

## **Thesis Project Portfolio**

**SurePace Walker: A powered walker for children with cerebral palsy**

(Technical Report)

**Disability Design, The Engineer's Dream: Cyborgs and How We Fail Them.**

(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

**Gabrielle M. Fuller**

Spring, 2022

Department of Biomedical Engineering

## **Table of Contents**

Sociotechnical Synthesis

SurePace Walker: A powered walker for children with cerebral palsy

Disability Design, The Engineer's Dream: Cyborgs and How We Fail Them.

Prospectus

## Sociotechnical Synthesis

Cerebral palsy is the general term for a group of disorders that affect muscle tone and posture (CDC, 2020). To help, people with cerebral palsy often use walkers to assist in improving posture and movement. However, the added burden of the walker can also impede the ability of the user to continue walking. As such, an algorithm-controlled, powered, posterior walker was developed, specifically for children with cerebral palsy by a local research and development company, Barron Associates. This new device falls into the category of “disability technology”, that is: technology designed to increase the mobility of disabled users. While designers may act in good faith, sometimes the results they create do not have the intended effect. Not all disability technology is effective or appreciated by its users. Despite this, designers don’t always know how to make good assistive technology. How can they, when they probably will never use their designs themselves?

### **Technical Project: SurePace Walker, an algorithm controlled powered walker for children with cerebral palsy**

My technical project is (largely) to redesign the working prototype of this walker in conjunction with advisors from Barron Associates. While the prototype is functional, it is not ready to be manufactured and sold on a larger scale. There are improvements to be made to the aesthetics of the walker, and the development of a unique posterior walker to be manufactured specifically for the intelligent powered walker. In particular, the project consists of three parts: developing a full CAD assembly of the walker, pursuing FDA clearance, and ensuring that the final design is compatible with manufacturing. Over the course of the project, my partner and I were able to tackle all three aims. We developed a complete CAD model of one possible design for the walker; we compiled all necessary information and paperwork for FDA clearance; and

made design choices in the process of designing the CAD model that lend themselves to large scale manufacturing. Overall, we believe the walker will help improve the quality of life for people with CP and other disabilities, by increasing the user's independence and mobility.

### **STS Thesis: Good Disability Technology: What is it? And how do we make it?**

My STS thesis is closely related to my technical project. The largest minority group in the world is disabled people. It is a group that can be joined by anyone, at any time (Thomson, 2017). Disability technology is common and diverse in today's day and age. However, these devices are often made by people without disabilities. While disability technology has come a long way from its first renditions in the 5th century BCE, it still does not fulfill all of the desires of its users ("Common Cyborg," 2018; "The History of Mobility Aids," 2020). While society values technology that is shiny, new, and flashy, users of disability technology rely on these devices to an extent that is not expected (or more accurately, respected) by the designers of the technology. Disabled people require robust and flexible technology that they can repair themselves. It is to this end that designers must focus their efforts. Designers must focus on making technology that is user-friendly, durable, and easier to maintain. While much of the drive for innovation centers on "better, faster, stronger", this leads to short term rather than long term solutions to the chronic challenges posed to disabled people. Disability is a long term problem that requires robust, long-term solutions. To examine this more closely, I utilize Actor Network Theory to trace power flows between the actors in this network, namely the disabled, the designers, and society. I find that society exerts an undue burden on designers to develop technology to fit society's view rather than the needs of the disabled people who actually use this technology. But, it falls to the designer to eschew these views and include disabled people in the conversation and process to develop the technology that they will use and rely on. Designers

must engage “with the cyborg bodies that currently exist” in order to “produce the kind of cyborg future that they claim to want.” (Earle, 2019)

### **Conclusion**

The intersection of technology and disability is a complex area that requires careful consideration and empathetic design. The developments of new technologies like in my technical project cannot and should not be undertaken without including the end user in the design process.

### **References**

- CDC. (2020, December 30). *Data and Statistics for Cerebral Palsy* | CDC. Centers for Disease Control and Prevention. <https://www.cdc.gov/ncbddd/cp/data.html>
- Common Cyborg. (2018, September 24). *Granta*. <https://granta.com/common-cyborg/>
- Earle, J. (2019). Cyborg Maintenance: Design, Breakdown, and Inclusion. In A. Marcus & W. Wang (Eds.), *Design, User Experience, and Usability. Design Philosophy and Theory* (pp. 47–55). Springer International Publishing. [https://doi.org/10.1007/978-3-030-23570-3\\_5](https://doi.org/10.1007/978-3-030-23570-3_5)
- The History of Mobility Aids. (2020, November 25). *ATLAS Surrey*. <https://surreyatlas.uk/2020/11/25/the-history-of-mobility-aids/>
- Thomson, R. G. (2017). *Extraordinary Bodies: Figuring Physical Disability in American Culture and Literature*. Columbia University Press.