viewed was very simple. As this first session was merely an introduction to the story, it was not actually clear where the story was going for the players. This caused the version of the game without the story to be very similar to the version of the game with the story. The only story element in the first session was an introduction where Ruby did not know anything, leaving the player with the same feeling of actually not knowing anything about the story. This could have caused the gap of the unknown to be too big for the player, which causes the loss of interest [33]. For future work, it would be better to make the story very clear in the first session, so that there is a big difference between a game with and without story. This could give more motivation for the player by having the narrative techniques be more present in the story.

Another setback of this study was that it was very difficult to find the target audience from elementary schools for testing. This was due to the fact that children from elementary schools had to do their final testing of the year, known as CITO-test in Dutch [4]. Due to this test a lot of schools did not find time for the experiments. Eventually it was necessary to widen the age of the target audience so that older participants could join the testing. This is why half of the participants were from a high school instead of an elementary school. As the correlations in the data also proved, it would be better for future work to get more children from elementary schools. The data showed that children from elementary schools enjoyed the game more than older children.

One more limitation of this study were the questionnaires. After testing, the collected data was more difficult to compare to each other than anticipated. Future work should look into changing the questionnaires and forming them in such a way that a learning gain can be measured easier.

7.2 Future work

For future work it is proposed to do longitudinal testing, to see if motivation and learning gain actually stay higher or not. With longitudinal testing it is also possible to try multiple sessions of the game. As in this thesis only one session was played. This might make the difference bigger between the no story and story version of the game. Longitudinal testing also makes it easier to

[4]The Dutch CITO test: https://www.cito.nl/

put more time between filling in a first and second questionnaire. This way it will be easier to measure the learning gain.

Something else that could be researched in future work is the chosen narrative techniques. This study chose six different narrative techniques to put into the story. It would be interesting to research if the same result would have happened with other or more narrative techniques, or that less narrative techniques would have give a better result. This has not been researched in this study, as the chosen narrative techniques were solely chosen on the fact that they fit together and that they encouraged the same goal as this study. It would be interesting to see if different narrative techniques that encourage the same goal would give the same or different results when added to a story of a serious game.

Another interesting research would be looking at the genders of protagonists in games. Even though the results were not significant, this study did show an interesting find on participants that gave the same pronouns to the protagonist of the game as themselves. It would be interesting to study if there would be a benefit of keeping the protagonist non-binary or ambiguous in games.

It is also important for future work that the story should be worked out in more detail to make sure that the story is clear from the get go. Lastly, it is expected to get more significant results when a bigger participant group is used.

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A: Questionnaire 1

Rieffe, C., Oosterveld, P., Miers, A.C., Meerum Terwogt, M., & Ly, V. (2008). Emotion awareness and internalising symptoms in children and adolescents; the Emotion Awareness Questionnaire revised. *Personality and Individual Differences, 45*, 756-761.

The way I feel

Please fill out your first name.....

And your date of birth.....

And whether you are a boy or a girl.....

On the next pages, you will find 30 short sentences. Every sentence is a statement about how you can feel or think about your feelings. You can mark each sentence if this is true, sometimes true or not true for you. Choose the answer that best fits you. You can only mark one answer. If you find that difficult, choose the answer that fits you most of the time. Different children have different feelings and ideas about their feelings. Therefore, there are no right or wrong answers, because it is just about what you think.

For example the sentence

“When I feel upset, I try to forget about it”

If this statement is true for you, then mark “true”

not true	sometimes true	true
☐	☐	☒

If this statement is sometimes true for you, then mark “sometimes true”

not true	sometimes true	true
☐	☒	☐

If this statement is not true for you, then mark “not true”

