Motorcycles and Electrification

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Motorcycles and Electrification

Electric motorcycles and electric bicycles may seem like different vehicles, but according to the definition of "motorcycle," they are both technically motorcycles (Merriam-Webster, n.d.b). As the threat of global warming grows many groups seek to reduce or eliminate harmful emissions from automobiles. Paris has banned automobiles from some streets. Generally, bikes are excepted from these bans and treated like pedestrians (Toll, 2022). On the other hand, electric motorcycles and combustion motorcycles are generally treated as alternatives to cars. Participant social groups in the United States disagree about how best to distinguish and utilize classes of electrified two-wheeled vehicles. These participants include trade associations such as the Motorcycle Industry Council (MIC) and motorcycle or electric bicycle manufacturers and retailers. Additional participants include government agencies such as the Environmental Protection Agency (EPA) and the California Air Resources Board (CARB), advocacies and non-profits such as Peopleforbikes and Earthjustice, and others. In this competition, electric bicycles are experiencing more support and growth than electric motorcycles.

Review of Research

A study reviewing the uses of two-wheeled transportation in China found that e-bikes and motorcycles had independent growth trends, indicating a societal or political difference between the two (Gu, Kim, & Currie, 2021). Fagnant, Nichols, and Kockerman (2013) found that motorcycles emit fewer greenhouse gasses than cars but emit more smog gasses such as carbon monoxide (CO). They also found that the limited seating on a motorcycle could offset the benefits as compared to a full-size automobile. A research team from the University of Michigan found the electrification of motorcycle taxis in Uganda to have a net positive impact on vehicle

emissions (Vanatta, et al., 2022). Electric motorcycles also cause much less noise pollution than conventional motorcycles (Hernandez et al., 2019). Drope and Hansen (2009) found that large, valuable industries "are more likely to maintain associations and have politically active associations, and these organizations will likely spend more." The automotive industry, which includes the motorcycle industry, is one of these large and valuable industries. Norton found that the automotive industry helped to normalize the domination of city streets by cars and stigmatize nonconformant pedestrians as "jaywalkers" (Norton, 2007). This shows a precedent for the automotive industry defying the public good to protect their interests. This also helps to show how the current status quo between automobiles and alternative mobility came to be.

Tomer and Kane (2015) found that more than 80% of goods traded in the United States passed through a metropolitan area at some point. This indicates that cities have a large role in transportation and have massive potential for sustainable mobility. Dalla, Verma, Rula, and Goodchild (2023) found that there were multiple steps that metropolitan areas could take to encourage the use of electric cargo bicycles and increase the sustainability of the transport of goods. Philips, Anable, and Chatterton (2022) found that electric bicycles could "reduce car CO2 emissions by 24.4 million tonnes p.a. in England". The United States Consumer Product Safety Commission (CPSC, 2023b) found that electric micromobility-related injuries increased annually by 23% on average. Electric bicycles contributed to 15% of micromobility-related injuries between 2017 and 2022 (CPSC, 2023a).

Recreational Motorcycles

In the United States, motorcycles are generally used as recreational vehicles. The motorcycle industry portrays motorcycles as an environmentally friendly mode of transport, and encourages their recreational nature. If the market is niche and the vehicles are portrayed to be environmentally friendly, then investment in the development of electric motorcycles is not a priority.

Pew Research Center (2014) found that car, bicycle, and motorcycle ownership differed between the US and other countries. They found that 88% of Americans claimed to own a car, far more than the median value of 35%. Bicycle ownership in the US was 52%, which was much closer to the median of 42%. Motorcycle ownership was even lower, with only 14% reporting ownership of a motorcycle. Motorcycles and scooters have much higher rates of ownership in Asia, especially the southeast. In 2022, researchers from the United States Census Bureau found that the amount of people commuting by bike was about 3%. The amount of people commuting by "taxicab, motorcycle, or other means" was about 1.5%, indicating that motorcycle commutes are an even smaller percentage (Burrows & Burd, 2024). Combining these datasets, it can be inferred that motorcycle and bicycle ownership in the United States are both primarily for recreational purposes. The difference in ownership between bicycles and motorcycles is likely due to the relative affordability of bicycles.

