Influencing Factors of User Engagement with Serious Games

How play literacy, attitude towards games, and framing affect the user engagement with serious games

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Contents

Abstract

In the last few decades, the interest in the benefits that games can offer has been growing. This has resulted in the development of so-called serious games: games that have a purpose aside from entertainment. Despite this growing interest, little research has been done to understand the factors that influence the engagement with, and thus determine the impact of, serious games. A factor that has been proven to influence user engagement is framing: how the game is presented to the user. Building on a study by Wechselberger (2013), the current study analysed the relationship between framing and engagement with serious games, and additionally analysed how play literacy and attitude towards games influence this relationship. An online experiment with two conditions was conducted to test these relationships. Participants played a serious game that was either framed in a playful way or in a serious way, and their play literacy, attitude towards games, and engagement with the game were measured. Contrary to results from previous studies, no significant relationships were found between framing, play literacy, attitude towards games, and engagement. Several factors were identified in the set-up of the current experiment which could explain the absence of these relationships. Differences in game type and design, as well as in user age and persuasion knowledge were discussed. Suggestions were made for the set-up of future experiments, and several guidelines for designers of serious games were provided. Furthermore, an exploratory analysis of the dataset revealed several significant correlations that serve as an interesting basis for future research.

Keywords: serious games, user engagement, framing, play literacy, attitude towards games

Introduction

Over the last few decades, the interest in entertainment games and its impacts on players has been growing. Early research on such impacts mostly focussed on the negative aspects of playing entertainment games, such as addiction and social isolation (Connolly, Boyle, MacArthur, Hainey, & Boyle, 2012). However, more recent research has been focussed on the positive effects playing games can have, and how games can be used for learning, changing behaviour, and attitudes (Vlachopoulos & Makri, 2017). This focus on positive impacts has contributed to the development of a different type of game, the so-called "serious games" or "games for change" (Bellotti, Kapralos, Lee, Moreno-Ger, & Berta, 2013; Mitgutsch & Alvarado, 2012). The difference between entertainment games and serious games is that serious games have a purpose aside from entertaining the player; they intend to convey a certain idea, and want to influence the players' opinions or behaviour outside of the game (Connolly et al, 2012; Iten & Petko, 2016; Mitgutsch & Alvarado, 2012).

Although developing serious games has been a trend in the past decades, there is little research on the effectiveness of serious games, and on the quality of their conceptual design (Mitgutsch & Alvarado, 2012). Mitgutsch and Alvarado (2012) believe that the relationship between a serious game's quality and purpose is essential to understanding the impact the game has on its players. In order to assess the overall quality of a serious game, and taking into consideration all the different components a game consists of, they developed an analytical framework. This framework can be used to study the relationship between the quality of the different components of a serious game and its intended purpose, and how these different components influence the overall quality of the game. The framework describes six components of the conceptual design of a serious game: the purpose or aim, the content and information presented, the fiction and narrative, the game mechanics, the aesthetics and graphics, and the framing of the game.

Mitgutsch and Alvarado (2012) state that the component framing is an important part of a serious game, but is a component that is often overlooked or not thought about enough, resulting in game play that lacks engagement for the users. Framing refers to how all components of a game are presented, and when doing this, it is important to take into account the target audience and their previous gaming experience (Mitgutsch & Alvarado, 2012). When developing a serious game, it is important to take into account the target audience as much as possible, as these games try to convey a certain idea or want to evoke behavioural change in their audience. The previous gaming experience, also called play literacy, of the target audience is often not taken into account however. This results in serious games that are easily accessible to players with a low play literacy, but are not engaging and challenging enough to the players with a high play literacy (Mitgutsch & Alvarado, 2012).

Wechselberger (2013) studied how framing a serious game in different ways influences the perceived credibility, entertainment, and engagement rating of this game by the players. They argued that rather than the overall design of a serious game, the subjective meaning a player gives to a serious game is a deciding factor in how a serious game is perceived. This subjective meaning the player gives to the game could be influenced by how the game is framed. To test this, they set up an experiment where two groups had to play the same serious game, only the instructions given on the purpose and nature of the game beforehand differed. The control group was instructed that they would play an educational game designed by an organization producing learning software for students, and the experimental group was instructed that they would play an entertainment game for adolescent gamers. The results showed that the experimental group rated the serious game lower in credibility, and the control group rated the serious game lower in entertainment. This research shows that the framing of serious games is indeed an essential factor that influences the user experience and overall rating of a serious game. Wechselberger (2013) noted that even

though their approach was on the right track to investigate how framing influences user engagement, they did not take into account certain characteristics of the players. They suggested that there are other factors that could be influencing the relationship between framing and engagement, such as the attitude the player has towards games and their play literacy.

As suggested by Wechselberger (2013), how the attitude towards games in general, and the play literacy of the player, influence the overall experience with and effectiveness of a serious game still has be assessed further. There are some examples that indicate that there may be differences in attitude towards serious games between players with a high play literacy and players with a low play literacy. High play literacy users often find serious games easy to learn, and quickly become bored (Zeeman & Jordaan, 2014). On the other hand, low play literacy users can easily become overwhelmed by all the new information that is presented to them, and require quite simplistic serious games in order for the game to be engaging (Iten & Petko, 2016; Wouters, Van der Spek, & Van Oostendorp, 2009).

These studies indicate that there may be differences between attitudes towards serious games, depending on the play literacy of the player. These differences in attitude could potentially influence the overall user experience of a serious game. Both Mitgutsch and Alvarado (2012), and Wechselberger (2013), have emphasized the importance of framing when designing a serious game. Both of these previous studies have stated that the play literacy and attitude towards games of the target audience are particularly important factors of framing that have not been assessed yet in terms of their relationship to the effectiveness of a serious game. Lehmann, Lalmas, Yom-Tov, and Dupret (2012) stated that in order for a serious game to be effective, it must not just be used, but engaged with. Players need to invest time and attention, and engage emotionally. Lehmann, Lalmas, Yom-Tov, and Dupret (2012) define user engagement as being the part of the user experience that focusses on the positive

aspects of the interaction between the user and the product. User engagement is an important determinant in assessing how effective a serious game is, and how successful it could be in reaching its intended purpose. Therefore, in order to assess the effectiveness of a serious game, one has to study the user engagement with the serious game (Bellotti, Kapralos, Lee, Moreno-Ger, & Berta, 2013).

Previous research such as the study by Wechselberger (2013) has examined the importance of framing and how this influences the user engagement with a serious game. However, since research on how and if attitude and play literacy affect this relationship between framing and user engagement is still missing, the current study has examined their influence whilst using two different types of framing. Therefore, the research question of the current study is:

"*How does framing influence the users' engagement with serious games, and is this influence moderated by attitude towards games and play literacy?"*

Theoretical Framework

Serious games and their effectiveness

As mentioned in the introduction of this study, serious games have an additional purpose aside from entertainment. Serious games have the intention to influence the players' opinions, behaviour or attitude outside of the game (Connolly et al, 2012; Iten & Petko, 2016; Mitgutsch & Alvarado, 2012). Serious games are designed to appeal to a broad target audience, in order to convey their purpose to as many people as possible and have a certain effect on this audience, aside from entertainment (Bellotti et al, 2013).

In the last decade, the interest in serious games has been growing rapidly (Mahue-Cadotte et al, 2018). A study on published articles that are related to serious games in the ACM Digital Library and IEEE Xplore Digital Library by Laamarti, Eid, and El Saddik

(2014) shows an exponential growth between 1995 and 2013 in the number of research papers published on serious games. A survey on serious games in the industry was conducted within the same study, and also showed an exponential growth within the last decade. This exponential growth has resulted in serious games being used and researched in different contexts, such as education, health, training, and public policy (Connolly et al, 2012; Laamarti, Eid, & El Saddik, 2014).

