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Personal Reflections on Engineering Ethics

Typically, especially in the context of sustainability, discussions of engineering ethics revolve around making technical decisions that influence the physical environment in positive ways. This can include environmental factors (such as air quality) and social factors (such as environmentally friendly norms like recycling). However, these factors are usually balanced against economic costs of a project (including projected risk factors and who is paying). The reliance on relating economic costs when considering the sustainability of a project can limit the discussion on engineering ethics. Having to meet technical specifications at a required economic cost can limit an engineer's scope of ethics by subscribing to the idea that innovation among engineers can be represented by the question "can it be done?" rather than the alternative, "should it be done?"

When it comes to engineering ethics in the context of sustainability, my mind goes immediately to the technical aspects in engineering such as material selection, power generation methods, waste deposition, recycling, and regulatory decisions made by policy makers. Within the context of environmental sustainability there are many areas where the discussion of ethics is critical, namely the issue of deployment of renewable energy sources for equitable consumer use. In a 2019 study conducted by Tufts professor Deborah Sunter, et al.[1], it was found that rates of installation of rooftop photovoltaics among majority Black and Latinx households in the U.S. lag significantly behind rates of installation among majority White households (see Figure 1). Even after controlling for household income, disparities in installation rates persist, indicating a more systemic root to the issue of inclusion. Some potential explanations offered by Sunter et al. include the difference in rates between home-ownership vs. renting, limited government incentives for installation, and lack of adequate messaging from leaders. This explanation gives clarity that in order for engineers to identify and confront issues of inclusivity in environmental sustainability, they must be willing to look at underlying factors through day-to-day conversations (not necessarily related to engineering) that reveal the present systemic injustices to stake-holders, consumers, and non-consumers alike.

As an undergraduate engineering student, the discussion around engineering ethics in my classes has seemed a little few and far between and when they do occur the discussions are centered on the economic impacts to the primary stakeholders. This might have to do with the nature of undergraduate engineering education in the U.S., much of which is under the direction and curriculum of the Accreditation Board for Engineering and Technology (ABET). Under the Student Outcomes section for all general undergraduate programs[2], students graduating from an ABET accredited program will have "an **ability to recognize ethical and professional responsibilities**in engineering situations and make informed judgments, which must **consider the impact** of

engineering solutions in **global, economic, environmental, and societal contexts**" While this is a nice enough guideline, this is the only mention of ethical behavior in their program criteria, offering little expansion on teaching the ability to recognize ethical concerns and even what ethical concerns might be. It seems that the defining and shaping of what this actually looks like is dependent on each individual program's department and institution to decide how much can be included in a regular curriculum, which can have benefits in that each institution is able to narrow their focus according to their immediate environment. Given the necessity instructors feel to cover all the technical topics of a course in one semester's time, the time allotted for engineering ethics typically covers the huge failures - such as the Space Shuttle Challenger disaster or the nuclear meltdowns and scares in Chernobyl, Fukushima and the Three Mile Island accident - but does little to cover the day-by-day decisions that are lead to issues systemic in nature - such as understanding why women typically earn less than their male peers, or understanding the impact of underrepresentation of different cultures in STEM fields. The focus on large disasters is definitely important and overcoming the failure is a telling trait of innovative engineers (the "can we" question). There are ethical issues, however, that cannot be solved by innovating but rather through discussions on critical thinking which shape the attitudes and values of students before preparing to make a difference in their world (the "should we" question).

A research paper exploring U.S. graduate engineering students' views on engineering ethics after an international experience in India [3] reiterates that failing to think critically about the "can we" / "should we" argument can have unstated impacts on the most distant of stakeholders (Berdanier, et. al, 2018). This was exemplified best by the seeming disinterest of factory workers in India to follow what the graduate students see as proper safety norms when working at heavy machinery. The students, however, are able to explain this difference through the lens of the difference of workplace culture between India and the U.S., where American business concerns revolve largely around avoiding costly lawsuits for work-related injuries. Additionally, the paper also addressed sustainability through cultural differences observed in India and might give insights as to how the differences of standards for engineering ethics might be informed by considerations of economic (cost of capital) and cultural (safety, gender norms) nature. It is explained that India's legacy of the Caste System, which has reproduced generations in poverty, as well as its booming population and mass consumption explains the industry of waste-picking among the nation's poorest. A study [4] in six Indian cities found that ~80,000 waste pickers recovered approximately 20% of waste, recycling an estimated three million tons. At a rate of 2.94 metric tons CO^2 per ton of waste recycled [5], an estimated total of 8.82 metric tons of CO^2 emissions are saved by India's waste-picking population per year (EPA 2019). Awareness of these different norms around waste and safety can help to explain differences in policies and culture specific to India, and stress the need of an engineer to think critically about stake-holders at the most extreme of margins in order to shape their experiences to a worldly level.