Due to their small size, internal combustion engine (or ICE) motorcycles are known to be more fuel efficient than cars and trucks. Due to this knowledge, there is a common misconception that because they are more efficient, they are "greener" or more eco-friendly than larger automobiles. This misconception is partly due to how motorcycles are portrayed by certain interest groups, such as trade associations, insurance providers, and retailers. This practice could be referred to as "greenwashing", which is "the act or practice of making a product, policy,

activity, etc. appear to be more environmentally friendly or less environmentally damaging than it really is" (Merriam-Webster, n.d.a). One of the stated goals of the Motorcycle Industry Council (MIC, n.d.a) is to "promote motorcycling's positive image of serious fun and a responsible, environmentally friendly mode of transportation". Progressive Insurance (n.d.), one of the largest insurers of motorcycles in the United States, states that motorcycles have a "lower impact on the environment" due to "fewer emissions" and "lower fuel costs". CycleTrader, one of the largest used motorcycle websites, states that motorcycles cause "less carbon emissions compared to owning a car" (Miller, 2023).

However, Fagnant, Nichols, and Kockelman (2013) found that "motorcycles emit fewer grams of many polluting emissions but more volatile organic compounds and carbon monoxide than most cars if a catalytic converter is not installed". They also found that the "low seating capacities render them little or no better than most cars and some light-duty trucks (assuming average vehicle occupancies) when compared in terms of fuel consumption per rider (or vehicle occupant) mile traveled". The industry is either aware of these emissions or indifferent to them, as the MIC states that they "supported adoption of an EPA and CARB exhaust emissions standard that doesn't require catalyst technology on all models". They also support "regulations that reduce stringency", "exemptions", and delays for various types of standards, especially those pertaining to "small volume manufacturers" (MIC, n.d.b). The EPA (2004) does not require motorcycle manufacturers to include catalytic converters, but the emissions standards in place may require catalytic converters to achieve compliance.

The industry does have some goals to improve the environmental effects of motorcycles. Motorcycles create significant noise pollution throughout normal usage (Hernandez et al., 2019). The MIC has helped to create a test procedure for evaluating motorcycle noise pollution and is

“committed to reducing excessive sound from off-highway motorcycles and ATVs on public lands” as they “threaten riding opportunities”. In 2022, Harley-Davidson published their goals for sustainability. Harley-Davidson plans to achieve net-zero carbon emissions for their electric motorcycle company LiveWire by 2035 and for the entire company by 2050 (Harley-Davidson, 2022).

However, one might argue that the handful of electric motorcycles Harley-Davidson has brought to market since 2019 are not enough, especially compared to the relatively robust electric automobile market. News site Powersports Business (2023) reported that the electric motorcycle market will not fully take off in the next decade. Citing a survey conducted with powersports dealers across the country, electric motorcycles are still in early adoption. Some of the dealers’ concerns were a lack of a charging network, range issues, and cultural pressure. Of the survey respondents, 61% said that they carried electric vehicles but were struggling to sell them. One dealer even referred to electric powersports vehicles as “a joke”. Global market research and consulting firm Global Market Insights (GMI, 2024) stated that the “lack of a well-developed and widespread charging infrastructure is a significant challenge for the electric motorcycle market”. Returning to Harley-Davidson, the LiveWire company reported operating losses for 2023, although revenues did increase in the 4th quarter (PR Newswire, 2024).

Support for Electric Bicycles

In the United States, bicycles are also used as recreational vehicles. However, due to their relative affordability compared to motorcycles and their ability to travel on both roads and pedestrian paths, electric bicycles stand as a more promising and well-supported form of electrified two-wheeled vehicles. Electric bicycles are supported by the majority of states

through policy. As of now, this support and growth is primarily driven by cities of various sizes both in the US and abroad.

