Merging of Virtual Technology into Reality

How has the development of virtual technology affected social groups in reality?

A Thesis Prospectus

In STS 4500

Presented to

The Faculty of the

School of Engineering and Applied Science

University of Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science in Computer Science

By

Jason Nguyen

October 27, 2023

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.

ADVISORS

Rider Foley, Department of Engineering and Society

Rosanne Vrugtman, Department of Computer Science

Introduction

In the contemporary job market, a significant number of professions require a combination of skills, education, and/or experience, spanning diverse fields from nursing to truck driving (Keiling, 2023). Unfortunately, acquiring these qualifications comes at a substantial financial cost. The average expense for higher education alone surpasses $100,000 (Hanson, 2023), and this figure does not encompass expenses related to postgraduate studies or the cost of living. Even for occupations where degrees may be optional, the substantial financial outlay persists for materials, certifications, and instruction.

Various online platforms have played a pivotal role in attempting to decrease this financial outlay. Websites like Khan Academy provide accessible and free educational resources for a wide array of subjects for users to enhance skills (Khan Academy, 2023). Similarly, platforms like LettCode cater specifically to software engineers, offering coding challenges and interview preparation materials (LeetCode, 2023). But while these platforms offer valuable educational resources for free, they do not replicate real life coding interviews or personalized teaching. Although technical interviews involve problem-solving skills that these platforms help develop, it also includes communication skills, effective problem solving, and context-specific tasks (Rand, 2022). Meanwhile, general education platforms fail to address individual learning styles, pacing, and specific challenges that may not be covered in a standardized online setting. The biggest issue with these online platforms is that they are unable to mimic real life environments. Although this is less impactful for software engineers and general education, it is abundantly clear when looking at the medical field, such as surgeons and pharmacists.

Given the limitations of these platforms replicating real-life environments, an emerging solution is Virtual Reality (VR), a simulated three dimensional environment that enables users to

explore and interact with a virtual surrounding that mimics reality (Sheldon). This technical topic focuses on the potential of VR as a more cost-effective and accessible method for professional training and education.

Technical Topic

This technical project focuses on the merging of virtual and physical worlds due to the evolution of virtual reality. Although VR technology has many different types, functional details of only two versions of the technology are necessary for this discussion, standard virtual reality headsets and augmented reality glasses. All other technologies discussed in this paper are extensions or improvements to these two models.

A virtual reality headset is a specialized device that enables users to immerse themselves in computer-generated virtual environments using sensory experiences. Headsets typically consist of a head-mounted display that wraps around and covers the user's head and projects stereoscopic images, optical, motion, and eye tracking sensors to capture user's head movements, allowing imagery to adjust in real time. Haptic actuators in controllers allow users to interact with displayed images shown in the optics while Specialized system-on-chips allow users to connect their headset to the WiFi allowing for new content to be downloaded (See Figure 1). Additionally, some headsets may include spatial audio systems to provide immersive soundscapes that enhance user sensory experience.

With such an affordable piece of technology that could mimic real life scenarios, much of society began integrating it into tasks and training. One such example is using the headset to create an interview simulator app, named VRJob, for software engineers (Stanica, 2018). The app allows users to practice their interview by answering hard and soft skills questions, all while being virtually present in an interview room. While this technology proposes good additions to

physical practices, problems arise when these virtual simulations become alternatives and replacements, rather than simply additions. These problems are addressed in the next section of this paper.