With this rapid growth in the development and research of serious games, there has been a more recent interest in the impact these games have on their players, and an even higher interest in the effectiveness of the game. A serious game is considered effective when it reaches its purpose to impact its players (Mitgutsch & Alvarado, 2012). In educational serious games such a purpose could be to transfer knowledge from the game to the real world, or facilitate learning in various topics. In persuasive serious games, the purpose would be an attitude change on a topic in real life (Backlund & Hendrix, 2013). During their research on the growth of serious games, Laamarti, Eid, and El Saddik (2014) conducted a survey on previous studies and determined that in order for a serious game reach its purpose, there needs to be a good balance between the fun elements the game has to offer, and the main serious purpose of the game. They emphasize that the entertainment level of the game should not be sacrificed in order to convey a certain idea or change the players' attitude. Based on this need for balance between entertainment and seriousness, Laamarti, Eid, and El Saddik (2014) described a few factors, based on existing articles and applications on serious games, that can contribute to a serious game's success and effectiveness. First, they found that providing the right information to the players, and providing guidelines on how to play the game properly, is of uttermost importance. The game should not make the player feel confused or lost, because of a lack of instructions. This would result in the player getting stuck, unable to reach the intended goal and purpose of the serious game. A second success

factor is to avoid negative in-game consequences for the player, such as losing in-game money or points. Negative consequences are demotivating to the player, and discourage the player to engage with the game further, reducing its success and effectiveness. Lastly, providing challenges within a serious game increases the immersion and interest players have in the game. However, the challenges should not be too difficult, which would lead to demotivation, or too easy, which would lead to uninterest. These factors are important for serious games especially, because in contrast to entertainment games, a serious game aims to have a certain effect on their audience. If a player would get bored or frustrated with a serious game, and stopped playing, the game could never convey the idea it intends to convey, or change the behaviour or attitude of the player.

Another study that examined the factors contributing to a serious game's effectiveness and success is the study by Bellotti et al (2013). Based on a survey of previous studies, they concluded that formative assessment, meaning that the assessment of the player's success in the game is present throughout the game and part of the experience, is particularly useful in educational games. This means that throughout the game, appropriate user feedback should be present in order to monitor the learning progress of the player, instead of just measuring the learning progress at the end of the game. This success factor as described by Bellotti et al (2013) together with the success factor of providing sufficient guidelines and instructions to players by Laamarti, Eid, and El Saddik (2014), are important elements in guiding the player through the game and keeping them motivated to play.

As mentioned earlier, a serious game's success strongly depends on the balance between entertainment and seriousness. When assessing the entertainment part of a serious game, Bellotti et al (2013) found two possible approaches in previous studies assessing serious games, a quantitative approach and a qualitative approach. The qualitative approach focusses heavily on user enjoyment and experience, with the most important dimension for

serious game assessment being user engagement. Hookham, Nesbitt, and Kay-Lambkin (2016) further emphasize the importance of engagement in serious games by stating that the more engaged a user is, the more committed they will be to the experience the game offers, and therefore the easier for a serious game it is to reach its intended purpose. With serious games designed to treat certain health issues for example, greater levels of engagement would lead to more commitment to completing the treatment, leading to greater health outcomes. Burns, Webb, Durkin, and Hickie (2010) evaluated such a health serious game, called Reach Out Central, designed to improve the mental health of young people aged 14-25. Through repeated online measures of psychological well-being of 266 people who played the game, they found that the women in their study were engaged enough to keep using the game, but the serious game failed to engage men. Because the serious game was not engaging enough, a large part of the target audience was not reached, and the game could not reach its intended purpose to improve the mental health in young men as well as young women.

To sum up, there has been a lot of research on serious games and their effectiveness. Several studies have defined factors that contribute to a serious game being effective, and therefore successful. Such factors include: to provide appropriate user feedback, to avoid negative in-game consequences, and to have balanced challenges. The most important reason for a serious game to be successful is to keep the user engaged through the previously mentioned factors. Therefore the most important element contributing to a serious game's success, and the most important measurement of effectiveness, is user engagement (Bellotti et al, 2013; Hookham, Nesbitt, & Kay-Lambkin, 2016).

User engagement

The concept of user engagement is defined in different ways and there is not one main definition, but this study uses the definition by Lehmann, Lalmas, Yom-Tov, and Dupret

(2012). They define user engagement as the part of the user experience that focusses on the positive aspects of the interaction between the user and the product. In the case of serious games, this means the player is captivated by the experience of the game and is motivated to play it. For a serious game to be successful, the game is not just simply used, players also invest time, emotion, and attention into the game (Lehmann, Lalmas, Yom-Tov, & Dupret, 2012).

When defining user engagement in the context of serious games, the term flow is mentioned often (Hookham & Nesbitt, 2019). Csikszentmihalyi, Abuhamdeh, and Nakamura (2014) define flow as the optimal experience. It is a balance between skill and challenge, and these two elements need to be approximately equal in order to create an optimal experience. Csikszentmihalyi, Abuhamdeh, and Nakamura (2014) define a few components that lead to experiencing flow: the activity needs to be challenging and requires skill, it needs to have clear goals, direct and immediate feedback; there needs to be a sense of control, a loss of self-consciousness, and a concentration on the task at hand. These components of flow align with the factors contributing to a serious game's effectiveness by Laamarti, Eid, and El Saddik (2014) as described earlier. Experiencing flow provides enjoyment and creates an intrinsic motivation to engage with a serious game (Hookham & Nesbitt, 2019). This means that when a player experiences flow while playing a serious game, their engagement with the game is likely to be high. As established earlier, high levels of engagement are necessary in order for a serious game to be able to reach its intended purpose. A higher user engagement will lead to players becoming more involved with the serious game. They will get more interested in the game's purpose, which could lead to a change in real-life attitude and behaviour as well, as is intended for by the serious game (Hookham & Nesbitt, 2019; Maheu-Cadotte et al, 2018).

To assess the engagement of a serious game, many different methods have been used. Hookham and Nesbitt (2019) reviewed 107 articles on measuring user engagement in serious

games, and concluded that the most used methods were questionnaires, and in particular the User Engagement Scale by O'Brien and Toms (2010). This scale consists of multiple subscales, including challenge, feedback and motivation. These subscales reflect the factors that have been defined as contributing to a serious game's success by Laamarti, Eid, and El Saddik (2014), and align with the components leading to the experience of flow, as described earlier. However, some previous studies have found that play literacy, the player's familiarity with playing video games, could influence the user engagement with the serious game as well (Mitgutsch & Alvarado, 2012; Wechselberger, 2013). Play literacy is not taken into account in the user engagement scale by O'Brien and Toms (2010), while it could have a potential influence on the user engagement with a serious game, and thus its effectiveness.

Framing, Play Literacy & Attitude

Framing in the communication sciences is defined as a process in which certain aspects of reality are drawn attention to at the expense of others in order to present issues or problems in a certain way (Ardèvol-Abreu, 2015). This means that all types of media, including games, can portray a topic in different ways to its users by presenting, or framing, it differently. An important aspect of serious games is how the key design elements of the game are framed with regard to the target audience of the game and their gaming experience (Mitgutsch & Alvarado, 2012). Framing can be used to give games a different purpose by presenting the game in a different way. Arnab et al (2012) stated that any game can be viewed as a serious game, because it depends on how the game is presented, or framed, and how the players perceive the game experience. There are some examples of this: the karaoke game Singstar was used to improve the pronunciation of English words of college students, and the quiz game Buzz! Quiz TV was used by history and geography teachers to test discussed concepts in class (Alvarez & Djaouti, 2011).

