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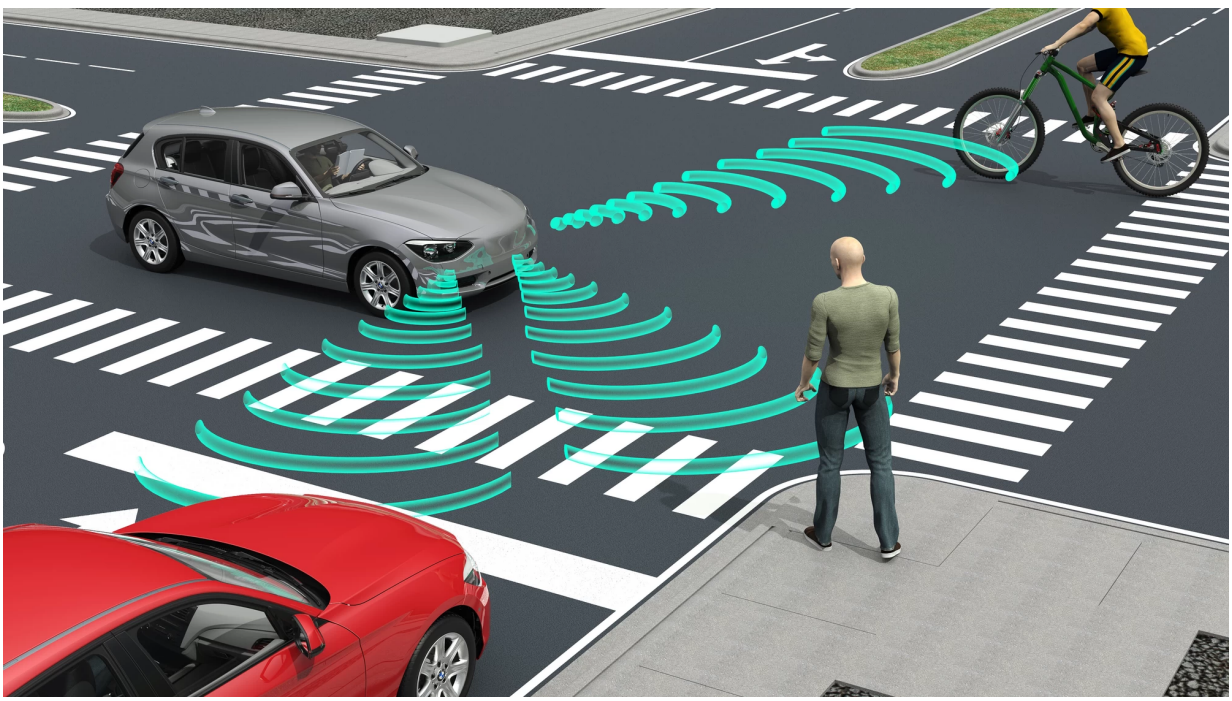
DRIVERLESS CARS

Driverless Cars Should Spare Young People Over Old in Unavoidable Accidents, Massive Survey Finds

In the Moral Machine Experiment, a survey of more than two million people from 233 countries, people preferred to save humans over animals, young over old, and more people over fewer.

By Tracey Lindeman | Oct 25 2018, 1:00am



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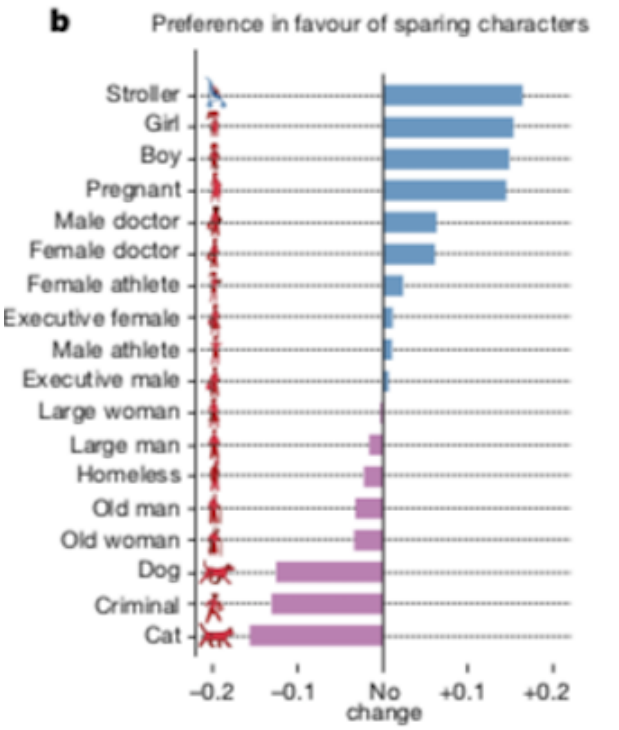
cats or some kids? Would you choose to kill yourself and your passengers by crashing into a concrete median, or would you rather kill several elderly people crossing the street?

