The Right to Repair Movement and its Social, Political, and Environmental Impacts

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

In the age of modern consumer electronics, the Right to Repair movement has grown in prominence as consumer devices have become widespread. Ensuring that consumers maintain the ability to repair their own devices is crucial to benefiting consumers and the environment. In chapter one of his book discussing the Right to Repair movement, author Aaron Perzanowski claims, "if consumers were more aware of these environmental and human costs, some may be more likely to repair a damaged device," (Perzanowski, 2022). Without ensured repairability and the support of an aftermarket repair industry, the carbon footprint and financial impact of the consumer electronic market will continue to grow.

Repair is an inherent aspect of mechanical systems and technologies. Long ownership periods and rough use will degrade the devices we use most often and demand for them to be repaired. Unfortunately, the accessibility and ability to repair consumer devices has too often been stripped from consumers for corporate profit. In some cases, essential tools such as repair manuals have been made proprietary and have had their access locked behind paywalls (Wiens, 2013). This harms the aftermarket repair industry, the end consumer, and the environment as it incentivizes replacing irreparable devices with new models. While this is financially beneficial for the device manufacturer, it is an overall negative experience for the consumer and harmful for the environment due to the waste it produces. This trend of replacing instead of repairing outdated or damaged devices has skyrocketed e-waste into the "fastest-growing component of the municipal waste stream in the country" (Meidl, 2023). The growing e-waste problem and the corresponding rise of consumer electronics has been incredibly taxing on the environment.

These issues have spawned the need for the Right to Repair movement. This thesis will seek to overview the Right to Repair movement as well as its environmental, consumer, and

political impacts. These diverse groups will be tied together through the STS framework of the social construction of technology (SCOT) which explains the interconnected relationships between technology and the relevant social groups responsible for its development.

Research Question and Methods

This research paper seeks to explore the impacts that the Right to Repair movement has had on the environment as well as consumers. It will analyze the political changes and social movements that have emerged from the Right to Repair movement. It will seek to answer: to what extent has the lack of repairability in consumer electronics impacted consumers and the environment? Additionally, it will explore the history of the Right to Repair movement and the movements current political progress.

These topics will be analyzed through a literature review with a specific focus on the difference between the consumer and environmental impacts as well as the political solutions being lobbied for. By collecting a variety of textual sources and compiling their findings, this thesis will provide a history and analysis of the current state of the Right to Repair movement for consumer electronics. The analysis will be performed through the STS framework of the social construction of technology.

STS Framework

This paper relies on the social construction of technology (SCOT) framework to explain the connections between the consumer, environmental, and the political impacts of the Right to Repair movement. The SCOT framework claims that technologies are not created in scientific isolation but instead are largely shaped by social, political, and cultural factors. This framework helps to connect the engineering of consumer electronics and the social and political movements

attempting to regulate their creation. The SCOT framework serves to provide a nuanced understanding of how societal values, political dynamics, and environmental concerns converge to shape the discourse and outcomes surrounding the Right to Repair in consumer electronics.

In the 2005 article extending Pinch and Bjiker's original concept of the social construction of technology, Lee Humphreys discusses the importance of relevant social groups in analyzing technologies under this framework. In her discussion, she separates these social groups into four main categories: producers, advocates, users, and bystanders (Humphreys, 2005). These groups are divided by two criteria: the types of interactions they have with the technology (direct or indirect), and their level of organization at a social level. Producers represent an organized group with direct interactions and are typically the engineers and organizations responsible for producing technologies. In the case of the Right to Repair movement, producers would represent consumer device manufacturers. Organized groups with indirect interactions represent advocates who have influence on the production of these technologies through social or political pressure, but not direct engineering influence. Advocates represent those politically involved with the Right to Repair movement as well as those users organized specifically into Right to Repair advocacy groups. These advocates fight for consumer rights as well as for environmental justice on issues stemming from consumer electronics. Consumers who are unorganized and have direct interactions with the technology are referred to as users. For the right to repair, this is the largest category as it encompasses all users of consumer electronics. Finally, bystanders are unorganized users with indirect use of the technology. This is by far the smallest category of users due to the frequency of consumer electronics in modern society. A bystander in the case of the Right to Repair would be those unaffected by the burdens of the Right to Repair due to their lack of device ownership. Humphreys notes that "bystanders help to create the zeitgeist surrounding a

certain technology," (2005). While certainly a smaller subset of those impacted by consumer electronics, it is still vital to understand how bystanders are impacted by technologies to better understand all social aspects responsible for technological development.

