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EDD SCHNEIDER
Ithaca College

ANTHONY BETRUS
SUNY Potsdam

User delinquency and instructional conditions: Undesirable behaviour in open virtual worlds

ABSTRACT

Virtual environments are becoming an increasingly common tool for instructional designers, but the creative freedom of these digital worlds can come with an increased risk of deviant behaviour from users. The scenarios at the centre of this research explore the impact different instructional conditions have on unwanted virtual behaviour. Participants in these scenarios were asked to play modified versions of the game Grand Theft Auto 3 *(Rockstar Games, 2001) under one of three different instructional conditions. The goal was to measure which instructional conditions had the greatest impact on player behaviour, with an emphasis on investigating which set of conditions resulted in the least amount of deviancy in the experiment's play period. Deviancy was measured through quantifying negative actions, such as killing computer controlled characters in the virtual space and reckless driving. The final results show that the instructional conditions given to users can have a major impact on behaviour, and thus have a major impact on potential learning.*

KEYWORDS

virtual worlds
virtual behaviour
instructional conditions
Grand Theft Auto
deviance
aggression

INTRODUCTION

Virtual spaces have become a common part of the communications landscape. There are thousands of online entertainment games, *Second Life* continues to host educational resources a decade after launch, and tens of millions of people have played *Farmville* together via Facebook (Cashmore 2010). How people behave in these online worlds is important on many levels. From a professional standpoint, issues such as cyber-bullying, micro-transactions, equitable access to technology, and ensuring quality time on task are all issues that educators in virtual space need to be concerned with. Historically, teaching people how to use and behave in computer-mediated environments has been the domain of instructional technology practitioners. The original version of the game *The Oregon Trail* was first used with a high school class in 1971 and first sold commercially in 1974. The first academic articles on use of the game arrived in educational technology journals in the early 1980s (Balajthy 1984; Hunter 1981). As the use of video games and virtual worlds has become more common and understood, the focus has moved away from the novelty of a new technology and towards an emphasis on user behaviour and outcomes.

Improvements in computer power continue to increase the fidelity and openness of these worlds. This research placed participants in a very open virtual world, predicated with one of three different types of in-game instruction. The primary emphasis of this enquiry is to investigate how participants reacted to different instructional scenarios in order to assist instructional designers when planning for user behaviour in virtual spaces. Every virtual environment is built with some concept of the type of user behaviour that will take place inside. This means the developers have to predict user behaviour, as well as teach users how to navigate and interact with their environments. Concisely, the way a virtual world is designed is directly related to the types of behaviour that are expected in that space. This research is designed to assist designers in fields that use virtual or augmented 3D spaces in having clearer expectations for virtual behaviour.

Increasing player autonomy in games has been weighed with problematic player activity since the beginning of gaming. Recently fans of Grant Theft Auto 5 made a downloadable Pride parade in the game, but to confirm it was made as an actual show of support the parade itself was indestructible in the game (Good 2016). When *The Oregon Trail II* was released, excessive hunting in the original game was addressed in both the gameplay (which made animals become scarce if players over-hunted) and with instructions that read, 'Few things will incur the wrath of the Indian peoples more than an overstayed welcome accompanied by the egregious waste of the natural resources upon which they depend' (Houghton Mifflin Harcourt 1994).

Today, professional game designers try to build fun into their environments while stopping abusive language and other negative behaviour (Lin 2013). Teachers and instructors who use virtual environments try to take advantage of the increased engagement virtual worlds can offer, but at the same time have to figure out ways to keep players on task (Franceschi et al. 2009). The three virtual scenarios at the centre of this study were designed to provide insight into the relationship between pre-game instruction and in-game behaviour.

RESEARCH QUESTIONS

The wider goal of this research is to investigate user response to instructions in an open virtual space. If users are to get instructions before going into an online world, instructional designers are the ones who should be designing

that instruction and managing user expectations. This growing role for instructional designers motivated this investigation of the intersection between real-world instruction and virtual behaviour.

The guiding research goal of investigating the relationship between instructions and virtual behaviour yielded three research questions, each designed to be answered through a related research experiment.