What if, instead of elderly, it was a pregnant woman and a child? Or two criminals? Or three homeless people? Or a couple of business executives?

These are precisely the questions that researchers, led by MIT postdoc Edmond Awad, tried to answer in their new paper, "The Moral Machine Experiment," published Wednesday in *Nature*. The purpose of the study was to understand how people think autonomous cars should decide who to kill if and when the need arises. Their research is based on the responses of more than two million survey participants across 233 countries.

Awad's team found that people generally preferred to save humans over animals, young over old, and more people over fewer. There were, however, some cultural differences about who to save first.

People living in Latin American countries preferred saving young people over older ones, for example, while the opposite was true for respondents from Asian countries. Most people, however, would rather spare pedestrians over passengers, as well as lawful people over jaywalkers—except in poorer countries, where drivers are generally more tolerant of jaywalking.



Screengrab: Awad et al.

The Moral Machine game is similar to the infamous trolley problem (a.k.a. would you kill one person to save five?), but calibrated for the autonomous car. Azim Shariff, a co-author on the study and the Canada research chair in moral psychology at University of British Columbia, said in an interview that most drivers rely on gut reactions in dangerous scenarios like these, but that autonomous cars will have the luxury of deliberation.

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"They'll make decisions that redistribute risks to different people on the road," Shariff said.

Participants were sucked in by a moral dilemma that is increasingly popping up more as automation becomes more central to our lives: How much power do we want to give to the machines? These real-life manifestations of the trolley problem—however rare they might actually be—home in on a very persistent fear people have of making life-or-death decisions.

"It does seem like 2018 was a tipping point where people turned against emerging technologies," Shariff said. "[The autonomous car] might be the first consumer product that could be programmed to the put the life of the owner at risk deliberately and against their will."

The moral dilemma is particularly pronounced with cars, Shariff said, because we spend so much of our time in them, and money on them.

> ***Read More:*** *Uber Self-Driving Car Kills Arizona Woman, the First Pedestrian Death By Autonomous Car*

Plus, nearly anyone who is a regular driver has encountered a scenario in which they have had to make a risky split-second decision. In 2010, Quebec woman Emma

Shariff thinks the research represents “the largest moral psychology study ever conducted.” The Moral Machine game went viral after VICE and others published stories about it, and it has recorded more than 40 million decisions since it launched in 2016.

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“Obama talked about it once. That helped. Then we had a bunch of these YouTubers who posted themselves playing the game,” Shariff told me on the phone. “One video-gaming review couple spent an hour and a half going through the 13 scenarios.”

He and his co-authors hope their research informs regulatory agencies and auto manufacturers about how to broach this ethical problem—and why it’s essential to include the public in the conversation.

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OPINION

How Self-Driving Car Policy Will Determine Life, Death and Everything In-Between

The time to think about ethics in autonomous vehicle accidents is now.

By Brett Frischmann and Evan Selinger | Mar 23 2018, 11:00pm

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Brett M. Frischmann is a Charles Widger Endowed University professor in Law, Business and Economics at Villanova University, and Evan Selinger is a professor of philosophy at Rochester Institute of Technology. They are co-authors of Re-Engineering Humanity, Cambridge University Press: forthcoming in April 2018.

giants are clamoring to develop and release fully autonomous cars to safely and efficiently chauffeur us. Some models won't even include a steering wheel. Along with many challenges, technical and otherwise, there is one fundamental political question that is too easily brushed aside: Who decides on how transportation algorithms will make decisions about life, death and everything in between?

The recent fatality involving a self-driving Uber vehicle won't be the last incident where human life is lost. Indeed, no matter how many lives self-driving cars save, accidents still will happen.

Imagine you're in a self-driving car going down a road when, suddenly, the large propane tanks hauled by the truck in front of you fall out and fly in your direction. A split-second decision needs to be made, and you can't think through the outcomes and tradeoffs for every possible response. Fortunately, the smart system driving your car can run through tons of scenarios at lightning fast speed. How, then, should it determine moral priority?

Consider the following possibilities:

1. Your car should stay in its lane and absorbs the damage, thereby making it likely that you'll die.
2. Your car should save your life by swerving into the left lane and hitting the car there, sending the passengers to their deaths—passengers known, according to their big data profiles, to have several small children.
3. Your car should save your life by swerving into the right lane and hit the car there, sending the lone passenger to her death—a passenger known, according to her big data profile, to be a scientist who is coming close to finding a cure for cancer.
4. Your car should save the lives worth the most, measured according to amount of money paid into a new form of life assurance insurance. Assume that each person in a vehicle could purchase insurance against these types of rare but inevitable accidents, and then, smart cars would prioritize based on their ability and willingness to pay.
5. Your car should save your life and embrace a neutrality principle in deciding among the means for doing so, perhaps by flipping a simulated coin and swerving to the right if heads comes up and swerving to the left if its tails.
6. Your car shouldn't prioritize your life and should embrace a neutrality principle by randomly choosing among the three options.
7. Your car should execute whatever option most closely matches your personal value system and the moral choices you would have made if you were capable of doing so. Assume that when you first purchased your car, you took a self-driving car morality test consisting of a battery of scenarios like this one and that the results "programmed" your vehicle.

