

Three- Dimensional Modeling of Lung Volumes in Application to Scoliosis
(Technical Report)

**Optimizing the Criminal Justice System with Algorithms:
A Case Study of Technological Politics**
(STS Research Paper)

An Undergraduate Thesis Portfolio

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Socio-technical Synthesis: Algorithms and Imaging Diagnostic Tools

My technical and STS research are connected through the idea that technologies have social and political implications and those must be carefully considered by engineers. My technical work is focused on the development of an imaging diagnostic tool in the medical field and my STS research is focused on exploring the politics of criminal justice system algorithms. In order for my technical project to succeed, it is important to understand the ways in which technical artifacts express and shape relations of power. This is especially relevant for medical diagnostic tools as it helps us understand networks of distribution of the medical tools, their usage, and accessibility. Thus, although my technical work and STS research are not directly linked, they can be weighed simultaneously through a common understanding that technologies shape and express relations of power.

My technical work addresses the need for better diagnostic tools for patients with scoliosis. The goal of the project was to develop a computational framework that would enable lung volume calculation based on X-ray images. This would allow the doctors to determine whether the patient should undergo final spinal fusion or not. This would be especially useful in cases of adolescent idiopathic scoliosis whose spinal correction is crucial for adequate lung capacity development. Currently, a CT scan is the state of the art for calculating lung volume; however, the amount of harmful radiation that the adolescent patient is exposed to is almost 200

times that of an X-ray. Thus, this tool developed by my capstone team would be a safer diagnostic alternative that would work just as effectively.

My STS research focuses on exploring the use of algorithms in the criminal justice system. My work focuses on elucidating how such algorithms are biased against black defendants and thus serve to maintain a system of white privilege in society. I use Langdon Winner's theory of technological politics to analyze the algorithm COMPAS and understand its design and impact. My claim is that technologies like COMPAS inject bias into the criminal justice system because they are designed based on a system of social order that privileges whites over blacks. My paper proves this claim and addresses the dangers of overlooking the potential of technologies to do political and social work. Ultimately, the goal of my STS research work is to help engineers understand the impact of existing forms of social order on their work and carefully consider the potential of their work to reify or create new forms of social order.

By simultaneously working on my STS work and my technical work, I gained a deeper understanding of the field of engineering and of the responsibility engineers assume in the field. My technical work gave me insight into the biomedical engineering design process for innovative diagnostic tools, which I was able to better understand through my STS research. My STS research helped me understand the social and political consequences of technologies. Working on both projects has allowed me to interpret technologies not only in terms of the technical work they produce, but also in terms of the power relations they express; furthermore, it is clear to me that both works complement one another.