Redesigning a Geospatial Data Catalogue
(Technical project)

Researching the Effects of Socialization in Virtual Reality on Self-Confidence
(STS project)

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

Virtual reality (VR) is a rapidly growing industry. Some of the first viable consumer VR headsets, namely the Oculus Rift, HTC Vive, and PlayStation VR, were released a short time ago in 2016. These headsets in this early wave of consumer VR headsets were slow to be adopted due to a variety of reasons such as the high price barrier and the small number of existing VR applications. More recently, however, the low-price release of the Oculus Quest 2 and Meta's shifted focus towards extended reality has massively increased the number of VR users and led a boom in the industry. As of June of 2022, less than two years after the release of the headset, an estimated 15 million Oculus Quest 2 units were sold (Heaney, 2022). For comparison, only five million PlayStation VR units were sold in the first three years of its release (*PlayStation™Network Monthly Active Users Reaches 103 Million*, 2020).

There are many uses for this new VR technology from fighter pilot training simulations, to virtually exploring faraway places, to playing games with friends. The wide range of uses of this rapidly growing technology will have many far-reaching effects on society. One of the most popular uses of VR technology is for meeting and socializing with people online. Two VR games that are primarily based around socializing with people, VRChat and Rec Room, are consistently ranked among the most played Steam VR games according to Steam player statistics and are currently ranked second and thirteenth, accordingly (*Most Played VR Games Steam Charts*, 2022). The virtual environments created in these games tend to make socialization in VR notably different from socialization in person for a number of reasons. For example, the flexibility of user avatars and appearance, the availability of different social environments that exist across different platforms, and the general lack of repercussions that exists in virtual spaces may all have different impacts on players' social experiences.

An important issue that comes to light regarding socialization in VR is how the social experiences people have in VR effect their social development. Given that this technology and this form of social interaction is still relatively young, this problem could have major implications for future VR social application development and use depending on the benefits or problems that socializing in VR is found to cause. This research project aims to study the effects of casual socialization in VR on users' self-confidence outside of VR.

For my technical topic, I will discuss a project I worked on as part of an internship. Similar to my STS research project, this project is based around peoples' interactions with a software application.

Technical Topic

Over the summer before my fourth year of pursuing my computer science degree, I had the opportunity to complete an internship with Astraea, Inc. Astraea, Inc. is a small company based in Charlottesville, Virginia, which provides solutions for satellite imagery collection and access. One specific task undertaken by Astraea, Inc. is to help maintain a catalogue of satellite imagery and related data for large clients. The cataloguing system is important for allowing clients to automatically process and organize large amounts of satellite data. It is also helpful for finding data selections where information is missing and needs to be provided in order to be added to the complete collection.

According to the specifications of the data catalogue established with one particular client, a selection of data associated together had to be provided in a single, uniquely named directory. This selection would be considered complete if it included a form of geospatial data referred to as raster data as well as the date that the data was collected on. Due to the large size of the client and the number people submitting data to be catalogued, there was a range of raster

types and date formats or date locations that the system needed to be able to accept. At the time of the beginning of my internship, the data cataloguing system did not support a broad enough range of raster types or date formats to properly support the customer. There were also a few new features that needed to be added, such as the ability to better organize the provided data and to properly report issues with provided data to the client.

One of my projects that I worked on during my time at my internship was to remake the cataloguing system for this client based on the newly agreed on specifications. In order to do so, I searched through a subset of the data already provided by the client to find the types of raster data that would be provided as well as common ways of storing the required date. I then expanded the system that was in place at the time to be able to search through files for the date formats that I encountered and to be able to process a larger range of raster data types. Any issues found with the provided data would automatically be compiled to a list and sent to the client so that they could provide the missing information. I also created new error handling for other issues that I found with data selections such as unexpected or nonunique file paths. Ultimately, the remade cataloguing system fit the established specifications with the client.

This project relates to the topic of socialization in VR only in that both topics are shaped by peoples' interactions with a software application. The specifications of this project were based off of the desired effects of a large number of people submitting data to our catalogue system, and the focus of my STS research is to analyze the results of a large number of people interacting with social VR applications.

STS Topic

My research on the ways that casual socialization using VR technology can affect self-confidence will be conducted in the frames of technological determinism and affordance.