These examples serve to show the multi-faceted nature of understanding engineering ethics as it relates to environmental sustainability domestically and abroad, as well as showing the necessity for engineers to reexamine the structures around the discussion of ethics in a way that is representative of the needs of the marginalized.

Appendix

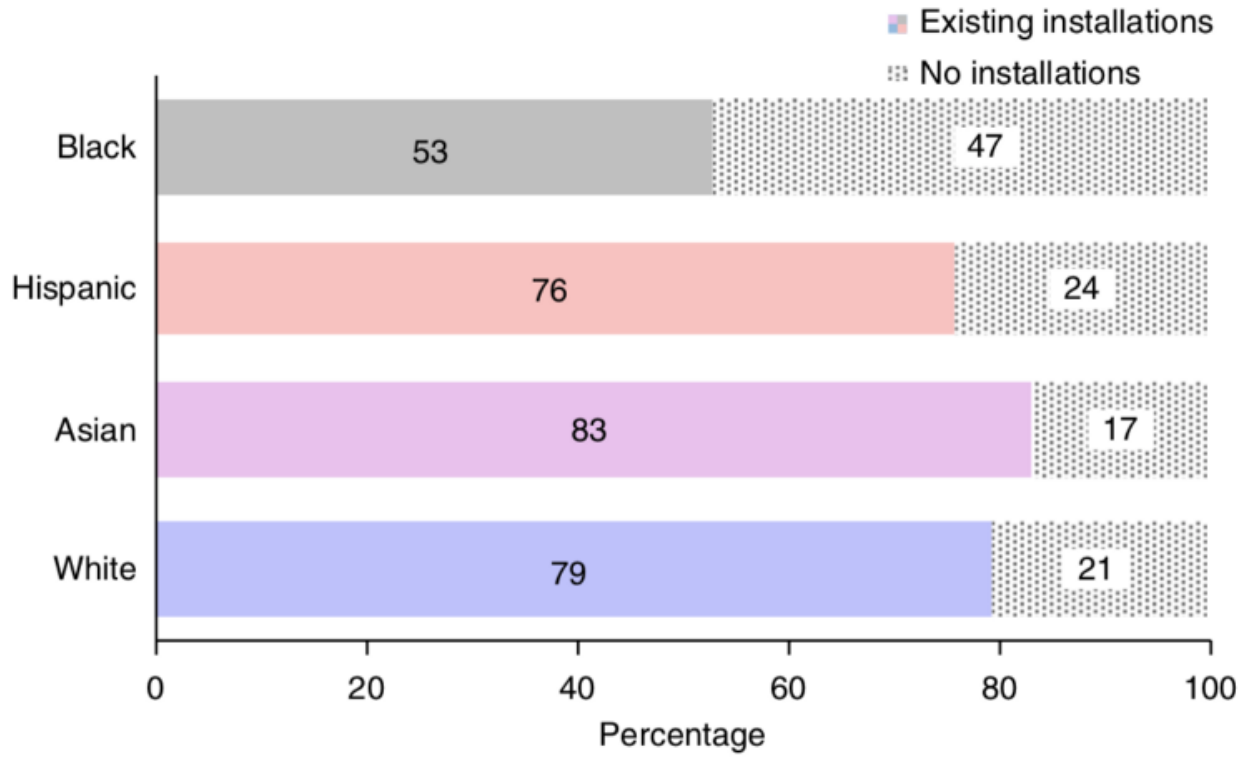

Figure 1: From Sunter et al., 2019, percentages of installation/no installation rates in major census tracts.

References

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