Thesis Project Portfolio

Capstone Design ECE 4440 / ECE 4991

(Technical Report)

Gaming the Brain: An Exploration of Video Games in Therapy

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring, 2022

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STS Paper:

In psychological treatment there is always room for improvement. There is no cast for a broken mind, or any completely effective way to deal with psychological issues. Therefore, any new approach that can improve treatment is well needed. On the other hand, the video game is a largely untapped platform capable of producing significant emotional effects that could be applied in therapeutic contexts. I aim to address these two topics and answer the questions: how can video games be used to enhance emotional therapy, and what would such a game look like? To narrow the scope of this goal, the paper focuses on two specific therapy cases: phobia patients and children. Some scholars have already recognized the potential of video games in these cases and have begun to study their ability to achieve a therapeutic effect. However, to my knowledge none have used a game made specifically for therapy. Therefore my paper aims to collect the best strategies implemented so far and combine them to determine what an optimal therapeutic video game would have to achieve. To do this, the paper studies four cases of video games successfully achieving therapeutic effects; two scholarly studies and two commercial video games. For each case, the paper dissects the strategies used to determine which are most effective. The studies conclude that these strategies are distraction, immersion, autonomy, customizability, and emotional expression. Distraction is an element of fun that diverts away some of the stress of treatment. Immersion helps players get lost in the game increasing its ability to affect an emotional response. Autonomy helps players feel more in control of their treatment, further easing stress. Customization allows treatment to be tailored exactly to patient needs. Finally, emotional expression allows release for patients and could give therapists more insight on their emotional state. Applying the most relevant strategies to a game for phobias

would look like a leveled game where each level the patient has to interact with the feared object in some challenging way. Each level would be created by the patient and therapist together to allow for autonomy and customization. For children, the game would have to be modeled after play therapy, allowing for open-ended interaction. Aspects like decorating, building, and character interaction could allow for such emotional expression.

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 would be targeted towards hobbyist musicians who don't want to pay for expensive complicated equipment or towards parents as a fun way to get kids into music. The project allows 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 consists of a wooden box with an attached microphone and an opening for usb-midi input. Users are 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 lights up as the the recording is processed. The recording then goes through a pitch shifting algorithm that produces 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 activates, signifying that the sound is ready to play. At the center of the project there is a Raspberry Pi running the core programs needed to function. The software works by waiting for a button press then recording any inputted audio into a WAV file which is then trimmed to remove silence. The pitch shifting is achieved by running a Pitch Synchronous Overlap and Add algorithm (PSOLA) on the original WAV file creating 43 new ones pitched up

and down. The program then waits for midi input and, based on the code received, plays the corresponding WAV file back. The final product is a streamlined, powerful musical instrument that allows the user to turn the world around them into music.