

Thesis Project Portfolio

Practical Exosuit Design for Patients with Amyotrophic Lateral Sclerosis

(Technical Report)

Duty Ethics Within Insulin Manufacturing

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

My technical project pertains to wearable electronics and is primarily focused on restoring quality of life for users. The main priorities for the project is that our product will be lightweight enough for prolonged daily use, and that it is cheap enough to be accessible to as many as possible. My STS research was inspired after having started my technical work. The research question arose while contemplating the cost and accessibility of many medical technologies. It seems that there are a lot of treatments or medicines that are essential for some people to live a normal life, but they cost a fortune to access. This leaves many people having to find compromises between their finances and their health. Both my technical and STS work pertain to access to medical technologies, with a focus on accessibility to those technologies.

For the technical project, my group is developing an upper limb textile exosuit meant to assist with movements of the arm. The device utilizes electromyography (EMG) signals given off by the wearer's bicep and inertial measurement unit (IMU) signals, which tracks the arm's position while it is moving. Our design utilizes a cable that runs the length of the wearer's arm and a motor housed in a backpack that the user wears. When the sensors detect that the wearer wants to move their arm, the motor starts pulling the cable, bringing the wearer's arm up. The primary demographic we are producing this for is individuals with neuromuscular dystrophy conditions, such as Amyotrophic Lateral Sclerosis, also known as ALS. Neuromuscular dystrophy causes muscles to deteriorate, making it so they cannot function at full capacity, resulting in a reduced functional range of motion. Our goal was to help restore the wearer's range of motion in their arm closer to where it was prior to the neuromuscular dystrophy.

As mentioned before, my STS paper is pertaining to pricing of medical technologies, with using insulin as a case study for this topic. Insulin is a hormone created by the pancreas in

order to regulate levels of glucose in the bloodstream. Diabetes is a condition that forms when the pancreas no longer produces enough insulin to regulate those glucose levels anymore, and is fatal without insulin treatment. This leads me to my research question for this paper, How have insulin manufacturers distributed insulin and made it accessible to those that need it? Although there is a large population of people that depend on insulin products to maintain their quality of life, insulin prices have been continuously rising over the years, putting financial strain on people that have no choice but to buy these products. I will be using Kantian Ethics as my ethical framework to see if the actions that these insulin manufacturers are taking align with their duty to provide life saving products to individuals that rely on them. Kantian ethics is a form of duty ethics that judges if actions taken are good or moral based on whether or not they come from a sense of duty to do right by others.

Working on these two projects simultaneously has definitely enhanced the experience of each. One of the main things that it has affected has been how I have perceived going about the design process of our technical project. Keeping in mind the pricing of every part we see and weighing the benefits of how cheap it is versus whether it can achieve the goal we needed it to as effectively. Since we would want this project to be as affordable as possible, trying to minimize the cost even though we had more than enough in the budget for the parts that we looked at was an added layer of complexity. In terms of the STS research, it helped me develop my thoughts and arguments when I was able to reflect and think about a product that I had a hand in making. It helped me imagine how I would want that product distributed and acquired by the customers, and further reflect upon the ethicality of it all. For instance, the pharmaceutical route with insulin has many different players that causes increased complexity when it comes to distribution and sales.