not true	sometimes true	true
☒	☐	☐

		not true	sometimes true	true
1	**I am often confused or puzzled about what I am feeling**	☐	☐	☐
2	**I find it difficult to explain to a friend how I feel**	☐	☐	☐
3	**Other people don't need to know how I am feeling.**	☐	☐	☐
4	**When I am scared or nervous, I feel something in my tummy**	☐	☐	☐
5	**It is important to know how my friends are feeling**	☐	☐	☐
6	**When I am angry or upset, I try to understand why**	☐	☐	☐
7	**It is difficult to know whether I feel sad or angry or something else**	☐	☐	☐
8	**I find it hard to talk to anyone about how I feel**	☐	☐	☐
9	**When I am upset about something, I often keep it to myself**	☐	☐	☐
10	**When I feel upset, I can also feel it in my body**	☐	☐	☐
11	**I don´t want to know how my friends are feeling**	☐	☐	☐
12	**My feelings help me to understand what has happened**	☐	☐	☐
13	**I never know exactly what kind of feeling I am having**	☐	☐	☐
14	**I can easily explain to a friend how I feel inside**	☐	☐	☐
15	**When I am angry or upset, I try to hide this**	☐	☐	☐

		not true	sometimes true	true
16	**I don´t feel anything in my body when I am scared or nervous**	☐	☐	☐
17	**If a friend is upset, I try to understand why**	☐	☐	☐
18	**When I have a problem, it helps me when I know how I feel about it**	☐	☐	☐
19	**When I am upset, I don´t know if I am sad, scared or angry**	☐	☐	☐
20	**When I am upset, I try not to show it**	☐	☐	☐
21	**My body feels different when I am upset about something**	☐	☐	☐
22	**I don't care about how my friends are feeling inside**	☐	☐	☐
23	**It is important to understand how I am feeling**	☐	☐	☐
24	**Sometimes, I feel upset and I have no idea why**	☐	☐	☐
25	**When I am feeling bad, it is no one else's business**	☐	☐	☐
26	**When I am sad, my body feels weak**	☐	☐	☐
27	**I usually know how my friends are feeling**	☐	☐	☐
28	**I always want to know why I feel bad about something**	☐	☐	☐
29	**I often don't know why I am angry**	☐	☐	☐
30	**I don´t know when something will upset me or not**	☐	☐	☐

Please check
that you have marked all of the sentences.

Thank you!

B: Questionnaire 2

Utrecht University

Default Question Block

1. Which ID did you get?

2. What is your age?

3. What gender are you?

- ◯ Male
- ◯ Female
- ◯ Other

4. What did you think of the game?

	Boring				Very fun
	1	2	3	4	5
Click to write Choice 1	○				

5. Can you explain why you gave the game a certain rating?

6. Are you curious how the story continues in the game?

	No				I am very curious
	1	2	3	4	5
Click to write Choice 1					

7. How much would you like to play again?

	Not really				I would love to replay
	1	2	3	4	5
Click to write Choice 1	○				

8. Can you explain why you would like to play the game more often or not?

9. What have you learned from the game?

10. How do you think Ruby felt at the beginning of the game?

11. And how do you think Ruby felt at the end of the game?

12. Did you want to help Ruby in the game? Why yes, or why not?

13. How badly do you want Ruby to learn more about emotions?

	I don't really care			I really want Ruby to learn more about emotions!
	1	2	3	4	5
Click to write Choice 1					

14. Why do you think Anouk was surprised when the built hut was destroyed by Tobi's brother in the game?

15. What have you learned from playing with your teammates?

16. How did the collaboration with your teammates go?

	bad				good
	1	2	3	4	5
Click to write Choice 1					

17. Do you have any remarks or tips for the game?

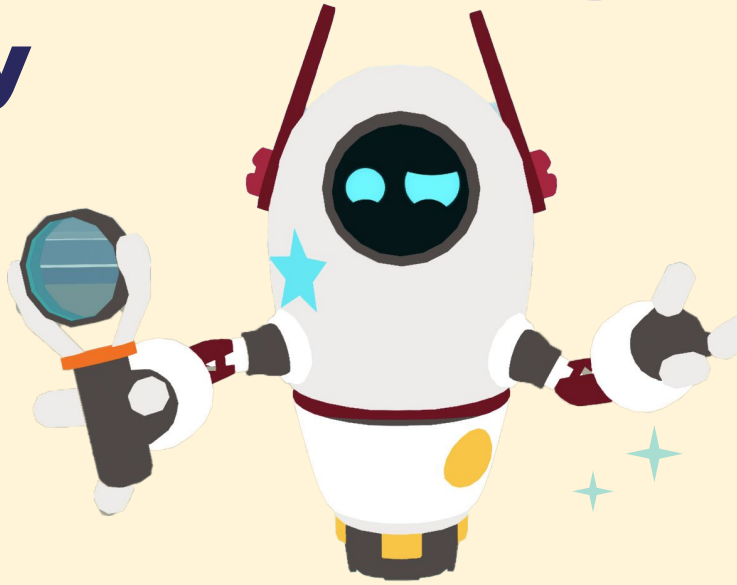
C: Dutch presentation, first story:

Ruby's Mission

The Story

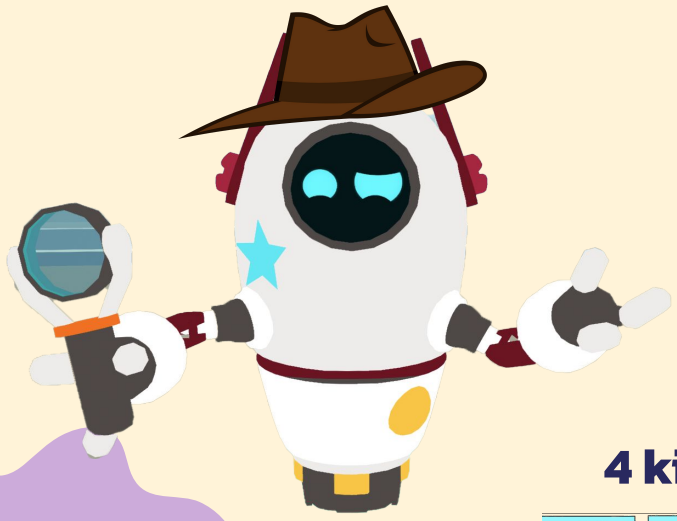
Roos Boekelman

In 6 sessies

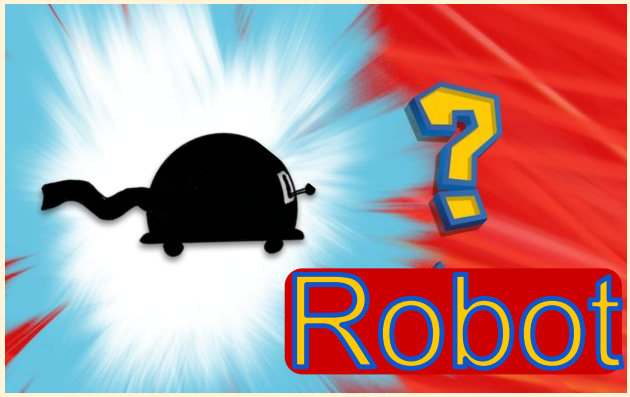


Karakters

