The Effect of a Persuasive Game on Attitude Towards the Homeless

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ABSTRACT
To investigate whether a persuasive game may serve as a way to increase attitude towards the homeless, this study examined the effects of persuasive mechanics in a video game designed to put the player in the shoes of an almost-homeless person. Data were collected from 5139 students in 200 middle/high school classes across four states. Classes were assigned to treatment groups based on matching. Two treatment conditions and a control group were employed in the study. All three groups attitude scores decreased from the immediate posttest but the game group was significantly different from the control group in a positive direction. Students who played the persuasive game sustained a significantly higher score on attitude after three weeks. Overall, findings suggest that when students play a video game that is designed using persuasive mechanics an attitude change can be measured empirically.

Categories and Subject Descriptors
K.8.0 [**General**]: Games

General Terms
Experimentation

Keywords
Attitude, Persuasive games, Quasi-experimental

1. INTRODUCTION
Approximately 3.5 million people, 1.35 million of them children, are likely to experience homelessness in a given year in the U.S. [1]. On any given night 656,000 to 744,313 people experience homelessness [1]. Due to the recent foreclosure crisis, homelessness has been on the rise, and families living on the edge of homelessness face more and more tough choices every day. In 2003 children under the age of 18 accounted for 39% of the homeless population, and the number of homeless families with children has increased significantly over the past decade [1, 2]. People who suffer from homelessness are white, black, Asian, Hispanic, working full time, unemployed, veterans, addicts, and teenagers with all levels of education – these are similar demographics to people that play video games.

To investigate whether a persuasive game may serve as a way to change attitude towards the homeless, this study examined, experimentally, the effects of persuasive rhetoric and ethos in a video game designed to put the player in the shoes of an almost-homeless person for thirty days. Data were collected from 5139 students in 200 middle and high school classes across four states. A short game that included persuasive rhetoric and ethos aimed at increasing positive attitude towards the homeless was used. Classes were assigned to treatment groups based on matching. Two treatment conditions and a control group were employed in the study. A control group only participated in the measures. The reading group read a short first-person story about being homeless for a night and the game group played *Spent,* a publicly available video game developed by the Durham Homeless Coalition. Prior to completing the treatments half of the participants took a pretest consisting of the *Attitude Towards the Homeless (ATHI)* [3] measure based on a Solomon design. Immediately after treatment all participants took the posttest. Three weeks later all participants retook the same test.

The findings indicate that playing the game did not appear to immediately change student's attitude towards the homeless score significantly. Moreover, reading about homelessness appeared to negatively affect student's homelessness attitude score significantly. After three weeks the game group scores significantly higher on the ATHI than the control group but was not significantly different from the immediate posttest. After three weeks the reading group did not score significantly different than the control group on the ATHI nor were the scores significantly increased or decreased from the immediate posttest or the pretest. Findings indicate that students who played the persuasive game *Spent* sustained a higher score on both the ATHI after three weeks. Moreover, the level of initial change in the game group was negatively correlated to the grade of the student for the ATHI. Overall, findings suggest that when students play a video game that is designed using persuasive mechanics an attitudinal change can be measured empirically. This paper describes the design, implementation and results of the study.

2. PERSUASIVE GAMES
Persuasive games have been studied in various contexts with differing definitions over the past forty years. Predating the invention of the computer, humans have used play and games for teaching necessary skills and socialization for millennia [4, 5] Games explicitly created to change attitudes and behavior date back to 1790, when British publishers of the *New Game of Human Life* advised parents to play the board game with their children and "request their attention to a few moral and judicious observations explanatory of each character as they proceed & contrast the happiness of a virtuous and well spent life with the fatal consequences arriving from vicious & immoral pursuits" [6].

In 1843 a board game released in the US called *Mansion of Happiness* gave instructions that instructed players to make good and moral decisions to gain the seat of happiness. Moreover, Milton Bradley created the *Checkered Game of Life,* in 1860 with the intention "to forcibly impress upon the minds of youth the great moral principles of virtue and vice." While a commercial success that helped launch Bradley's board game business, there is no evidence that it had any moral affect on the minds of children [6,7].

