The inner workings of Augmented Reality
(Technical Paper)

Augmented Reality and its effects on psychology and society at large.
(STS Paper)

A Thesis Prospectus
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Introduction

The issue of mental health has become a commonplace issue within American society and solutions to mental health are scarce. A lot of these issues also stem from the way humans have socially interacted with each other as well as biological reasons.

As of late, there has become a greater demand for augmented reality due to a "gravitation toward non-pharmacological approaches" to those with mental issues such as dementia (Zhu et al, 2021). In addition, there is always the desire to improve in the way people learn and there are some that are researching the ways in which motivation can be improved through augmented reality (Serio et al, 2012). Augmented reality has also been brought up numerous times for therapeutic purposes as an alternative option in treating mental illnesses (Freeman et al, 2019).

The emergence of augmented reality allows for humans to change the way they interact with each other and to alter the way mental health can be handled. The demand by humans to create technology that facilitates social interaction as well as treating mental illness could create a change society based on the way society may apply augmented reality. These changes could lead to outcomes that enhance the way we perceive others and the way we learn, but it's very plausible that there could be negative psychological effects that emerge from augmented reality in addition to the positive psychological effects.

In this prospectus, I will address "psychological effects" as any mental disorder or illness, changes in the way people think, and changes in the way people learn that are influenced by augmented reality. I will explore what various studies and journals have to say about the topic in order to come to an objective conclusion to determine whether augmented reality is worth

pursuing with regards to its feasibility and safety to society. I will try to reach this conclusion by evaluating how each study shows the positive and negative mental effects and its accessibility to evaluate whether this will change society for better or for worse if at all.

Technical Topic: The inner workings of augmented reality

My technical paper will cover the various ways in which augmented reality has evolved over the years to become what it is today. My technical paper will research specifically on modern examples of augmented reality used for the general public, different techniques to implement augmented reality, issues faced by augmented reality, and current and future applications of augmented reality. The evolution of augmented reality can hopefully evolve to better suit the needs for a solution to a mental health crisis or to facilitate human interaction better in society.

Augmented reality began as a concept of allowing a user to receive information or stimulus without the user's direct senses. This concept eventually extended to 6 potential uses for augmented reality: medical visualization, maintenance and repair, annotation, robot path planning, entertainment, and military aircraft navigation and targeting (Azuma, 1997).

Some problems that modern augmented reality systems face is possibly improving the system to reduce lag so that the user does not detect it (which could be important in certain psychological treatments or experiments). Another issue is that augmented reality needs to be perceived as effective and harmless by the public in order to be accepted as a potential tool to be used, because if augmented reality is perceived as dangerous to the general public or ineffective then it will undermine what the public wants from it: a safe new way to have new experiences or effective treatments.

One such modern example of entertainment that became fairly widespread during its prime was for the kinect on the Xbox. The kinect was impressive for its time since it performed real-time mapping of physical interior scenes of homes while also capturing the player as well. The breakthrough of the kinect emerged due to the simultaneous localisation and mapping (SLAM) which allows for fast real time mapping that was optimized for fast camera movement (Newcombe et al, 2011). The method in which the kinect was developed was through the use of 6 degrees of freedom camera that calculated the boundaries of each physical surface using various mathematical equations and formulas. This technology can be improved on by moving from rudimentary scene mapping to detailed dense scene reconstruction in real-time which are currently held back by user scene lighting and better camera motion detection (Newcombe et al, 2011).

The Kinect is an interesting case study since it shows the potential for how people can have an improved user interface experience based on how the kinect sensor generates augmented reality based on the surroundings and the user. Further research into how augmented reality could be used in terms of entertainment could enhance the way people experience media but it could also act as an improved user interface for those who can't hold a controller or prefer to use their body as the controller. In addition, improved mapping could have other applications in other areas such as recreating a 3d model of a robot's pathing, a 3d model of inside the body for medical purposes, or to create a 3d model of an area of land through aerial navigation.

STS Topic: Augmented reality and its effects on psychology

Augmented reality has been shown in a mostly positive light in order to gain a positive public traction, but could it potentially contain negative side effects that are yet to be seen? I will consider augmented reality in the context of mental illnesses, learning, and socializing. I will

assess whether augmented reality presents a greater boon compared to its potential negative effects in addition to how accessible it is to the general public.

