Thesis Project Portfolio

Design and Manufacturing of a Commuter Human-Powered Vehicle in Conjunction with the 2021 ASME Human-Powered Vehicle Challenge

(Technical Report)

Understanding and Changing the American Opinion of Human-Powered Commuter Vehicles

(STS Research Paper)

An Undergraduate Thesis

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

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring, 2021

Department of Mechanical and Aerospace Engineering

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Labelling Technology in Sociotechnical Systems

Modes of transportation are often given names closely tied to their purpose. A racecar, of course, is meant to be driven competitively, just as a moving truck is meant to carry items from one house to another. This phenomenon also manifests itself in the context of commuter vehicles, albeit more subtly. As a way to help offset the contributions of gas-powered vehicles to climate change, environmental scientists have begun to suggest using human-powered vehicles as commuter vehicles. One problem with this approach, though, is an apparent reluctance among Americans to adopt human-powered commuter vehicles. While my STS research focuses on why this reluctance may have developed and how to reduce it, my team's technical project focused on designing one such vehicle.

My technical project revolved around designing and fabricating a human-powered vehicle for the American Society of Mechanical Engineers' (cancelled) Human-Powered Vehicle Challenge. However, the motivation of my technical project changed rather rapidly. What started as a design for a racing human-powered vehicle shifted to a more practical commuter vehicle once the race was cancelled. This meant that the specifications to which my team was designing our vehicle also changed. Instead of aiming for speed, my team focused on creating a reliable and safe vehicle. The vehicle was built as a tadpole tricycle, with two front wheels and one rear wheel. It was primarily built around a sturdy central spine, and equipped with rear-wheel drive via a two-chain system connected to an internal hub. Other safety features included in the design of the vehicle were disc brakes mounted on both of the front wheels, go-kart-style steering, and a rollover protection system built off of the spine. All of these systems were designed to provide a safe and reliable ride for commuters.

Part of understanding the potential role of a human-powered commuter vehicle is understanding how people will adopt the technology, and this served as the focus for my STS research. Frank Geels' multi-level perspective was used to understand the development through time of commuter vehicles (2011). Interestingly, this research led to the discovery that early human-powered vehicles, especially bicycles, were intended to serve as commuter vehicles. Manufacturers also described them as such. But as new vehicles were introduced as commuter vehicles, human-powered vehicles were relegated to a recreational role. Modern human-powered vehicles are introduced as recreational, and a recent push by environmental organizations to use more human-powered vehicles for commutes brings this limited perspective to light. Users of a technology often find themselves only following the manufacturer's intent. In terms of adopting a human-powered vehicle as a commuter vehicle, this means that users fail to recognize the potential for their recreational bicycles as a potential commuter vehicle. My STS research suggests that creating a new class of human-powered vehicles, specifically described as commuter vehicles, may help to enable the adoption of human-powered vehicles as commuter vehicles.

The most important finding from my STS research is that labels affect how users perceive a technology's purpose. In the context of my projects, this means that increasing adoption of human-powered vehicles as commuter vehicles may require introducing an entirely new type of vehicle. The differences between current human-powered vehicles and the new vehicle would include added safety and ergonomic features, but perhaps more importantly a specific label setting it apart from its recreational counterparts. Taking the findings of my STS research into account, specifically how to consider perceptions based on labels, will prove vital in developing future technologies. My technical project would not have been possible without help from my

advisor, Natasha Smith, and my fellow team members: Joe Flynn, Trevor Marchhart, Kavi Patel, Ryder Sadler, Riley Roe, and Lauren Weis. Work on my STS research was assisted by my STS professor, Kathryn Neeley.

References

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