

**Improving the Skin Prick Allergy Test: Exploring the Effect of Operator
Dependent Factors on Test Variability**

(Technical Paper)

Health, Mining, and Justice in Appalachia: A Rawlsian Approach

(STS Paper)

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Sociotechnical Synthesis

Health, Mining, and Justice in Appalachia: A Rawlsian Approach

“Being first virtues of human activities, truth and justice are uncompromising.”

–John Rawls

My parents and I joke that the government must have been conducting experiments on our little town. It seemed that all the kids we knew who were about my age, born in our town in Southern West Virginia, had food allergies. I was allergic to cow’s milk. My sister was allergic to sesame seeds. Another friend was allergic to tree nuts. Since leaving West Virginia, my milk allergy was replaced by a nut allergy. I’ve developed further allergic diseases as part of the *atopic march* (described in my STS thesis) while simultaneously realizing that allergies were not generally as common as they were in my hometown. I became curious about the reasons why there may have been so many kids with food allergies where I was born as well as the reasons why my allergies had progressed as I got older. When I was offered an opportunity to work on a technical capstone about allergy diagnostics, I was excited for the chance to dive into these topics. For my sociotechnical work, I thought to focus on allergies in Appalachia. In searching for answers, however, I found a noticeable lack of information. I had to expand my work to discuss general health outcomes in the region so that I could find any information for my paper.

My technical work aimed to improve the common allergy diagnostic test called Skin Prick Test (SPT). In this test, a sharp device is dipped in oil containing a potential

allergen. The device then pricks the skin. After 15-30 minutes, the skin is observed for any redness or swelling to diagnose allergy. Benefits of the SPT over other tests such as blood tests are that the SPT is relatively cheap and results are available quickly. A major issue with SPT, however, is that the results are extremely variable. My capstone team aimed to identify the factors causing this variation and provide design recommendations to address these factors. Through our work, we were able to test three factors: device type, angle of insertion, and force of prick. Only one of these factors – device type – was correlated with a decrease in variability. We found that further work needs to be done to identify factors that affect variability in testing. Some potential targets include time between dipping in oil and pricking of skin; technique used for pricking; and volume of allergen oil carried by the device.

My sociotechnical work looked at the effects of the mining industry in Appalachia on health effects, and how the interactions between people, government, and industry can be rectified to restore justice. One of my first findings was that very little information exists about health and environment in Appalachia compared to other regions of the United States. Coal and politics in the region are closely intertwined, causing, at the very least, a disinterest in research on the negative impacts of mining. Throughout my research, however, I found statements by Appalachians describing the health effects that they and their neighbors were experiencing. I felt vindicated by the testimonies and few data points that I found that indeed, Appalachia is sick – and even more, she is being poisoned by industry and lax regulations. Disturbed by this injustice, I searched for frameworks with which to interpret this situation, and found John Rawls'

A Theory of Justice. Using Rawls' principles, I came up with three recommendations to restore justice to the region.

By combining my technical work with organizational and social elements from Appalachia, I was able to craft a well-rounded capstone and senior thesis. Because I was personally interested in the topic, working on both a technical and social satisfied me in a way that only one could not. I am now convinced that every biomedical innovation should consider its target audience and the context of disease in that community. Healthcare in Appalachia, for example, exists in a context of industrial negligence that is not found in many other regions of the United States. How then does the rollout and education of a medical device in this sort of environment differ from any other? Additionally, I believe that all of us – engineers and not engineers – should be more aware of social problems in our world. Knowledge arms us with the tools to recognize, treat, and prevent similar problems. Though not all engineers may be working in Appalachia, the question of how to deal with natural resources and the people who live there will continue to emerge. We must be part of the solution because we are more than our occupation; we are people with a responsibility to others, to society.