The Hunt: Exploring the role of player involvement in fostering empathy using a virtual reality game.

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ABSTRACT

In a world where technology is often blamed to cause violence and lack of empathy, technological interventions to foster empathy are starting to get proposed by designers. Various ways seem to exist to foster empathy through technology. This study explores the possibilities of virtual reality within this context. Although studies on this application of VR exist, few efforts have been put in to add the power of play to this formula. By looking at player involvement in a self-made virtual reality game about rhino poaching, the fostering of empathy and immersion has been studied. Participants were exposed to two versions of the same VR game with the same storyline, with the difference being that the player fulfills an active of a passive role in the experience.

The results indicate that there is no significant difference between an active role in a virtual reality game on creating empathy in comparison to a passive role. Both versions of the game have the same effect on empathy. But there is a correlation between presence, autonomy and emotion and empathy. This finding can be used in further studies.

Author Keywords

Virtual Reality; Persuasive Technology; Empathy; Games; Behavioral Change;

ACM Classification Keywords

K.8.0 [General] Games.

INTRODUCTION

Empathy is defined as the degree to which a person identifies and sympathizes with a victim and feels

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emotional distress [2]. With the world becoming smaller by becoming more connected, the role of empathy seems to become more important than ever. However, a recent study has shown that since 2000 the empathic concern in American college students has sharply dropped [15]. While the causes of this development are probably diverse, the increased usage of technology and new media seems to play a substantial role [15]. People spend a considerable amount of their everyday life on the internet, leading to a 350% increase in information traffic outside of working hours [6]. 'With so much time spent interacting with others online rather than in reality, interpersonal dynamics such as empathy might certainly be altered', a study by Anderson et al. [2] argues.

The aspects of technology that might cause empathy to decline are numerous, but one of the bigger concerns that exists is the effect that video games are claimed to have [23]. Meta-analysis on the effect of violent video games has revealed a relation between game exposure and lack of empathy [2]. However, studies have also shown that the effective use of games can influence real life behavior and attitude positively [11]. These so-called 'persuasive games' present multiple opportunities to foster empathy [17,6,21,13,16]. Persuasive games use the qualities of play such as their goal driven nature and opportunities for role-taking to encourage players to see new perspectives on the world they inhabit.

Another factor that has been proven to increase the persuasive quality of a game is immersion [16]. Recent studies have shown that virtual reality (VR) can be used to bring this immersion to another level and allow people to experience different perceptions by reproducing them in a first-person perspective [5]. VR thereby enables individuals to experience deviant perspectives more easily.

Although research has been conducted on increasing empathy through VR, this has mostly been done for documentaries [18]. Therefore, opportunities lay in defining the effects on empathy through actively engaging in a virtual reality game. This study aims to explore the role of player involvement in fostering empathy, exploring the possibilities a virtual reality game offers.

RELATED WORKS

In research, VR is often used to increase immersion and to create a feeling of being present in the virtual world [16]. The challenge, interactivity, realism, fantasy, cooperation and especially immersion are benefits that are created by games and simulations, and can be used to transfer a persuasive message or foster empathy [20]. Virtual Reality is often used to let someone experience someone else's point of view which can stimulate empathy. An example of this is creating empathy for red-green color blindness in VR [2]. Embodied experiences, with a red-green color blindness filter in VR, were being compared to traditional perspective taking in three different experiments. These experiments mostly consisted of a color matching exercise in which participants matched red or green colored screws with holes with respective colors on a board. After the exercise the participants were asked to help a color-blind person, so the empathy is measured by looking into the helping behavior. The study shows that participants who experienced the virtual color blindness found the experience to be more vivid and more realistic. The Interpersonal Reactivity Index, which measures the personal differences in feeling empathy, also had an effect on the outcome. The people with a lower value developed more positive attitude towards people with colorblindness, even after 24 hours after the experiment. Additionally: There was also twice as much helping behavior when VR was used.