The 1960s and 1970s witnessed a surge of multiplayer simulations. Given credibility by the Rand Foundation, which developed a number of persuasive games for use in the Cold and Vietnam wars, most of these were intended for education, training, and exploring alternative courses of action [5] with some persuasive purposes. For example, sociologists at Johns Hopkins developed *The Life Career Game, The Family Game, The Representative Democracy Game, The Community Response Game* and *The Consumer Game* with game aims at the player learning the necessity to defer gratification through persuasion techniques [8].

Persuasive games today are an established part of video game landscapes. They have attracted the attention of the media, academics and funding agencies [9, 10, 11, 12]. Websites, both academic and commercial, feature persuasive games such as: Ben Sawyer's Serious Games Initiatives website which has a repository of information about serious games (including persuasive games) and has served as a news source since 2002. Ian Bogost has established a commercial site, www.persuasivegames.com and a non-commercial site www.watercoolergames.org to serve as a forum for the uses of video games in advertising, politics, education and other everyday activities. In 2008 serious game creators and scholars Mary Flanagan and Helen Nessenbaum launched www.valuesatplay.org to harness the power of video games in the service of humanistic principles. To achieve this goal Values@Play sponsors an annual "Better Game Contest" and encourages developers to consider the effects of their games and to include positive principles like equity, creativity, diversity, and negotiation [13].

Persuasive games are not new. Persuasive board games that aim at having children make moral decisions have been around since the 18th century and continued to evolve to the current incarnation that is appearing in video games. But why is the history of persuasive games important to understand? Given that the idea of persuasion is not new, it is important to understand the history of persuasive games because the purpose of this study was to investigate the short term and long term effect that playing a persuasive game had on the attitude towards the homeless on adolescents in grades 7-12. Following this brief discussion of persuasive games in history and current culture, it is important to describe exactly how persuasive games persuade.

2.1 How Persuasive Games Persuade

How can video games "modify or change values, wants, and beliefs of others"? Once again, this study was not about changing behaviors, but beliefs; it is important to note that behavior change is different than attitude change. Attempts at analyzing persuasion date back to ancient Greece; according to Aristotle persuasion is achieved through rhetoric, and three parts that include ethos, pathos, and logos [14]. Ethos uses claims about the persuader's moral character and his or her trustworthiness, an important aspect of the persuasion process if it is to be effective [15]. Pathos is an emotional appeal to secure the goodwill of the listener while logos is the reasoned argument that appeals to the listener's rational mind. Aristotle's categorization has been elaborated over time but is still useful for analysis of persuasion [11]. An important addition to the definition of persuasion is Burke, who in 1969 defined it as "the use of words by human agents to form attitudes or induce actions in other human agents". While the term 'words' is limiting, Burke does also include non-verbal means of communication.

However, decades of research on advertising and marketing have confirmed that persuasion is a complex phenomenon dependent on many interrelated factors that make the cross-effects of these factors difficult to separate [16]. Factors such as the interest of receivers of the message, their level of education, their knowledge of the issue, their cultural background, their feelings about the originator of the message, the medium used for the persuasive message, and competing factors all influence the success or failure of an attempt at persuasion [16]. Persuasive games use several mechanisms of persuasion that have been posited by game researchers, including: immersion, flow, engagement, persuasive rhetoric, and persuasive ethos.

2.1.1 Immersion

Immersion is the experience of being transported to an elaborately simulated place that takes over all attention and becomes enveloping [17]. Technology has increased the power of immersion through video games, "it seems that games as persuasive technology hold much promise for changing people's attitudes: games are by nature interactive, and people tend to retain more impressions" [18]. Related to immersion is the concept of agency, which Murray describes as the satisfying power to take meaningful action and see the results of our decisions and choices. Agency helps immersion build when our actions in the video game are appropriate to the game narrative, strengthening the belief in the consistency of the game world.

2.1.2 Flow

Flow has been a theory posited by some game theorists [19] that games are compelling because players are in a highly energized state of concentration and focus [20]. Flow is achieved when the level of the challenge and the level of the player's skill in in dynamic tension, creating a highly focused state of mind. Amory posits that the player can assimilate tacit knowledge through the process that is then assimilated and constructed after emerging from the state of flow.