The research questions are:

> **Q1:** *If users are placed in a virtual world that allows negative behaviour, but are asked to play an exciting role as a positive character, to what level do they adhere to the request?*
> **Q2:** *If users are placed in a virtual world that allows negative behaviour and are asked to complete a mundane task, to what level do they adhere to the request?*
> **Q3:** *If users are placed in a virtual world that allows negative behaviour and are asked to select and complete from a range of tasks, to what level do they adhere to the request?*

Modern virtual worlds present a very large set of choices and interactions to a user. For example, *Second Life* hosts areas for university campuses and organizations like NASA, but other areas in the world are dedicated to both sexual content and drug abuse (Linden Research Inc. 2011). With this in mind, games from the *Grand Theft Auto* series were chosen for use as research stimuli. This decision was motivated by a desire to observe user behaviour in a very open-ended environment. Getting participants to follow directions in a sterile virtual space with minimal distraction should be a basic task for an instructional designer. A central experimental theme in this research is to test instructional conditions in a taxing environment, exploring the interactions between temptation and instructional goals in as wide open an environment available.

LITERATURE REVIEW

While it was over 40 years ago that the game *The Oregon Trail* was first used in a classroom, wide adoption of virtual worlds as a teaching technology is still relatively new. This can potentially be attributed to limited resources in many educational settings. Creating an online virtual environment is still a resource intensive undertaking. Trenholme and Smith (2008) detailed that virtual world creation can be very time consuming and expensive. This does not mean virtual worlds are completely out of the question for the instructional designer. The previously mentioned *Second Life* has made virtual space development within their world a possibility for instructional designers for over ten years. At the time of *Second Life*'s release, the game *Quake III Arena* represented cutting edge graphics. Frey et al. (2007) in the journal *Computers in Human Behavior* discussed using *Quake III* as an easily modifiable research tool for studying human behaviour. Today there are hundreds of options for game making, for example the Scratch game programming language from MIT (Resnick 2002). The tools for virtual world development are getting easier to use and there are multiple well-documented, cost-free options for game design available, such as the open source application *Blender* and the free to use *Unreal Development Kit*.

Real world role-playing has a well-established ability to impact behaviour. What has come to be known as the Stanford prison experiments (Haney et al.

1973) showed that live role-played experiences can bring out behaviours and emotions that closely mimic the real world. Researchers have begun to see what behaviours emerge when participants role play in virtual spaces ranging from retail settings (Wood and Solomon 2009) to exploring race's role in emergency training (Gamberini et al. 2015).

The impact of researcher requests in an experiment scenario is similarly well-established. Milgram (1963) found that participants were willing to follow experimenter's instructions, even to the point where nearly two thirds of participants thought they were administering lethal shocks to another person. Researchers have begun to weave virtual space into experiments that resemble the Milgram experiment. Bartholow and Andersen's 2002 study had participants play both violent and non-violent video games, and then administer punishment through headphones to their opponents. They found that participants who had played the violent video game administered harsher punishments.

Using a virtual environment specifically as research stimuli is still a relatively new phenomenon. Kozlov and Johansen (2010) found that stress and peer pressure could negatively impact behaviour in computer-mediated environments. They conducted two experiments that monitored player behaviour in virtual space in an effort to establish virtual spaces as potential research stimuli. Their first experiment placed research participants in a virtual maze that also contained virtual bystanders and computer controlled characters that asked for help. The goal of the first experiment was to measure the role of time pressure on helping behaviour. Their second experiment placed participants in a virtual space and measured their willingness to help virtual characters in rooms with differing numbers of virtual characters. The goal of the second experiment was to measure if the presence of virtual bystanders influenced player choices. Participants that were given time pressure to complete the maze assisted significantly less virtual bystanders than those who were given as much time as they wanted to complete the maze. Participants also were more likely to help the computer-controlled characters that asked for help if there were virtual bystanders in the room with them. However, the overall point that they were trying to prove with their research was that virtual worlds can be appropriate spaces for laboratory controlled experiments.

