

**Improving Patient Experience During In-Office Procedures Using PARVA - Patient
Augmented Reality Vibratory Array**
(Technical Report)

Troglitazone: An Analysis of Warner-Lambert's Utilitarian Approach
(STS Research Paper)

An Undergraduate Thesis Portfolio

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Bachelor of Science in Biomedical Engineering

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Sociotechnical Synthesis

My technical work and my STS research are connected by the fact that the product's end goal is to improve patient outcomes and experiences, meaning that the way that utility offered to the patient is measured is a central aspect of both projects. The STS research paper focuses on the moral responsibility of drug manufacturer Warner-Lambert in presenting clinical trial data and marketing their product. They sought to justify the novelty of their product by claiming it would improve the lives of type II diabetics. My technical work focused on creating a multisensory device to distract patients from painful stimuli during in office procedures. Throughout development and testing, the cost and benefits of our intervention had to be analyzed to determine what would improve patient experience.

My technical project consists of a two-part device that aims to reduce patient pain and anxiety during an in-office procedure. An augmented reality headset displays a game for the patient to play and is combined with a modular vibrostimulation device, which supplies tactile stimulation near the injection site to reduce the pain experienced during injection. The two components operate together in that the vibration in the tactile stimulation device is modulated in relation to events happening in the game. The game and vibrostimulation device were built from scratch, while the augmented reality headset was purchased. Due to COVID-19 restrictions, we did not get to test the device on patients, but we have written a protocol for testing and our advisors will be able to collect data on whether this intervention successfully reduces patients' pain and anxiety during an in-office procedure. The way in which our metrics were defined and how we will assess our success has been shaped by my STS research project.

My STS research paper explores the ethics involved in testing and marketing biomedical products, specifically pharmaceuticals. The paper argues that that manufacturer Warner-Lambert

took a utilitarian approach in testing, presenting, and marketing the novel drug troglitazone to the type II diabetic community. It explores the ways in which it presented data to justify and minimize the negative impacts of its product. Troglitazone lead to kidney failure in many patients, and at least 66 deaths are attributed to the product. In applying a utilitarian ethical framework, I underline the ways in which testing standards, regulatory practices, and financial incentives can influence the way biomedical product manufacturers test and collect data for their products.

Working on these projects simultaneously added value to both. The STS research paper made me consider the larger network involved in testing and marketing a biomedical product and that, as part of a larger organization, one must have the courage to advocate for ethical practices that actually add value to the end user's life. As a soon-to-be biomedical engineer, I must understand the larger role of regulators and other actors within the American healthcare system that may allow me to walk a fine line of doing the right thing. My STS research paper taught me valuable lessons about the importance of ethics and widely examining costs and benefits of a given technology. Completing my STS research paper and technical project this year has helped me develop my technical skillset as well as that the notion that nothing is purely technical. All technologies impact society in both predictable and unpredictable ways, and we as the designers of technology must take responsibility for this.