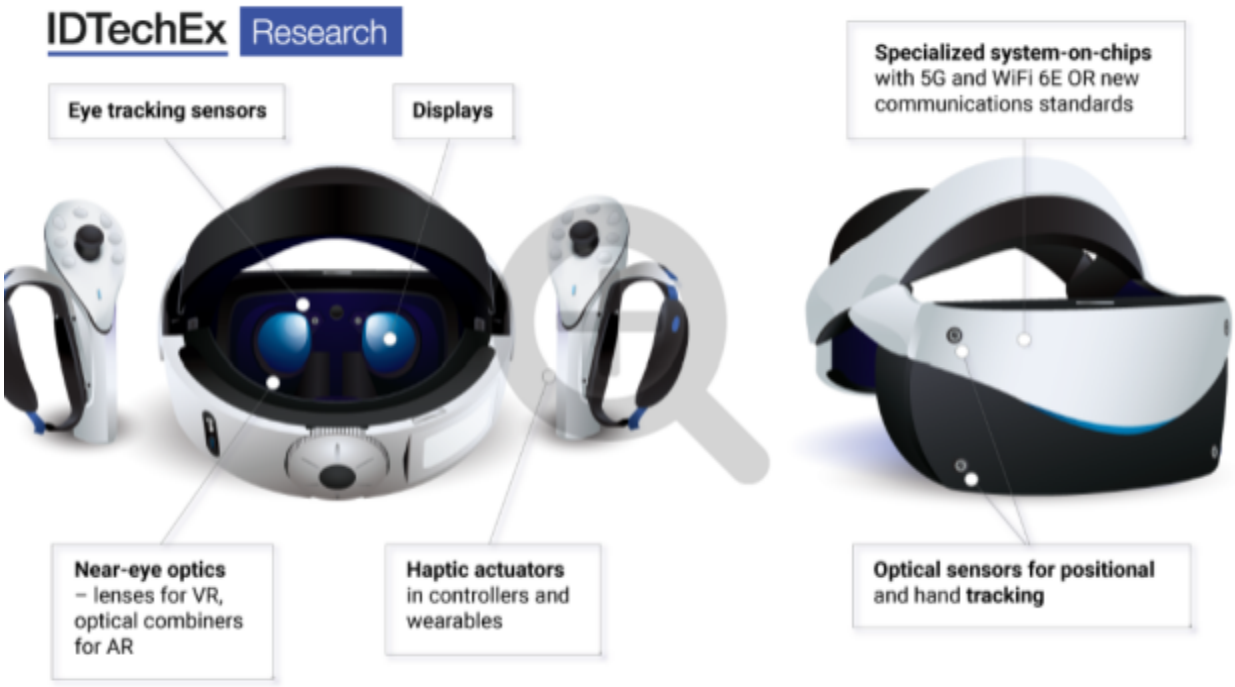

Figure 1. Names and Descriptions of Different Parts of a VR Headset (Source: IDTechEx, 2023)

Augmented reality (AR) glasses are wearable devices that overlay digital information, graphics, or virtual objects on top of the user's real-world environment. Glasses generally include transparent displays that allow users to see both real surroundings and virtual content. Integrated cameras and sensors capture the user's surroundings and track head movement, enabling accurate positioning of virtual elements within the physical space (See Figure 2). Additionally, AR glasses may feature built in speakers to provide users with immersive audio experiences which complement visual augmentations as well as hand gesture recognition and voice commands for hands-free interactions with content.

This model seamlessly integrates the virtual world into reality with seamlessly no repercussions, as simply removing the glasses resets everything for users. With endless possibilities and no consequences, other fields in society are already taking advantage of the extra data and views AR glasses provide (Kanuganti, 2019). For example, schools are using the glasses' visualization by showing concepts in real time, instead of simply reading about theory in books. Some Medical institutions like Duke and John Hopkins are prototyping using AR headsets in order to view key patient data and digital images in real time during operations. The reason this technology has minimal consequences is because its effect on users is temporary. But with recent announcements in neurotechnology, such as Elon Musk's brain chip (Neuralink, 2023), this technology suddenly isn't temporary anymore, creating much greater consequences that need to be discussed.

