Thesis Portfolio

Electrification of Utility Tractor Rigs at Maritime Container Ports

(Technical Report)

Exploiting Human Nature: The Dark Side of the Technology in Our Pockets

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Thesis

Technology has been booming at an unprecedented rate in the 21st century. As more technological innovations are engraved into society, a comprehensive understanding of the complex sociotechnical world-wide system is essential. Two seemingly unrelated topics are explored in this paper, but hold the same themes: advising how to adjust to emerging technologies. First, a research paper on the effects of mobile phones and social media platforms on adolescents was studied. Specifically, how the constantly-adapting designs of these technologies have switched to prey on addiction to compete for user attention, causing growing negative mental health consequences globally. Secondly, a technical research project was conducted to aid the Port of Virginia in converting their current diesel-powered port vehicles to electrically powered, with the motivation of reducing harmful environmental output. While these two topics specialize in dissimilar fields, they both help to solve the same overarching problem of successfully implementing and adjusting to new technologies, whether for mental health, environmental impacts, or a different reason.

The STS research paper investigated the full system that represents how social media is used. To break this down, Actor-Network Theory was used to describe the codependent relationship between adolescents and their mobile phones and social media accounts. The paper starts with researching why adolescents are forming increasingly toxic relationships with their phones: what about adolescents makes them more susceptible to addiction, how social media design is increasing addiction, and why social media is designed addictively. The effects of social media addiction were explored as well, specifically how mental health is impacted. Lastly, the paper researches various avenues for combating addiction, from a general standpoint as well as specifically for mobile phones and social media. The book *Dopamine Nation: Finding*

Balance in the Age of Indulgence by Anna Lembke served as the main motivation, and is used largely as a source for addiction cause and rehabilitation in the paper. Throughout the research, two important conclusions were found. First, social media is being updated with features that inhibit addictive behavior, to keep users on their applications long after fulfilling the reason the application was opened. Second, while legal hearings are proceeding against social media companies presently, the best way to combat mobile phone and social media addiction comes through individual measures, such as practicing mindfulness and dopamine fasting.

The technical research project revolved around assisting the Port of Virginia in converting their fuel-powered port vehicles to electrically-powered, in an effort to reduce their carbon emissions to zero by 2040. To aid the port, simulation modeling was used to construct several scenarios that experiment with alternative port configurations. The results allowed for a sensitivity analysis of determining the extent to which different metrics impacted port performance with EVs (electrical vehicles). A generative AI source, ChatGPT 4, was used to explore alternative results beyond the capabilities of the simulation software that was utilized. Simplified results of simulation and generative AI exploration lead to many recommendations. Primarily, the port was advised to prioritize battery charging and loss rates in newly implemented port vehicles, as they had the biggest effect on performance.

Both projects would benefit from further research. Research on the mental health effects of social media on adolescents is just beginning to be studied, with little proven conclusive evidence. Similarly, addiction rehabilitation methods heavily rely on theory and experimentation rather than empirical evidence. A more in depth neurological understanding of our brains would allow a better specialization of approaching and solving the problem of adolescent social media addiction. The Port of Virginia will also need more guidance as decisions on what electrical

chargers are purchased, how many to purchase, and where to install them in the port. Implementing an electric grid to provide power for the anticipated electrification of the port in the future is a complicated task. The port has not yet progressed to this point, but this will be a critical question that simulation modeling would serve as an influential tool to assist the port when the time comes.

I would like to thank Dr. Anna Lembke and her book, *Dopamine Nation*, for introducing me to the underrepresented problem of compulsive overconsumption and creating a passion within me for the topic. Once again, her book was the central inspiration behind my research paper. I would also like to thank Port of Virginia Vice President of Operations, Dan Hendrickson, for providing my capstone group with an enriching technical problem to solve and make our own over this year, and meeting with us weekly to provide critical feedback. I also would like to thank Professor James Lambert, who provided invaluable advice from his experience, always encouraging us to attempt innovative, out of the box problem solving.