

# Order Versus Entropy in Virtual Spaces: Takeaways from Three Experiments in Virtual Behavior.

Dr. Edd Schneider, University of South Florida, [efschneider@usf.edu](mailto:efschneider@usf.edu)  
Dr. Anthony Betrus, SUNY Potsdam, [betrusak@potsdam.edu](mailto:betrusak@potsdam.edu)

**Abstract:** This presentation summarizes the results of three experiments on how users behave in open virtual environments with varying degrees of guidance. The goal is to provide information about how to best keep users engaged with the instructional content, rather than the environment itself. The three studies summarized here used Grand Theft Auto games with modified graphics and/or rules, and measured subject reactions. The first study asked subjects to take the role of a firefighter to test adherence to research instructions against the temptation of virtual experimentation. The second study was similar, and tested adherence to an easier, yet tedious task. The third study had one group of subjects select tasks of varying difficulty on their own while a second group had their tasks selected by the experimenter. The results, framed in current learning theory, provide insight on techniques for getting learners to stay on task in virtual worlds.

## Introduction

Online virtual environments have been part of the Instructional Technology landscape for over a decade. For example, the decade-old world of Second Life launched in 2003 and hosts thousands of educational locations and groups. In the first five years over 65,000 students have used Indiana University's online science space, Quest Atlantis, to explore science. The adoption of this new technology creates problems as well as opportunities for Instructional Designers. One of the most basic challenges is keeping users on task.

Instructional designers having to consider aberrant behavior of learner's 3-D avatars in a virtual education space isn't science fiction. For example, Second Life hosts educational environments on subjects from outer space to archaeology, which are shared by users from around the world. Universities such as Penn State host campuses in their virtual space. However much like the wider internet, the game is also home to areas and content totally inappropriate for education. Wide areas have been dedicated to erotica, gambling, and drug abuse.

The three experiments at the foundation of this session measured how users in a very open virtual environment reacted to different kinds of instructional scenarios. The first one tested dedication to instruction in a frustrating scenario, the second tested dedication to instruction in a tedious scenario, and the third tested dedication to instruction in a scenario where subjects could choose tasks with a range of difficulties. In short, the impact of difficulty, tedium, and choice on virtual behavior was investigated.

## Previous Research

The term 'virtual environment' has had a changing meaning. Some academic descriptions have been very specific, dictating that virtual environments must have visual representations of space. (Tomek, 1999) Others consider simpler, web-based, text-centric message systems to be virtual environments (Blanchard, 2004). There is an implication of multi-user, online functionality in some definitions of 'Virtual Environment' as well. (Redfern et al, 2002)

For the purposes of this research 'virtual environment' means digitally created, interactive spaces with 3-D rendered graphics. The virtual environments used here do have online connectivity, but it was not used in this research.

The basics of the Instructional Design process dictate that the need for a 3-D virtual environment should be considered before opting to use a 3-D virtual environment. Part of that consideration should involve user training. Virtual environments require specific and immediate training for users, unlike more traditional media such as written text and video. One analysis of Second Life indicated training users can be difficult, and encouraged practitioners to consider if other delivery systems meet their instructional needs instead. (Berge, 2008)

The impact of virtual stimuli on task performance has been assessed on other ways. One study (Zabanka et al, 2004) found that research subjects reacted similarly to having their tasks observed by a real human and a virtual avatar. Other research (Rickel & Johnson, 2000) has found success in using virtual agents to guide task-based training. No research could be found directly dealing with keeping individual users on task in interactive, 3-D spaces.

## Experiment goals & design:

The first experiment was designed to investigate how long will subjects adhere to a frustrating assigned task in a virtual space. In this experiment, subjects were given control over a fireman character, standing in front of a fire truck, parked in front of a fire station. Subjects were read a script thanking them for testing a new fireman game. Their only assigned task was to play the game as a firefighter. They could fight fires, but doing so was not easy. The virtual behavior of players was noted and quantified. Aspects of their behavior, such as the time at which they abandoned playing the game as a firefighter, were especially important.

The second experiment was designed to investigate how long will subjects adhere to a tedious task in a virtual space. In this experiment subjects were given a car on one side of the Grand Theft Auto map, and simply asked to drive to another point on the map. The map of the game is expansive, and the drive, performed as an actual driver would do it, was designed to take between 10 and 20 minutes. Again, the virtual behavior of players was noted and quantified, and again in this instance the point of task abandonment was of particular importance.

The third experiment was designed to investigate if giving subjects choices in task selection would impact performance on tedious tasks in a virtual space. In the first two experiments the participating subjects were all given identical tasks at the beginning. In the third subjects were split into two groups. The first group was given instructions to choose tasks themselves, and the second had the tasks chosen for them. While the first two experiments were designed to measure the impact of factors design to negatively impact task performance, the third experiment was designed to measure the impact of a variable intended to increase task performance. Studies have shown that giving subjects choice over tasks can positively impact task completion. (Ramsey et al, 2010; Mechling et al 2006)

In each study 40 different subjects were recruited from the campus community, with the age range between 18 and 58. The gender split among subjects was approximately 30% female and 70% male. For the first study a modified version of Grand Theft Auto 3 for the PC was used, and in the second two studies Grand Theft Auto 4 for the Xbox 360 was used. In each the player played the game under laboratory conditions with a research observer. The play period for each study was 20 minutes.

## Results and Interpretation

The experiments' results provide several statistically clear patterns of behavior.

