

**Thesis Project Portfolio**

**Self-Playing Xylophone with Real-Time Note Detection**

(Technical Report)

**AI Generated Art:**

**Commercial vs Creative -- When Does It Matter?**

(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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## Sociotechnical Synthesis

### *Technology Meets the Human Spirit of Creativity Through Art and Music*

*“Creativity is allowing yourself to make mistakes. Art is knowing which ones to keep.” \_ Scott Adams*

Numerous research studies have demonstrated the positive effects of incorporating technology and AI into music education. These studies link musical training to improvements in various cognitive abilities, which, while not directly musical, include intelligence, visuospatial skills, processing speed, executive function, attention, vigilance, and both episodic and working memory. My Capstone team was focusing on making music education straightforward, enjoyable, and accessible, enabling everyone to experience these cognitive advantages. We came up with the idea of self-playing xylophone called “Simophone” that runs on advanced algorithms that guide the user through the learning journey while providing feedback and challenges. The technical portion of my thesis details the design of the Simophone which combines music, technology, and gaming to create an engaging musical learning experience. It features an automated xylophone that plays melodies from a large MIDI library. Players improve their listening and musical memory by echoing these melodies on the xylophone. Real-time analysis of the player's performance against the MIDI tune provides instant feedback, challenging the player to accurately reproduce the melody, thus enhancing memory and musicianship. In the Simophone, we have seamlessly merged the worlds of music, technology, and cognitive stimulation, offering a combination of entertainment, learning, and musical expression.

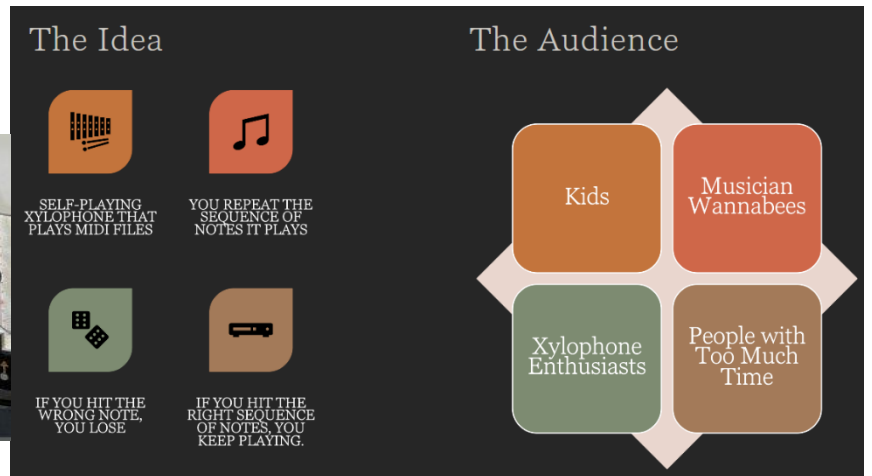
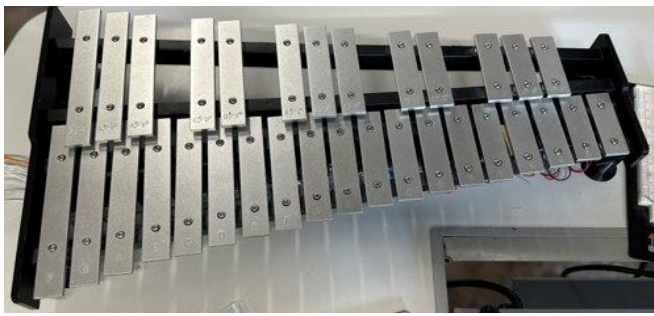


Figure 1 2023 Xylophone Capstone Project

The STS portion of my thesis explores the intersection of AI and creative art, examining the challenges and opportunities that emerge when technology intersects with human creativity. It aims to determine the societal boundaries for using AI in artistic creation, questioning how AI's algorithms and data collection compare with human creativity in art production. The goal of my paper is to answer the question of when the source of art matters and to whom it matters to.

As an Electrical engineer graduating in December, the STS research is meaningful to me for its ethical and societal implications. The paper touches on ethical considerations important for any engineer. It raises questions about the responsible use of technology, a key concern in my field.

Understanding where to draw the line in AI's application to art can inform broader ethical standards in engineering practices. AI can be a useful tool for electrical engineering design.

However, not knowing the ethical lines separating where it is appropriate or not can be critical.

Therefore, the process of producing the STS paper gave me deeper understanding and insights to navigate a new technology changing our world as we know it.

Both topics: the Simophone project and AI-generated art are inspired by the same interest in music and advanced technology. One can see similarities between the integration of technology and AI in both fields. Just as the Simophone uses advanced algorithms to enhance music education, AI-generated art utilizes similar technologies to augment human creativity. Both fields demonstrate the potential of AI to expand the boundaries of traditional practices. In music education, as exemplified by the Simophone, AI aids in developing cognitive skills like memory and attention through interactive learning. In art, AI opens new sources for creative expression, allowing artists to experiment with styles and concepts beyond human limitations. This intersection between AI and human creativity in both music and art exemplifies the transformative impact of technology on creative disciplines.