Chiodo and Flaim (1993) point out that post-game debriefing is as important as the instructional game itself. Basically the participants in Chen et al. (2011) and Kartiko et al. (2010) knew they had a course grade at stake, as well as classmates external to the virtual space pushing them to do their best. If no post-environment interaction is used, the impact of the environment can be lessened. Social identity concerns the sense of belonging to a team, and social identity theory is interested in how this impacts behaviour of a group (Tajfel and Turner 1986). There has been research showing social identity theory can impact player behaviour in virtual space (Hsu et al. 2011). Hsu's study looked at 100 students in an online group-work activity and found that a sense of social identity positively impacted team trust and team success.

Some experiments have measured subject reaction to changes in game difficulty. Qin et al. (2010) found that changes in game difficulty can impact a participant's feeling of immersion. They discovered that rapid changes in difficulty level can be oppositional to the level of immersion experienced by players. Orvis et al. (2008) also did a study to measure the learning effects of changing difficulty in an instructional game. They found that changes in

difficulty made some impact on learning, the amount of experience participants had playing video games made a more significant impact.

METHODOLOGY

Other than the research questions' influence on available participant choices, the three research scenarios that form the core of this research were each carried out under very similar conditions. A participant pool was recruited from a local campus community, with a goal of forty participants per scenario. The basic procedure was the same for each of the three scenarios; participants would arrive, sign informed consent forms, fill out a survey instrument, receive instructions from the experimenter, play a game for twenty minutes, and then fill out a post-game survey instrument. The researcher would observe the participants and note information on specified behaviours using a standard form during the play period. Additionally the researcher would record preselected information that the game collects directly after the play period. In each scenario the participants were asked only to complete specified tasks, and were given no further instructions on in-game behaviour.

Scenario 1

In the first scenario, participants were screened to find those who had never played a Grand Theft Auto game using a pre-participation survey. These participants were told they were playing a game that asked them to take the role of a firefighter. When the screen turned on in front of them they saw their fireman character, standing by a fire truck, in front of a fire station (Figure 1). They were told how to get into the fire truck, how to locate fires, and how to spray the fire hose. They were not told that the game they were playing was a modified version of *Grand Theft Auto 3*, and their screen was controlled so they would not see any indication that they were playing *Grand Theft Auto* (*GTA*) before or after play. They were not given any indication on a correct way to play the game. Participants played the game on a Windows PC with a generic gamepad. Once the instruction was over the participants were asked to play the game for twenty minutes as they normally would.

The guiding research question in the first scenario was based on the question of how much time users will devote to a role in an environment ripe with temptation. Playing in the *GTA* world as a fireman takes dedication; players only have a short amount of time to race to each fire. During game play the researcher noted indicators of each subject's level of commitment to the fireman role. A consistent method for coding in-game behaviour was used. For example, a fireman would generally not drive a fire truck at full speed on a crowded sidewalk to reach a fire. Thus, driving recklessly was noted as participants beginning to experiment in the fireman role. Participants were also told they could defend themselves from criminals, and taught the button to press to attack. However, there is nothing in traditional firefighter duty that requires firing a gun at bystanders. Thus if the subject attacked people indiscriminately, it was recorded as a secondary indicator of their experimentation with the fireman role.

Once the twenty-minute play period was over, the subject was asked to pause the game. After the subject had left the research area, relevant final statistics from the game were collected. The game itself keeps meticulous records of in-game behaviour, from number of bystanders killed to the total distance travelled, and all of this data are easily available once game play is finished.

Figure 1: The Participants' Viewpoint. In the first experiment, players were given the role of a firefighter and asked to drive the truck to put out fires.

Scenario 2

In the second scenario participants were asked to complete a long drive in the *Grand Theft Auto IV* map. They were given no direction on how to drive, fast of slow. As the virtual world of *GTA* is designed to resemble a real city, traffic congestion, stoplights and other traditional driving obstacles occur. In the second scenario participants could take as much of the twenty-minute experiment time to complete the drive as they needed. Participants were not aware of the timer, so they did not feel as if they were racing against the clock. Thus in the first scenario the participants were gauged on their adherence to the prescribed role, in the second they were gauged on their adherence to the prescribed task.