Rather than directly analyzing the Right to Repair movement by studying the decisions made by major product manufactures, the SCOT framework draws focus on the interactions between these social groups as the catalysts for technological innovation. These relevant social groups each have unique viewpoints on the problems and solutions associated with consumer electronics. Producers are often concerned with device success and profitability, while users are frequently concerned with pleasant and low-cost ownership experiences. It demands the opinions and work of bystanders and advocates to induce change into the technology. The wants and needs of these relevant social groups direct technological innovations into their most socially optimal forms.

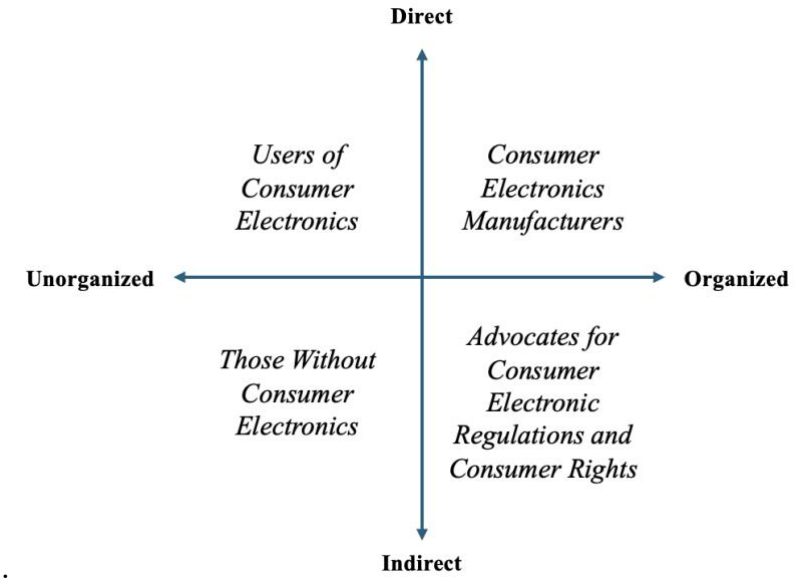

Figure 1: The separation of relevant social groups within the Right to Repair movement.

A major criticism of the social construction of technology is outlined by Langdon Winner in his 1993 article titled, "Upon Opening the Black Box and Finding It Empty: Social Constructivism and the Philosophy of Technology." Within this article, Winner critiques SCOT for its failure to consider the social consequences of technical choice and the reasons why certain technologies prevail over their competition (1993). Winner writes, "What the introduction of new artifacts means for people's sense of self, for the texture of human communities, for qualities of everyday living, and for the broader distribution of power in society-these are not matters of explicit concern" (1993). He argues that studying the competition within a market is vital to understanding the interactions between related sociotechnical actors, and the reasons people choose prevailing technologies is important to understanding their societal importance.

While Winner's viewpoint provides a perfectly valid critique on the micro-level interactions between consumers and their individual device choices, the Right to Repair movement itself is associated with general consumer device ownership as a whole. While individual market options may provide consumers with increased repair options, the broader market share of available consumer devices is still riddled with social issues stemming from technical choices. The social construction of technology adequately explains how the technical choices to limit consumer repair generates social and environmental problems demanding political solutions. The broad interplay of these groups disproves the necessity to analyze individual cases of society and technological interaction. The Right to Repair movement serves as a compelling example of how the SCOT illuminates the power dynamics and social consequences inherent in technical choices. By examining the broader societal impacts of restricted repair options, it becomes evident that SCOT remains a valuable tool for analyzing contemporary issues in technology and society such as the Right to Repair movement.

