

**Engineers' Responsibility to Mitigate Negative Sociopolitical Effects of Autonomous  
Vehicles**

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On my honor as a University Student, I have neither given nor received unauthorized aid on this  
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## Introduction to Autonomous Vehicle Technology

Throughout this research paper, I hope to expand upon the development of autonomous driving technology. More specifically, my goal is to consider ways for engineers to create a helpful technology that has the maximum benefit on society. While designing autonomous vehicles, I also hope that ways to mitigate negative effects become clear.

However, this is only possible by first studying the societal and political effects of autonomous vehicles. This provides a way to discover issues and benefits the technology might have. To do this thoroughly, I am going to utilize a technopolitical conceptual framework. The framework considers how technologies have much wider effects than they seem. Technology can shape society in many unforeseen ways. I intend to consider some ways that autonomous vehicles may shape society through interviews and articles with the lens of autonomous vehicle's technopolitical effects. As a result, there might be concrete design considerations for engineers to practice as they continue to improve and develop this technology.

## Technopolitics

The framework of technopolitics is laid out well by Langdon Winner who wrote a paper titled "Do Artifacts Have Politics?" which was published by MIT Press. Within this paper, Winner refers to technology from bridges to robotic farming equipment as artifacts. He then goes on to cite various ways these artifacts have had significant impacts on their immediate community or a broader society. For example, bridges, a transportation technology, in Long Island, New York were used to enforce segregation. Robert Moses deliberately designed these bridges to be low hanging to prevent the public buses from being able to reach the beach. As a

result, only residents with private vehicles could get to the beaches which effectively excluded a majority of the African American community.

While this is an example of a very harmful effect artifacts can have, they also have the possibility of really improving society. However, Winner's point is that we must consider what purposeful and unintended consequences a technology may have to ensure that it is truly achieving what it was designed to do. Technopolitics looks at each technology asking the question "how will this affect the users" and "how will it affect society around the users." By using this conceptual framework, it is possible to gain a more accurate picture of an artifact. Furthermore, it can enhance design decisions to ensure that the developing technology has the achieves its purpose.

### Technopolitics and Autonomous Vehicles

Autonomous vehicles are still a new technology. In fact, they are not even really used on the road. While there are a few companies which have developed something close to autonomous vehicles; for example, SAE international has created self-driving trucks that platoon with a human driven lead and Tesla has an autopilot feature which can steer and control the car without user input, fully autonomous vehicles which can make decisions about route and entering or exiting traffic are still being tested and are not available to the public.

This is partly because the technology is not quite complete, society also has a lot of decisions to make before autonomous vehicles can be a common transportation option. Traffic laws must be created which specifically discuss liability for autonomous vehicles. Regulations surrounding the operator of an autonomous vehicle must also be put into place. Nevertheless, this technology will likely be a form of transportation in the future.

Therefore, it is important to consider it an artifact which will shape society. To do this, we can apply the technopolitical framework to the autonomous vehicle, in the hopes that this technology is designed with the most knowledge possible.

In the article “Autonomous automobilities: The social impacts of driverless vehicles,” the authors understand that autonomous vehicles will have wide-reaching effects. In light of this, they emphasize mobility studies could help us understand the effects on experiences, labor, inequality and interlocking systems. These categories are vital because they are core pillars of a society. So, considering how autonomous vehicles change the way we will move can be a great insight into their possible sociopolitical effects through those categories.

As a transportation technology, autonomous vehicles will change society significantly. This is why I believe the technopolitical framework is an effective way to critically think about how to design these vehicles. This will certainly remove jobs while creating others. It could shift the way that our culture views time because commuting will no longer be something that is a task to complete. So, looking at the many applications of this artifact to try and see ways it shapes the community it is in, can provide tangible ways to better design these vehicles. Furthermore, technopolitics does not assign inherent value to an artifact’s effects. The framework helps us notice the impacts. As a result, using this framework will also highlight a variety of positive changes that autonomous vehicles could bring.

The goal is to better understand how to design this young technology and technopolitics provides a way to notice both the positive and negative impacts past the immediate user. Then engineers may gain understanding about how to develop this artifact.

## Specific Sociopolitical Effects of Autonomous Vehicles

To gain further insight into the technopolitics of autonomous vehicles it is important to consider their relationship with socioeconomic status. First, it is likely that only very wealthy citizens will be able to afford autonomous vehicles until they have become a common technology and grown normalized. As a result, it is possible they could create or increase economic disparity because citizens could work in autonomous vehicles and increase productivity. As they increase productivity they may be promoted and increase their salary while people driving nonautonomous cars have less time to work and will be unable to compete for high paying jobs against autonomous vehicle owners. McCarroll and Cugurullo focus on this in their jointly authored paper, “Social implications of autonomous vehicles: A focus on time” which highlights the possibility of increased work time leading to further economic disparity. Within the article they cite the theory of social acceleration which states that as technology has improved humans have used that to increase their work time.

