

Capstone Design ECE 4440 / ECE 4991

(Technical Paper)

Gaming the Brain: An Exploration of Video Games in Therapy

(STS Paper)

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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:

Every year, there are major break-throughs in life-saving technologies to combat the many infections, disorders, and diseases that the human race faces. In the few past decades cancer survivability has risen from 49% to 70% (Hassan, 2022) in the past few years deaths from infectious disease has fallen by 19% (Soucheray, 2018) and over roughly 2 years the Covid-19 death rates have fallen from 6.24% to 1.10% (Mathieu et al., 2022) . However, one field seems to be lagging behind: mental health treatment. Suicide rates have been rising over the past two decades, going up 35% since 1999 (Galvin, 2020), and from 2007 to 2017, mental health issues rose 13% ('Mental Health', n.d.) . Furthermore, most antidepressants only out-perform placebo by about 10 percentage points (Khan & Brown, 2015). Most of the significant technological breakthroughs in mental health treatment have just been ways to make current therapy methods more accessible, like telemedicine, smartphone apps, and hotlines (Thompson, 2022). While these advances are incredibly beneficial there is a need for more innovation in mental health treatment.

Though often dismissed as childish or vulgar, videogames have incredible power in engaging, immersing, and affecting players. In the field of mental and emotional therapy these features could fill a hole in innovation, so the question arises: How can videogames be used in mental and emotional therapy? One option is using videogames' immersive quality for exposure therapy for people with PTSD and extreme phobias. Videogames therapy could also be especially effective for young children by helping them process their emotions through artistic narratives that could unpack heavy subjects in a way that's engaging. I will build upon previous work on this topic as well as conduct interviews with potentially affected people to determine the viability of these options.

Technical Project:

My technical project, though unrelated to my STS project, builds on similar themes of creativity and fun. The goal of the project is to create a unique, versatile musical instrument using knowledge from previous courses like ECE Fundamentals 3 and Operating Systems. The project will allow users to record any 5-second sound, whether its a guitar chord or a cat meowing, and play back pitch-shifted versions of the recording on a midi device to make music. The design will consist of a wooden box with an attached microphone and an opening for usb-midi input. Users will be able to press a button on the box to record their sound using the microphone causing a red LED to light up. Once the user is finished recording, a yellow led will light up as the the recording is processed. The recording will then go through a pitch shifting algorithm that will produce a tone for each key on the keyboard with the original recording mapped to middle-C. Once the audio has been processed, a green LED will activate, signifying that the sound is ready to play. The final product will be a streamlined, powerful musical instrument that will allow the user to turn the world around them into music.

STS project:

Videogames have had a long complicated and controversial journey in the eyes of the public.

They have long considered to be trivial entertainment at best, and violent, bad influences at worst. For a long time maybe this was the case. Early videogames served merely as colorful distractions, designed to stimulate the senses and create an enjoyable experience. As

videogames

progressed they began to take on narratives and more cohesive gameplay, but many games like *Doom* or *Wolfenstein* still merely sought to provide excitement and action with violent shooter

games. Such titles earned videogames notoriety as cheap, vulgar entertainment, and gave rise to myths that videogames incited aggression in youth (‘A Timeline of Video Game Controversies’, 2022). Today, many videogames still contain similar themes of violence and excitement, but modern technology has opened up doors to far more subtle and atmospheric games. Higher graphics, processing speeds, and memory, as well as streamlined game design processes allow developers to tell enriching stories with emotional depth, created not only to entertain, but also to provoke thought and genuine emotion. The advent of virtual reality allows almost complete immersion, putting players in scenarios they never would have been able to experience otherwise. The platform of videogames has revealed itself as an artform and a powerful tool to be harnessed, so what strengths exactly do videogames have and how can they be used in mental and emotional therapy?

Some strengths of videogames have already entered common use in the form of gamification. Gamification is the act of incorporating game-like elements into a non-game activity. This method is can create motivation and excitement in an otherwise tedious or unenjoyable task. It is most commonly used in educational settings. For instance, there are many games that teach basic spelling and math in the context of gaining points and defeating enemies. Furthermore, many teachers incorporate game elements like point systems, competition, and roleplaying into the classroom (Schaaf & Quinn, 2017). These examples display the power of games to engage players and take the edge off of tedious or difficult subjects. In the context of mental and emotional therapy, videogames could make the painful process of working through emotions less direct, more engaging, and therefore, more manageable.