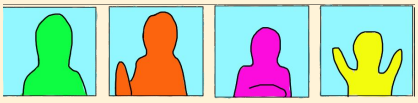
Ruby

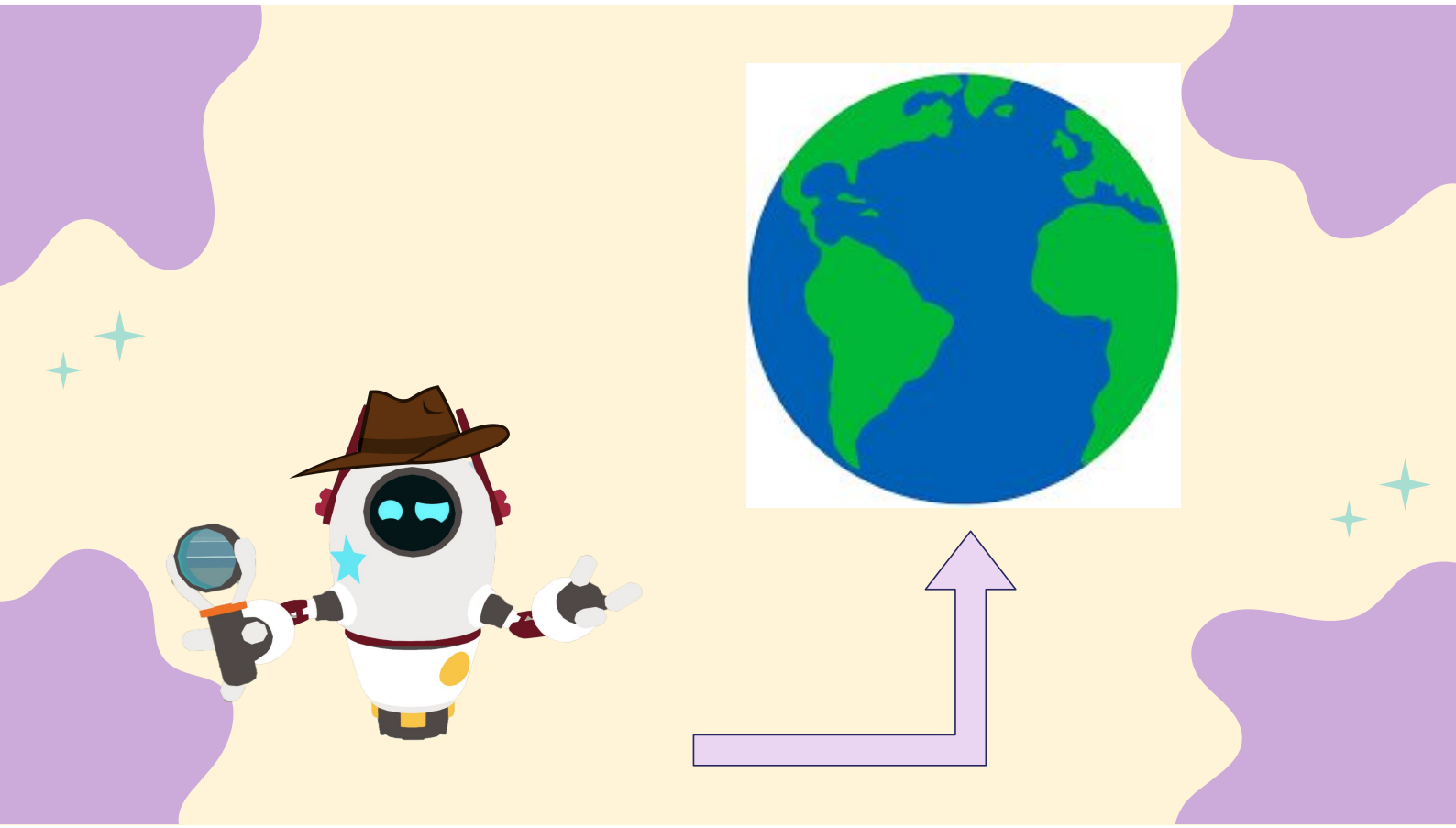


Een Robot

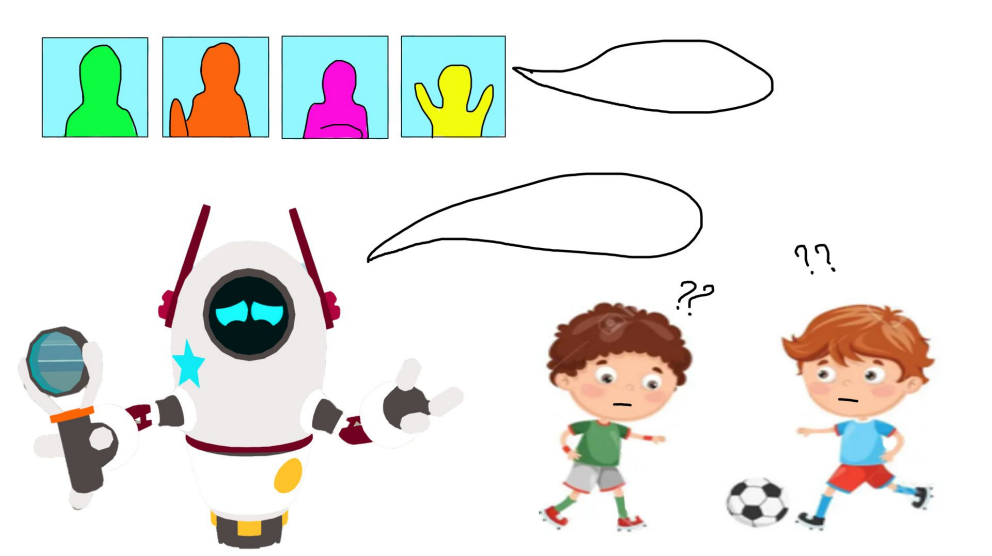


4 kinderen





1.