As mentioned in the introduction of this study, Wechselberger (2013) investigated the importance of framing when it comes to serious games, by presenting a serious game in two different ways. To one group the serious game was presented as a serious game with a serious purpose, and to another group the same game was presented as an entertainment game with an entertaining purpose. The serious framing of the game resulted in the game being rated higher on credibility, but lower on entertainment by the participants. The entertainment framing of the game had the exact opposite results, being rated higher on entertainment, but lower on credibility. How a serious game is presented to its target group, influences their experience with the game greatly, and therefore also has an impact on the user engagement and in turn on the effectiveness of the serious game.

As stated by Mitgutsch and Alvarado (2012) an important element of framing is taking into account the user's play literacy. When framing a serious game, the play literacy of the target audience should be considered, as users with a low play literacy differ in their knowledge and skills from users with a high play literacy. However, even though framing as a whole has been researched in studies such as by Wechselberger (2013), and proven to be of great influence on the user engagement with a serious game, the play literacy of the target group of the game is often overlooked. Wechselberger (2013) stated in the limitations of their study that they did not include the play literacy of the players in their study on framing. As play literacy is an important part of framing, it needs further investigation to determine its influence on the user engagement, and thus effectiveness, of the serious game as well.

The user's play literacy, whether the user is experienced with games or not, also influences what a user expects and wants from a serious game. Experienced gamers, users with a high play literacy, value games that provide a flow experience (Chen, 2007). They expect a game to be challenging, provide them with clear goals and immediate feedback, and want to lose self-consciousness and lose a sense of time. Zeeman and Jordaan (2014)

investigated these expectations of high play literacy users by studying what influences the attitude of computer science students with high play literacy towards serious games. They concluded that computer science students thought serious games would be easy to learn and use, and might even become boring, because they are not challenging and engaging enough. Users with a low play literacy on the other hand, need more guidance and want easy access. They could easily become overwhelmed by all the information that is presented to them, because it requires a lot of cognitive processing (Wouters, Van der Spek, & Van Oostendorp, 2009). The attitude of low play literacy users was studied by Iten and Petko (2016), who examined what influences the attitude of children with low play literacy towards serious games. Children wanted a serious game to be useful and easy to learn. Another group that has low play literacy, elderly people, also want a serious game to be easy to understand and learn, and they want sufficient information and feedback in order to be able to interact with the game (Gerling, Schulte, Smeddinck, & Masuch, 2012).

Even though the study of Wechselberger (2013) examined how framing influences the user engagement with a serious game, little is known about how play literacy and attitude towards games could potentially influence this relationship and the engagement with a serious game in general.

Current study

As mentioned in the introduction of this study, the current study aims to answer whether play literacy and attitude of the player influences the relationship between framing and the user engagement with a serious game. Figure 1 shows how these factors relate to each other.

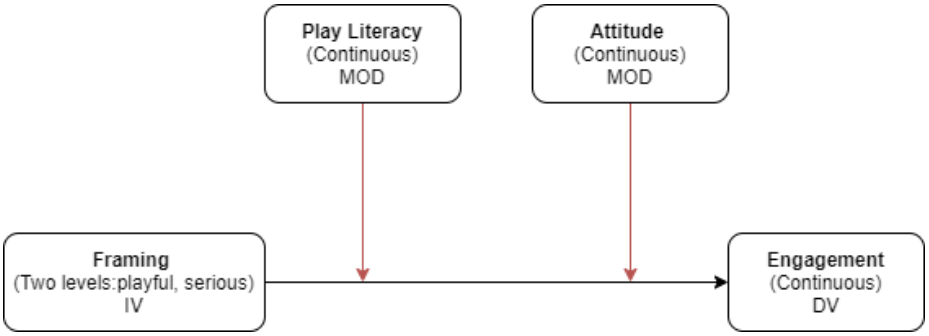

Figure 1. Conceptual model of the variables in the current study and their relationships.

The study by Wechselberger (2013) has proven that framing serious games in either a playful way, presenting it as an entertainment game, or a serious way, presenting it as a serious game, influences the player's ratings on user engagement. Presenting a serious game as an entertainment game increased its engagement ratings. Presenting a serious game with its intended purpose that is non-entertaining, lowered the ratings on user engagement. Considering these previous findings, the first hypothesis, concerning the main effect of framing on engagement, for the current study is as follows:

> *H1: A playful frame positively affects the engagement in serious games, and a serious frame negatively affects the engagement in serious games.*

Considering that users with a high play literacy value challenges and engagement, and expect serious games to be boring (Chen, 2007; Zeeman & Jordaan, 2014), and that users with a low play literacy value easy access and clear feedback, and expect serious games to be easy and useful (Gerling, Schulte, Smeddinck, & Masuch, 2012; Iten & Petko, 2016; Wouters, Van der Spek, & Van Oostendorp, 2009), the next hypotheses, concerning the main effects of gaming experience and attitude on engagement, for this study are as follows:

> *H2: Play literacy negatively affects engagement in serious games.*

H3: Attitude towards games positively affects engagement in serious games.

Based on previous studies and findings, the last hypotheses for the current study concern the interaction effects and relationship between the variables framing, play literacy, attitude, and engagement:

H4: Play literacy positively affects engagement in serious games with a playful frame, while play literacy negatively affects engagement in serious games with a serious frame.

H5: Attitude positively affects engagement in serious games with a serious frame, while attitude negatively affects engagement in serious games with a playful frame.

Method

Design

To investigate the influence of attitude towards games and play literacy on the relationship between framing and user engagement with serious games, an experimental study with a between-subject design was used. The current study replicated the experiment set-up of the study by Wechselberger (2013) on the relationship between framing and user engagement, and added elements to measure attitude and play literacy to it accordingly. The experiment consisted of two conditions: the serious frame condition and the playful frame condition. In the serious frame condition, participants received instructions telling them they were about to play a serious game, and in the playful frame condition they received instructions telling them they were about to play an entertainment game. Participants were randomly assigned into one of these conditions. Participants played the same game, regardless of their condition,

and had to answer questions in an online survey regarding their attitude towards games, play literacy, and their engagement with the game.

Participants

Participants were recruited with the help of the Tilburg School of Humanities and Digital Sciences Participants Pool, and with the use of convenience sampling. Participants had to be at least 18 years old, and be proficient in English, in order to be able to understand and play the serious game used in this experiment. Wechselberger (2013) used a total of 54 participants in their experiment, but this sample size was too low, resulting in a low statistical power as well. Their statistical power was only 15%, as measured by SPSS, meaning that there was a 85% likelihood of falsely rejecting hypotheses. Therefore, the current study recruited 126 participants to partake in the experiment, in order to ensure more statistical power. However, 26 responses were removed from the dataset, either because they included invalid answers, or because the response time was too low for them to be considered valid. Filling in the survey and playing the game takes at least ten minutes, therefore responses with a response time lower than this are not likely to have been accurate, and were removed from the dataset. The average of the participants was 21.44 years old (SD = 2.86). There were a total of 39 male participants, and a total of 61 female participants.

Materials

The serious game used for this experiment is called Spent, which can be accessed through http://playspent.org/. Spent is an online serious game created by McKinney for the Urban Ministries of Durham, an organisation focussed on creating experiences that bring human insights to life (McKinney, 2020). Spent can be played in the web browser online, is single-player, and only requires the use of a mouse. This serious game is about poverty and

homelessness, and the challenges this brings. The game's purpose is to help players understand the problems that come with managing a small home budget. The developers of the game want people who do not have to worry about money have more empathy for people who live in poverty and have to deal with such challenges in everyday life. The goal of Spent is to survive one month, by trying to manage the budget the player has. At the start of the game, the player has 1000 dollars as their budget. Through various decisions the player has to make, this budget can increase or decrease based on the player's choices. When the month is over, and the game is finished, the player is invited to donate to a non-profit organization that helps those who are dealing with poverty. Playing the game takes about fifteen to twenty minutes in total. Figure 2 and Figure 3 show some screenshots taken from Spent, showing the interface and design of the game.