I will be framing my argument in the context of actor network theory, which states that various actors share relationships with each other that shows how each actor interacts with each other in order to show the dynamic between groups or people that are facilitated or prevented by certain actors (Moore, 2009). In essence, it's a web of relationships that ultimately show how people/technology interact with each other or how people interact with technology.

As of late, the use of augmented reality in the medical field has become more accepted in treating various mental illnesses. Srivastava, a qualified individual on the topic with a PhD with a peer reviewed journal, is one such researcher who found that in various preliminary studies and studies that there are a lot of applications of augmented reality in healthcare such as treating mental illnesses such as PTSD, various phobias, eating disorders, and more (Srivastava, 2014). Her study reveals that augmented reality in the medical field could be beneficial and has already seen positive outcomes for its users since doctors are better equipped to help them through the use of augmented reality. This relationship between patient and doctor is thus improved upon by augmented reality.

However, there is still a possible issue with the cost that arises from widespread use of augmented reality and some minor side effects such as eye soreness, reduced limb control, reduced postural control, and more. This does raise concerns with regards to the cost of augmented reality and some of the side effects that could occur. These side effects aren't as significant as the more pressing issue at hand (mental illnesses), but one such researcher found a possible alternative to cheaper access to augmented reality.

Riva, a researcher in the VEPSY project for treating mental illness through augmented reality, found a way to lower the cost of augmented reality by PCs that will execute clinical modules that will receive user feedback on its work. Her project helps to provide a possible solution to accessibility issues with augmented reality (Riva et al, 2004).

With regards to augmented reality in learning there are various studies that point to both negative and positive effects of augmented reality. Wu is one such researcher that found that the use of augmented reality was not worth the effort. He and his team found that despite helping kids with learning disabilities with augmented reality, they found that augmented reality could face issues with regards to how students learn and how teachers teach. This is because augmented reality would be in direct conflict with how traditional teaching was originally intended in school and lacks flexibility in terms of time constraints. The research provided by Wu found that in one article that "reported that students often felt overwhelmed and confused when they were engaged in a multi-user AR simulation because they had to deal with unfamiliar technologies as well as complex tasks." (Wu et al, 2012).

Another research group led by Serio found that augmented reality in the classroom could be beneficial. Serio and his team wanted to find out whether augmented reality had a considerable difference in difficulty in terms of learning and motivation. Research was done on 69 middle school students and given a questionnaire afterwards to measure their motivation and how well augmented reality worked. They found that the middle schoolers reported that they had an increased motivation for learning as well as enjoying the experience more compared to the traditional classroom setting (Serio et al, 2012).

I find that in the context of learning that augmented reality would benefit in only niche situations with those who have learning disabilities. While Serio found that there may be more

motivation amongst students, it did not do the study over a long period of time, and I believe that Wu may be correct when he states that augmented reality may interfere with the social relationship between students and teachers by adding an additional complication that may not add too much into enhancing learning.

Augmented reality has also been seen to facilitate positive social interaction amongst peers. One study by Lee and his team found that Pokemon Go, a form of entertainment in augmented reality, facilitated physical activity and improved mood for psychological effects. They further pointed out that continued use of Pokemon Go could promote a better lifestyle in its users both physically and mentally through social interaction (Lee et al, 2021).

Some opponents to augmented reality with regards to its social effects might argue that excessive augmented reality usage could result in negative social traits as seen in other technologies such as video games. However, this was debunked by Schimmenti and he found that in-game disorder (IGD) in video games (such as MMORPGs) is not an addictive behavior but rather is a more nuanced issue that is caused by multiple factors.

Conclusion

I have found that augmented reality has many positive and negative traits to it. Through the lens of ANT, augmented reality allows for two groups to better interact with each other through the use of augmented reality, such as social outings among peers for entertainment purposes such as games or to allow doctors/psychiatrists to better treat their patients through the use of augmented reality. However, there are also cases where augmented reality may not be that great in the sense that it could impede existing social constructs such as the roles of teachers and students, and it could not be cost effective. I find this dynamic a worthwhile topic to further

research to find out whether it enhances or debilitates the interactions between current actors. I will further research the potential benefits and harmful effects of augmented reality in my research paper through various academic journals.

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