1. Emoties weg
    a. Mensen verward
2. Spoor volgen
    a. Robot zoeken
    b. Mensen helpen

Sessie 1

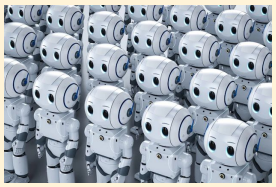
Ruby op aarde

Professor Schoonmaak

Glimp robot

Intro | **Angst** | **Schuldig** | **Woede**

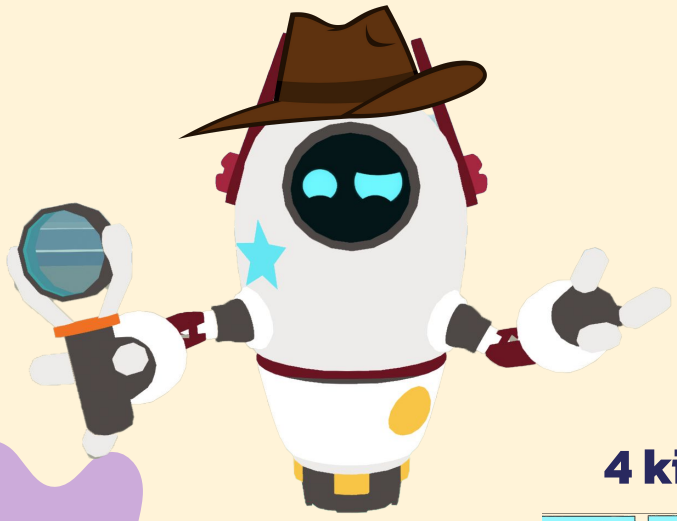
Leger/bewakers



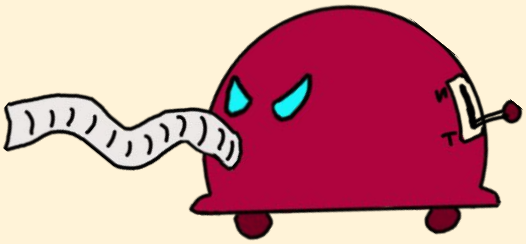