Figure 2. The first choice the player has to make in Spent, which job does the player want to choose.

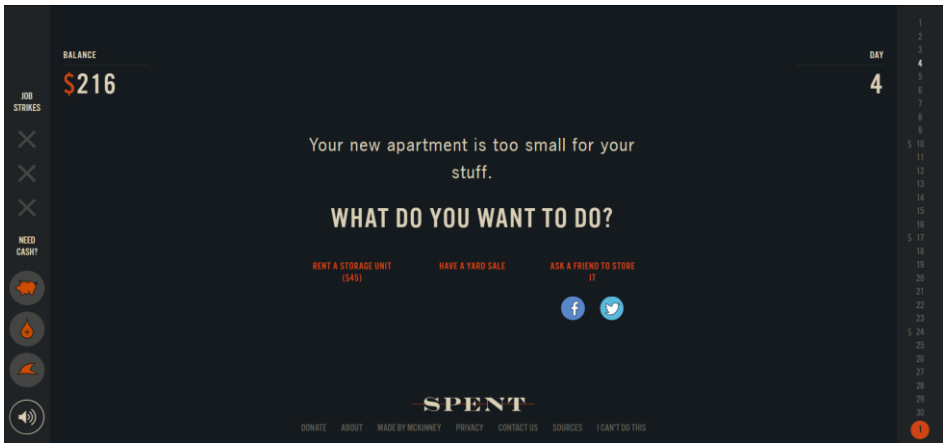

Figure 3. An example of a choice the player has to make in Spent.

This particular game was chosen because it fits the experiment, it can be accessed online and does not require much time to be completed, and also because this game can be framed in multiple ways. The game has relatively simple graphics, and not a lot of instructions or context, which allows this experiment to fill in the game's purpose and provide instructions for the participants in the way that suits the experiment conditions and different framings.

This experiment consisted of two conditions, using different framings. Based on the study by Wechselberger (2013), the conditions differed in how participants received their experiment instructions. The participants received almost the same instructions, but the key-words referring to two different frames, either serious or play, were different. In the serious frame-condition, key-words that refer to seriousness were used. These instructions focussed on conveying the participants that they were about to play a serious game, with a serious purpose. In the playful frame-condition, key-words that refer to play and entertainment were used. The instructions of this condition were focussed on conveying the participant that they were about to play an entertainment game, with an entertaining purpose. In both instructions, the nature of the game and the goal of the game were explained. Table 1 shows how the conditions differed in instructions with the use of key-words referring to the different frames, the full instructions can be found in Appendix 3 and Appendix 4.

	Serious frame-condition	Playful frame-condition
Nature of the game	Serious game	Entertainment game
Goal of the game	To make players aware of the struggles of those that deal with poverty	To challenge the player to manage their small budget as well as they can

Table 1. Differences in instructions both conditions received, with key words referring to either a play or serious frame.

Measurements

Attitude. To measure the attitude of participants towards games, the New Computer Game Attitude Scale (NCGAS) was used, created by Liu, Lee, and Chen (2013). This scale has a high validity and reliability in measuring the attitude towards computer games (Liu, Lee, & Chen, 2013). This scale consists of 22 items on a 4-point Likert scale. The NCGAS measures three different subscales: cognition, affection, and behaviour (consisting of participation and leisure). As the cognition subscale is more focussed on measuring learning and confidence outcomes of playing computer games, and less on the attitude the player has before playing a computer game, this subscale was omitted from this experiment. The participation part of the behaviour subscale is more focussed on educational and school-related activities, and is thus not relevant to this study, and was omitted as well. The remaining subscales, affection and the leisure part of behaviour, were measured on a 5-point Likert scale, instead of the original 4-point Likert scale, in order to fit this experiment. The resulting questionnaire consisted of 7 items, all measured on a 5-point Likert scale. This included items such as ‘I am very interested in solving problems in games’ and ‘Playing a game makes me feel happy’. At the end of the experiment, together with the debriefing, the participants also received a short explanation on what serious games are, and their purpose.

Play literacy. To measure the play literacy of the participants, the gaming experience measure by Ausburn, L. J., Ausburn, F. B., and Kroutter (2013) was used. This measure of participants’ prior experience with games consists of one item, asking the participants to rate their level of gaming experience on a 5-point Likert scale (1 = I have never played video games, 5 = I have played video games a lot). To ensure more information on the participants’ play literacy, three more questions on experience and gaming were added. This included a question on whether the participant sees themselves as a gamer, how many hours the participant spends per week on playing games, and which games they play. In order to ensure

that the participants know what can be categorised as games, a short explanation precedes these questions about the kinds of games that they could think of, like mobile games and casual games, besides the more general hardcore video games.

Engagement. To measure the user engagement with the serious game, the same scale that was used by Wechselberger (2013) to measure engagement was used in order to replicate their study on the effect of framing. They operationalized their scale based on a measurement created by Klimmt (2006). The reliability for this scale is high (Cronbach's alpha = .93). The scale consists of eight items, measured on a 4-point Likert scale. To better fit the current study, the items were adapted to be measured on a 5-point Likert scale. The scale includes items such as 'The game awoke my interest' and 'I would have liked to interact longer with the game'.

Procedure

The experiments were conducted through an online survey. Participants had to read an information letter regarding the nature and purpose of the experiment (Appendix 1), which also explained that they would have to be in a quiet room and alone, and use headphones in order to be able to participate. The participants were then presented with a consent form (Appendix 2), which had to be read and signed, before starting the experiment. Then they had to fill in the pre-test questionnaire, consisting of demographic questions and the scales on attitude towards games and play literacy. Depending on the experiment condition, the participants received either a playful frame instruction on what to do, or a serious frame instruction. The participants then proceeded by playing the serious game Spent until they had reached the end of the game. Afterwards, they filled in the post-test questionnaire, consisting of the user engagement scale. After the post-test questionnaire, participants were asked a few questions on their personal experience with poverty and the game they had to play, in order to

control for the poverty status of the participants, as the game is about dealing with such issues (Appendix 8). Once they were finished, the participants received a debriefing (Appendix 9) about the different conditions of the experiment, and the different frames. The debriefing also explains the purpose of serious games in general. The survey then thanked the participant for their participation and the experiment was over.

Results

There were a total of 100 valid response in this study. There were 53 responses in the serious framing condition, and 47 responses in the playful framing condition. First, the differences in participants between these two conditions were analysed, in order to check whether the two groups are normally distributed and could be statistically compared to test the hypotheses. Table 1 shows the general descriptive statistics of the two conditions.

Table 1

General Descriptive Statistics of The Two Framing Conditions

Variable	Serious framing condition	Playful framing condition
Number of Participants	53	47
Male	20	19
Female	33	28
Age	M = 21.43, SD = 2.83	M = 21.45, SD = 2.92
Dealt with Poverty	29	16
Play Literacy	M = 2.63, SD = .16	M = 2.57, SD = .15
Attitude towards Games	M = 3.26, SD = .10	M = 3.22, SD = .12

In the questionnaire participants had to fill in, they were asked whether they have dealt with poverty themselves, and whether they know someone who has dealt with poverty in their lives. The answers to these two questions were combined into one variable, called ‘dealt with poverty’. A Chi-square test showed that the difference between the groups in whether

participants had dealt with poverty in their live is significant, χ^2 (1) = 4.30, p = .038. This means there were significantly more people that have dealt with poverty in the serious framing condition than in the playful framing condition. It was observed that 54.7% of the participants in the serious framing condition are likely to have dealt with poverty, whereas 35.6% of the playful framing condition are likely to have dealt with poverty. The other variables between the two groups did not differ significantly.

