PEOPLES 3D

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A UCD Approach to VR

Rachael Marr's Capstone Proposal

LITERATURE REVIEW

Virtual reality (VR) is defined as, "a computer-generated environment with and within which people can interact" (Columbia Encyclopedia 2016). This literature review will define Virtual Reality, next, covering the history of Virtual Reality and, finally discussing the advantages of wireframing and the UCD approach. The paper will end with work that has been done thus far in usability and the VR space.

Although, many people refer to Virtual space as VR, there are different kinds of Virtual space (SAGE, 2009). The definition of VR is heavily dependent on the term, "interact," the ability to enable the user to change their virtual environment is the reasoning for using a user-centered design approach when building VR systems. At its core, VR aims to "alter the perception of reality by providing artificial computer-generated stimuli (Bovik, 2016)." These stimuli can be multi-modal or only visual, however for a truly immersive experience many VR systems employ multi-modal senses, such as the addition of auditory or haptic feedback to the user. It is this immersion and interaction that is at the core of Virtual Reality (Bovik, 2016). Augmented reality (AR) is slightly different from its VR counterpart, in that it works as an overlay on our reality. Both spaces have become more and more mainstream in recent years. This is mainly due to the computing capabilities of phones, as prior VR/AR interactions required a computer with the neccessary proccessing power and in the case of AR, GPS. As this technology becomes more pervasive in our everyday lives there is a need to apply user-centered design principles, specifically the process of wireframing. This paper will analyze prior work that has focused on both examining and applying UCD design principles to the VR space which will in turn help to inform the formation of a 3D wireframing tool that would help interactive designers apply their user-centered principles to this design space easily.

The earliest known use of the term "Virtual Reality" dates back to 1938 as "la Realite Virtuelle" by French dramatist Antonin Artaud. At the time, the term had a fairly different meaning than what we currently think of as VR. Artaud was referring to "Virtual Reality" as a way to create. Indeed, the human ex-

perience has always been working toward an idea of a "Virtual Environment," which is exemplified in everything from cave paintings to photography, up to 3D movies and game play.

In order to adequately study VR, it is important to also study the way in which VR works. Humans by and large rely on their sense of sight, more than any other sensory organ. As such, our depth perception and visual feedback is one of the best in the animal kingdom. At its core, sight is a perception of the reflection of light off of an object (Bovik, 2016). Within the view of light, the human is able to observe two properties: and object's intensity and approximate wavelength (Bovik, 2016).

A wireframe, often described as a architectural plan for a house, is a way in which a "flow" can be tested (Banga 2014). The advantage of a wireframe prior to actually building a system is that a rudimentary version of the system can be tested with the user prior to spending countless hours working on the visual design of the product only then being made aware of problems.

What is a user centered design approach (UCD)? At its most basic a UCD is a way of designing a product whereby the user is the focus. The approach makes sure that the product or service is "meeting the needs of the user (Sanders)." This means within a typical user-centered two dimensional design flow, the designer would first sketch and then wireframe out the system. Typically, wireframes are very sparse when it comes to design elements. Most designers try not to use images, colors, and only use one generic font. That way the user is not critiquing the visual design on the system, but rather focusing on the system itself. There are many advantages to wireframing out a system prior to performing a full build out. Wireframing can give the designer a clearer understanding of how the system should work. Wireframing also helps to show other stakeholders a designers thought process as well as to help to concretely communicate the elements needed for the final product early. Most importantly, the wireframe is a way to get feedback from users early on in the process. There are some downsides to using wireframes when user testing. Specifically they have a hard time showing interactivity such as dropdowns and transitions, although this is changing slightly thanks to the abun-

dance of programs available for wireframing. Many have started to implement hover states and more accurate transitions between pages. There has not been much work done on wireframing in the 3D space. As stated prior, there is a lot of literature which works to test the VR/AR space as well as working on setting forth documented principles for the VR space. Specifically, what is the standard of practice for setting interfaces in a VR space? Though not conclusive, this work is being pioneered by the likes of Google and other tech giants.

There are several papers that go through how to accurately test a VR system with user-centered design principles. The most utilized reference within the HCI field, Don Norman's Design of Everyday things, proposes seven fundamental design principles. Another well known way to test/design is with a Heuristic evaluation proposed by the Nielsen Group. Though these are both well tested and accepted forms of user testing, these had to be tweaked in order to navigate 3D worlds and address perceptual orientation.

In the paper entitled, "A Usability Evaluation Method for Virtual Reality User Interfaces" the author utilizes both Norman and Nielsen's evaluation methods to assess a 3D system. Within this system the author proposes that there are three cycles within the realm of Virtual Reality. Firstly, and most important cycle is the goal cycle. The user must be presented with a goal and then they have a purpose within the VR realm. The second and third cycles are subordinate to the goal, and they consist of exploration and system initiative. Exploration refers to a users need to explore the environment, this is usually based on the user receiving a goal. The third cycle is system initiative which is another way of saying how the user interacts with the system. These three cycles are a way to test VR/AR systems.

In direct opposition to the prior paper, entitled, " What does virtual reality NEED?" John Wann analyzes the physicality of VR systems. How is the user perceiving objects, and which object manipulations work best? Beginning with the principles of direct manipulation, the author proposes that all of the prior work done by Nielsen and Norman is directly applicable to the VR space and no adjustments are necessary. This paper, first written in 1996, suggests that there is no need for a VR environment to mimic the "real world." Though many

subsequent papers discussed here do not agree with this sentiment, it is important to bring this mental model forward.

The paper entitled, "Human-Centered design of 3D interaction devices to control visual environments" discusses various processes for collecting user feedback and proposes several VR/AR guidelines when evaluating a VR/AR system. This paper thoughtfully puts forward an evaluation system for VR. The paper states, "The success of the end product in human centered design depends on an iterative design and evaluation process." The paper proposes a tool called VIEW which would be modeled after how an artist models with clay. Prior to designing the VIEW, the authors held two experiments. The first experiment tested the usability of VR. The authors then used the analyses to create their tool, and then tested the tool that was built for experiment two. The users consisted of both expert and non-expert. The study found that many of the products on the market did not perform very well technically, and were not ergonomic. Both of these aspects had to change if the user was going to purchase and use these products. The paper closes by advocating for the user centered design process to help bridge the gap between the user and the market.

In conclusion, there are many ways in which a VR system could be implemented, thanks to prior work on the usability aspects of VR/AR I was able to come to a more concise conclusion on how I want to implement my prototype. Coupled with the case for wireframing, this proposed tool will help to change the accessibility of VR to the average user, while still taking a user-centered design approach. ***References available in Appendix 2***

DISCOVERY PHASE:

In order to identify the characteristics of the user base I did an initial requirements gathering using the Contextual Design Method. Two users, both males aged between 25 and 35, were asked how they would complete a 3D project if tasked to. I let the user pick the software they would like to use to create a 3D project. ***See Appendix 3 for full transcripts.***

Appendix Two
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