Another study that explored creating empathy through virtual reality is the game 'A Breathtaking Journey' [16]. It is a mixed-reality game, meant to create empathy for refugees. The player is a refugee who is hiding in a back of a truck that is transporting mandarins, fleeing from a war-torn country. This study focused on multi-sensory experiences, which means that the researchers add other senses. In this case feeling of a 'real' truck setting and smell. Besides using an Oculus Rift virtual reality headset, an installation was built to resemble the back of a truck including a tiny window where players could peek at the outside. Also, a mask was made to diffuse the scent of mandarins and pick up the breathing of the participants. The game was exciting, as the participants could get caught when their breathing was too loud in the physical world. The outcome of the research was that emotions and physical stimuli, real or simulated, may mutually influence and reinforce each other.

All studies listed above have a quality in common: all studies take advantage of the qualities of play. In his work 'Homo Ludens' [12], J. Huizinga describes the game environment as 'a temporary world within the ordinary world, dedicated to the performance of an art apart'. This temporary world also called the 'magic circle', allows for a unique mindset in which the player functions by the rules of the game, and is open for new information.

Previous research by P. Zak suggests that oxytocin induces empathy, and that empathy resolves in generosity [26]. He found that during storytelling two kinds of emotions are felt: distress and empathy. Distress causes the body to release cortisol and experiencing empathy results in the body releasing oxytocin. Participants were asked to donate money to a charity, after being exposed to a story. The study shows that the more cortisol and oxytocin the participants had released, the more money they would donate. Other work shows that prosocial behavior, like volunteering and donating to charity, is stimulated by the experience of empathy [9,8]. These studies clearly state that the experience of empathy leads to action, and that storytelling can be a useful tool to achieve this.
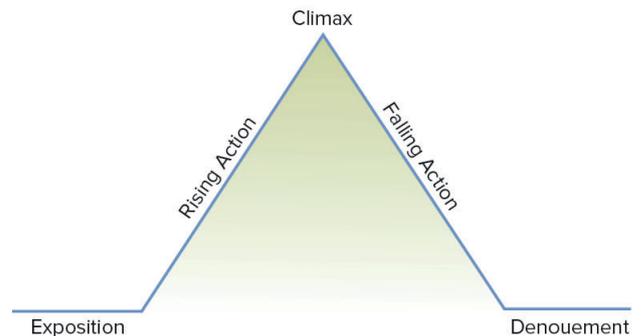

Fig. 1 - The Dramatic Arc [24]

Multiple studies are dedicated on how to write a good and emphatic story. In the research of Zak [26], storytelling was examined in detail. There was concluded that when stories followed the dramatic arc [10], the brain releases chemicals. Cortisol is released when tension appears in a story, this makes people pay attention. If the attention is sustained long enough, people start to identify with characters in the story. The identification, or transportation, causes the brain to release oxytocin [24]. As previous studies have shown, leads the oxytocin release to empathy. The game that was created for this study also uses the principle of the dramatic arc [10] and is written as a tragedy [7].

METHODS

The Hunt

In two experiments the following research question was tested: *What is the effect of an active role in a virtual reality game on creating empathy in comparison to the effect of a passive role?* To investigate these effects, a virtual reality game called the Hunt has been developed specifically for this study. The theme and storyline were taken in account in order to design a game that creates as much empathy as possible, while raising awareness for Wildlife Crime in Africa. The near extinction of the rhino and the seriousness of illegal poaching [3,25] has been chosen as theme for the game because of its high potential for fostering empathy. Because the research is based on the difference in effect of a passive or active role in a virtual reality game, two versions of the game were designed. This way the participants could play the same game, but with a different level of involvement.

In the game, the player plays as a rhino poacher, while being supported by a non-player-character (NPC). Two variants of the game were used during the study. In these games, a distinction in player-role has been made. In the active variant (AVR) the player has to carry the gun and eventually shoot a rhino; in the more passive variant (PVR) the NPC carries the gun and the player follows the NPC around and watches the NPC shoot the rhino.

Fig. 2: Screenshot of 'The Hunt'

This game is based on the concept of 'procedural rhetoric', created by Ian Bogost [5]. Procedural rhetoric is based on the notion that the processes and activities that interactors engage in during play are more persuasive than the information that is layered on top of those processes [11]. In other words, the players' behavior can change by playing the game actively. By experiencing rhino poaching, players have the opportunity to gain a new perspective about the situation and what they can do about it. Because this study is based on creating empathy, the storyline is based on the dramatic arc [10]. At the start of the game, a short verbal introduction is given in which the main characters (the player and the companion hunter) are introduced. The action rises when the player starts hunting the rhino. The climax occurs when the rhino gets shot by the player or the companion hunter. The climax suggests that the experience is finished, but afterwards an end scene is initialized. The falling action and denouement (conclusion) appear here, as the player is confronted with the consequences of his actions. By using a tragedy [7], the player is confronted with disturbing facts on illegal poaching, which could result in empathy outside of the game.