2.1.3 Engagement

Engagement is closely related to flow where the player finds the game so engrossing that they assimilate facts and values without realizing they are doing so [21]. Research [22, 23] supports the claims made above that games increase engagement through flow, immersion, and agency. Accordingly when players are more engaged with the game, they are more likely to see the situation from the perspective presented in the game. Yee and Bailenson placed college age students in a virtual environment where they used avatars that resembled elderly people. The researchers tested the attitudes of the subjects towards the elderly and found that the computer simulation increased empathy toward people with similar traits to that of the avatar and decreased players' stereotypes of the elderly. Another study on engagement by Goldsworthy, Barab, & Goldsworthy found that adolescents with ADHD who played a simulation game performed significantly better than the control group on measures of engagement. Both of these studies demonstrate that games with a persuasive message can affect engagement through manipulation of the immersion elements within the game context.

2.1.4 Procedural Rhetoric and Ethos

Both procedural rhetoric and ethos are Aristotelian theories of persuasion updated by Bogost and Evans. While Bogost defines procedural rhetoric as "the practice of using processes persuasively" (p.2), Evans argues that rhetoric is not enough and includes ethos or "persuasion by empathy, fact, and integrity" (p.71). The *McDonald's Videogame* and the *Redistricting Game* are used to demonstrate where procedural rhetoric and ethos are exhibited through gameplay. The *McDonald's Videogame* is an anti-advertising game, where games are a satire of specific companies and their business practices [24]. The player has four views including the farmland, the slaughterhouse, the restaurant, and the corporate HQ. From each of these views the player is given options as the McDonald's CEO whether or not to do morally questionable things such as plowing over rainforests or feeding the player's cows other cows. Characterization of Ronald McDonald as portrayed by an essentially evil looking Ronald, in addition to the opening directions, make it clear to players that they are not taking a moral stance by being a McDonald's CEO.

By demonstrating that every action in the game has consequences, which are built into the game structure by the designers, the rhetoric and ethos of these procedures not only allow the player to learn through game play but also are a more effective and longer-lasting way of assimilating information [11]. While Evans argues that rhetoric alone is not enough, his use of the *Redistricting Game* to demonstrate the power of procedural ethos is important to this study because it examines not only the message being sent but the messenger and the final outcome for integrity, empathy, and fact. *The Redistricting Game* has the player redraw the lines in a political redistricting simulation. The player experiences first hand not only how the system works but also how it is open to abuse depending on the party the player chooses, the votes he or she covets, and the tenets of good governance that are being supported. As discussed above procedural ethos is a large part of this game as it creates both moral and ethical questions about redrawing district lines. Moreover, the player needs to make judgments about redistricting based on their constituents and prior knowledge. The mechanisms that make a persuasive game work as a persuasive tool can be seen through current examples of persuasive games. The next section examines games that are currently on the Internet that persuade toward a certain ideology.

2.2 Measuring Impact

Having established how games can persuade is there a way to determine how effective they are? How many students who play *Food Force,* a game that puts them in the shoes of a World Health Organization food worker and that has been downloaded 4 million times [25] retain an interest in the politics of food distribution after game play concludes? *America's Army,* a game developed by the U.S. Army, has had players dedicate more than 160 million hours of game time [26] but how many of those players actually enlist in the Army? Games that are intended to lead to actions are easier to evaluate because you can measure the effect. For example, the effectiveness of a game that is aimed at persuading people to visit a website can be calculated by the number of players who clicked through from the game to the website.

When measuring a game without such concrete goals, such as the intention to influence the players' attitude, this influence is more difficult to measure. While O'Keefe states that persuasion can be measured by comparing attitudes other persuasion theorists such as Miller flatly state that no means exist for directly observing or measuring an attitude where only a minimal relationship is often observed between indicators and attitudinal behaviors. According to Miller [27, p.14] "persuasion is seldom, if ever, a one-message proposition; people are constantly in the process of being persuaded." This impacts the study, as there is a lack of generalizable empirical studies in gaming research that the researcher was able to locate that have shown a measure for persuasion in relation to playing a game one time and most other evidence was anecdotal rather than empirical.