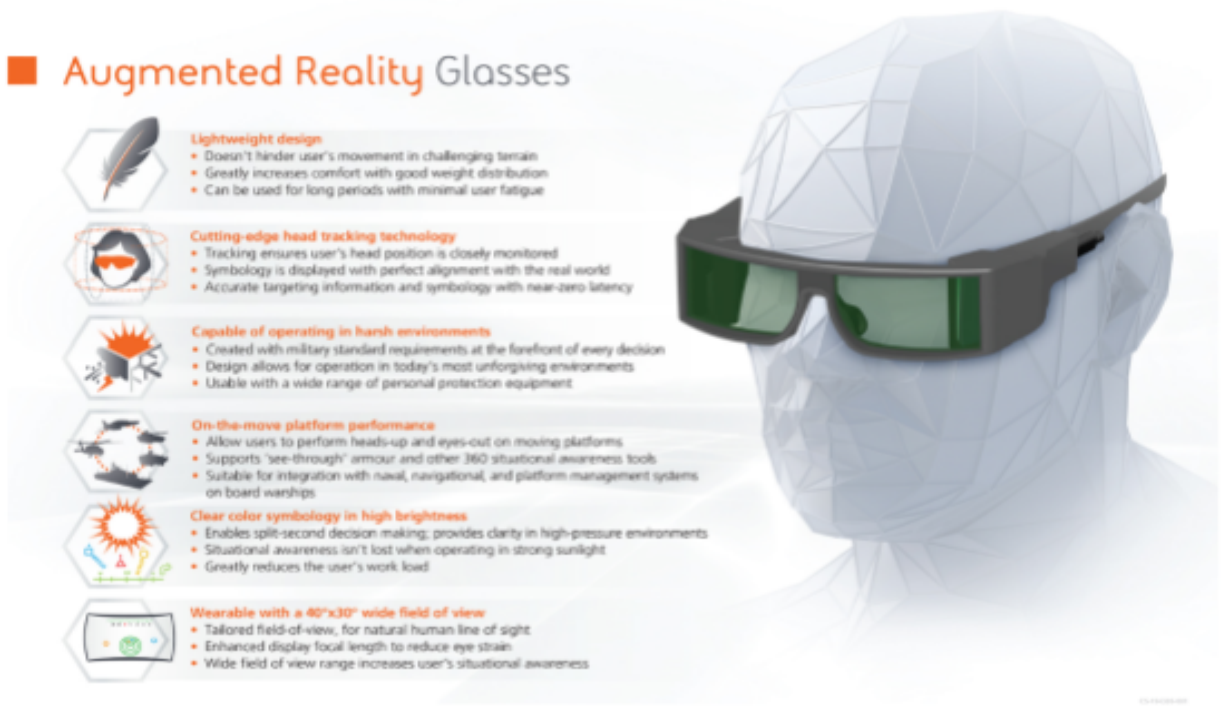

Figure 2. Features of a Pair of Augmented Reality Glasses (Source: BaeSystems, 2023)

STS Topic

The integration and evolution of VR in career development will be dependent on and create many complex interactions between the human, social, and technical elements. Using the framework of the Social Construction of Technology (SCOT) described in Trevor Pinch and Wiebe Bijker's article, *The Social Construction of Facts and Artifacts*, we can analyze the interplay among these elements from this integration within a broader context of STS .

Important aspects of SCOT that will be valuable in analyzing VR in career development are interpretative flexibility as well as closure and stabilization. Interpretative flexibility is the concept that different stakeholders or social groups have various interpretations to a technology, which can influence its development, adoption, and impact (Pinch & Bijker, 2008). Closure and stabilization is the process in which various interpretations of a technology become relatively stabilized within specific social groups over time (Pinch & Bijker, 2008).

Big businesses originally believed that VR would "emerge as the next social and communications platform" (Meta, 2014). Although it did become a new social and communications platform, different groups saw different uses for this technology, including career development. Within career development, there were varied perspectives on VR's effectiveness and necessity. While certain social groups, such as the developers of VRJob, saw VR as a great resource, others saw this integration as a way to fuel mental health issues. Certain social groups saw this as a way to promote escapism, a need of wanting to 'leave' the real world, cognitively and emotionally (Han et al., 2022). With the implementation of VR in career development, which incentivises users in reality by improving real world skills, these social groups believe that people with issues of escapism will not leave the VR, leading to potential health issues, including eye strain, mental fatigue, and motion sickness (Afolabi, 2023).

However, similar to smartphones, VR as a means for career development will gradually become accepted as a good alternative so long as safety measures are in place. VR practices within educational and professional contexts have already begun, as many instructors have begun to trial run using the technology to create immersive classrooms, in which images are projected onto the internal walls of the room (ImmersionVR). Medical social groups have also shown interest that VR is a cheaper alternative for career development, shown from the release of MetaMediicsVR, a virtual simulation training program for medical staff (MetaMedics, 2023). As VR continues to demonstrate effectiveness in professional development, there will be societal acceptance and adaptation of this technology in the field.

