Thesis Project Portfolio

The Missing Link: A Historical Analysis of Pedestrian Signal Design and How it Demonstrates Shortcomings in the Innovation Process

(STS Research Paper)

Biscuit Run Park Development

(Technical Project A)

Streets for People

(Technical Project B)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

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In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Sociotechnical Synthesis
(Executive Summary)

THE FAULT IN OUR SIGNALS

"There are no traffic jams along the extra mile" –Roger Staubach

Traffic control is omnipresent in our society. While many simply abide by the systems around them without a second thought, I am unable to stop myself from observing every detail. For example, as a kid, my family would vacation in Ocean City, Maryland every summer. The way I knew we had left Virginia was not by watching for the "welcome" sign, but rather from seeing red arrows in place of balls on the left turn signals, which had not yet been adopted by VDOT. With this focus, over time, I have developed a keen sense of some deep-rooted flaws in our traffic systems. Pedestrians in particular are egregiously overlooked quite frequently. As such, I chose to research the history of pedestrian signals in America so as to analyze what led to our presently flawed system, as well as what can be changed to fix it. Such STS analyses are essential to the advancement of engineering systems through the understanding of unconscious psychological factors. I chose this topic to research rather than the focus of my technical project, trail design, because the latter was rather – well, technical – and had less ethical substance to be expanded upon.

The technical portion of my thesis was designing a central segment of the future Biscuit Run Park in Albemarle County. This work was done largely in the CAD software Civil3D. The scope included soccer fields, trails, and stormwater retention; these focuses were taken up by different group members in accordance with their particular area of study. Being an infrastructure

track student, I designed the trails. This necessitated compliance with standards such as the ADA Accessibility Guidelines. Although such standards already have decades of sociotechnical advancement ingrained in them, designs can always use additional customization to maximize public benefit. For example, I created two routes connecting the same two destinations. One was wheelchair accessible, but the other required stairs due to a more abrupt elevation change. Instead of having a single set in the middle, however, I split the steps into two sets, positioned at either end of the path. That way, it would be implicitly understood which route was accessible, and no wheelchair turnarounds would have to happen halfway through. This was not a requirement, but rather an optimization under sociotechnical considerations – a small sample of the betterment I hope to promote in my career as an engineer.

In my STS research, I conducted a detailed analysis on the history of pedestrian signals in America from the onset of electric traffic signals to present day, delving into why some innovations were accepted by the technological regime while others failed. Such innovations include changes in wording, phasing, and even the addition of wild features such as animated LED eyeballs. In many cases, regime adoption did not correlate with the individual success of a product, which demonstrates flaws in the sociotechnical system surrounding the industry. An important way I explained this problem was through a dichotomy between the behavioral psychology of drivers and pedestrians, with a demonstrated lack of understanding for the latter in the field of traffic engineering. Ultimately, I developed three key takeaways from my research: (1) cost-focused design often puts an excessive emphasis on retrofitability within existing systems, which puts a limit on potential improvements; (2) the government organizations responsible for regulating signal design are too passive with promoting new technologies they

have already proven to be effective; and (3) more research must be done through the perspective I develop in order for positive change to develop.

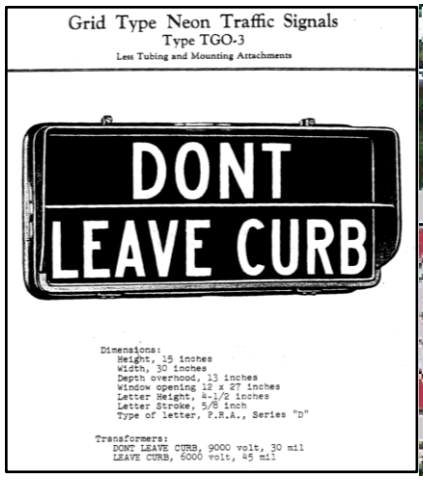

Figure 1

Examples of unique pedestrian signal designs that were proven effective, but were unsuccessful either commercially or regulatorily.

Figure 2

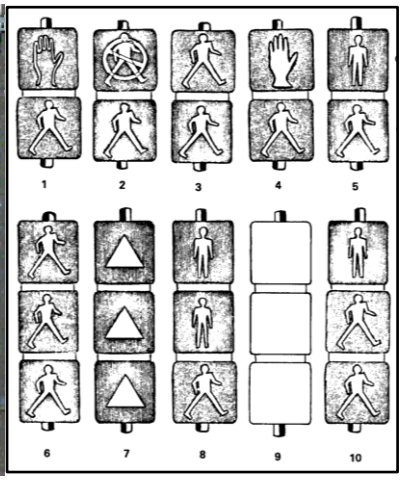

Figure 3

Numerous designs tested during a 1970s trial of newly-considered symbolic indications.

The psychology of actors behind the scenes of technical systems is an oft-overlooked but significantly impactful factor in the good and bad that such systems generate. While technical failures may seem to be just that on the surface, in many cases, they have proven to be rooted in social failures. For example, the Boeing 737 MAX disasters were attributed to a culture of corner-cutting fueled by a high-level lack of individual accountability. Unconscious moral and social foundations can limit how well individuals interact with each other, which in turn affects the trajectory of their collaborative work. Finding a common ground – or at least a mutual awareness of these foundations – is essential to achieving better results. In addition, it allows for the effective instillment of a uniform ethical framework, ensuring results are not only better, but considerate of society at large. As such, **understanding sociotechnical systems** is essential for the establishment of professional responsibility and progression toward a better future.