

## **Thesis Project Portfolio**

### **Loneliness in Blind and Low-Vision Individuals and the Use of AI Voice Generation to Facilitate Social Connection**

(Technical Report)

### **A Web of Responsibility: On the Promotion of Personal Agency for the Visually Impaired Community**

(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

The term “visual impairment” describes a wide spectrum of conditions, among which vision loss is one of the most significant. In 2020, about 14% of the global population was experiencing vision loss (IAPB, n.d.). The recent digitalization of daily life in much of the world has had mixed effects on how those with serious vision loss connect with the world. While the rapidity of technological advancement has made text-to-speech services ubiquitous on personal devices, that same progress has exacerbated the social focus on visual content. Consider the social media application, Instagram, which was one of the most downloaded apps in 2023. Instagram’s interaction model centers around pictures or videos. While a device’s native screen reading toolkit can help a low vision user to navigate the app, the bulk of the app content is inaccessible due to a lack of alt text. In my STS and technical research, I explored how this new digital divide between the standard sighted and visually impaired communities can be bridged by key applications of technology. My technical project sought to reduce visually impaired individuals’ perceived feelings of social exclusion by utilizing a combination of text-to-speech technology and artificial intelligence voice cloning. My STS research used technology as a lens to investigate the ethical responsibilities of various groups in improving the independence of people with visual impairments.

My capstone research stemmed from the issue of lower reported emotional quality of life from those with visual impairments (Klauke et al., 2023). By reading journal articles and studies, I found that people with moderate to severe vision loss experienced depression, anxiety, social isolation, and loneliness (Klauke et al., 2023). I sought to facilitate human connection in the digital age for blind and low vision by creating an iPhone messaging application with enhanced text-to-speech functionality. The application uses artificial intelligence to clone users’ voices, allowing blind and low vision users to listen to messages in the familiar voices of the messages’ senders. I developed a horizontal, high-fidelity prototype to demonstrate proof of this concept. In the future, I would like to run a usability study on my design to test its effectiveness in reducing loneliness among blind and low vision users.

My STS research centered on the issue of personal agency for visually impaired individuals. I investigated the role that technology can play in the furtherance of this community’s independence, and I finished with a stakeholder analysis to discuss the distribution of responsibility. I examined journal articles, personal blogs, legal codes, and interviews to understand this issue and structure my concluding recommendation. The most important finding of my research was that while the technology to improve certain aspects of visually impaired individuals’ lives exists, the deployment and general investment by industry and government is lacking. Due to the positions of power that large technology companies and the government hold, I conclude that they have a significant ethical responsibility to improve vision accessibility and thus facilitate greater personal agency for the visually impaired.

In terms of the overall problem of this vision-centered digital divide, I contributed at a nascent stage. My STS research provides a thorough analysis of the personal independence facet and raises awareness of the disparities in technological support for the visually impaired community. My capstone project outlines an innovative solution to blend the emerging technology of artificial intelligence with a human-centered accessibility mindset. I am satisfied with what I have accomplished during my undergraduate thesis journey, but there is still work to be done. Future

researchers should continue developing on my capstone application codebase, and they should investigate further, through the lens of technology, the web of ethical responsibility in improving daily conditions for the visually impaired community.

I would like to thank Dr. Caitlin Wylie for her guidance and support in constructing and refining my STS research project. Also, I would like to thank Dr. Panagiotis Apostolellis for his encouragement and enthusiasm in helping me with my capstone project, as well as sparking my initial interest in user interface/user experience (UI/UX).