Literature Review

The Right to Repair Movement's History

The Right to Repair movement gained significant prominence in the early 2000's with its first major political success being the 2001 Motor Vehicle Owner's Right to Repair Act. This congressional bill requires vehicle manufacturers to supply vehicle owners and aftermarket repair shops with the necessary guides and equipment to service and repair their vehicles. This landmark bill was the first of its kind and largely affirmed the publics distaste towards monopolized dealer repair. As electronics grew in quantity and capability throughout the early 2000's and 2010's, their ability to prevent consumers from self-repair and the amount of people this impacted grew in unison.

The impact of electronics in vehicles has largely plagued farmers and the ability to repair their tractors. In his 2022 speech before the United States Congress, Nathan Proctor, head of the Public Interest Research Group, shared his thoughts on the repairability of modern John Deere tractors. He stated, "Of the roughly 700 codes the [repair] manual lists, 89% state that the farmer should contact their John Deere Dealer with very little other information to help the farmer address the issue" (United States Congress, 2022). He follows this fact by claiming, "That's not a service manual, that's a sales brochure" (United States Congress, 2022). The case of agriculture workers being denied the ability to repair the products they base their livelihoods on is one of the most extreme case of consumer electronic repair monopolization.

In 2014, the Unlocking Consumer Choice and Wireless Competition Act was signed by then-President Obama which ensured that individual users maintained the right to unlock their phone from their wireless carrier. Again, the legislature produced here worked to ensure that

consumers truly own the products they purchase. These political acts led to the modern successes that the Right to Repair movement has seen since 2018.

The Social and Political Impacts

The Right to Repair movement has specific focuses on the impact that the removal of repairability has on the end consumer. While removing repairability generally benefits the device manufacturer, it directly harms the end consumer. By forcing consumers to return only to the proprietary device manufacturer for repairs, the repair market becomes monopolized and removes the ability for secondary repair shops to discount the required service. Aaron Perzanowski claims that, "Accessible, affordable repair presents a threat to the business models of companies that manufacture and sell consumer goods by the billions," (2022). One of the largest consumer device manufacturers, Apple, specifically note some of their concerns with device repair. In a 2019 letter to Apple investors, the company's CEO Tim Cook wrote to address their lower-than-average quarterly revenue. In this letter, he claims, "While macroeconomic challenges in some markets were a key contributor to this trend [of lower than anticipated iPhone revenue], we believe there are other factors broadly impacting our iPhone performance," including "some customers taking advantage of significantly reduced pricing for iPhone battery replacements" (Cook, 2019). The notion that increased repair has harmed the company's profits seems to indicate that the company would prefer the sale of a new device over the repair of an older one. Despite this, the political advocacy groups have seen success in requiring increased device repair support.

In 2018 it was revealed that Apple was throttling the performance of older iPhones with the intention of extending the battery life of the phones as their components aged. When this was revealed, consumers were rightfully angered as many believed that the device throttling was

done to promote the sale of newer, faster iPhones. Additionally, the fact that the throttling was done without the consumers knowledge and with no way to revert it left consumers with a distasteful opinion of the company. To combat this poor public image, Apple introduced the battery repair program that Tim Cook claimed was a source of low quarterly sales. Shannon Liao, a tech writer for *The Verge*, writes, "in 2018, many of the less pleasant quality of life issues for older iPhone models disappeared, and that may have meant people's main reasons for upgrading to a new phone also vanished," (2019). Since 2018, Apple has begun to show support of repair movements. A 2023 *Verge* article written by Makena Kelly details Apple's newest commitment to nationwide device repair accessibility. Following California's 2023 Right to Repair Act, Apple has officially endorsed a nationwide Right to Repair bill. Kelly's article states, "Apple also believes that consumers and businesses would benefit from a national law that balances repairability with product integrity, usability and physical safety" (2023). These claims come following many years of diminishing support for consumer repair, but the changes are incredibly positive for the Right to Repair movement.