Scenario 3

Participants were allowed to choose tasks to complete from paper cards in two sub-scenarios. This structure is based on the concept of scaffolded instruction by Sharma and Hannafin (2007). Using results from the previous scenarios, it was concluded that tasks should not be overly difficult and frustrating, especially at the outset. Thus easy, medium and hard objectives were designed for the participants, with an expected completion time of fifteen seconds, 30 seconds and one minute, respectively. The tasks were designed to progressively build the participants' skills, with single-step, easy tasks providing a base for the multi-step medium and hard tasks. Ultimately 30 tasks were created, with ten each in the easy, medium and hard categories. Tasks such as: 'get out of your car, walk around it, get back in', or 'drive until you find a mailbox, pull over and park next to it' were typical of the tasks in the third experiment.

The participants in the third scenario were separated into two groups. In the first, task presentation and order was designed to accommodate both subject freedom and instructional design principles. The first approach was to give the tasks to the participants in a sensible order, shaping the participants' skills by first providing easy and medium tasks, ultimately building a ladder to more difficult tasks. The second approach was allowing the participants to decide which tasks to choose and allowing them to choose tasks in whatever order they wanted, knowing that they might not make the most efficient choices. This decision was based on the idea that participants might take a higher degree of ownership of the tasks in a scenario where they choose their own tasks. This is generally what someone following a learner-centred approach to instructional design might propose. Thus in the first group, participants were given tasks in a predetermined order based on a basic skill ladder. In the second group, participants chose their own order of the tasks. Both groups were told they were also told that it was up to them if they wished to complete or abandon any given task.

The point was to measure the impact of choice on participant behaviour. The concept of self-determination has been shown to have a significant impact on behaviour (Ryan and Deci 2000). As in the first two experiments, the participants were presented with directions by the experimenter and then were placed in the virtual space. As in the first two scenarios, participants were not required to follow directions.

RESULTS

Participants were generally college-age undergraduate and graduate students, with some participation from the surrounding campus community. Across all experiments there were 116 participants, 53 male and 63 female, with a median age of 24 (see Table 1).

Players were free to attack and kill the computer controlled characters in the virtual space, but in no way were directed to do so, and were in no way were rewarded by the game or externally for doing so. The number of pedestrian kills was used as a relative indicator of undesirable player behaviour, as participants are typically deviating from the instructions given to them when killing virtual pedestrians.

In all scenarios a portion of the participants acted violently for at least part of their participation. However, the type of instruction preceding the

	# Male participants	# Female participants	# Total participants	Median age
Scenario 1: Firefighter	23	17	40	26
Scenario 2: Tedious Drive	18	18	36	27
Scenario 3: Task Choice	12	28	40	21
Total for three studies	53	63	116	24

Table 1: Participant demographics in the three scenarios.

	μ kills male	μ kills female	μ kills total
Scenario 1: Firefighter	30.6	11.0	19.4
Scenario 2: Tedious drive	6.4	8.2	12.3
Scenario 3: Task choice	1.2	0.7	1.0

Table 2: Experimental behaviour as indicated by the mean number of kills.

experiment had a major impact on the amount of violent activity. As seen in Table 2, the first scenario resulted in a considerable amount of violent behaviour, despite participants being asked to play as a heroic firefighter. In a twenty-minute play period, average male participants killed more than 30 pedestrians. While the task in the second scenario was tedious, it was more structured than the first scenario. It is relatively easy to drive from place to place in the game, and a majority (56%) of participants completed the drive. A reduced amount of violent behaviour was seen in the second scenario, with 37% fewer killings per subject play period than in the first, and a 47% decrease in killing on the part of male participants. Participants adhered most closely to the instructional conditions in the third scenario, where tasks were made significantly shorter and more granular. In the third experiment players on average killed only one pedestrian in twenty minutes of gameplay.

While there were commonalities among the experiments (around 40 participants each, twenty-minute play periods, similar research settings), there were also results unique to each scenario.