The game *Bronchi the Brachiosaurus,* [28] aimed at increasing content knowledge about rescue skills for asthma and self-efficacy in taking care of asthma needs, is one example. Measuring persuasive games should take into account that superficial attitudes and deeply held beliefs and values are constantly in flux [21]. Inasmuch, this study examined the effect of playing the game on affective learning processes (as described previously) and attitude towards the homeless that is directly related to gameplay.

When measuring a game without such concrete goals, such as the intention to influence the players' change in attitude towards the homeless by experiencing what it's like to be almost homeless, this influence is more difficult to measure. In order to measure a change in attitude towards the homeless by playing a persuasive game the first step is to establish whether or not there is a significant change when playing a game designed to be extremely persuasive through the use of both mechanics and topic. Thus, the following research question was proposed:

> *R1: To what extent does attitude towards the homeless differ immediately* ***and three weeks*** *after playing the persuasive game Spent for the game treatment group, controlling for gender and hours playing video games, as measured by the Attitude towards the Homeless scale compared to the control and comparison groups?*

3. METHODOLOGY

This study used a quasi-experimental design with control and two treatment groups to compare the effects of playing a persuasive game on attitude towards homelessness.

3.1 Participants

The population of this study consisted of adolescents in grades 7 through 12 in formal education settings in the Midwestern U.S. The sample consisted of adolescents in grades 7 through 12 in public, private, and religious schools in four states of the Midwestern U.S. Using a purposive sampling [29], an email was sent to all principals of schools in Indiana, Michigan, Illinois, and Ohio asking them to forward a letter of introduction to their teachers. Given the nature of the study it was nearly impossible to get a probabilistic representational sample and a total of 346 classrooms agreed to participate. Ninety-four classrooms agreed to participate but did not start the project or completed only the demographic information; thirty-one classrooms did not complete the three-week posttest; twenty classrooms had fifty percent or more unlabeled student data; and one classroom had only three students. In total, 200 classrooms (n= 5139 students) completed the study (Table 1). Twenty-four classrooms were from religious schools, eleven were from private schools, and 165 were from public schools.

Table 1. Classrooms distributed per group and pretest condition

Group	No Pretest	Pretest	Total
Control	14	10	24
Game	46	70	116
Reading	31	29	60
Total	91	109	200

As this study does not introduce novel teaching methods it was approved through the Institutional Review Board (IRB) as exempt research and every teacher who agreed to participate had their entire class enrolled in the study.

3.2 Design

Pretest-posttest control group design [30] occurred in two steps. The first step was where matching was employed on individual classrooms to ensure that there was equal representation in the pretest and no pretest groups. Second, randomization occurred for the experimental condition. For example, using a Solomon design (Table 2), classes were assigned to game, reading, or control with a pretest and two posttests: one, immediately after treatment and a second at three weeks after the treatment. The pretest was used to ensure that the control and treatment groups were equivalent. Additionally classrooms were matched using the following variables: state, setting, and grade. This was done to minimize variance in the scores due to contextual effects and to create equal numbers for each of the treatment and control groups. We wanted to ensure that across states, setting, and grade there were an equal number of classrooms participating in each of the groups. To do this we looked at the total number of classes participating in each grade. After that we split those classes in each grade by state and the type of school setting. Finally classes were randomly assigned to one of the three groups (control, reading, or game).

Table 2. Solomon Design

Group	Pretest	Treatment	Post-Immediate	Post-3 weeks
T1 (Game)	O1	X	O2	O3
T1 (Game)		X	O4	O5
Control	O6		O7	O8
Control			O9	O10
T2 (Reading)	O11	X	O12	O13
T2 (Reading)		X	O14	O15

Key: T= Treatment, O= Observation, C= Control

3.3 Materials

3.3.1 Attitude Towards Homeless Inventory (ATHI)

The dependent variable was defined as the total score obtained by computing responses on the 11-item 6-point Likert scale on the ATHI [3]. Initially the ATHI was chosen for it's ability to measure four relevant dimensions of homelessness; 1) personal causation, 2) societal causation, 3) affiliation, and 4) solutions to homelessness as one score. To examine reliability for the current sample, the measure was checked after pretest and the reliability coefficient, Cronbach's alpha, with all 11 items was .633.

