

# **Thesis Project Portfolio**

## **Portative Pipe Organ**

(Technical Report)

## **Analog vs. Digital Music: A Never-Ending Struggle**

(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, 2023

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## **Sociotechnical Synthesis**

For both my capstone and STS research paper I explored the world of analog and digital music. As a longtime music lover, this topic was extremely interesting to me, so exploring its many facets was my goal going into both projects. Specifically, my capstone project involved me creating a Portative Pipe Organ which involved both digital and analog aspects to function, and my STS research paper compared the mainstream analog and digital methods for listening to music. My capstone project allowed me to physically explore analog and digital technologies, and I was able to gain a solid understanding of the uses and benefits of each technology. On the other hand, my STS research paper allowed me to explore the societal effects of each technology. Exploring exactly why people prefer one technology to the other. Both projects helped me to develop a good understanding of analog and digital technologies.

The Portative Pipe Organ project was a difficult project completed over a single semester. Given a budget of \$600 the scope of the project had to be narrowed down to allow for the project to be completed adequately. The other limitation was that our only forms of prototyping and manufacturing were 3D printing and laser cutting. Given this, we were limited in what we could accomplish in design. Regardless, we were successful in creating a working prototype. The organ itself had three main parts: the flues, the bellow, and the pressure regulator. The flues are the long pipes that create a sound when air is blown through them. They are basically large flutes. To create these, the tubes were laser cut out of thin plywood and the head/whistle part of the flues were 3D Printed. This allowed for interchangeable parts and quick prototyping, which proved to be extremely helpful. The bellow is the section that works to pump air into the flues. Our bellow system involved a gear and motor system that moved bellows back and forth inside of a pressure regulated box. Using one-way valves, the air could be continuously pumped into the box containing the flues. Finally, the pressure regulator box was designed to help regulate the

amount of pressure coming from the bellows into the flues. The pressure regulator was designed so that it released pressure if there was too much, and it maintained pressure when there was not enough. All three of these sections worked together to pump air into the pipes and eventually make a sound. The act of pumping air and having it resonate through a pipe to make sound is a purely analog technique. The digital aspects come from the opening and closing of the desired flues. Using a solenoid and eventually a MIDI keyboard, the desired pipes could be opened to actual music. This combination of analog and digital technology is what allowed for the entire pipe organ to work.

My STS research paper focused on analog and digital music listening technologies. I sought to understand why there is such a heated debate around which type of technology is better for music. There are many people who would prefer to listen to a vinyl record instead of using Spotify on their phone which is interesting considering Spotify is the “newest” technology. To understand this issue, a framework of the technical, psychological, biological, and social aspects of this issue was created. Using this framework, most aspects of this issue were able to be understood prior to conclusion. In exploring this, an interesting understanding of people’s technical preference was developed. I was able to understand the importance of social and psychological forces over technical sophistication which allowed me to both understand the differences between analog and digital music technology and to understand the many different forces that drive people’s technological preferences.