Results of Scenario 1

The first scenario measured participant dedication to their assigned role. In order to measure this, prior experimentation had shown that participants gave two clear indicators they had abandoned the firefighter role. The first indicator was noted when participants began driving in ways that were clearly harmful to pedestrians. It is basic knowledge that firefighters are interested in public safety. For the purposes of this experiment, researchers used activity like driving a fire truck at high speed on a crowded sidewalk, or making no effort to avoid pedestrians in crosswalks as an indicator of participants leaving the firefighter role. The second behaviour used to indicate that participants had abandoned the firefighter role was the use of weapons to kill or harm pedestrians. When deliberate killing was seen, researchers considered participants to have completely left the fireman role. As can be seen in Table 3, male participants were much quicker to experiment with dangerous driving and weapon use. The results showed 29 per cent of female participants did not use a weapon at all during Experiment 1, in comparison to 4.3 per cent of male participants. This is a potential indicator that women were more reluctant to leave the firefighter role, or generally less interested in violence.

	Males	Females	All
Vehicular experimentation	03:35	11:04	06:36
Weapon experimentation	06:25	19:10	11:48

Table 3: Time before experimentation in scenario 1.

Learning preference	μ kills	μ time to first vehicle kill	μ time to first weapon kill
Never look at instructions or documentation	50	0:52	1:07
Install it and try it first before looking at any documentation or directions	26	5:21	6:01
Read a quick start guide and then refer back to documentation as needed	16	8:17	11:51
Read instructions first before installing and trying	6	9:00	15:00

Table 4: Learning preferences and pedestrian killing in scenario 1.

There were also other relevant patterns in the data. On the paper survey, participants were asked about their learning preferences when it comes to new technology. Participants who indicated that they never read instructions before using a new piece of software had higher indicators of negative activity than people who indicated they read instructions before using a new technology.

As seen in Table 4, there is a clear pattern between participants' indicated preferred learning style and how they behaved in the game. Participants who preferred to learn with little direct instruction and more experimentation killed over eight times as many pedestrians as participants who indicated they preferred instruction before trying new software. Similarly, there was a clear pattern between a subject's preferred learning style and their propensity for experimentation. The participants that indicated they did not read instructions were very quick to experiment, and on average they had killed a pedestrian with both a weapon and another with their vehicle within the first 70 seconds of game play. The participants that indicated they preferred instruction before using new software, on average, did not begin experimentation until almost into the second half of their play period.

Results from Scenario 2

Subject participation in the second scenario can be divided into two parts: the time spent on the long drive to the destination, and the time after that point had been reached, but before the end of the twenty-minute play period. As can be seen in Table 5, two-thirds of male participants reached their driving destination, with an average of about half of their allocated time (ten minutes) remaining. A little less than half of female participants reached the destination, and those who did had an average of three minutes of free time remaining.

	Males	Females	Total
Finished (%)	67	44	56
Did not finish (%)	33	56	44
Average time to finish	10:10	16:58	12:43

Table 5: Scenario 2 task performance.

	Males	Females	Total
Percent who stole at least one car	89	94	92
Average time to first car stolen	7:02	7:32	7:17

Table 6: Car theft in Scenario 2.

	μ males	μ females	μ total
Kills per minute (Pre)	.133	.167	.164
Kills per minute (Post)	1.53	1.78	1.54

Table 7: Kills per minute, pre and post destination in Scenario 2.

Up to the point that they reached their destination, most participants stayed on task, attempting to reach the destination. While most participants showed some basic undesirable behaviour, such as stealing a car (Table 6), this was generally done as a means to complete their goal of reaching their destination.

Once the original destination was reached (the virtual equivalent of the top of Lombard Street in San Francisco), participants were instructed that they could choose to drive back to where they started, or they could use the time to do as they pleased. As seen in Table 7, undesirable behaviour increased sharply at the completion of the drive. As each player had a different amount of time after the completion of the long drive, a good comparison measure is kills per minute. During the long drive activity there was very little killing activity. Male participants averaged 0.133 kills every minute, but once they completed the task they killed with over ten times the frequency, averaging 1.53 kills every minute of free time. There was a similar pattern with female participants, with an overall subject average of 0.167 kills per minute during the long drive, and 1.78 kills per minute after activity completion.

The stark difference in pre and post destination behaviour in Scenario 2 led to conclusion that idle time is a breeding ground for undesirable behaviour.