Another highly useful aspect of videogames is its power of immersion. With technology like virtual reality (VR), videogames can transport the player to a completely different place and

offer a wide range of visual and emotional experiences without the limitations of the real world. In the context of medicine, VR's power of immersion has already found use in applications such as exposure therapy for those with phobias and PTSD. However, in these cases the participants were only passive observers of a VR experience (Brandt, 2012), where videogames could offer more active participation. Not only would this interactivity engage and more fully immerse the participant, it also would offer control over a potentially stressful situation. For instance, in normal VR exposure therapy, an arachnophobic patient might be placed in a virtual room and shown virtual spiders. A VR videogame could do the same thing but also give the patient a virtual flamethrower. Giving the player such autonomy could help exposure therapy become more enjoyable as well as give patients a sense of actively overcoming their fears.

With these strengths in mind, the groups that would probably most benefit from videogame therapy are people with severe phobias, people with PTSD, and children. In the case of phobia and PTSD patients, VR videogames could offer a more interactive and comfortable form of exposure therapy. In the case of children videogames could offer an engaging and fun way to work through tough emotions. In fact 'play therapy' has already found widespread success in children's therapy. Such methods could be expanded and refined through the many powerful features of videogames. Since these three social groups seem to be the most relevant to my topic, they will be the main subjects of my research paper. Although people with more minor symptoms of phobias and PTSD could probably benefit from therapeutic videogames, this study will focus mainly on people with diagnosable cases. Such people need the benefits the most so it is more important that their specific needs are met. In this case, 'children' will be defined as young persons between the ages of 3 and 11, as this is the age where play therapy is most effective (O'Connor, 2016).

The main method of my thesis will be case studies of various instances of people using videogames or something similar to provide any kind of emotional or mental therapy. I will examine what each case did and how effective it was, and try to synthesize what methods would maximize positive mental effect. I believe this will be effective because there are many examples of methods that achieve something similar but very few examples of cases that attempt a true therapeutic videogame. Therefore I can piece together the different aspects of different cases to build a picture of what one might look like. Furthermore, I hope to use some ethnography as well and conduct interviews with both mental health workers and patients to gather input on what they think would be the most useful. I plan to do the case studies first so I can get a good idea of how a therapeutic might be executed before I pitch the idea to the relevant social parties and gather feedback on how the idea could be tweaked to best serve them.

Key Texts:

1. Brandt, M. (2012). From “the ultimate display” to “the ultimate skinner box”: Virtual reality and the future of psychotherapy. In A. N. Valdivia, *The International Encyclopedia of Media Studies* (p. wbiems160). Blackwell Publishing Ltd.
<https://doi.org/10.1002/9781444361506.wbiems160>

This is a study conducted by Marisa Brandt on the use of VR in treating PTSD using virtual reality. She was able to find success in providing PTSD patients certain virtual experiences that disrupted negative symptoms. This isn't a direct use of videogames in therapy but it is a strong example of success with a similar strategy. I will be able to study what worked about this particular method and synthesize how the method might be improved in a more game-like environment.

2. Lv, S., Zhang, Q., & Wang, L. (2020). VR virtual reality technology and treatment progress. *SID Symposium Digest of Technical Papers*, 51(S1), 35–38.
<https://doi.org/10.1002/sdtp.13745>

This Article covers the use of virtual reality as method of desensitization therapy for phobias.

Again this article doesn't directly deal with videogames but it does cover a similar topic. I would like to explore how such desensitization could be paired with a sense of interactive control to help create a sense of actively overcoming fears, while making the entire experience less uncomfortable.

3. Li, W. H., Chung, J. O., & Ho, E. K. (2011). The effectiveness of therapeutic play, using virtual reality computer games, in promoting the psychological well-being of children hospitalised with cancer: Effectiveness of therapeutic play. *Journal of Clinical Nursing*, 20(15–16), 2135–2143. <https://doi.org/10.1111/j.1365-2702.2011.03733.x>

This is a study that covers the effect of virtual reality videogames on depression and anxiety symptoms in young cancer patients. This study is almost directly related to my own project, and I would like to closely examine what worked in this study and how it can be expanded. This will likely be the subject of my first case study.

4. Bukar, A., Abdullah, A., Opara, J. A., M, A., & Hassan, A. (2019). Catharsis as a therapy: An overview on health and human development. *Journal of Physical Health and Sports Medicine*, 31–35. <https://doi.org/10.36811/jphsm.2019.110007>

This is a study of catharsis and its effectiveness in treating trauma and overall improving mental health. It details how catharsis helps to process difficult experiences and emotions and how it can be achieved. I plan to connect this study to aspects of videogames to reinforce their viability in for use therapy. I would also like to examine ways that catharsis can be achieved to maximize its effect in a potential therapeutic videogame.

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<https://www.cnn.com/2022/09/21/health/cancer-deaths-decline-research-report/index.html>

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Thompson, K. (2022, February 19). Advances and breakthroughs in mental health worth celebrating. *Good Good Good*. <https://www.goodgoodgood.co/articles/advances-in-mental-health>