In conducting this study, two test sessions took place. Session one was executed at Enversed, a virtual reality center in Eindhoven. Session two was executed on Demo Day, a technology exhibition at the department of Industrial Design of Eindhoven University of Technology.

For this study, a quantitative approach was chosen due to the limited amount of time of participants could spend in our game, along with the need to be able to generalize the results of this study. Furthermore, a quantitative approach allowed for more control over what questions were asked to make sure the approach was consistent for each participant. The questions are mostly based on validated questionnaires, as is further elaborated on in the section measurement instruments. In this study, only the short-term effects of the virtual reality game are addressed.

Materials
The experience was delivered using an HTC Vive VR headset along with the Vive controllers, a pair of Bose QuietComfort 25 headphones and two versions of the VR game 'The Hunt'. Laptops were used to fill in the two surveys.

Measurement Instruments
A survey has been taken by the player before (I) and after (II) the game to assess change in affective state. Questions about demographics, attitude, presence, autonomy, empathy and the game itself were being asked. If the questions were not validated the Likert Scale 7: Fully Disagree <> Fully Agree was used.

There are two surveys used:
I: Demographics and attitude
II: Attitude, presence, autonomy, empathy and positive/negative emotions

Attitude
To get a clear insight of the participants' attitude towards rhino poaching, questions about the current attitude are asked beforehand. Afterwards the same questions about the cause are asked and compared to see if their attitude is changed after the experience. The questions were made by the research team, to make the questions specific to rhino hunting.

Presence
The Igroup Presence Questionnaire (IPQ) [22] is a scale for measuring the sense of presence experienced in a virtual environment. The scale has been constructed using a large pool of items and two survey waves with approximately 500 participants. Originally constructed in German, the scale is now also available in English and Dutch.

Autonomy
The questions of the autonomy questionnaire are taken from Peng, W., Lin, J. H., Pfeiffer, K. A., & Winn, B study [19]. This way, a validated method to research autonomy in a game has been put in place.

Empathy
The questions used in this questionnaire are inspired by The Game Experience Questionnaire [14].

Positive/Negative Emotions
The questions used in this questionnaire are inspired by The Game Experience Questionnaire [14]. These questions play in on the feelings of the participant. These can lead to more in depth knowledge about findings in the empathy questionnaire.

Session I - Enversed

Thirteen participants (3 women, 9 men), ages vary in categories of 18-25 to 50+ years, were recruited out of groups that were playing other VR games. The participants were asked for help with a study by playing our game. A survey was filled in before and after playing the game. One participant had to be excluded from the analyses because of data loss.

Arriving participants were randomly assigned to one of two experiences: AVR or PVR. The participants were tested individually and started prior to the experience (AVR or PVR) with filling in survey I. After this, the participants received a short explanation of what had to be done in the game (without giving them information about the cause), how to walk in the virtual reality environment and how to shoot (only in AVR). After the explanation, the Vive headset was placed on the participant, followed by the pair of headphones and the experience began. While one participant was playing the game, another participant was asked to start filling in survey I. This made sure that there were no waiting times and the research flow went smoothly. After the participants finished listening to the end scene in the game, they were asked to fill in survey II.

Session II - Technical University Eindhoven

Eighteen participants (9 women, 9 men), with ages varying in categories of 18-25 to 40-50 years, were recruited when they visited the game setup during Demo Day. The visitors were asked to experience virtual reality and take part in this study. Participants who agreed to take part in this study were asked to fill in a survey before and after playing the game to participate in this study.

Hypothesis

For the situation as described in the method section, two

outcomes were considered likely. Yet a clear consensus on which hypothesis was considered most likely could not be reached.