Peopleforbikes is an advocacy that works to make “biking better for everyone by uniting millions of Americans, thousands of businesses, and hundreds of communities to make every bike ride safer, more accessible, and more fun”. One of the ways that they work to achieve this is by advancing “pro-bike and pro-bike business policy at all levels of government” (PFB, n.d.b). According to their overview of regulations page, 41 states have enacted policies that Peopleforbikes has identified as “model legislation”. These policies regulate “three classes of electric bicycles within states’ motor vehicle codes” and give “riders similar rights and responsibilities to that of traditional bicycle riders”. They identify the states of Oregon, Montana, Kentucky, Pennsylvania, North Carolina, South Carolina, and Hawaii as states that have “acceptable” policies. These policies are similar to the model policies. Lastly, they identify Alaska and Rhode Island as states with “problematic” electric bicycle policies. In these states, electric bicycles are “regulated as a moped or motor vehicle” and have confusing “equipment and use requirements”, “licensing and registration requirements”, and policies about “access to bike infrastructure” (PFB, n.d.a). Overall, the vast majority of states have enacted policies that are friendly to electric bicycles.

For an example of the “model legislation”, the state of Virginia regulates electric bicycles like regular bicycles and “the same rules of the road apply to both”. This also means that electric bicycles do not require “registration, licensing, or insurance” like regular motor vehicles. Virginia regulates three classes of electric bicycles: Class 1, 2, and 3. Class 1 bicycles provide assistance when the user is pedaling up to speeds of 20 mph. Class 2 bicycles provide assistance when activated by a throttle, but are also limited to 20 mph. Class 3 bicycles work in a similar

manner to Class 1 but have a speed limit of 28 mph. All three classes are allowed “on bicycle lanes and multi-use paths where bicycles are permitted”. Only Class 3 bicycles have age and helmet requirements. Virginia state lands allow Class 1 and Class 2 bicycles “wherever traditional bicycles are allowed” (PFB, n.d.c). With the majority of states maintaining policies like these, the US seems to be quite friendly towards the use of electric bicycles.

Electric bicycles are critical in metropolitan areas as well as in smaller cities due to the large amounts of people concentrated there. In New York City, Citi Bike (a company owned by Lyft) operates the “nation’s largest bikeshare program”, offering both normal bicycles and electric bicycles (Citi Bike, n.d.). Citi Bike has been steadily growing, with more than 3 million rides per month in the second half of 2022 (Hurford, 2022). Another electric mobility company is Veo, which operates with a mission “to end car dependency by making clean transportation accessible to all”. Veo claims to be operating in over 50 cities, including large cities like the Bronx borough of NYC and Washington, D.C. as well as smaller cities like Charlottesville, Virginia (Veo, n.d.). Veo offers both electric scooters and electric bicycles to users. Veo specifically advertises to college students as part of their business model (Veo, 2023). With many of Veo’s target cities containing colleges and universities, college students likely make up a large portion of Veo’s user base. Veo even works directly with university leaders (Veo, 2018).

Transportation of goods is another key factor in the role of electric bicycles in cities. Tomer and Kane found that more than 80% of goods traded in the United States passed through a metropolitan area at some point. Dalla, Verma, Rula, and Goodchild (2023) proposed a nine-point recommendation plan for cities to encourage the use of electric cargo bicycles and to decrease the amount of ICE delivery vehicles. The recommendations include building new cycling infrastructure, creating legal frameworks for electric cargo bicycle usage, and various

financial incentives to ease the burden of transitioning delivery fleets. They also identify various examples from cities in the US where electric cargo bicycles are already in use. Grocery deliveries in Manhattan, NY, campus deliveries in Seattle, WA, and business-to-business deliveries in Portland, OR are all examples of cities currently using electric cargo bicycles. Electric mobility news site Electrek (2022) asserted that electric cargo bicycles are suitable replacements for many SUVs.

Cities outside of the United States can also provide insight into the potential for electric bicycles within the US. Paris has taken steps to ban cars from certain sections of the city, instead favoring bicycles, scooters, and pedestrians (Toll, 2022). Similar to Veo, Lime is an electric bicycle and scooter company that works in the US as well as Europe and some additional cities in Asia, South America, and Oceania (Lime, n.d.). Paris is one of these cities, although only for electric bicycles. Electric scooters were banned from Paris in 2023 for safety concerns and to focus on replacing cars with bicycles and foot traffic (Keane, 2023). Amsterdam, typically known as a cycling utopia, has struggled with the speed and misuse of electric bicycles, especially by modifying them to travel faster (Boztas, 2023).