"solved" by big data, sophisticated algorithms, machine learning, or any form of artificial intelligence. These tools can help evaluate and execute options, but ultimately, someone—some human beings—must choose and have their values baked into the software.

Read more: *Tempe Police Release Footage of Fatal Uber Self-Driving Car Accident*

Who should get decision-making power? Should it be politicians? The market? Insurance companies? Automotive executives? Technologists? Should consumers be allowed to customize the moral dashboard of their cars so that their vehicles execute moral decisions that are in line with their own preferences?

Don't be fooled when people talk about AI as if it alleviates the need for human beings to make these moral decisions, as if AI necessarily will take care of everything for us. Sure, AI can be designed to make emergent, non-transparent, and even inexplicable decisions. But since the shift from human drivers to passive passengers in self-driving cars shifts decision-making from drivers to designers and programmers, governance remains essential. It's only a question of which form of governance gets adopted.

> **The critical social policy questions need to be addressed proactively while systems are being designed, built, and tested**

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The scenario we've described is based on an old philosophical thought experiment called the trolley problem. In the original experiment, a person is faced with the decision about pulling a level to divert a trolley from one track to another and in doing so, save five lives but take another. MIT developed a modern interactive version called the Moral Machine.

It's not surprising that the trolley problem comes up in virtually every discussion of autonomous vehicles. To date, the debate has primarily focused on death-dealing

are given free rein on the roads. Others argue that such decisions concern edge cases and should be deferred to the future so that innovation won't be stalled. And some deny that the trolley problem scenarios are even relevant, once super smart braking systems are built into each car.

The critical social policy questions need to be addressed proactively while systems are being designed, built, and tested. Otherwise, values become entrenched as they're embedded in the technology. That may be the aim of denialists pining for perfectly safe systems (unless they're truly deluded by techno-utopian dreams). The edge case argument is more reasonable if you focus exclusively on the trolley problem dilemma. But the trolley problem captures one small albeit important piece of the puzzle. To see why, we need to consider scenarios that don't involve life-or-death decisions.

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Let's focus on accidents. Self-driving cars will reduce the number of accidents, but again, do not be fooled by the siren's call of perfection. There still will be accidents that cause:

- considerable bodily loss, such as the loss of limbs, but not death;
- considerable bodily damage that disables the injured person for 24 months;
- considerable mental damage that limits the injured person's ability to ride in an automobile and forces the person to use less efficient modes of transportation;
- considerable damage to the person's vehicle; or
- damage and delays.

Assume that the smart system driving your car is presented with various options that allocate these costs according to the logics reflected in the death-dealing accident scenario. Again, there's no value-free way to decide, and it's not an ad hoc decision. Engineers will embed the ethics in decision-making algorithms and code. Again, society must determine how to proceed proactively. Keep in mind that this governance issue is not about assigning fault; it is only about how to determine moral priority and who should bear the social costs. (Of course, as we transition to smart transportation systems over the next few decades, determining fault may be quite important.)

Read more: *Who's Guilty When a Brain-Controlled Computer Kills?*

Now, put aside accidents, and still, there are many other costs and benefits that smart transportation systems will be asked to manage. Suppose weather causes a disruption and smart traffic management systems kick in. What should the systems optimize? Should the objective be to minimize congestion or the social costs of congestion? Perhaps letting some folks wait for a while on a fully congested road would allow other

cars, ambulances, and buses sometimes get special treatment. But these narrow exceptions aside, our roads are managed without prioritization. First-come, first-served is the default.

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In the future, however, we will be able to make finer discriminations about the identities, destinations, and activities of individual passengers. Armed with this information, would you place some folks in the fast lane and stick others in slower ones? Perhaps a woman on her way to a business meeting should get priority over a woman who is attending her son's music recital. Or should it be the other way around? The decisions don't end there. Suppose only one of the drivers is going to make her event on time and the other will arrive too late even if she speeds. Should the smart traffic management system determine who gets to go and inform the other person to stay home? Over time, these sorts of decisions can be expected to occur frequently.

Traffic management is a form of social planning. Decisions that get made in any single instance of solving the trolley problem, or any of the other scenarios we've noted, reflect broader governing principles and ethical logics embedded in technology. These decisions aggregate and over time become social patterns. So, don't be fooled when engineers hide behind technical efficiency and proclaim to be free from moral decisions. "I'm just an engineer" isn't an acceptable response to ethical questions. When engineered systems allocate life, death and everything in between, the stakes are inevitably moral.

