

Thesis Project Portfolio

Protecting Pilots: Designing a Variable Cervical Neck Brace to Mitigate Ejection Injuries

(Technical Report)

How Framing Engineering Ethics Changes our Conception of the Engineer

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis (Executive Summary)

How Shifting the Problem Framework can Provide Novel Insights

Females are 17.0% more likely to perish when sitting in the passenger seat than males, according to an engineer for the NHTSA. My technical project is about developing a cervical neck brace to decrease the incidence of injury in pilots who have to eject from their aircraft, but this project introduced me to an even greater problem. While combing through the literature on airplane ejections it was brought to my attention that all of the models that produce injury criteria are developed using a 50th percentile male, which is deemed to be the “standard” anthropometry. My capstone advisor has performed research for the Navy previously that specifically tested this long held assumption, that assumption being that all people can be modelled as a 50th percentile male that is simply scaled up or down for size. Despite my advisors work this flawed model continues to prevail not only among the very niche aviation community, but also in the automotive industry, an industry which affects the vast majority of Americans since we are so heavily reliant on cars.

In my STS prospectus I investigated the difference in language used by institutions to try shedding light on why the automotive industry continues to use such an obviously flawed model. I discovered that there is a vast difference between the writing styles of engineers, and the writing styles of both journalists and researchers. This difference culminates mostly in engineers not wanting to make recommendations. Engineers in the NHTSA will perform tests and compile evidence that points clearly to the fact that females are especially vulnerable in automobiles, but will not take the final step to recommend change of any kind. This kind of paralysis by engineers is like a doctor who discovers cancer in a patient but wants to run every test conceivable in triplicate before cutting it out; by the time the patient goes under the knife the

situation will almost certainly have been made unnecessarily worse. There is a clear need engineers who are not afraid to give recommendations based on the information their research yields, and my STS research project concerned itself with the question of how we go about producing more ethically competent engineers.

In my STS research project, I looked at framing engineers as a function to change the way we view ethics training and education, especially as they relate to engineers. The purpose of developing this new framework was to help us determine not only what factors are most important for developing the ethical abilities of engineers, but also to help educators and trainers to determine which of these factors are most accessible. By focusing on viewing engineers as functions we can start to view them as a collection of inputs and outputs, and historically ethics education has focused on outputs by reading case studies and classical works of ethics. This approach leads us to the realization that ethics is too on the output side of the function, too focused on right action, and not at all focused on developing environments that precipitate desirous actions. My work on the STS prospectus led me to develop this insight; although researchers and journalists are perfectly content foisting all responsibility on the engineers within the NHTSA, my investigation led me to believe that the problem does not exist at the level of the individual, but at the level of the organization. The journalists and researchers are understandably myopic in their approach to the problem frame; without a grounding in sociotechnical systems thinking, it is easy to miss the fact that organizations are as much actors as the individuals who inhabit them.

The overarching theme of my STS and technical research projects combined to illustrate how when trying to address the causes of inequitable safety design it is not enough to simply judge the actions of the designers. Although this insight feels obvious many ethics case studies

focus superficially on the actions of individual actors, completely ignoring the interplay that exists between individuals and organizations. The redefining of the ethical actor in a way that emphasizes interactions between the individual and the organization paves the way for more constructive conversations surrounding ethics in the future.

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