

# Issues in self-driving car technologies



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There is a race in the auto industry to become the first company with a fully self-driving car. Most new cars today have some autonomous features like adaptive cruise control and lane-keeping assist, but there are no fully autonomous cars yet. Cars are categorized by the Society of Automotive Engineers in levels ranging between no autonomy to full autonomy and are given a rating from 0 to 5. In a level 0 vehicle, the driver is responsible for all core driving tasks. However, Level 0 vehicles may still include features like automatic emergency braking, blind-spot warnings, and lane-departure warnings. Level 1 vehicles require navigation controlled by the driver but driving-assist features like lane centering or adaptive cruise control are included. In level 2 cars like Tesla's and other newer cars, the core vehicle operation is still controlled by the driver, but the vehicle is capable of using assisted-driving features like lane centering and adaptive cruise control simultaneously. For level 3 cars the driver is still required to perform most functions but is not needed to navigate or monitor the environment, if certain criteria are met. Some of the criteria needed include the ability to see road lines and street signage (i. e. absence of snow cover or thick fog). However, the driver must remain ready to resume control of the vehicle once the conditions permitting ADS (automated driving system) are no longer met. Level 4 vehicles can carry out all driving functions and do not require that the driver remain ready to take control of operation. However, the quality of the ADS navigation may decline under certain conditions such as off-road driving or other types of abnormal or hazardous situations. In Level 4 vehicles, the driver still has the option to control the vehicle. With level 5 the ADS system is advanced enough that the vehicle can carry out all driving

functions no matter the conditions. The driver may have the option to control the vehicle, if desired.

The current best technology right now is Tesla with a level 2 autonomous car. Tesla's strategy is to release cars now with all of the sensors and hardware needed for greater levels of autonomy than currently needed. Then, the cars can help Tesla by collecting data to help the AI learn and improve. Later, Tesla releases software updates to unlock more and more features, eventually reaching level 4 or 5 self-driving cars. One of the most recent updates is Tesla's " Smart Summon" feature which your car can navigate a parking lot and come pick you up. Other companies are like Google's Waymo have a different strategy. They take a regular car and retrofit it with sensors. Right now, the cars are only driving in pre-determined areas in Arizona. Waymo's cars have level 3 technology but they have lots more sensors and can only drive in certain areas. Also, unlike Tesla you can't but one right now. Human's brains are incredibly good at recognizing different objects. The only thing a human needs to drive a car is eyesight. Right now, a computer needs a plethora of sensors to 3D map the whole environment. As computers and AI advance, self-driving car won't need expensive sensors because they will be able to recognize and learn like humans.

Self-driving cars look great at first glance, but some people think that they aren't the future of cars. As the race for full autonomy goes on, some may question the safety of self-driving cars. Can we trust that a car controlled by a computer will be as good as a human driver? There have already been crashes from autonomous cars that could have been avoided if there was a

human driving. Most of the cases it was partly the driver's fault for not paying attention although it still raises the question of self-driving cars safety. " Elaine Herzberg, 49, died after she was hit in March 2018 by a Volvo SUV, which had an operator in the driver's seat and was traveling at about 40 mph in autonomous mode at night in Tempe Arizona" (McCausland). This accident was one of the first self-driving car accidents. It brings up some of the issues of who to blame for a car accident. If a self-driving car crashed is it the driver's fault or is it the company that produced the car? In regard to safety, self-driving cars still have a long way to go before they can be trusted.

Another issue with self-driving cars is cybersecurity. Having computers control our cars opens us up to a cybersecurity threat. Just like your home computer, your car would be susceptible to viruses and malware. Although the chances of your car getting hacked are very low, this still needs to be considered before fully self-driving cars come to market.

Self-driving cars will eliminate many driving jobs like taxi and truck drivers. Right now, 3.8 million people operate motor vehicles for their job (Winick). Jobs like truck driving will probably be replaced first because it's mostly easy highway driving. This will put a lot of truck drivers out of work. We are still a few years out from full self-driving capabilities, but don't be surprised by how fast this technology develops. So, if you're in the truck driving industry you might want to start considering new career paths.

Self-driving cars will cost more to produce so it will be harder for people with low income to afford them. Since self-driving capabilities are a relatively new

technology, they will cost more than regular cars. As the technology becomes more mature the prices will drop making them more accessible for everyone.