Research Question & Methods

It is these key principles in SCOT that show us that VR evolution in career development and stakeholder interactions are dependent. So now I ask: can virtual reality serve as an adequate method for individuals seeking to acquire skills and qualifications relevant to career development?

To address this question, my approach involves conducting experiments with two distinct groups of students utilizing the VR laboratory in the University's library. Leveraging pre-existing software and applications embedded in the laboratory, scenarios such as code interview rooms, testing centers, and surgery rooms will be replicated. The experimental design entails one group undergoing skills training with VR, while the second group engages in training without VR. Following a predefined duration, participants will undertake short, timed tests aligned with their respective areas of study, such as software engineering or medical training. Exam scores will be recorded and analyzed to determine whether VR-based training demonstrates an equal or superior correlation with qualification acquisition compared to conventional training methods

Understanding the potential impact of VR on education and skill development addresses issues of accessibility, democratizing learning opportunities to a broader population. This adoption of VR technologies become social processes, shaped by stakeholders and their various interpretations. If proven effective, VR could emerge not just as a technological tool but as a socially constructed and adaptable means of acquiring qualifications. This, in turn, has the potential to influence individual career paths and the economic landscape

Conclusion

The issue of the escalating financial burden in obtaining qualifications requires innovative solutions for broader accessibility. The integration of Virtual Reality (VR) into education emerges as a possible solution, with the potential to democratize learning and lessen financial burdens. The experiments to be conducted aim to validate the efficacy of VR-based training, resulting in a future where VR becomes a cost-effective and adaptable means of professional development. The expected results foresee gradual societal acceptance and adaptation of VR technology, easing financial barriers and reshaping the educational and professional landscape. Ultimately, this research aims for a future where VR acts as a catalyst for positive change, cultivating accessibility and affordability in education and skill development.

Resources

Afolabi, Oluwademilade. (2023). 4 Ways Virtual Reality is Bad for You. *MUO*

BaeSystems. (2023). Augmented Reality Display Glasses. BaeSystems.

BaeSystems. (2023). Features of Augmented Reality Glasses. Available at: https://www.baesystems.com/en-us/product/ar-glasses

Contributor, TechTarger. (). VR headset (virtual reality headset). *TechTarget*

Dale, Sam. (2023). Virtual Reality & Augmented Reality Headsets 202302033: Technologies, Players and Markets. *idTechex*

Dingman, Hayden. (2016). HTC Vive review: Reach out and touch the virtual world. *PCWorld.*

Gillis, Alexander. (2022). What is augmented reality (AR)?. *TechTarget*.

Han, D. I. D., Bergs, Y., & Moorhouse, N. (2022). Virtual reality consumer experience escapes: preparing for the metaverse. *Virtual Reality*, *26*(4), 1443-1458.

Hanson, Melanie. (2023). Average Cost of College & Tuition. *EducationData*

IDTechEx. (2023) Parts of VR Headset. Available at: https://www.idtechex.com/en/research-report/virtual-reality-and-augmented-reality-headsets-2023-2033-technologies-players-and-markets/889

Immersion VR. (2023). VR For Education. *Immersion VR.*

Keiling, Hanne. (2023). 25 High-Paying In-Demand Jobs (With Salary and Requirements). *Indeed*

Khan Academy. (2023). *Khan Academy.*

LeetCode. (2023). *LeetCode.*

Meta. (2014), Facebook to Acquire Oculus. *Meta*.

MetaMedicsVR. (2023). MetaMedicsVR.

https://metamedicsvr.com/.

NeuraLink. (2023). NeuraLink. https://neuralink.com/

Pinch, T. J., Bijker, W., Bijker, F. W., Hughes, T. P., & Pinch, T. J. (2008). 8 “the social construction of facts and artifacts”. *Technology and Society: Building our Sociotechnical Future*.

Rand, B. (2022). How To Prepare for Your Coding Interview in 10 Steps. *Indeed*

Sheldon, Robert. Definition of virtual reality. *TechTarget*

Virtuix. (2023). *Virtuix*.