These positive changes within the repair movement ride along the larger political pressures seen through presidential executive orders, state government acts, and FTC regulations. In 2021, the FTC unanimously voted to increase support for the consumer repair market (Kavi, 2021). This support came alongside a larger FTC report documenting the specific methods manufacturers employ to prevent consumer and third-party repair. The FTC's report notes that there is, "scant evidence to support manufacturers' justifications for repair restriction" (Kavi, 2021). Additionally, President Biden has endorsed the need for increased consumer repair in a 2021 executive order designed to promote competition in the American economy. In this, he orders that the FTC must actively pursue, "unfair anticompetitive restrictions on third-party

repair or self-repair of items," (Biden, 2021). These changes are meant to ensure that the repair market thrives and is not monopolized by device manufacturers. The pressures and legislature produced by consumer advocacy groups and politicians have forced device manufacturers to cater to the consumers by restricting their ability to monopolize device repair and promoting a diverse repair market.

The Environmental Impacts

The impact that consumer electronics have had on the environment has been nothing short of devastating. As the trend of replacing instead of repairing continues, the frequency of consumer electronics disposed of will increase in parallel. In fact, the United Nations 2020 Global E-waste Monitor noted that e-waste generation increased 21% in the last five years (Forti, 2020). Furthermore, it is predicted that the global e-waste produced will increase at an alarming annual rate of almost 2 Mt from 44.4 Mt in 2014 to 74.7 Mt by 2030 (Forti et. al., 2020). The steady annual increase indicates that recycling and waste management programs are not effective at properly reducing the amount of e-waste generated.

In his 2022 congressional appearance, Nathan Proctor also provided his opinion on the state of repairability in consumer electronics. In his speech, Proctor claimed, "disposable electronics are incompatible with a livable planet. A phone takes about 122 pounds of carbon to make, mostly from mining and smelting the components" (United States Congress, 2022). The rate that consumers are replacing their devices is simply too high for current waste management systems. Proctor continues by noting that, "if we used our cell phones for 1 year longer on average as Americans, it would have the same climate benefits of taking 636,000 cars off the road" (United States Congress, 2022). Increased device lifespan would be irrefutably positive for the environment as well as financially beneficial for consumers. Proctor claims that a one-year

increase in device ownership periods will, “save the average household about $330 per year, which totals $40 billion across the country” (United States Congress, 2022). For many Americans, this is a serious incentive and has the added benefit of environmental protection.

A major contribution to the overall e-waste problem has been the semiconductor industry. The advent of semiconductors has quickly accelerated the demand and capabilities of consumer electronics. Unfortunately, the level of demand has proven to be environmentally harmful as semiconductor manufacturing consumes large amounts of energy. In fact, Greenpeace, an environmental activist organization, claims that, “semiconductor manufacturing is projected to consume 237 terawatt hours of electricity globally by 2030, roughly equivalent to Australia’s 2021 electricity consumption” (Greenpeace, 2023). The Taiwan Semiconductor Manufacturing Company (TSMC), the largest global semiconductor manufacturer, is projected to increase energy consumption by 267% by 2030 with the declared intention to progress towards carbon neutrality by the distant goal of 2050 (Belton, 2021) (Greenpeace, 2023). With a 2023 quarterly revenue of 625.53 billion dollars, TSMC is profitable enough to invest in renewable energy sources. Pádraig Belton, a technology journalist for *The Guardian*, wrote an article discussing what he describes as the paradoxical nature of the semiconductor industry. He claims the industry is paradoxical in that “meeting climate goals will, in part, rely on semiconductors,” but “chip manufacturing also contributes to the climate crisis” (Belton, 2021). Belton noted that in 2020, the Taiwan Semiconductor Manufacturing Company used “almost 5% of all of Taiwan’s electricity” (Belton 2021). While the advancement of our society will in part rely on the production of semiconductors, the environmental impacts their production must not be ignored.