Lastly, some people just like to drive themselves. If driverless cars become the standard, over time people will lose the ability to drive themselves. This is similar to how people have lost the ability to drive a manual shift car today. Like driving a stick-shift car today, there will be people that will want to drive non-self-driving cars in the future.

Self-driving cars are not just all bad, they actually have a lot of benefits too. One of the largest draws to self-driving cars is safety. The first safety benefit of self-driving cars is they can't be impaired, like drivers under the influence of alcohol or drugs. "Every day, 29 people in the United States die in motor vehicle crashes that involve an alcohol-impaired driver. This is one death every 50 minutes. The annual cost of alcohol-related crashes totals more than \$44 billion" (Impaired Driving: Get the Facts). Also, you won't have to call an Uber for a ride home when your self-driving car can take you. Another safety benefit is self-driving cars don't have blind spots. Self-driving cars have many cameras and sensors looking in all directions around the car. A human driver has a substantially smaller field of view with blind spots. Self-driving cars are able to see things human drivers may not. The last safety improvement is the reaction speed of self-driving cars. The average human reaction time is a quarter of a second. So, traveling at 60mph, a driver would travel 22 feet before being able to react to a given input or problem. On the other hand, a computer's reaction time is near instantaneous. This is good for when you need to make a split-second decision to avoid crashes.

An additional benefit of self-driving cars is reduced traffic. “ The average U. S. commuter spends around 42 hours in traffic per year and loses \$1, 400 idling away gas. The development of vehicle platooning, or the ability of vehicles to travel closely and safely together at high speeds in response to a lead vehicle’s movement could exponentially decrease traffic while increasing the capacity of roads and providing a more steady flow of traffic.” (Self-Driving Cars: Pros And Cons To The Next Big Shift In Transportation).

Self-driving cars will also be more fuel-efficient. With decreased amounts of traffic, cars will spend less time idling in traffic ultimately saving fuel. Also, self-driving cars will drive more efficiently, not accelerating and braking as hard as people might. The way you drive can have a big impact on fuel economy. Many self-driving cars are electric too so that will be a lot better for carbon emissions.

The final reason why self-driving cars are better than regular cars is time saving. The average American spends on average of 1. 1 hours driving per day reported in the American Time Use Survey (ATUS News Releases). If the car is driving itself the passengers can spend the time they usually be driving on other things. Imagine being able to watch tv or movies on your way to work.

We’ve talked about the pros and cons of self-driving cars but there is one thing we all can agree on, and that is the desire for increased safety. The solution to this problem is to have self-driving cars be fully tested to be better than human drivers before they can be used on roads. The question is how much safer do they need to be? Is only 10% safer good enough or do

they need to be 100% safer. Should we wait for self-driving cars to become substantially safer than regular cars when more people could die while we wait? A 2017 study from RAND Corporation found that the faster automated vehicles are deployed, the more lives will ultimately be saved, even if the cars are just slightly safer than cars driven by humans (Kalra).

Measuring safety is going to be very hard. Self-driving cars will have to drive millions and maybe billions of miles in order to fully test their safety. Also, not all miles are equal, navigating the busy streets of a city will be a lot harder than just driving on an open highway. Self-driving cars will need to be tested to be better in all situations. Some self-driving companies are using computer simulations to test their self-driving cars for all possible situations that could happen in the real world. Self-driving cars are an amazing new technology that can change our world. The faster it can be developed and deployed safely; the more lives can be saved.

## **Annotated Bibliography**

- “ ATUS News Releases.” *U. S. Bureau of Labor Statistics* , U. S. Bureau of Labor Statistics, [https://www. bls. gov/tus/](https://www.bls.gov/tus/).
- “ Car Safety & Efficiency - Consumer Reports.” *Product Reviews and Ratings - Consumer Reports* , [https://www. consumerreports. org/issue/car-safety-efficiency](https://www.consumerreports.org/issue/car-safety-efficiency).
- This article talks about car safety and efficiency. It will help me learn more about care safety.
- Costa, Ana Nicolaci da. “ Self-Driving Cars May Not Be a Widespread Reality for Years, but the Potential Is 'Great'.” *CNBC* , CNBC, 21 Nov.

2019, <https://www.cnbc.com/2019/11/21/self-driving-cars-may-not-be-widespread-reality-but-potential-is-great.html>.