Another effect of autonomous vehicles will be changing how we view liability entirely. This issue is much larger than the developing technology because a computer will be making decisions that could be life or death. Currently, driving is not a very safe task. Thousands die every year from car accidents and many more are injured. Autonomous vehicles could offer a much safer alternative. However, when accidents do happen a simple computer bug could be at fault. Now a person has always had to take the responsibility in vehicle accidents prior to autonomy. But, the fundamental question “who is at fault” no longer has a clear answer when an inanimate object is the sole reason a human was killed. As a result, our judicial system will have to change the way it views automobile liability. Insurance companies will need to reconsider

how to assign blame. These are all unknowns regarding implementing autonomous cars, but it is certain that this will require new laws from speeding regulations to vehicular manslaughter.

However, autonomous vehicles could also revolutionize transportation for disabled citizens. If designed well, many individuals who could not have attained a driver's license will have incredible independence with an autonomous vehicle. Currently, disabled residents often are unable to use either personal transport or public transport by themselves because bus stops are inconveniently placed or the subway is difficult to navigate. Furthermore, many people expressed that they traveled less because they did not want to burden others whenever they needed to go somewhere. This meant fewer trips to a grocery store or enjoyable outings away from their house. Autonomous vehicles could be a complete solution to disabled individuals' transportation problems. They would offer even more independence than public transportation without burdening another person and in a more convenient place. The only step is to design autonomous vehicles with disabled citizens in mind.

### Autonomous Vehicle Design

Creating affordable autonomous vehicles is a significant challenge. I do not think that it is possible to immediately produce quality low-cost autonomous vehicles. Nevertheless, negative socioeconomic impact could be mitigated by engineers prioritizing simple safe design rather than elegant fancy autonomous cars. This would mean the amenities and very fancy interiors that current expensive cars have could be replaced by lower end but adequate materials.

There is no simple solution regarding safety and liability issues. However, in a collaborative paper entitled "A cooperative mobility model for multiple autonomous vehicles"

the authors propose a platooning method of organization where autonomous vehicles would communicate with one another to maintain speed and avoid collisions. The only challenges would be merging into traffic or exiting traffic. There are logistical complications here as well because cars from different manufacturers would have to communicate with one another and that implementation would likely take standardized government regulations. But, developing platooning software would hopefully create an incredibly safe transportation environment because there would be no human error and the cars would be in constant communication with each other. Unfortunately, liability is likely an effect that engineering design could not mitigate other than proper testing and safety standards to ensure the technology works seamlessly.

In order to see other software design challenges in more detail, I interviewed Kayla Boggess who is a graduate student working in explainable AI. While she develops AI systems, specifically for search and rescue teams, she also trains the users on ways to implement the technology correctly. Based on this understanding of the user side of AI technology, Kayla had great insights into ways that society views autonomous technology. This is valuable knowledge because engineers need to ensure that the user trusts the vehicle design as they develop autonomous vehicles. One of Kayla's main points was that users will often trust autonomous technology too much or too little. As a result, it is the engineers' job to ensure that system warnings are reliable, consistent and accurate. Once these warnings are successfully implemented into the system, society begins to trust the technology. This is quite complex for an autonomous vehicle system. However, software engineers first prioritizing safety features would obviously minimize negative sociopolitical effects, such as wrecks, and increase the implementation rate of autonomous vehicles.

Finally, to gain a better understanding of car feature requirements for citizens with disabilities, I spoke with the University of Virginia's Accessibility Specialist in the Engineering School, Courtney MacMasters. She deals with helping students with permanent or temporary disabilities get to their classes daily and discussed how every person has unique needs. But, she did explain that features like ramps to enter the vehicle are a quite common need. Power adjusted seats can also help increase the user's comfort and ease getting into and out of a wheelchair. However, autonomous vehicles could go further with a voice-controlled cockpit which read commands or directions to a blind user. There could even be morse code vibration on the car dashboard for a user who is blind and deaf. While these are challenging technologies individually and incorporating them into an autonomous car would be even more complex, they could increase the standard of living of many disabled citizens.

If engineers educated citizens on exactly how the autonomous vehicles navigate so the user understands and trusts their vehicle, the general public use would increase. Furthermore, as developers view autonomous vehicles as a way to allow disabled citizens to drive, they will certainly create a technology with positive effects on society. If engineers make safety, accurate information and disabled access the top priority this technology would have minimal negative consequences on society in the long-run.

## Conclusion

Autonomous vehicles will certainly shape society in new ways and alter culture. In order to design a successful technology, we must consider the possible changes it will create as we develop this technology. This ensures that it can be designed in a knowledgeable manner to mitigate negative side effects as well as unintended consequences. Since autonomous technology

is still being developed, it is important that its sociopolitical elements are considered. That way autonomous vehicles can be designed to maximize their benefits.

Technopolitics provides a great way to understand what effects this artifact might have on society. In light of the economic, social and cultural effects we can see new ways to design these vehicles. First, understanding that self-driving transportation might increase economic disparity and limit economic mobility of the lower class means that engineers should focus on cost efficient designs. Next, software engineers should be aware of how artificial intelligence will alter the justice system and redefine liability. As a result, they should design the vehicles with extensive safety systems and platooning capability, even at the cost of transportation efficiency or vehicle independence. Then seek to remove the information gap between society and engineers developing autonomous vehicles to increase acceptance of this new technology. Finally, autonomous vehicles could also revolutionize transportation for anyone with disabilities preventing driving. This feature of the technology should be highlighted so the autonomous vehicles are user friendly for their disabled users to maximize societal benefit.

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