The first hypothesis suggests that the active involvement in the VR experience increases the attitude change created by

participants. Making the active version of the game more effective in creating empathy. The second hypothesis revolves around the 'magic circle' effect [12]. The magic circle effect could reduce the sense of responsibility, thus decreasing the attitude change created by the VR game. Making the passive version more effective in creating empathy.

RESULTS

The outcome of the surveys are being analyzed using the software SPSS. For all the different surveys used (Attitude, presence, autonomy, empathy and positive/negative emotions) a reliability analysis is executed. In table 1 the respective Cronbach's alpha of each survey can be seen.

Survey	Cronbach's alpha
Attitude Before	0.652
Attitude After	0.519
Presence	0.827
Autonomy	0.793
Empathy	0.693
Emotions	0.675

Table 1: Reliability Analysis

A low value of the Cronbach's alpha can be seen, in the 'Attitude After' questionnaire. This can be related to the fact that this survey was not validated. The Attitude Before, Empathy and Emotions questionnaire almost hit 0.70 and can be seen as moderate reliability. The Presence and Autonomy questionnaire are reliable, as their alpha is above 0.70.

To look into the differences in attitude change between group A and B an ANCOVA was carried out. As seen in Table 2. An ANCOVA controlling for the active and passive group showed no significant effect of condition on attitudes before and after playing the game; $F(1,27) = 0.350$, $p = .559$.

Not only attitude change is being compared within Group A and Group B, also the means of Presence, Autonomy,

Tests of Between-Subjects Effects

Dependent Variable: AttitudeAfter_Mean

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	15,235[a]	2	7,618	25,270	,000
Intercept	2,763	1	2,763	9,165	,005
AttitudeBefore_Mean	14,165	1	14,165	46,989	,000
group	,105	1	,105	,350	,559
Error	8,139	27	,301		
Total	701,833	30			
Corrected Total	23.374	29			

Table 3: Independent Samples Test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
AutonomyMean	Equal variances assumed	,693	,412	,237	28	,815	,08889	,37546	-,68021	,85798
	Equal variances not assumed			,237	26,723	,815	,08889	,37546	-,68186	,85964
EmpathyMean	Equal variances assumed	,247	,623	,938	28	,356	,22857	,24380	-,27082	,72796
	Equal variances not assumed			,938	27,730	,357	,22857	,24380	-,27104	,72818
EmotionMean	Equal variances assumed	,025	,876	1,104	28	,279	,22051	,19973	-,18861	,62964
	Equal variances not assumed			1,104	27,999	,279	,22051	,19973	-,18861	,62964
PresenceMean	Equal variances assumed	,663	,422	,079	28	,938	,02381	,30193	-,59466	,64228
	Equal variances not assumed			,079	26,722	,938	,02381	,30193	-,59599	,64361

Table 4: Independent Samples Test

Empathy and Emotions were compared by means of a Independent Samples Test (Table 3). In Levene's test for equality of variances and the t-test. The significance of all four subjects are above 0.05, which indicates the two groups insufficiently.

The correlation between the several parts of the survey can also be interesting to look at. The Attitude Change of each group was calculated by subtracting the mean of the Attitude Before from Attitude After (AttitudeAfterMean - AttitudeBeforeMean). In Table 4, in order to apply for a correlation, a significance of 0.01 between the result is expected. Interesting is the correlations linked to empathy. Both presence, autonomy and emotion seem to have significant a significant correlation:

Empathy and Autonomy $r(30) = .556$, $p < 0.001$
Empathy and Emotion $r(30) = .659$, $p < 0.001$
Empathy and Presence $r(30) = .690$, $p < 0.001$

DISCUSSION

For this research, two hypotheses were drawn. The first hypothesis is that an active involvement in the VR experience increases the attitude change and is more effective in creating empathy. The second hypothesis is that the magic circle effect could reduce the sense of responsibility, thus decreasing the attitude change created by the VR game and making the passive version more effective in creating empathy. From the ANCOVA can be concluded that there are no significant differences between active and passive group in attitude change. This means that both hypotheses are rejected. When looking at the t-test between the topics, one notices that there is no significant difference between the active and passive group for either the autonomy, empathy, emotion or presence survey. However, there was verified that the use of a virtual reality experience can foster empathy