Ruby boos

Karakters

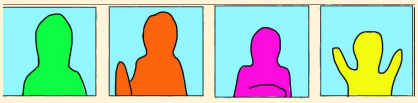
Ruby



Hettie



4 kinderen



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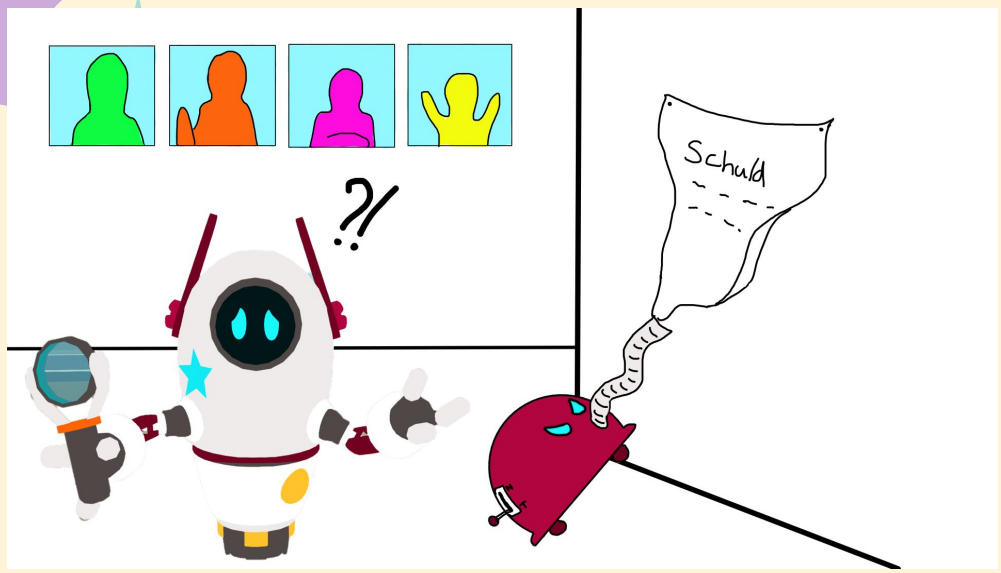
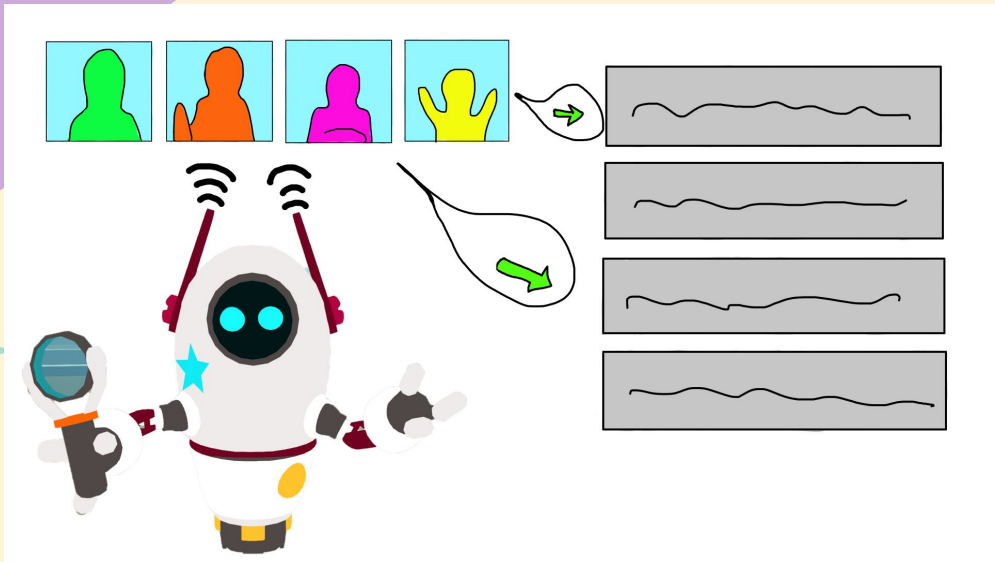


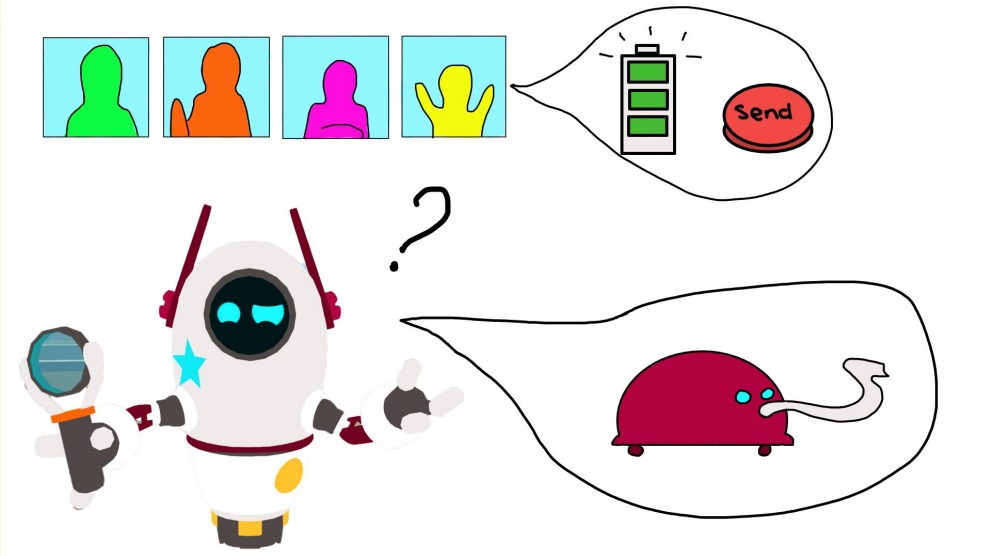
1. Spoor volgen
    a. Mensen helpen
2. Hettie boos
    a. Turbo stand

3.