Technological determinism embodies the ideas that technological development is the key governing force in society that determines social change, as described by Smith and Marx (1994) as well as Bimber (1990). Technological determinism is applicable when answering this question because I am interested in the ways that VR technology as it currently stands guides social change, especially on an individual user level, regardless of how society has shaped VR technology. Donald Norman's expansion on the theory of affordance focuses on the perceived interactions that software provides to users (2004). Looking at the design elements of social VR applications and the perceived inter player interactions they afford will be helpful for understanding how player interactions may affect users' self-confidence.

A number of studies suggest that VR and related technologies can be used to promote social development or effect sociability in different ways. Some analyze existing VR and related technologies to find an overview of the effectiveness of VR technology in promoting certain social developments. These studies have shown the success of early computer simulations in mitigating social problems such as eating disorders and substance abuse (Smokowski & Hartung, 2003) and newer VR based training programs in aiding with developing social skills such as communication skills (Howard & Gutworth, 2020). They have also shown the effectiveness of using VR technology for exposure therapy (Diemer & Zwanzger, 2019). Targeted experiments have also shown the effects that VR experiences can have on social attributes and behaviors. VR based public speaking exposure intervention has been shown to be comparably effective with traditional exposure intervention techniques (Denizci Nazligul et al., 2019). In a negative light, experiments based on social exclusion in VR have proven to have negative impacts on participant prosocial behaviors and proxemics (Kothgassner et al., 2017). Studies have also shown that body insecurities can still affect the interactions of VR users (Tremblay et al., 2022),

showing that body and other similar insecurities can still have negative impacts on social interactions in VR. Studies on harassment in VR show the difficulties of preventing harassment in VR social applications and bring to light additional ways that users social development can be harmed (Blackwell et al., 2019).

Whether positive or negative, these studies all suggest that social interactions in VR can have noticeable effects on users' social development. However, they all focus on controlled test or simulation environments rather than casual interactions that people are likely to experience on their own. Research has found a correlation between positive experiences in social VR platforms and users feelings of relatedness, self-expansion, and enjoyment (Barreda-Ángeles & Hartmann, 2022), and I plan to expand on this. Given the popularity of social VR applications, I hope to bring to light the ways that casual social interactions in a natural VR environment can affect the social development, specifically the self-confidence, of VR users. It may be difficult to find compelling evidence that suggests a correlation between VR social application use and self-confidence without the ability to take concrete measurements. Despite this, I hope to find a positive correlation based on users' own perceptions about their experiences in VR and their self-confidence that can encourage the continued growth of the use of VR technology in society.

Research question and methods

The question that I aim to answer with this STS project is as follows: how does social interaction in VR, particularly in VRChat and Rec Room, affect self confidence in social interactions in non-virtual settings? The focus of this research will be on American social VR users. VRChat and Rec Room were chosen because they are two of the most popular social VR applications and because they encourage the casual social scenarios that I am interested in. This question will help to understand the effects socializing in VR can have on social development.

To explore this question, I will conduct 6 interviews with VRChat players and 6 interviews with Rec Room players. Due to the unexplored nature of this research question, the interviews will be semi-structured so that the interviewees can lead the conversation with their own thoughts and experiences. Some examples of what I will ask about include the social habits of the interviewee when in VR, how similarly they act and feel in and out of VR (including how self-confident they are), and how they feel their experiences in VR might affect their social experiences and self-confidence out of VR. I will then extrapolate any themes between the responses I get in each interview. This should provide insight on the specific ways that socialization in VR affects people and their self-confidence out of VR, expanding on the ways in which the previously mentioned literature suggests VR use has the potential to affect people.

Conclusion

My technical work was successful in redesigning the satellite imagery data cataloguing system so that people could more easily interact with it when uploading and processing or accessing data. My STS research project aims to provide a greater understanding of the impacts of socialization in VR on social development and could affect the direction of or the focus on social application development for VR. Additionally, it could affect the development of relevant VR hardware such as full body tracking, face tracking, or haptics. The findings of my research can also be used to create more targeted interview or survey questions to further explore this topic in the future. Exploring this topic could help to promote the possible benefits of still relatively new VR technology. In the event that social interaction in VR is found to have some negative impact on self-confidence outside of VR, this research can also serve as a caution for new users and as a basis for social application developers to try to mitigate these problems. I

don’t imagine this is the case for the majority of VR users, but it may be for some groups of people.

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