Correlations

		AttitudeChange	AutonomyMean	EmpathyMean	EmotionMean	PresenceMean
AttitudeChange	Pearson Correlation	1	,126	,209	,134	,185
	Sig. (2-tailed)		,506	,268	,479	,328
	N	30	30	30	30	30
AutonomyMean	Pearson Correlation	,126	1	,556**	,659**	,690**
	Sig. (2-tailed)	,506		,001	,000	,000
	N	30	30	30	30	30
EmpathyMean	Pearson Correlation	,209	,556**	1	,742**	,639**
	Sig. (2-tailed)	,268	,001		,000	,000
	N	30	30	30	30	30
EmotionMean	Pearson Correlation	,134	,659**	,742**	1	,675**
	Sig. (2-tailed)	,479	,000	,000		,000
	N	30	30	30	30	30
PresenceMean	Pearson Correlation	,185	,690**	,639**	,675**	1
	Sig. (2-tailed)	,328	,000	,000	,000	

Table 5: Correlations

Out of the correlations between presence, autonomy, emotion and empathy some interesting conclusions can be drawn. The results indicate that empathy can be influenced by creating presence, autonomy and emotions in a game. Or that presence can be influenced by adding autonomy, empathy and emotions and so on. From this it can be concluded that the developed VR experience effectively influences these factors.

Design Opportunities
While conducting our study some aspects of the game, that could have influenced the results, surfaced. First, the duration of the game was too long. This created boredom for some of the participants, especially with the passive version. Also, some of the participants needed vocal guidance, while playing the game. The fact that they got more information than other participants, could have influenced the dataset.

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Attitude1After	23,0333	21,137	,320	,446
Attitude3After	22,8333	20,695	,302	,456
Attitude4After	26,0333	25,137	,002	,622
Attitude5After	24,0000	18,759	,630	,298
Attitude2After_r	22,2667	23,651	,322	,460
Attitude6After_r	24,5000	23,155	,198	,508

Table 5: Item Total Statistics

The attitude questions in the survey's are not validated, this could also create a blurred outcome. When looking at the Cronbach's alpha values of this part of the survey, one notices that question 4 has been inconsistently filled in (Table 5). The question in question has a grammatical error which makes it easy to misinterpret. There has been decided to leave this question out of the conclusions to avoid incorrect results.

For further research, the above notions can be kept in mind. Furthermore, the correlations between presence, autonomy, emotion and empathy can be assessed. To influence one of these subjects in a game, the other subjects can be altered. For example, for the creation of a game with great presence autonomy, emotion, and empathy should be included. If one of these subjects is influenced, the presence should be influenced as well.

The game could be more active by providing more choices. The player was not able to choose if actions were executed in the game, the game made the decisions for him. It is unclear what the outcome would have been if the player had made the decision to shoot the rhino on own initiative.

CONCLUSION
While the use of social media is rising, empathy levels are dropping. Social media gives people the opportunity to interact online more often, yet this relates to them not being able to easily relate to others anymore. The immersiveness of Virtual Reality seems promising for creating empathy, as the opportunity to almost literally stand in someone else's shoes is given to the player. This can be achieved by

watching a documentary, but also by playing games. These games, *persuasive games*, are already often used to communicate issues and values. These persuasive games can also be applied in Virtual Reality and add extra immersion in the game aspect. Some studies have already been executed to explore persuasive elements in VR, but little research has been done that focusses on the role of a player in a game and its relation to empathy.

A game was created called "The Hunt", a game that focusses on rhino poaching in Africa. With this custom made game, the difference in effect of an active role in a virtual reality game on creating empathy in comparison to a passive role was examined. The game consists of two different versions: an active and a passive one. In the active version, the player carries a gun in VR and eventually shoots a rhino. In the passive variant a NPC carries the gun and the player follows the NPC around and watches the NPC shoot the rhino. A quantitative study was conducted at Enversed and the Demo Day at the faculty Industrial Design of the Technical University of Eindhoven to assess the difference in effects of the two versions. This quantitative study consists of two surveys. To measure attitude change, one survey is conducted before playing the game and one after playing the game. The results have been analyzed using SPSS.

Using an ANCOVA test, it can be concluded that there is no significant difference between the active role in a virtual reality game on creating empathy in comparison to a passive role. Both versions of the game have the same effect on empathy.

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