To further explore the relationships between the independent variables (age, gender, dealt with poverty, play literacy, and attitude towards games) and the dependent variable (engagement), a correlation analysis was performed. The variable play literacy was not normally distributed (z-score$_{skewness}$, = 2.96, z-score$_{kurtosis}$ = -1.29), and therefore Spearman correlations were calculated for this variable. The variables gender and poverty are dichotomous variables, and therefore point-biserial correlations were calculated for these variables. Table 2 shows the correlation matrix resulting from this analysis.

The correlation analysis showed a few significant relationships. First, there is a significant positive correlation between play literacy and attitude towards games (R_s = .76, p < .001). A large part of the variance in play literacy (57.76%) is accounted for by attitude towards games. This means that high scores on play literacy go with high scores on attitude towards games. Second, there is a significant negative correlation between gender and play literacy (R_s = -.56, p < .001), and between gender and attitude towards games (R_{pb} = -.47, p < .001). A part of the variance in play literacy (31.36%), and a part of the variance in attitude towards games (22.09%), is accounted for by gender . This means males are likely to have higher scores in play literacy and attitude than females. Lastly, there is a significant positive correlation between having dealt with poverty and play literacy (R_s = .23, p = .023), and between having dealt with poverty and attitude towards games (R_{pb} = .24, p = .018). A small part of the variance in play literacy (5.29%), and a small part of the variance in attitude

towards games (5.76%), is accounted for by whether you have dealt with poverty. This means that participants having dealt with poverty are likely to have higher scores in play literacy and attitude towards games than participants who have not dealt with poverty.

Table 2

Correlation Matrix

Variable		Engagement	Age	Gender	Poverty	Play literacy	Attitude
Engagement	Correlation coefficient	1.00	-.10	-.08	.17	.06	.19
	Sig. (2-tailed)	-	.323	.413	.086	.570	.057
Age	Correlation coefficient	-.10	1.00	-.02	.13	-.09	-.05
	Sig. (2-tailed)	.323	-	.878	.202	.374	.653
Gender	Correlation coefficient *	-.08	-.02	1.00	-.06	-.56	-.47
	Sig. (2-tailed)	.413	.878	-	.555	**.000**	**.000**
Poverty	Correlation coefficient *	.17	.13	-.06	1.00	.23	.24
	Sig. (2-tailed)	.086	.202	.555	-	**.023**	**.018**
Play literacy	Correlation coefficient **	.06	-.09	-.56	.23	1.00	.76
	Sig. (2-tailed)	.570	.374	**.000**	**.023**	-	**.000**
Attitude	Correlation coefficient	.19	-.05	-.47	.24	.76	1.00
	Sig. (2-tailed)	.057	.653	**.000**	**.018**	**.000**	-

* Point-biserial correlations

** Spearman's correlations

Bold = significant

Hypotheses testing

Hypothesis one. To test whether participants in the playful frame scored higher on engagement than participants in a serious frame, an independent t-test was performed. Engagement was measured on a scale with eight items, and the scale had a good reliability, α = .86. The data on engagement was normally distributed. On average, the serious frame (*M* =

3.09, *SD* = .75) scored higher on engagement than the playful frame (*M* = 2.80, *SD* = .80), these means are visualized in Figure 1. However, this difference was not significant (*Mdif* = .29, *t*(98) = 1.89, *p* = .062) and does not generalize to the population, 95% CI [-.02, .60]. This difference represents a medium-sized effect *d* = .37. This means that there is no difference in engagement depending on the framing of the serious game.

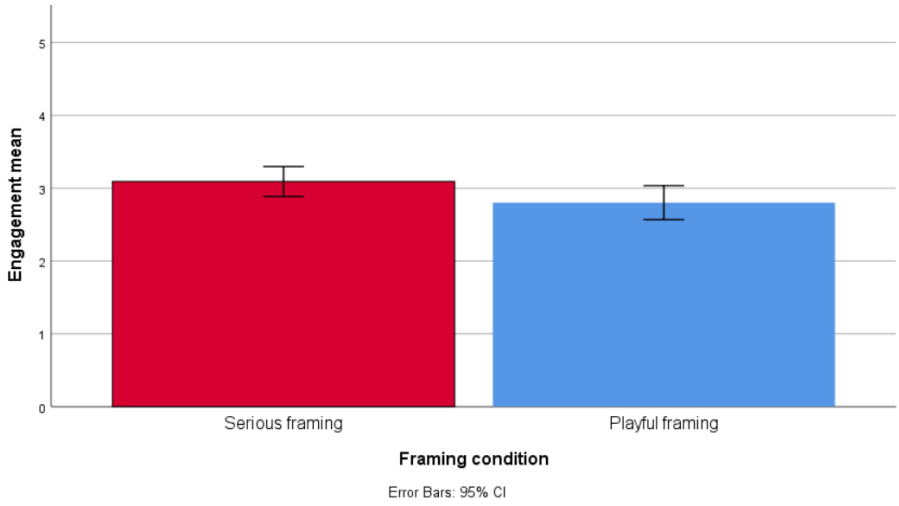

Figure 4. Mean engagement per framing condition.

Hypotheses two and three. In order to test whether play literacy negatively affects the engagement with serious games, and whether attitude towards games positively affects the engagement, regression analyses were performed. Attitude towards games was measured on a scale with seven items, and the scale had a good reliability, α = .77. Play literacy was measured on a scale with three items and the scale had a good reliability (α = .87) as well. However, play literacy and attitude towards games are highly correlated, which causes multicollinearity. Because of their high correlation, it can be assumed that play literacy and attitude towards games measure the same constructs, and therefore only one of these variables was chosen to further analyse their relationship to engagement. The data on play literacy was not normally distributed (z-score$_{skewness}$, = 2.96, z-score$_{kurtosis}$ = -1.29), therefore

the variable attitude towards games was chosen to use in the analysis. To test the relationship between attitude towards games and engagement, a regression analysis with attitude as the predictor variable (M = 3.24, SD = .75) and engagement (M = 2.96, SD = .78) as the outcome variable was performed. No other variables were used as control variables, because the correlation analyses showed there were no significant correlations between any other predictor variables and engagement. The regression analysis showed attitude towards games does not predict engagement (b = .20, β = .19, $t(98) = 1.92$, p = .057). The regression model also does not significantly explain any variance in engagement (R^2 = .04, $F(1, 98) = 3.70$, p = .057). This means that attitude towards games does not affect the engagement with serious games.

Hypotheses four and five. In the same manner as with hypotheses two and three, the last two hypotheses were analysed as one, since the variables play literacy and attitude towards games are highly correlated. Again, it was chosen to use the attitude towards games variable for this analysis, rather than play literacy, because this variable does meet the assumptions of normality. To test whether attitude towards games positively affects engagement with serious games with a playful frame, while attitude towards games negatively affects engagement in a serious frame, a dichotomous moderator analysis was performed. The framing condition is a dichotomous independent variable (two framing conditions: serious frame and playful frame), and there is a moderator present, namely attitude towards games. The analysis showed that there was no significant relationship between framing and engagement with attitude towards games as a moderator (R^2 = .08, $F(1, 96) = .58$, p = .448). This means that attitude towards games does not affect engagement in any way, regardless of the framing condition.

Exploratory analyses

Gender. The correlation analysis showed that there was a significant negative correlation between gender and attitude towards games, which means that male participants on average scored higher on attitude towards games than females. When taking only the male participants into consideration when analysing the hypotheses, there are some different results. To test whether males' attitude towards games affects the engagement with serious games, a regression analysis was performed with attitude as the predictor variable (M = 3.68, SD = .53) and engagement (M = 3.04, SD = .90) as the outcome variable. The regression analysis showed that engagement can be predicted by males' attitude towards games (b = .62, β = .36, $t(37) = 2.34$, p = .025). The regression model was significant (R^2 = .13, $F(1, 37) = 5.48$, p = .025), but only 13% of the variance in engagement could be explained. However, there was no significant regression model when testing the relationship between male's attitude towards games and engagement when taking the influence framing could have onto this relationship into consideration (R^2 = .17, $F(1, 36) = 1.78$, p = .190). This means that hypothesis three would have been supported when using only the male participants, and hypothesis five would not have been.