Results from Scenario 3

Using the outcomes of the first two scenarios, a goal was set to try and establish an experimental method that would reduce undesirable behaviour and to keep learners on task for the full time period. As the virtual body count of the first studies revealed, when users have the ability to street race or unleash violent mayhem in a game world, getting them to follow instructional conditions can be a challenge.

Using the number of killed pedestrians as an indicator, the third scenario was by far the most successful in terms of getting participants to obey researcher instructions. While there was an observed difference between the user choice task group and the researcher ordered task group, both groups displayed significantly less undesirable behaviour than participants from the first two scenarios. The group that was given the freedom to choose their own task cards killed on average 1.75 people in their twenty-minute play period.

Abandoned	Easy	Medium	Hard	Overall
Teacher choice	19	14	8	41
Learner choice	3	12	2	17

Table 8: Tasks abandoned in Scenario 3.

Group	μ easy	μ medium	μ hard	μ total
Learner choice	2.0	2.5	3.3	7.8
Teacher choice	5.15	5.3	2.5	12.95

Table 9: Subject task performance by experimental group.

Meanwhile, the group that was given the pre-ordered cards killed on average 0.35 pedestrians during the same time frame. The average number of pedestrian kills for the self-choice group was almost exactly five times the amount recorded for the researcher-choice group. In Scenario 1 the average number of kills in the same twenty minutes was just over nineteen, and in Experiment 2 it was just over twelve. So while there was a higher rate of kills in the learner choice group, when compared to the previous experiments there was a marked decrease in undesirable behaviour, as measured by kills, in both subject groups.

The number of abandoned tasks in each subject group was used as a measure of ownership of tasks. Overall, the Teacher Choice group took less ownership of their tasks, and abandoned 41 tasks. The Learner Choice group abandoned seventeen tasks (Table 8), which proved to be significantly less than the Teacher Choice group (p-value 0.42, significant at the 95 per cent level), indicating that the learners who were allowed to choose their own tasks took more ownership of them.

In terms of performance on the tasks themselves, as can be seen in Table 9, on average the teacher choice group completed significantly more easy tasks, more medium tasks, more overall tasks (p=0.0073), and earned more points (p=0.055) than the learner choice group. There was no significant difference in the number of hard tasks completed.

CONCLUSION

The results of Experiment 1 clearly demonstrated that participants were not committed to the frustrating task, as the majority of participants clearly veered from the instructional conditions. In Experiment 2 it was discovered that participants were willing to commit to a long and tedious task if they know there was an end goal, but there was a high degree of variability in terms of subject performance. Experiment 3 indicated that giving participants task choice yielded the highest level of compliance with instructional conditions.

The continued reduction in deviancy across experiments can in part be attributed to the task design. Participants in the first experiment had to actively work to stay on task, to stay in character, and complete the assigned task. Participants had to fight the fires in rapid succession in order to stay in the fireman role. If they did not locate and fight the fires fast enough, participants would have to choose between returning to the fire station or plotting off on their own course. The activity of the second two studies was more passive;

participants could veer off course and then return to instructed behaviour at any time during the experiment session. Unlike the first study, participants in the second two studies were not asked to play a character role, meaning a further reduction in challenge. The differences between experiments were pronounced. For example, there was a total of 887 pedestrian kills for the 40 participants of Experiment 1, while the 40 participants of Experiment 3 had a total number of 21 kills.

An instructional designer who decides on using a virtual environment for learning should know that they present unique challenges. They are exciting and engaging, yet sometimes in the wrong ways. Guiding user behaviour in these environments is certainly not easy, especially in the crime-ridden virtual worlds of *GTA*, but it is possible. Sound planning and appropriate goal setting, whether teacher-centred or learned centred, will positively influence an instructional virtual experience.

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CONTRIBUTOR DETAILS

Dr. Edd Schneider is an Assistant Professor in the Department of Strategic Communication in the Park School of Communications at Ithaca College.

Contact: 953 Danby Rd, Ithaca, NY 14850, USA.
E-mail: eschneider@ithaca.edu

Dr. Anthony Betrus is a Professor in Instructional Technology at the State University of New York at Potsdam.