3.3.2 Independent Variables

The independent variables of this study were group membership (i.e., game, reading, and control group assignments) controlling for gender, hours playing video games at home, and pretest scores on the ATHI. Students were asked to provide demographic information such as gender, age, number of hours playing video games, and volunteer experience with the homeless.

3.3.3 Control, Game, and Reading Group Assignment

Using matching protocols [30] classes were matched first by variables (e.g., grade, state, setting) and then randomly assigned to either the game, reading, or control group to ensure equivalency across the participant. This was done to ensure that an equal number of students were assigned to each of the control, reading, and game groups from each of the grades, states, and school settings. The matching failed over the course of the data collection due to classrooms dropping out of the study and students not completing the measures. This led to an unbalanced design with different amounts of classrooms in each group.

3.3.4 Spent

Spent is a text based game developed by the McKinney advertising studio in cooperation with the Durham Homeless Coalition. The player starts off with a scenario that they are a single parent, have no job, and just lost their home. The gameplay starts when the player is challenged to see if they could survive on $1000 for the next month. After securing a job the player is faced with a series of choices including finding housing, paying for car insurance, joining the union, and buying food. Every decision has an effect on the player's money barometer and the challenge is to make the choices you would normally make in your own life but on the limited financial means that the player currently has available (Figure 1).

Figure 1. *Spent* opening title screenshot

3.3.5 Reading

Written in the first person this account is of the first night of homelessness and the experiences that lead to and follow from living on the edge of financial ruin. Published by the Huffington Post the author leads the reader through carrying all of their belongings, finding a safe place to sleep, getting a job interview, buying food, and applying for benefits. The reading level of this article is grade 5 (see Figure 2).

"There are first times for everything. The first time I drove a car, first time I broke my leg, first time I ate sushi, first time I went to work, first time I was fired -- and I'll never forget my first kiss. 'Firsts' are memorable parts of life and growing up. Well, the same goes for that first night spent on the streets or in a homeless shelter. The first time you're homeless, the intense feelings of fear and uncertainty are impossible to forget."

Figure 2. Opening paragraph for reading group

4. PROCEDURE

In the fall of 2011 9816 emails were sent to every school in Indiana, Ohio, Illinois, and Michigan asking principals to forward an email invitation to participate in the study. A total of 200 classrooms (n=5139 students) completed the study by June 2012.The researcher contacted each teacher that expressed interest in participating in the study via email in March 2012. Upon receiving the approval of the Institutional Review Board (IRB) the researcher began recruiting individual classrooms for the experiment to be conducted in the spring 2012.

Teachers read a brief introduction telling the students how to log on to Qualtrics™ and take the pretest, the length of time to play the game or read the story and how to access the posttest. First students took the pretest on Qualtrics™. They then played *Spent* or read a first-person narrative about being homeless for approximately 30 minutes. Then they accessed the Qualtrics™ survey site again to complete the posttest measure.

The measure was made up of one scale. Participants in the game, reading and control groups took the ATHI. The treatment groups took the ATHI directly before and after playing the game or reading and the control group took the ATHI without playing the game. Each group took the ATHI three weeks later to test for long-term effect of change in attitude towards homelessness.

5. DATA ANALYSIS

Hierarchical Linear Modeling (HLM) was originally chosen for the data analysis because the data were reported by students nested in classrooms, with the classroom receiving the assignment of control, game, or reading group. HLM is a multi-level multiple regression technique that is useful in analyzing nested data [31]. In order to proceed with HLM analysis, the number of levels in the data needed to be specified and models needed to be constructed. The current study data were best described in two levels: student level (level 1), and classroom and teacher level (level 2). Level 1 was represented by student background such as; hours playing games at home and at school, pretest score, and gender which are unique across students.

Teacher and classroom background variables such as treatment grouping and grade level represented level 2.
However, a preliminary interclass correlation determined that there was not enough variance between classrooms on ATHI scores and ANCOVA was used to complete the model testing.