Poverty. The correlation analysis showed that there was a significant positive correlation between having dealt with poverty and play literacy and attitude towards games. When taking only the participants into consideration who have dealt with poverty when performing the analyses, the results were the same. The regression model for the relationship between attitude towards games and engagement was not significant (R^2 = .04, $F(1, 43) = 1.59$, p = .215), and the regression model for taking the influence framing could have on this relationship was not significant either (R^2 = .04, $F(1, 42) = .24$, p = .628).

Type of games. In the pre-game questionnaire on attitude towards games, participants were also asked which type of games they play in an open-ended question. These answers

were coded into a variable with two values, either casual or core. Casual games can be defined as games that are easy to understand and learn, and require little time per play session (Tuten & Solomon, 2017). Also, most casual games can be played using a mobile app. Examples of such casual games that participants mentioned are Candy Crush, Wordfeud, and Fruit Ninja. Tuten and Solomon (2017) describe core games as games that require a larger time investment, are more immersive, and require more advanced skills in order to be able to understand and play the game. Example of core games that were mentioned by the participants are Call of Duty, The Witcher, and Assassin's Creed. There were 59 participants who were coded into the casual games playing category, and 41 participants that were coded into the core games playing category. None of the participants mentioned games from both categories. An independent samples t-test revealed that there was no significant difference between engagement in the casual gamers group (M = 2.87, SD = .69) and the core gamers group (M = 3.08, SD = .88), $Mdif$ = -.21, $t(98)$ = -1.33, p = .185. However, on average, the core gamers group scored higher on attitude towards games (M = 3.85, SD = .43) than the casual gamers group (M = 2.82, SD = .63). An independent samples t-test revealed that this difference is significant ($Mdif$ = -1.03, $t(98)$ = -9.08, $p < .001$), and represents a large-sized effect d = 1.91. The average score on play literacy for core gamers was higher (M = 3.64, SD = .87) than the average score for casual gamers (M = 1.88, SD = .45). This difference is also significant ($Mdif$ = -1.76, $t(98)$ = -13.22, $p < .001$) and represents a large-sized effect d = 1.91. Figure 2 shows the mean differences for both attitude towards games and play literacy per game type.

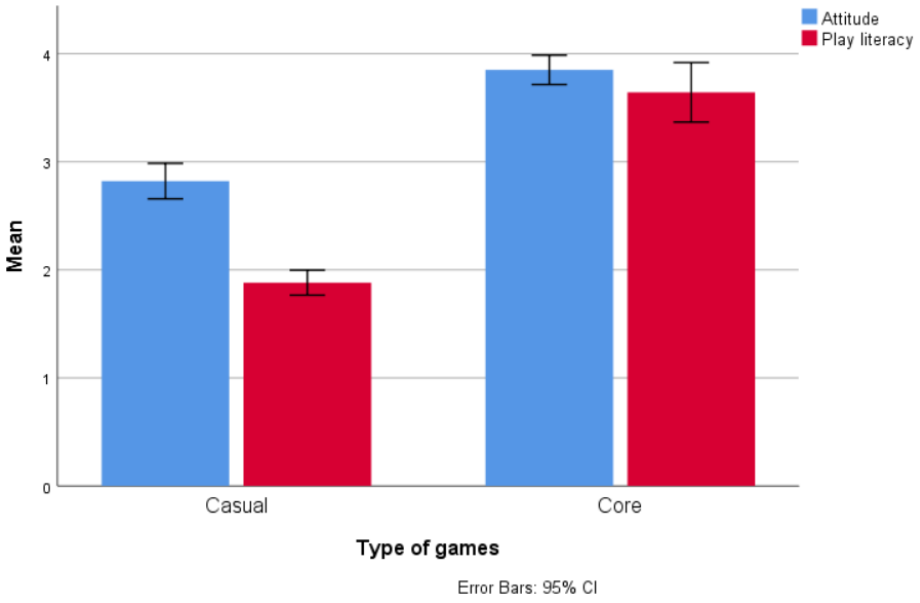

Figure 5. Mean differences for attitude and play literacy per game type.

Discussion and Conclusion

The aim of this study was to investigate the effect that play literacy and attitude towards games have on the user engagement with serious games, whilst using two different type of framing. Using an online serious game, called Spent, participants were asked to fill in questionnaires regarding their attitude towards games, their play literacy, and the engagement with the serious game. Using this set-up, five hypotheses regarding the effect of framing on engagement with serious games, the effect of play literacy and attitude on engagement, and the interaction effects between these variables were tested. This study revealed that there was no significant relationship between framing and engagement, and no significant effects of play literacy and attitude towards games on this relationship either. However, this study did reveal a few significant correlations, such as a relationship between having dealt with poverty and play literacy, and the difference between core gamers and casual gamers in play literacy and attitude towards games.

Hypothesis one, stating that a playful frame positively affects the engagement in serious games, and a serious frame negatively affects the engagement in serious games, was

not supported. This means that how the serious game is framed, whether that is in a playful or a serious frame, does not have an effect on the engagement the user has with the game. This implies that serious game designers do not have to frame their serious game as an entertainment game in order to increase user engagement. These findings contradict the study by Wechselberger (2013), which has proven that framing a serious game in either a playful or serious way does influence the player's engagement. They found that a serious frame reduces the player's engagement, and that a playful frame raises the player's engagement. The experiment set-up of Wechselberger (2013) was replicated in the current study. Hypothesis one was tested using the same scale on engagement, similar instructions were given in the two different framings, and the same number of participants were used. However, there are two major differences between the two experiment set-ups that could explain the contradicting results. First, the study by Wechselberger (2013) used an educational serious game and the current study used a persuasive serious game. According to Alvarez and Djaouti (2011) an educational serious game's purpose is to transmit knowledge, and a persuasive serious game's purpose is to influence the player in a certain way. In the case of the persuasive game used in the current study, its purpose is to influence the player's attitude towards poverty and make them more empathetic to people dealing with poverty. Something that could explain the difference in outcome between the study by Wechselberger (2013) and the current study, is persuasion knowledge. Persuasion knowledge is the knowledge a person has about certain tactics that are used in a persuasion attempt, and helps them identify how and why they are being influenced (Friestad & Wright, 1994). The current study used a persuasive serious game, rather than the educational serious game used in the previous study, which means that there is an attempt to influence and persuade the player which they could be aware of. Once the player is aware of the persuasion attempt, it would be harder for them to believe that the game they are playing solely has an entertainment purpose. This could

explain why there was no difference in user engagement found between the two different framings in the current study, whereas Wechselberger (2013) obtained a different result with an educational serious game.

The second difference between the study by Wechselberger (2013) and the current study is that the participants in the study by Wechselberger (2013) were junior high school students (aged 12-15 years), and participants in the current study were young adults (aged 17-30 years). This difference could have affected the results on user engagement, and this may again be explained by persuasion knowledge. Friestad and Wright (1994) stated that persuasion knowledge is something that develops during puberty, through your own experiences and socialization process. As the participants in the current study were older, their persuasion knowledge is more developed, and they would have been more aware of the game being a persuasive serious game. This could have influenced their perception of the game, and could have influenced their user engagement.