It is crucial to note that the solution to this growing problem is not completely halting the production of semiconductors and their resulting consumer electronics. Instead, the issues they

create can be largely mitigated by managing the methods in which they are produced, and the impact that their production has on the environment. The lack of device repairability in consumer electronics has profound and far-reaching environmental implications. As we move forward, it is imperative for manufacturers to prioritize repairability and sustainable practices to mitigate the environmental impact of consumer electronics. Only through concerted efforts from industry stakeholders, policymakers, and consumers can we pave the way for a more sustainable future.

Results and Discussion

The Right to Repair movement has seen significant progress in combatting the threat of monopolization that grows with our society's reliance on electronics. With initial success in maintaining repair for vehicles and recent success in state-based repair acts, the movement continues to grow and fight for consumer repair rights. This progress is largely influenced by the interactions between the relevant social groups involved with consumer electronics. The needs of consumers are fought for by advocates who create regulations for producers. Despite the recent political success, the environmental impacts that the consumer electronic market continues to have cannot be understated. With distant renewable energy and carbon neutrality goals, device and component manufacturers have been shown to prioritize rapid profits before minimizing environmental impacts.

While manufacturers bear the majority of the burden of minimizing their overall climate impact, there are still proposed solutions towards minimizing consumer climate impact. In a study published in the *Journal of Cleaner Production,* researchers suggested promoting "a CE Repair Society, one in which repair is a cost-effective, convenient, and mainstream activity," (Svensson-Hoglund et. al., 2021). They continue this sentiment by claiming "an upscale with the objective to liberalize the aftermarket through equitable competition is believed to enable more

opportunities for consumers to repair," (Svensson-Hoglund et. al., 2021). Through political pressures, corporations will slowly return to supporting aftermarket repair for the benefit of both the environment and the consumer.

Another major component of the consumer electronic industry's environmental impact is the amount of e-waste produced due to irreparable devices. A proposed solution to this growing issue has been created by the Environmental Protection Agency (EPA). The EPA has produced the Alternative Disposition of Electronics Planning Tool (ADEPT), "a modeling tool that uses electronics purchasing data to estimate the composition and quantity of electronic materials designated as waste or reuse," (US EPA, 2021). By quantifying and tracking the purchases of consumer electronics, the EPA has been able to predict and prepare for incoming e-waste in landfills across the country. This software has aided in the proper disposal and recycling of e-waste but does nothing towards reducing its production.

While the Right to Repair movement is largely supported by consumers, there are some advocates concerned with the economic impacts presented by mandating consumer repairability. In a Harvard Business Review article on these potential negative consequences, the researchers claim, "manufacturers might strategically adjust new product prices to mitigate their foreseeable profit loss from the right-to-repair legislation" (Yang et al., 2023). While the increase of the base price of consumer electronics would still financially impact consumers, mandating devices remain repairable would allow the consumer to keep and maintain their devices for longer. By increasing the time between device purchases, this initial financial burden on the consumer is alleviated. The rate of e-waste generation would also be slowed by reducing the rate of device replacement which would be beneficial for the environment. While a link between increased

repairability and initial device cost may exist, the financial burdens it may place on the end consumer are still largely alleviated through longer device lifespans as a result of repairability.

Conclusion

The Right to Repair movement has been largely successful over its lifespan. Social and political reformations have served to return valuable repair capability to the consumer while also aiming to alleviate negative environmental impacts. Issues of consumer financial burden, e-waste generation, and a growing carbon footprint demonstrate the significant impact that stripping the ability to repair devices has on our society. Political advocates, like Nathan Proctor, must continue to lobby for consumer rights and By continuing to promote the reuse and repair of consumer devices, the environment and end consumers will benefit.

As consumer electronics continue to develop and permeate through everyday life, the importance of repair and longevity for devices is growing. Encouraging a culture of repair and reuse empowers policymakers, industry stakeholders, and consumers to collaboratively alleviate the environmental impacts of consumer electronics. Without repair, the economy and consumers will continue to be threatened by the ever-looming desire of profit seeking corporations to monopolize the consumers purchasing choices. These threats spotlight the many needs of end consumers and draw upon the actions and legislature expected from repair advocacy groups. These policies will serve to regulate producers and shape the production of the technologies that define our society.

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