6. RESULTS

There is a significant difference between groups (see Table) for immediate posttest score of attitude towards the homeless, and the ANCOVA model as a whole is significant ($p<0.01$). The significance of the model as a whole demonstrates that with this model it is possible to predict ATHI immediate posttest score with the included variables (Table 3). The above table shows that the group membership (control, game, and reading) is a significant predictor of ATHI immediate posttest ($p<0.01$). Hours playing video games at home and at school and gender do not significantly predict ATHI immediate posttest score.

Students in the game group increased their score and it was not significantly different from the control group by .990 points ($p=.115$), but most interesting is the finding that students in the reading group decreased their score although it was not significantly different from the control group by -1.264 points ($p=.057$). This could be interpreted to mean that immediately after reading about being homeless students in the reading group had a negative attitude change towards homeless people.

Table 3. Immediate posttest model

Source DV: Immediate Posttest ATHI	df	Mean Square	F	Sig.
Corrected Model	6	4823.024	102.441	p<0.01
Intercept	1	25518.167	542.004	p<0.01
GENDER	1	33.500	.712	.399
GAMES HOME	1	159.990	3.398	.065
GAMES SCH	1	2.886	.061	.804
PRETEST	1	26526.386	563.418	p<0.01
TTC	2	1279.620	27.179	p<0.01
Error	2318	47.081		
Total	2325			
Corrected Total	2324			

a. R Squared = .210 (Adjusted R Squared = .208)

While the game group did increase their score and had a positive attitude change it was also not statistically significant. On average students in the game group scored approximately one point higher than students in the control group, with ATHI pretest score serving as the largest predictor, after grouping, of the ATHI immediate posttest score. This could imply that immediately after playing the game attitude towards the homeless was still relatively constant and a more permanent change would be seen at the three week posttest.

There are 11 items on the ATHI, with a total possible score of 66. The control group average score of 37.739 (Table 4) represents a slightly higher than median score of the belief that homelessness has societal causes, a willingness to affiliate with homeless people, the belief that homelessness is caused by personal characteristics, and the belief that homelessness is a solvable problem. Controlling for all other variables, the game group scored 38.730 and the reading group 36.475 immediately after treatment. The only significant difference from the control group was the reading group and that group had a negative change from the pretest and a negative difference from the control group. This was not expected but could imply that reading about being homeless decreased students' attitude towards the homeless.

Table 4. Immediate posttest ANCOVA

Source DV: Immediate Posttest ATHI	Coefficient	Standard Error	Approx. d.f.	P-value
CONTROL	37.739	.221	197	p<0.01
GAME	.990	.626	197	.115
READING	-1.264	.660	197	.057
GENDER	-.335	.305	2318	.272
GAMES HOME	.031	.019	2318	.103
GAMES SCH	-.003	.037	2318	.931
ATHI PRETEST	.499	.021	2318	p<0.01

In summary, as previously discussed, immediately after treatment the control group increases approximately .8 points. This finding could imply that a carry over effect occurred given the lack of time between pretest and immediate posttest. The game group gained an average of 1 point but this was not a significant positive difference from the control group. This could imply that the effects of the game are not immediately realized after treatment. Finally, the reading group had a negative change of .4 from the pretest but was -1.26 points lower than the control group, a

nonsignificant finding, implying that students who read about homelessness have a poorer attitude towards the homeless.

Three weeks after treatment (see Table 5), group (TTC) remains the only factor significantly able to predict the individual score on the three week posttest. However, the overall model (p<.001), is able to predict the ATHI three week posttest score. Students in the game group had a base score of 1.94 points (p=.009, r=.286) higher than control group students and 1.472 points higher than the reading group (Table 6). The reading group had a .518 points higher than the control group but this was not found to be significant (p=.5). These findings could be interpreted to mean that students in the game group scored higher on the ATHI and maintain a higher score on the ATHI after three weeks.

