Thesis Portfolio

FSAE Car Clutch Automation System
(Technical Report)

Shortcomings of Artisanal Mining:
A SCOT analysis of corporate-led mining projects in the DRC
(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

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Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

This thesis portfolio consists of two projects: a technical project completed in a team for the Mechanical and Aerospace Engineering department and a paper written for the Science, Technology, and Society department. The technical project, completed in the fall of 2021, consisted of the design and implementation of an electronic clutch control system for a motorcycle engine. The system was created in the hopes of allowing for a better and more consistent launch of the Virginia Motorsports FormulaeSAE competition car. The project was successful in creating a system able to launch a vehicle at a similar speed to an experienced driver, meaning that it could successfully lower the bar for the skill level needed to drive the car at competition. The paper focuses on the cobalt supply chain in the Democratic Republic of the Congo which feeds into consumer electronics and electric vehicles. The paper analyzes formalization schemes, which allow for a legal interface between the international market and wageless individuals who partake in cobalt mining, known as artisanal miners. This interface is very contentious, as it directly links the international supply chain of cobalt to issues like child labor and unsafe mining practices.

My interest in this topic began when I started to consider the ethics of buying an electric car. I was well aware that electric vehicles are the way of the future, but I was also aware of some of the material concerns coupled with them. An electric car has a much more diverse bill of materials than a traditional internal combustion engine vehicle and many of those materials have problematic supply chains. I was worried about my personal responsibility for these supply chains and the human and environmental exploitation within them as a potential buyer of a new

electric car. This question of consumer responsibility also seems relevant to my technical project. Although the intention of our team was from the beginning to produce a one-off solution to a specific problem, we utilized at many steps of the project product development techniques which would be used in the development of any new product for mass production. Our project focused on prototype development, but had we continued, we might have begun to draft plans for larger scale production and sought out suppliers for the necessary components. We would have then become a part of many interconnected global supply chains, some of which undoubtedly would rely on some form of upstream exploitation. The most important finding of my research into cobalt mining is that demand for responsibility will always travel upstream. If a link in the supply chain demands responsible sourcing, that pressure will cause a wave to move upstream. When it comes to electric cars, or any product, if we, as end consumers, demand that everything possible be done to prevent exploitation, that demand will be heard all around the world as it travels back up supply chains.