-Without guidance, all subjects abandoned their virtual role and experimenter instructions eventually.

In the first study subjects were asked to play the game in the fireman role, within ten minutes of playtime not a single subject was still in the fireman role. Although the willingness of subjects to try and stay in character varied, and not all subjects turned to violence, all subjects showed some level of experimentation. The adherence to the fireman role was assessed by two indicators, the point at which the player stopped showing concern for pedestrian safety was used as an indicator of the beginning of experimentation, and the point at which the player started actively killing pedestrians with weapons was used as an indicator of the subject fully abandoning the fireman role.

-Males are much more likely to experiment with violent behavior in a virtual space.

The virtual space used in these experiments is filled with computer controlled characters. The average number of kills for male subjects in the gameplay time period was consistently at least double the number of kills for female subjects. None of the experiments asked players to kill digital pedestrians, and more specifically the instructions gave subjects tasks they were supposed to be engaged in. Male subjects also fired more bullets from their guns, even though they were not asked to use guns. There was also a much wider standard deviation in behaviors related to violence. In the first experiment, with the frustrating task, male users killed on average 30.6 people in 20 minutes, while women killed 11.1 in the same period. In this experiment's design the subjects were given instructions and allowed to play for 20 minutes. In the second experiment men killed on average 16.4 pedestrians and female subjects killed 8.2. (See Figure 1) In the third experiment the tasks were smaller, and regardless if they chose their own tasks or were assigned them, the number of kills dropped dramatically. On average, male subjects only killed 1.2 pedestrians, and women on average killed 0.6 pedestrians.

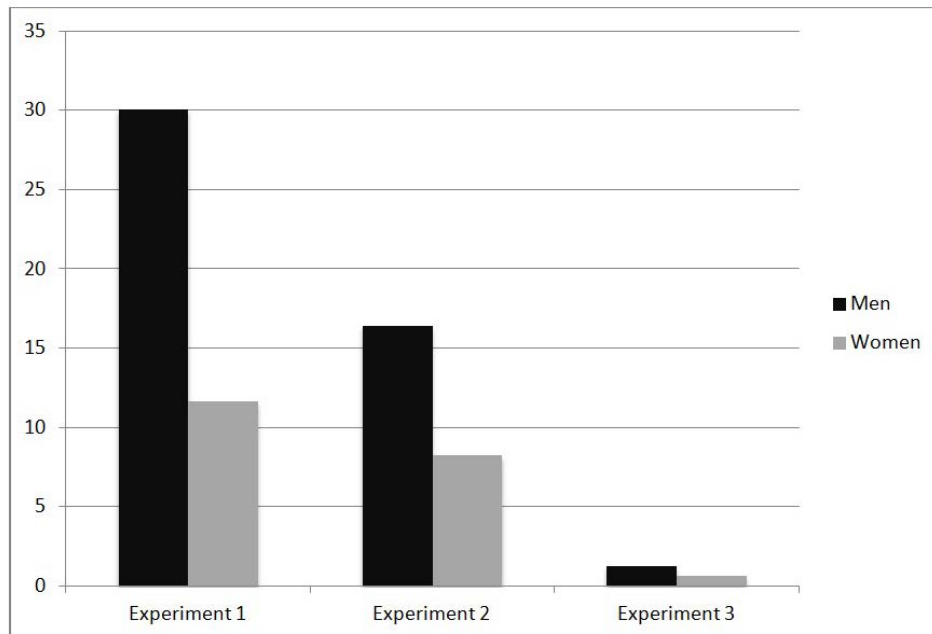


Figure 1: Number of Kills Per Experiment by Gender

-More structured tasks produced greater adherence to the tasks.

The three experiments presented subjects with three different tiers of tasks, each more clearly defined than in the experiment that preceded it. As the specificity of the tasks increased, subjects spent significantly more time trying to complete the tasks. In the first experiment all subjects abandoned the fireman role for the majority of the play period, in the second study most subjects completed the boring drive, before entering an exploration phase, and in the third study all subjects completed multiple tasks with extremely little experimentation from any participants.

-Structure and choice combined produced the most desirable outcome.

The third experiment contained two research conditions, one group could choose tasks and the other was prescribed tasks. The group that had their tasks chosen for them completed more than the subjects who were able to choose their own. At the same time, subjects who selected their own tasks chose and completed a relatively similar number of difficult tasks, and had more fun with their experience.

Finally, it should not go without mentioning that the Grand Theft Auto series of games was chosen as Virtual Environments because they were deemed to be among the most difficult environments to keep people on task in. The game is designed to steer the player to menace and mayhem, with distraction and potential interaction at every turn, with pedestrians, criminals, police officers, or simply the allure of the buildings and streets themselves. Our rationale was simple: if a strategy is successful in keeping users on task amidst the chaos of Grand Theft Auto, it should work in any virtual environment. So while in the first experiment users were nowhere near staying on task, in the second, things got a little bit better, and finally in the last experiment they stayed on task for the full time, regardless of treatment type. And this is where perhaps the most fascinating part of the study lives: in the two varying treatments. One was picked to give the players ownership, and the other with tasks deliberately chosen to scaffold the learners from easy to medium to difficult tasks. If success is measured by how much fun a player had, the ownership group would win. If success is measured by difficult tasks alone, the treatments were equal. If easy, medium, and hard tasks are all considered, the group that was given a pre-chosen task order was more successful. Whichever lens you choose to look at the results through, at the very least they stayed on task in both cases, and in the world of GTA that's not done easily.

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