The two differences between the study by Wechselberger (2013) and the current one reinforce one another. The choice for the game used in this study may contributed to the different outcomes as well. Although the game fitted the requirements of being easily accessible online, and requiring little time to play and finish, it might not have been the best choice regarding framing. The game is quite heavily focussed on bringing across a message, making the players more aware of people dealing with poverty. At the beginning and ending of the game the player is confronted with certain statistics and facts about poverty in the United States of America. This serious game might therefore have not been easy to frame as an entertainment game. Although the game does challenge the player to try and deal with such a situation, these real life facts might make it hard to believe that this game is purely an entertainment game and does not have any other purpose.

These differences in experiment set-up and the choice of serious game could explain the contradicting results on framing found in the current study. Taking these differences into account, this could imply that framing a persuasive serious game as an entertainment game does not have an effect on the user engagement. However, since the persuasive serious game used in the current study was quite straightforward in its purpose, it would be interesting to use a persuasive serious game which is more ambiguous in its purpose for future research. Such a game might be easier to frame as being an entertainment game, and this could lead to different results on the influence of framing on engagement than found in the current study. Moreover, comparing the results from this study to the results of previous studies suggests that younger players of serious games might be more affected by framing than adult players. For future research it would be interesting to compare younger players with adult players, and how the framing of a serious game influences their engagement, and how this differs. Such future research could provide answers as to why these two age groups might differ in how framing influences them, and if persuasion knowledge indeed plays a role as suggested earlier.

Hypotheses two and three regarded the main effects of play literacy and attitude towards games on engagement with serious games, expecting play literacy to negatively affect engagement with serious games and attitude to positively affect engagement. A correlation analysis showed a strong, positive correlation between play literacy and attitude towards games. A previous study by Hoblitz (2015) on students' attitude towards educational games also found a correlation between students' previous gaming experience and their attitude towards games. However, the correlation they found between the variables was weak. Hoblitz (2015) argued that experienced gamers would have a positive, but also more critical attitude towards serious games, and games in general, because of their play literacy. This would mean that experienced gamers like the idea of a game being used for different

purposes other than entertainment, and would therefore have a positive attitude towards serious games, but would be more critical as well because they have certain expectations of what a game should be based on their play literacy. The current study has further supported this argument, by finding a strong positive correlation between players' play literacy and attitude towards games. Because of this high correlation however, it can be assumed that play literacy and attitude towards games would measure the same constructs and therefore hypotheses two and three were analysed as one. The results did not support the hypotheses. This means that attitude towards games did not influence the player's engagement with the serious game, and because of their high correlation, the same can be assumed for the influence of play literacy on engagement. This would imply that the player's engagement with a serious game is not influenced by attitude towards games and their play literacy, and therefore game designers of serious games would not have to take this into consideration when designing a persuasive serious game.

This contradicts findings by previous studies on the relationship between play literacy and engagement (Chen, 2007; Gerling, Schulte, Smeddinck, & Masuch, 2012; Iten & Petko, 2016; Wouters, Van der Spek, & Van Oostendorp, 2009; Zeeman & Jordaan, 2014). These previous studies found that players with a high play literacy expect serious games to be boring, and would therefore rate their engagement with them lower, and players with a low play literacy value the usefulness of serious games and would therefore rate their engagement with them higher. A possible explanation for these contradicting results was given in the exploratory analysis in this study. This exploratory analysis showed that participants who play casual games, rather than core games, rated themselves low on play literacy and attitude towards games, even though they do play games regularly. Egenfeldt-Nielsen, Smith, and Tosca (2019) argued that people who play a lot of casual games are hesitant to call themselves gamers, or even admit that they play games at all, because of the stigma attached

to being a video gamer. This could explain the differences in the self-perception casual and core gamers have of their play literacy, and their attitude towards serious games, and games in general. Because the casual gamers rated themselves lower on play literacy and attitude towards games than they actually are in the current study, this could have affected the results on the relationship between these variables and engagement. This could be a possible explanation as to the second and third hypotheses not being supported contradicting the results of previous studies. Taking this possible explanation into account, this could imply that the type of games the user plays should be taken into consideration rather than their play literacy and attitude towards games. The type of games a user is accustomed to could potentially have a greater influence on their engagement with serious games, than their previous experience with games in general. For serious game designers, this could mean that they would need to base their design around the type of games their target audience usually plays in order to increase user engagement. Future research could examine these potential implications by assessing the differences between core and casual gamers, and how these differences influence their engagement with serious games. Such future studies could provide more insight into how serious game designers could improve their design in order to increase the user engagement for their target audience.

The last two hypotheses, hypotheses four and five, concerned the interaction effects and relationships between the variables framing, play literacy, attitude towards games, and engagement. Hypothesis four expected that play literacy positively affects the engagement with serious games with a playful frame, while play literacy negatively affects the engagement with serious games with a serious frame. Hypothesis five expected that attitude positively affects the engagement with serious games with a serious frame, while attitude negatively affects the engagement with serious games with a playful frame. Both hypotheses were rejected however, which is explained by the fact that no main relationships were found

between framing and engagement, play literacy and engagement, and between attitude and engagement. This means that there is no relationship between framing and engagement, and both play literacy and attitude towards games do not influence this relationship.

Besides the main goal of this study to test the five hypotheses, an exploratory analysis of the dataset provided a few interesting findings. First, the exploratory analysis showed that when taking only male participants' data, engagement can be predicted by participants' attitude towards games and their play literacy. The male participants in this study on average scored higher on play literacy and attitude towards games than the female participants. This may be explained by the fact that males spend more time playing video games than females, especially in their adolescence (Rehbein, Staudt, Hanslmaier, & Kliem, 2016). These results imply that males with a high play literacy would find a persuasive serious game more engaging than females with a low play literacy. These results are important for serious game designers to keep in mind when designing for certain target audiences. Future research has to determine whether these results can be generalized to all users with a high play literacy, regardless of gender.

Another finding in the exploratory analysis was a positive correlation between having dealt with poverty and play literacy. Although weak, this correlation suggests that people who have dealt with poverty have more experience with games. There is little research on the relationship between poverty and playing games, but an explanation could be escapism. Games provide an escape from real life, and real problems, by providing an engaging experience that is different from the player's real life situation (Calleja, 2010). Because the serious game used in this study was about poverty, people having dealt with poverty themselves might have not found this game engaging, because it did not provide them a so-called escape from real life and might have actually reminded them of their experience with poverty. Even though these participants scored higher on play literacy, which would suggest

they would score higher on engagement as described in the first section of the exploratory analysis, they did not score high on engagement. This could be because the serious game did not provide what they would normally look for in a video game, namely an escape from their real life situation. Future research could provide more insight into the factors that influence a player's play literacy, such as having dealt with poverty, and their gender as mentioned earlier. This identified relationship between having dealt with poverty and play literacy could also provide an interesting basis for future research outside of the serious game industry.

Limitations

While conducting the experiments, and during the data analysis period, a few limitations to this study were found. The current study tried to replicate the experiment set-up of the study by Wechselberger (2013) on framing in serious games. This previous study conducted their experiments offline in neutral rooms on campus. In the current study however, due to circumstances, the experiment could not be carried out in person and on site, and had to be conducted online. Due to the researcher not being able to be present during the experiment, there was no control over the participants' environment. The overall engagement of the participants was pretty low ($M = 2.94$), and this could have been affected negatively by their surroundings or any other distractions that the researcher was not aware of. For example, there might have been other people present distracting the participant from fully engaging with the serious game. If all experiments would have been conducted in the same neutral room, the circumstances would have been identical for every participant, and the results would have been more reliable. On the other hand, games normally are being played in the user's own environment, typically at home. Conducting the experiment online, making the participants play the game at home, does raise the ecological validity of the experiment.

The current study did not perform a manipulation check with a few participants before conducting the actual experiments. Because of this, there was no guarantee that the participants actually noticed the entertainment or serious framing cues. If the participants did indeed not notice these, then it would explain the fact that the current study did not find any differences between the two framing conditions. Such a manipulation check would also have been relevant to check if the serious game used in this study is ambiguous enough in its purpose for it to be framed also in a playful way, and could therefore have provided insight into how well suited this game was for this study and its set-up.

