Thesis Project Portfolio

The Abaclock
(Technical Report)

Gender Bias in Artificial Intelligence: An Analysis of Man-Made Technology and Its Effects on Women in the Workplace
(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

Mollie Bauer
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Department of Mechanical and Aerospace Engineering

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Executive Summary

The following portfolio contains two projects which both draw inspiration from the intersection between culture and technology throughout history. There is a clear connection between my experience as a woman in mechanical engineering and the motivations behind the STS research paper. Efforts to close the gender gap in this field remain modest, and current strategies for doing so are ineffective. These unsuccessful efforts show a pattern that can be seen through history and is why an investigation into this area is necessary. How does the underrepresentation of women in STEM lead to technological bias and further inequalities? How can these themes be tracked through history and through different technologies? These thoughts are inspired by the process of my technical capstone project. As the sole woman in my project group, and one of three women in the entire class, it was easy to ask why this was, and what social constructions and deterministic technology made this to be true. The technical capstone group had a clear vision and motivation for the mechanical engineering project at hand. We decided to make an installation that encapsulated all the technical learning we achieved in the mechanical engineering, electrical engineering, and computer science fields. To demonstrate this engineering mastery, we landed on creating an unconventional clock in the form of an abacus. Our goal was to combine an old mathematical instrument with new mechatronic techniques to create something unique and interesting for the UVA community.

Despite the numerous hours involved in studying mechanical engineering, there are very few opportunities for University of Virginia undergraduates to demonstrate their knowledge and skills. Lab and course work provide adequate experience when it comes to the theoretical practice of mechanical engineering through simulations and closed experiments. However, such methods of learning often disregard real life variables such as feasibility, reliability, and

practicality. Shifting from theoretical studies to real-life problem solving, the senior design project requires students to learn from inevitable, temporary failure. This technical project relied on skills learned in the UVA mechanical engineering curriculum while also providing an opportunity for us to grow those skills through our own design iterations.

The subject of the STS research paper is the investigation of gender bias in AI algorithms. It explores to what extent historical biases, present-day AI, and big data practices have an impact on these cases. The research question is: In what ways has the emergence of Big Data and Machine Learning technologies perpetuated marginalization against women in the STEM community? The frameworks of the social construction of technology and technological determinism are used to analyze this research question. These analytical tools help uncover the relationship between the biases against women and how technology has fed into that in history and today. The anticipation is that the biased algorithms have their foundations rooted in historical biases but perpetuated by misused data collection practices. The conclusion may be open ended, but this research is very important to engineering. The implications show engineers a path forward to make the industry and its technology more inclusive.

Both projects were worked on simultaneously which was mutually beneficial to the final product of each. The technical capstone recognized and honored historical numerical methods in engineering, but I know I grew as a person through researching social constructions against women in STEM during this time. It helped my group and I become much more cognizant of how ideas were represented in the technical project. Furthermore, recognizing the old and new technologies through the technical capstone allowed me to appreciate different angles of arguments posed in the STS paper. The projects lessons reflect each other. Historical practices, weather socially or technologically, are meant to be learned from and developed into something

modern and progressive. Being able to adapt old ideas into something new is what makes engineers so special, and a key idea I developed while working on both projects at the same time.