

Development of a Novel Lumbar Spinal Phantom for Rivanna Medical
(Technical Report)

Using Technological Politics to Examine Adoption of the Accuro Ultrasound Device
(STS Research Paper)

An Undergraduate Thesis Portfolio

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STS 4600

Socio-technical Synthesis: Spinal Phantom and Shifting Power Dynamics

My technical work and STS research are related because they both pertain to the implications of the adoption of the Accuro. The Accuro is a handheld ultrasound device that allows a doctor to identify an injection point for spinal anesthesia. However, the technical work and STS research differ in their perspectives on the adoption of the Accuro. My technical work focuses on creating a training device that complements the Accuro so that doctors can learn the new clinical process. My STS research focuses on how clinical biases have been exposed through the Accuro's reshaping of the patient-doctor power dynamic. However, the shared thread between my STS and technical work is the implications of the adoption of the Accuro, viewed from different perspectives.

The technical work explores the implications of Accuro adoption from a training perspective by developing a lumbar spinal phantom. A phantom in medicine is a training device that mimics the properties of human tissue to create a realistic simulation for a procedure. My capstone team created a lumbar spinal phantom by developing and synthesizing a tissue layer and skin layer, combining these with a 3D printed spine, and finalizing production instructions for manufacture. The ratios of the skin and tissue layer's components were optimized to mimic the sonic properties of human tissue, with the tissue layer additionally optimized for self-healing. This phantom is unique among current commercial phantoms due to its long lifespan and self-healing properties. The phantom will provide Rivanna Medical with an in-house product that will increase its company visibility and decrease costs. The project may also decrease the cost of healthcare by reducing phantom replacement rate, thus reducing the cost of Accuro adoption.

My STS research project explores the implications of the adoption of the Accuro from a different perspective. The research focuses on how clinical biases have been exposed by the Accuro's adoption. The Accuro's reshaping of the patient-doctor power dynamic is explored through Langdon Winner's Theory of Technological Politics. I argue that the Accuro has a political dimension by showing how doctors exert power through the manual palpation method and how patients are being empowered through adoption of the Accuro. Specifically, I identified leadership as the predominant way in which doctors maintain power over patients and also identified how the Accuro alters the empowerment by catering to specific characteristics of the patient population. The goal of this research is to advance discussion on the effect a new device's adoption has on power dynamics and indicate that a new device can highlight silent biases and discrimination in the treatment of certain patient groups.

Conducting the technical and STS research projects concurrently has provided important insights to both projects that I wouldn't otherwise have gained. While working on the technical project, I realized that bodyweight bias in addition to gender bias may affect treatment. This indicated that I needed to broaden the scope of the biases under study in the STS research. By working on the STS project, I realized the magnitude of the procedural change the Accuro represents compared to current methods. This indicated that the phantom needed to be as simple as possible to facilitate clinician training with the Accuro. Overall, these improvements to the technical and STS projects occurred because of their shared subject matter and simultaneous completion.