Table 5. Three week posttest model

Source DV: Three Week Posttest ATHI	df	Mean Square	F	Sig.
Corrected Model	6	433.354	6.474	p<0.01
Intercept	1	164777.263	2461.706	p<0.01
GENDER	1	2.296	.034	.853
GAMES HOME	1	23.516	.351	.553
GAMES SCH	1	65.425	.977	.323
IMMEDIATE POSTTEST	1	110.916	1.657	.198
TTC	2	1147.367	17.141	p<0.01
Error	3451	66.936		
Total	3458			
Corrected Total	3457			

a. R squared = .011 (Adjusted R Squared = .009)

The change from immediate posttest to three week posttest are statistically significant and the scores are significantly different from the control group. The reading group decreases significantly from pretest to immediate posttest but does not significantly change after three weeks. However, the practical significance of these findings is weak because the current model explains less than 1% of the variance. Other variables that were not included in the research questions such as; years teaching, income level, type of class, or GPA could possibly increase the R squared and explain more of the variance in the model. One variable that was found to increase the R squared of the model (R squared =.21), and is a significant predictor of ATHI three week posttest score, is the grade level of the individual student.

Table 6. Three week posttest ANCOVA

Source DV: Three Week Posttest ATHI	Coefficient	Standard Error	Approx. d.f.	P-value
CONTROL	36.397378	.207350	197	p<0.01
GAME	1.949401	.730179	197	p<0.01
READING	.518693	.768835	197	.500
GENDER	-.335573	.305337	2318	.272
GAMES HOME	.031543	.019336	2318	.103
GAMES SCH	-.003325	.037998	2318	.931
ATHI IMMEDIATE POSTTEST	.499488	.021568	2318	p<0.01

Figure 3, shows how the scores from each group changed from test to test. Visual examination demonstrates that both the game and control groups had an increase in scores after the treatment on the immediate posttest. The increase of the game group was significant. From immediate posttest to three week posttest the game group shows a significant difference from the control group, a possible sleeper effect. The reading group students showed a significant difference from the control group from pretest to immediate posttest where the score decreases. From immediate posttest to three week posttest the scores increase slightly but are not significantly different from the control group.

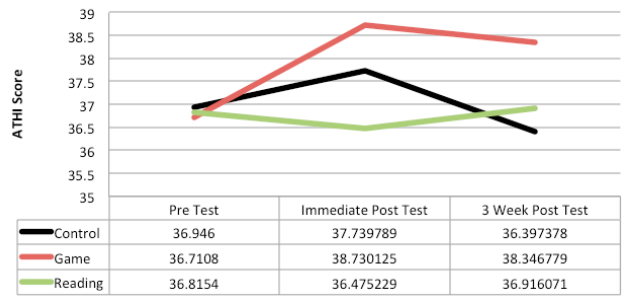

Figure 3. ATHI scores by test and group

In summary, as discussed above and displayed in Table 5, the ANCOVA model for the ATHI three week posttest is a significant predictor of three week posttest score. Additionally, the game group differs significantly from the control group after three weeks (p=.009, r=.286), but the reading group does not (p=.500). This suggests that it was not the topic, homelessness that acted as the catalyst for a sustained higher score on the ATHI three week posttest score, but the persuasive game mechanics of *Spent.*

7. DISCUSSION

The findings indicate that playing the game did not appear to immediately change student's attitude towards the homeless score significantly. Moreover, reading about homelessness appeared to negatively affect student's homelessness attitude score significantly. After three weeks the game group scores significantly higher on the ATHI than the control group but was not significantly different from the immediate posttest. After three weeks the reading group did not score significantly different than the control group on the ATHI nor were the scores significantly increased or decreased from the immediate posttest or the pretest. Findings indicate that students who played the persuasive game *Spent* sustained a higher score on both the ATHI after three weeks.

7.1 Immediate Posttest

Playing the game did not immediately change students' attitude towards the homeless score significantly as compared to the control group. Additionally, reading about homelessness negatively affected students' attitude towards the homeless score as compared to the control group.

It is the latter finding that is most interesting. Why does reading about the homeless significantly affect the score on the ATHI while playing the game does not? Plus, why is that change negative? One potential explanation for the negative change from pretest to immediate posttest for the reading group is that the students did not link the two activities as being related. Another explanation is the reading level was either too high or too low for the students. While the reading level was tested at fifth grade, the range of students who participated was not limited to only those reading at grade level. The reading group was significantly different negatively than the control group for the immediate posttest, indicating that reading about being homeless was a negative experience for the subjects. One additional potential explanation for finding a strong difference between reading about homelessness and the control group was the context of the reading material. The subjects read a first-person account of being homeless for one night and the realities that are encountered by this person. It is clear that the subjects as a group had a statistically significant negative reaction to the reading.