Critics of Electric Bicycles

One of the primary concerns critics have against electric bicycles is safety. Electric bicycles can travel faster than traditional bicycles with less effort, which makes them prone to misuse. Safety issues regarding both users and those around them pose a threat to widespread usage of electric bicycles.

As stated previously, most states do not require licensing, registration, or insurance to operate an electric bicycle. The Bicycle Helmet Safety Institute (BHSI, 2024) reports that no

states require all bicycle riders to wear helmets; however, some states and many localities require riders below a certain age to wear helmets. Some localities also have helmet requirements for all riders or for certain types of bicycles. The New York Times (NYT, 2023) reported that many parents have concerns about the safety of children and teenagers using electric bicycles under these policies. Some parents even stated that their children had modified their bicycles to exceed the built-in speed limit. The United States Consumer Product Safety Commission (CPSC, 2023b) reported that "micromobility-related injuries have trended upward since 2017, increasing an estimated average 23% annually". The CPSC considers micromobility devices to include "e-scooters, hoverboards and e-bikes". Children younger than 14 accounted for 36% of micromobility injuries from 2017 to 2022. 233 deaths have been associated with micromobility devices in this time, although "reporting is ongoing and incomplete". Electric bicycles accounted for 15% of micromobility injuries and 104 deaths from 2017 to 2022. An estimated 94% of micromobility injuries were inflicted on the user; the remainder were inflicted on bystanders (CPSC, 2023a). The CPSC recommends that riders wear a helmet, avoid damaging or tampering with the device, and driving predictably to reduce the risk of injury. This recommendation shows a disconnect between state laws and safety guidelines regarding electric bicycles and helmets.

In 2023, Paris voted to ban rental electric scooters due to safety concerns, although the city still allows companies like Lime to provide electric bicycles. One of the city's reasons was to focus on bicycles and pedestrians (Keane, 2023). However, if rental electric bicycles were also determined to pose a safety concern, they could be banned as well. The Guardian (2023) reported that Amsterdam is also facing young users driving in an unsafe manner and modifying electric bicycles to travel faster, stating that "experts warn that nations rapidly adopting them, such as the

UK, will soon face the same issues". Incidents reported in Amsterdam injured people other than the user, so electric bicycle safety is not just a matter of "personal risk".

Conclusion

Although electric motorcycles and electric bicycles are similar, they are treated as different machines in the United States in both public opinion and government policies. The niche nature and arguable "greenwashing" of the motorcycle market hinder the widespread acceptance of electric motorcycles, whereas the relative affordability, flexible usage, and widespread usage of electric bicycles has enhanced their adoption. Overall, electric bicycles receive more acceptance and support than electric motorcycles. Electric bicycles do face concerns over their safety, although there are paths to improve safety through public policy, both locally and nationally. Helmet requirements, strict speed limits, age restrictions, and separation of the different classes of electric bicycle could all help to reduce the dangers of widespread usage.

Additional research could be done into the role of scooters and mopeds as additional methods of two-wheeled transportation. Scooters are slower than bicycles and mopeds are faster than bicycles and slower than motorcycles, and could allow for a full range of electrified two-wheeled mobility. Even hoverboards could be included as an even smaller form of electric mobility. Perhaps if the United States begins to shift towards motorcycles and bicycles as the primary method of transportation, similar to some eastern countries, then electric motorcycles could replace both ICE and electric automobiles in urban and rural areas alike. However, this would require a cultural change beyond just the shift to electric vehicles.

The electric automobile industry could learn from the challenges facing the electric motorcycle industry to better reach niche sections of its own market, such as muscle cars or off-roading sport utility vehicles. The safety issues faced by the electric bicycle industry offer a lesson on how every solution comes with its own unique drawbacks which must be dealt with. The effort to combat climate change by altering the role of automobiles in today's society is a massive undertaking. The policy dilemmas and decisions discussed in this paper, as well as many more which remain unmentioned, are a model for how to make large changes within society and alter industries that have been a mainstay for over a century. This provides valuable lessons on how to make changes and to deal with the negative effects of those changes.

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