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Electric Cars Make Excellent Autonomous Vehicles—So Why Are Most AVs Gas-Powered?

These engineering students are making an autonomous electric car.

By Tracey Lindeman | May 3 2018, 8:00pm

Keenan Burnett and Mona Gridseth of the University of Toronto's aUToronto autodrive team adjust sensors in the trunk of the all-electric Bolt. Image: Laura Pedersen/Engineering Strategic Communications

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Right now eight teams of university students are out in the middle of the desert near Yuma, Arizona, using computers to try and make their electric Chevy Bolts make tight turns without involuntarily changing lanes.

team. The challenge is to transform an electric, non-autonomous car into a Level 4 autonomous one—that is, the "mind off" level that would allow a passenger to sleep, text, or watch TV safely while the car drives itself—by the end of the third year.

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As these students are learning, it's easier and cheaper to autonomize an electric car than a gas-powered one. That's because EVs are already computer controlled and have more powerful batteries. Given those advantages, it may appear strange we aren't seeing more electric AVs being developed—until you remember the realities of energy lobbies and proprietary technology. Still, we desperately need to solve the electric-car conundrum, because our planet is dying.

Two of the eight teams competing in Yuma are Canadian; one is from the University of Waterloo and the other is from the University of Toronto. Keenan Burnett, a member of the U of T team, told me by email that so far the first challenge—which began April 30 and continues to May 5—has been going well. "Today [May 1] we had a technical inspection which went off without a hitch. We performed perfectly on the static mapping challenge," he wrote. "Our first dynamic challenges begin tomorrow."

Mona Gridseth and Keenan Burnett take their all-electric Bolt for an autonomous test run in Toronto. Image: Laura Pedersen/Engineering Strategic Communications

Unlike gas cars, most EVs come with "drive-by-wire" functionality, which allows people to run a car from a laptop using a USB cable. This, combined with the fact that EVs have bigger and more powerful batteries to help run power-sucking advanced driver-assistance systems, makes them ideal bedfellows for autonomous technology.

"Powering sensors and computers is much easier when you have access to a high-current power source, which is readily available in electric cars. In a gasoline car, you would try to power everything off of the battery/alternator, but this just isn't enough power," Burnett explained.

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Because most gasoline cars aren't drive-by-wire, autonomizing them involves expensive, bulky, and heavy upgrades that can cost upwards of $100,000, Steven Waslander, an associate professor at the U of T Institute for Aerospace Studies (which also does autonomous-car research), told me on the phone. "Electric cars would be easier and less expensive to upgrade," he said. "It's literally just exposing the interface to allow control over [acceleration], steering, and braking."

lobby are behind it—and in fact, energy-sector lobbyists' efforts to kill electric cars has been well-documented. The infamous Koch brothers, as well as ethanol (biofuel) producers and Big Oil, are all working to undermine the electric car. "[We] think we should be working to promote the longevity of the internal combustion engine," American Fuel and Petrochemical Manufacturers president Chet Thompson said last year.

Read More: *The US Energy Grid Is Making Electric Cars Dirtier Than They Should Be*

Sure enough, in 2017 oil and gas lobbyists spent $126 million to woo members of the US government to their side; of that, Koch Industries and AFPM spent a combined $14 million last year.

In spite of production troubles, Elon Musk has helped build new interest in electric cars anyway. Tesla is actively recruiting tech bros and high-middle-class earners to the electric side, but we mustn't forget: it took an eccentric billionaire with a grand master plan to compete against powerful government influencers and force other automakers to become competitive.

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Lobbyists aside, Waslander of U of T pointed out that many automakers don't actually want to expose their interfaces. For instance, Tesla has routinely chosen to develop its technology in-house, save for a few select partnerships including one with Jeff Dahn, a professor at Halifax's Dalhousie University, to develop lithium-ion batteries.

"There's a lot of proprietary knowledge in the actual interfacing system for controlling a car," said Waslander. "When you expose that interface the OEMs get worried about exposing trade secrets."

Video: U of T Engineering/YouTube

Ford's Lincoln MKZ—which comes as both a gas-only and gas/electric hybrid—is one of a very small handful of combustion-engine cars with a drive-by-wire system that can be easily tapped into. That's why it's the model of choice for so many autonomous test drives.

If automakers want to put their electric models at the forefront of the autonomous generation, they should consider allowing research teams to readily interface with its steering, accelerator, brakes, and other wired components. The AutoDrive Challenge is a good first step.

"Autonomous cars and electric cars are solving two very different problems," said Waslander, citing safety and environmental reasons, respectively. "There's no reason you can't do both at the same time."

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