If we look back to the non-statistically significant difference between the game and control group immediately after playing, we can also see some interesting connections there. One potential explanation for not finding stronger differences between playing the game and the control group was the measure of assessment. *Spent* was not intended to teach about homelessness but to support conceptual learning, best measured by attitude items. However, initial analysis of the attitude items, a part of the immediate posttest, produced low Cronbach's alpha coefficient for the total 11 items, limiting inferences from the attitude towards the homeless measure (ATHI). An additional troubling problem is that the correlation between the pretest and posttest were high and that the actual score values before and after playing the game were similar. Although literature [30] shows that pretest performance can predict posttest scores, it is clear that the subjects as a group were relatively homogenous in their attitude towards the homeless (less than 10% ICC on the HLM analysis). While the difference between the game group and control group was not statistically significant, it was practically significant. The students in the game group did gain more than 2 points from the pretest showing a positive change in attitude towards the homeless immediately after playing the game. To put this in perspective, we can look to recent research in the field of games and learning. As discussed in the literature review, there are studies that demonstrate a short-term change in affective and cognitive processes. The findings from this study are not unlike the other studies with students in this age group [32, 33, 34] where a large heterogeneous group does not show a statistically significant change without aggregating to grade level or breaking down the results by other variables.

Taken together with the insignificant statistical difference between the game and control group, the statistically different results between the reading and control group suggests that the immediate posttest is not a reliable statistical indicator of attitude towards the homeless for this population. However, looking at the bigger picture, this finding showed that for a first step in a barren area of research on persuasive games, it is possible to measure attitude change across a large group of students using quantitative empirical means.

7.2 Three Week Posttest

While the findings for the short-term research question was interesting, the three week scores are where the study demonstrates both practically and statistically significant across all areas. The big picture and significance of the study is seen clearly within this section. After three weeks the game group scores significantly higher on the ATHI than the control group but was not significantly different from the immediate posttest. After three weeks the reading group did not score significantly different than the control group on the ATHI nor were the scores significantly increased or decreased from the immediate posttest or the pretest. This finding implies that students who were in the game group were still significantly higher in terms of attitude towards the homeless than the control group. This finding is one of the most notable of the whole study- there is both statistical and practical significance associated with this one finding. Students in the game group, who got the same content as the students in the reading group, maintained a more positive attitude towards the homeless than either the reading or the control groups. This can be interpreted to mean that something about the game helped sustain a more positive attitude towards the homeless after a period of three weeks.

One potential explanation for finding strong differences between playing the game and the control group was that the increased positive attitude students had displayed on the immediate posttest was sustainable over three weeks while the control group returned to stasis. Taken together with the immediate posttest score, the relationship between being in the game group and attitude towards the homeless was significantly more positive statistically than the control group.

Other studies that have examined long term sustainability of attitude have shown that when there is a personal connection between what is being presented, and the level of cognitive importance associated with the topic sustained learning takes place [18, 22, 23, 28]. One way to interpret this finding is that the game mechanics, in particular the persuasive mechanics, are responsible for the sustained change over time. This interpretation is not supported by the prior research in persuasive games simply because there is none. One statement that appears over and over again in reports by Future Labs on serious games [25] is "one element that has not been investigated by (insert game here) is the impact on the trials on knowledge retention and behavior change". Currently there are frameworks on persuasive technology [35] that support this finding because it falls within the motivation and ability levels of the students while using persuasive triggers that are meant to affect attitude change. However, to reiterate the significance of this study, and these findings in particular, is that they are a first step in the otherwise sparse field of measuring persuasive game effectiveness.

Playing a persuasive game aimed at social issue such as homelessness has a significant immediate and sustained positive effect on attitude scales that measure the social issue compared to the control and reading groups. Findings suggest that it is the mechanics of the game *Spent* more than the homelessness content, that are responsible for the increased scores and sleeper effect on attitude.

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