- This article talks about the self-driving cars. It will help me learn more about self-driving cars.
- “ Impaired Driving: Get the Facts.” *Centers for Disease Control and Prevention* , Centers for Disease Control and Prevention, 22 Mar. 2019, [https://www.cdc.gov/motorvehiclesafety/impaired\\_driving/impaired-driv\\_factsheet.html](https://www.cdc.gov/motorvehiclesafety/impaired_driving/impaired-driv_factsheet.html).
- Kalra, et al. “ Deploying Autonomous Vehicles Before They're Perfect Will Save More Lives.” *RAND Corporation* , 7 Nov. 2017, [https://www.rand.org/pubs/research\\_reports/RR2150.html](https://www.rand.org/pubs/research_reports/RR2150.html).
- Lori, Alessandro. “ Are Self-Driving Cars Safe?” *Verizon Connect* , 20 Aug. 2019, <https://www.verizonconnect.com/resources/article/are-self-driving-cars-safe/>.
- This article talks about the safety of self-driving cars. It will help me learn more about the safety of self-driving cars.
- Markman, Jon. “ Real Autonomous Cars Hit The Road In Arizona.” *Forbes* , Forbes Magazine, 24 Nov. 2019, <https://www.forbes.com/sites/jonmarkman/2019/11/23/real-autonomous-cars-hit-the-road-in-arizona/#59f447e032c6>.
- This article talks about the current state of self-driving cars. It will help me learn more about the current state of self-driving cars.
- Marshall, Aarian. “ We've Been Talking About Self-Driving Car Safety All Wrong.” *Wired* , Conde Nast, 29 Oct. 2018, <https://www.wired.com/story/self-driving-cars-safety-metrics-miles-disengagements/>.



- This article talks about the ethics of self-driving cars. It will help me learn more about the ethics of self-driving cars.
- Matthew. lynberg. ctr@dot. gov. “ Automated Vehicles for Safety.” *NHTSA* , 12 Aug. 2019, <https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety>.
- This article talks about self-driving car safety. It will help me learn more about self-driving car safety.
- McCausland, Phil. “ Self-Driving Uber Car That Hit and Killed Woman Did Not Recognize That Pedestrians Jaywalk.” *NBCNews.com* , NBCUniversal News Group, 11 Nov. 2019, <https://www.nbcnews.com/tech/tech-news/self-driving-uber-car-hit-killed-woman-did-not-recognize-n1079281>.
- Noonan, Keith. “ What Does the Future Hold for Self-Driving Cars?” *The Motley Fool* , The Motley Fool, 30 Sept. 2019, <https://www.fool.com/investing/what-does-the-future-hold-for-self-driving-cars.aspx>.
- This article talks about the future of self-driving cars. It will help me learn more about the future of self-driving cars.
- “ Self-Driving Cars Explained.” *Union of Concerned Scientists* , <https://www.ucsusa.org/resources/self-driving-cars-101>.
- This article talks about the impact of self-driving cars. It will help me learn more about the impact of self-driving cars.
- “ Self-Driving Cars: Pros And Cons To The Next Big Shift In Transportation.” *The Pollack PR Marketing Group* , <https://www.ppmgcorp.com/in-the-red/self-driving-cars-pros-and-cons-to-the-next-big-shift-in-transportation>.

- Stewart, Emily. “ Self-Driving Cars Have to Be Safer than Regular Cars. The Question Is How Much.” *Vox* , Vox, 17 May 2019, <https://www.vox.com/recode/2019/5/17/18564501/self-driving-car-morals-safety-tesla-waymo>.
- This article talks about the viability of self-driving cars. It will help me learn more about the viability of self-driving cars.
- “ The Science of Self-Driving Cars.” *The Franklin Institute* , 10 Aug. 2016, <https://www.fi.edu/science-of-selfdriving-cars>.
- This article talks about how self-driving cars work. It will help me learn more about how self-driving cars work.
- Winick, Erin. “ Self-Driving Cars Endanger Nearly Four Million Jobs but Could Create a \$7 Trillion Industry.” *MIT Technology Review* , MIT Technology Review, 23 Apr. 2019, <https://www.technologyreview.com/f/609747/self-driving-cars-endanger-nearly-four-million-jobs-but-could-create-a-7-trillion-industry/>.