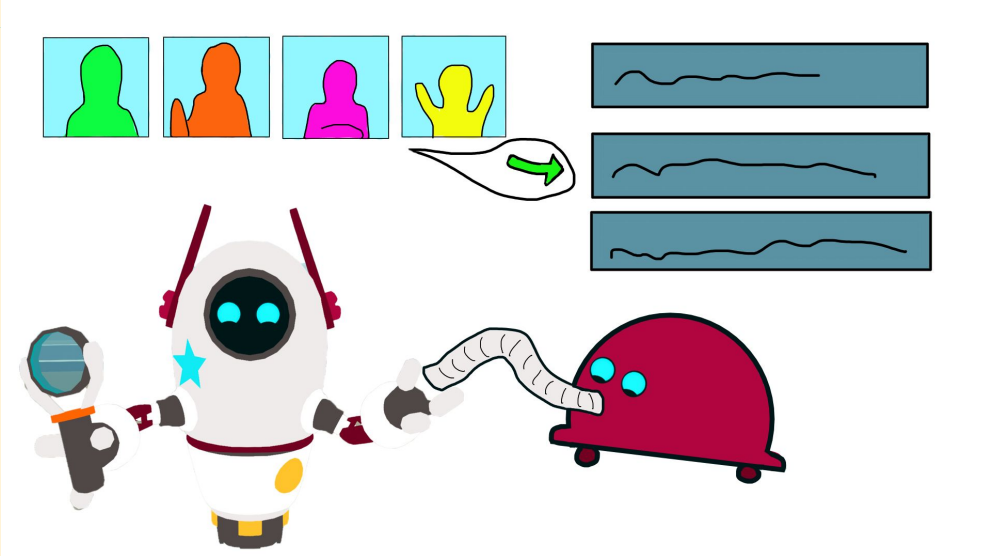
1. Antenne
    a. Professor Schoonmaak
2. Ruby emoties leren
    a. Kinderen helpen

4.



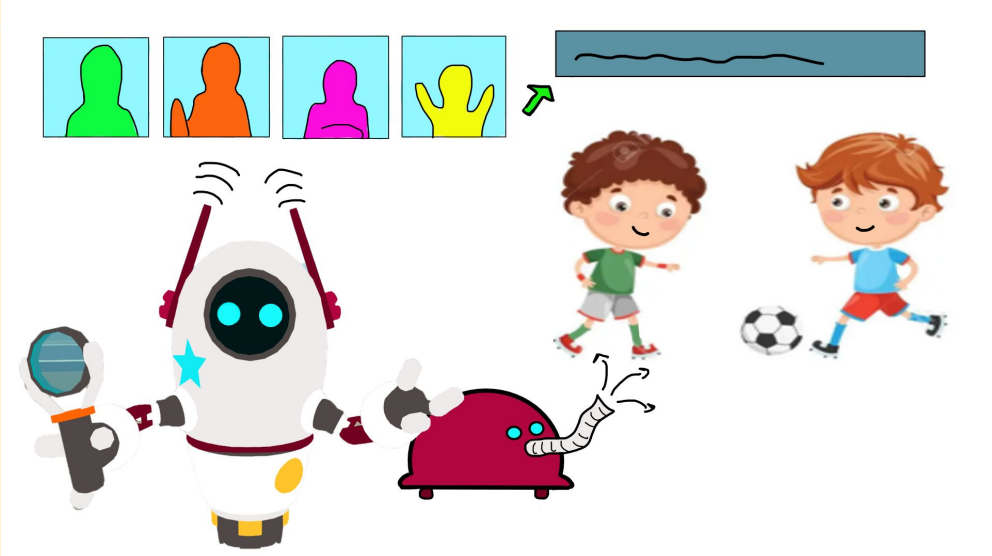
1. Ruby emoties leren
    a. Antenne klaar
2. Hettie ook gevoelens?
    a. Hettie zoeken

5.



1. Hettie begrijpen
    a. Hettie emoties leren
2. Moraal: Emoties zijn goed

6.



1. Alle emoties terug
   a. Mensen helpen
   b. Samenwerking
2. Huis planeet helpen

Verhaal in 6 sessies