Another limitation of the current study was that the dataset was relatively small for many analyses. This increased the possibility of wrong conclusions being made, and reduces the generalisability of the results found. However, some of the analyses' purpose was to explore the dataset, and were not performed in order to test any hypothesis. As a consequence, these results provide suggestions for future research only, and their generalisability should be studied further with a different dataset.

Conclusion

This study analysed the relationship between framing a persuasive serious game in two ways and engagement, and the influence play literacy and attitude towards games have on this relationship. The results of this study showed that framing a persuasive serious game in either a playful or serious frame does not affect the user engagement. However, certain player characteristics do have an influence on the user engagement with such serious games, like gender, play literacy, and the type of games you play. These findings have both scientific and practical implications for the design of persuasive serious games and future research on persuasive serious games. These implications include that serious game designers should differentiate between educational serious games and persuasive serious games when it comes

to the effects of framing, and they should take into consideration their target audience's gender and whether they usually play core or casual games. Future research could examine the differences between the various types of serious games and how framing may be used to increase the user engagement with them. Such future studies could also provide more insight into the factors contributing to a user's play literacy, such as gender, and whether they have dealt with poverty in their lives.

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Appendices

Appendix 1: Information Letter

Study Name	Principal Investigators	Supervisor
Gaming study	Femke van der Riet	Karin Slegers

Dear participant,

We kindly ask your participation in a study regarding games. This study is part of the master thesis research of a student in the New Media Design track of the Communication and Information Sciences master's program offered by Tilburg University. This information letter provides all information you need before you decide whether to participate in this study. Please read the information in this letter carefully and contact the principal investigator if you have questions or need more information to participate in this study.

Aim & procedure

This study focuses on playing games. During the study, you will first complete a short questionnaire, after which you will get to play a game. Once you have completed the game, which takes roughly 15 minutes, you will fill out a more elaborate second questionnaire. The expected duration of the entire study is 30 minutes. After answering the final questionnaire, you get a debriefing that further discusses the rationale of this study.

Data collection & privacy

This study has been approved by the Ethical Review Board of Tilburg School of Humanities and Digital Sciences. There are no physical or psychological risks involved. There are no right or wrong answers; all data is valuable. Your participation in this study is voluntary and

is fully anonymous: the only personal details that are collected are your age and gender. Furthermore, we will record your answers to the questions in the questionnaires. No data will be collected while you are playing the game. All data that we collect will be stored anonymously so they can never be traced back again to you. The data will be stored offline on a secure storage device.

If you decide to take part in this study, you are still free to withdraw at any time, for any reason, with no costs. If you withdraw from the study before or after data collection is completed, all data will be destroyed. If you do take part, your data are anonymously added to a dataset and will be stored for a period of ten years. After that, the dataset will be destroyed. Data will only be shared within the research team, consisting of the principal investigators and their supervisor.

Compensation

If you are registered in the Human Subjects Pool of Tilburg School of Humanities and Digital Sciences, you will receive 0,5 credits for participation in this study.

Contact information

If you have questions after this study, or if you experience adverse effects as a result of participating in this study, please feel free to contact the principal investigators whose contact details are provided at the top of this letter.

If you have any remarks or complaints regarding this research, you may also contact the "Research Ethics and Data Management Committee" of Tilburg School of Humanities and Digital Sciences via tshd.redc@tilburguniversity.edu

Before you start this study, please make sure you are in a quiet, empty room which offers no distraction. Also, please put on a pair of headphones, you will need them for playing the game.

Appendix 2: Informed Consent

Study title: Gaming study

Please read this text carefully. Your explicit permission is required for participation.

You must be at least 18 years of age to give your consent to participate in research.

The information letter provided all the necessary information to decide to take part in this study. If you have any further questions about the study, the information letter or the informed consent please contact the principal investigators.

In this informed consent, we would like to ask you to confirm the following statements:

- I have read and I understand the provided information in the information letter. I have had the opportunity to ask questions. I have had sufficient time to consider my participation. I understand that my participation in this study is voluntary and that I am free to withdraw from the study at any time if I want to, without giving a reason and without costs.
- I give permission to process my data without being linked to my personal details for the research described in the information letter.
- I give permission to store my research data for a period of 10 years.
- I voluntary agree to participate in the current research study.

By selecting ‘I agree’, I consent to the conditions described above.

-I agree

-I don’t agree

Appendix 3: Instructions Game, Serious Condition

You are about to play a serious game. The purpose of this game is to make players aware of the struggles of those that deal with poverty and money problems. You will need headphones in order to play this serious game. Playing the game will take about 15 minutes total. Please click the link below to start the game:

http://playspent.org/

Once you are finished, please return to this survey and click next.

Appendix 4: Instructions Game, Playful Condition

You are about to play an entertainment game. The goal of this game is to challenge the players to manage their small home budget as well as they can. You will need headphones in order to play this game. Playing the game will take about 15 minutes total. Please click the link below to start the game:

http://playspent.org/

Once you are finished, please return to this survey and click next.

Appendix 5: Serious Game Attitude Scale

All items are measured on a 5-point Likert Scale (1 = “I completely disagree, 5 = “I completely agree).

1. Affection
    1. I am very interested in solving problems in games.
    2. If there are any unresolved issues in games, I will continue thinking of them at another time.
    3. If I encounter a problem that I do not understand while playing a game, I will keep trying until I find the answer.
2. Behavior

1. Playing a game makes me feel happy.
2. Playing games is part of my life.
3. I kill time by playing games.
4. I talk about games with my friends in my spare time.

Appendix 6: Gaming Experience Scale

Items measured on a 5-point Likert Scale.

1. Rate your level of experience with video games. (1 = "I have never played video games", 5 = "I have played video games a lot")
2. I would describe myself as a gamer. (1 = "I completely disagree", 5 = "I completely agree")

Other questions.

1. How many hours a week do you play video games? (none, 0-5 hours, 6-10 hours, 11-15 hours, more than 15 hours)
2. Which games do you play? (open-ended question)

Appendix 7: User Engagement Scale

All items are measured on a 5-point Likert Scale (1 = "I completely disagree, 5 = "I completely agree).

1. Interacting with the game made me feel relaxed.
2. Interacting with the game was a pleasant divertissement.
3. The game was a welcome diversion from other obligations.
4. The game was a pleasant pastime.
5. The game was exciting.

6. Interacting with the game was an appealing task.
7. I would have liked to interact longer with the game.
8. The game awoke my interest.

Appendix 8: Debriefing questions

1. Were you already familiar with the game you just played, called Spent?
    a. Yes
    b. No
2. Have you experienced, at any point during your life, poverty?
    a. Yes
    b. No
    c. I'd rather not say
3. Has someone you know experienced poverty?
    a. Yes
    b. No
    c. I'd rather not say

Appendix 9: Written debriefing

The aim of this study was to investigate the influence of attitude towards serious games and previous gaming experience on the engagement in serious games, and if this influence is moderated by the way the game is presented.

Depending on the experiment condition you were in, you either received instructions that you were about to play a serious game, with a serious purpose, or that you were about to play an entertainment game with an entertaining purpose. The game you played however, was the same game for both conditions. This game is a serious game, with the intention to create

more empathy and respect for people who live in poverty, to shine a light on their hardships and to make those who do not have to worry about their money more aware of all of the different challenges poor people face.

Your attitude towards games and your previous gaming experience were measured before playing this game, and the engagement you felt with the game was measured afterwards, These measures will provide insight into the influence attitude and previous gaming experience have on the engagement of a serious game, and whether how this game was presented to you had an effect on this influence.

We kindly thank you for your participation in this study.