

## 21st Century Challenges: Autonomous Vehicles

Rabbi Mois Navon

Rabbi Mois Navon designed the Mobileye System-On-a-Chip - the “brain” enabling autonomous vehicles. He also gives a weekly Torah U’Madda shiur at the Jerusalem College of Technology. This essay is a synopsis of one of those shiurim.



## ETHICAL DILEMMAS ON THE ROAD TO REDEMPTION

*To fix the world in the name of God*

**O**ur world is about to change. Dramatically. Computing technologies, with artificial intelligence at their core, are revolutionizing our world. Leading the charge to this brave new world are autonomous vehicles, or “self-driving cars.” They have been called the most disruptive technology to ever hit humanity. Autonomous vehicles are not just going to change the way we commute — they are going change

the way we live. Here is a short list of just some of the areas that are going to be revolutionized:

**Transportation:** People will no longer need to have their own cars, since robo-taxis will be ubiquitous and inexpensive. Furthermore, classes of people who were less mobile will now be able to get around like the rest of humanity — e.g., the elderly, the seeing impaired and children.

**Traffic and Pollution:** There will be far fewer cars on the road due to

the multi-use of a single car. Some estimate that by 2035, there will be 80% fewer cars in the world.

**Commute Time:** Since all cars will know exactly where all other cars are and will be able to respond to changes immediately, cars will be able to travel at speeds unimaginable for human drivers limited by human reaction times.

**Real Estate:** As a result of faster transportation (less traffic, higher travel speeds), people will be able to

live farther from city centers. City centers will also be transformed since robo-cars will not need to park in the city center, where real estate is at a premium. Massive parking lots in buildings will now be available for apartments, offices, stores, etc. The sprawling parking lots not in buildings will be freed up for other uses, such as parks.

**Accidents:** The World Health Organization reports that over 3,400 people die in traffic accidents every day, and that between 54,000 to 136,000 people are injured daily on the world's roads. These numbers will approach zero when only computers are driving.

**Insurance:** As result of the negligible accident rate, car insurance will also approach zero.

**Car Body Parts:** This now one-trillion-dollar industry is also going to virtually vanish due to the extremely low accident rate.

**Traffic Tickets:** With cars programmed to obey traffic laws, traffic tickets will become a thing of the past. Municipalities that depended on this revenue may have to seek it elsewhere (e.g., toll roads). On the other hand, the World Health Organization estimates that road accidents cost countries 3% of their GDP — this will now be a boon to governments that should offset any lost penal income.

**Price of Goods :** A significant component of the goods we buy are due to the costs of delivering them. With robo-trucks, goods will be delivered faster and cheaper than by drivers limited to eleven hours of driving per day. Furthermore, it is estimated that energy consumption will be greatly reduced, since

computer-driven cars will operate at consistent and optimal speeds, avoiding the inefficiencies of human drivers. And on top of this, trucks will be able to “freight-train” themselves one to the other to reduce wind drag.

While all these changes, as well many others, will vastly improve our world, there will also be challenges. For example, there is a significant social question: What will happen to all the people whose livelihoods are dependent on driving — i.e., drivers, truck stop owners, etc.? This is an issue that governments and big business will have to address to soften the transition to the autonomous culture. In addition to the societal issues raised by autonomous vehicles, there are ethical issues that demand consideration. Perhaps the most talked about is: How should autonomous vehicles be programmed if they encounter the infamous Trolley Dilemma?



The Trolley Dilemma, formulated as an ethical thought experiment in 1967, describes a trolley hurtling down its track upon which five men are tied. A bystander watching can throw a track switch that will divert the trolley from its current track to a parallel track thus saving the five. The dilemma arises when the bystander realizes that on the parallel track is tied a single man. What is the right thing for the bystander to do?

This question has divided respondents into two camps:

Those who look at the “utility” of the outcome — in this case, saving more people — and are known as

utilitarians; those who make their decision based on rules — in this case “though shalt not murder” — and are known as deontologists (*deon* being Greek for duty).

While the utilitarian approach is appealing, for saving as many people as possible always seems like a good thing, we enter murky territory when we begin to attach names or titles to the people on the track. For example, what if the single man is the head of state — should he take precedence over five ordinary citizens? Before tackling this problem, let's look at a “simpler” version of the problem, known as the Tunnel Dilemma. Here a driver approaching a single-lane tunnel sees a pedestrian in the road. The driver does not have time to brake and is left only with the choice of running over the pedestrian or killing himself by driving into a wall.

In pitting one individual against another, we have removed the quantitative element from the dilemma, thus allowing us to focus on the qualitative aspect — i.e., the value of the individual. Regarding such an evaluation, the Mishna (*Ohalot 7:6*) teaches that man does not have the wherewithal to judge between individuals, and so: “one life is not set aside for another.” While most people are quite comfortable with this egalitarian stance, they get apprehensive when, as in the Tunnel Dilemma, the question gets personal. That is, if the choice is running over a stranger or sacrificing your own life, what do you do?

The Talmud (*Pes. 25b*) formulates this dilemma as follows: The governor of a city said, “Go and kill Ploni or you will be killed.” What do you do? The Talmud responds that one must give his own life rather than commit

murder, for, “in what way do you see that your blood is redder than his? Perhaps his blood is redder?” Egalitarianism, then, applies even when it gets personal.

That being said, the Tosafot (*San. 74b, ve’ha*) note that self-sacrifice is demanded only when one will *actively* murder another. However, they explain, if the governor said, “allow me to throw you unto a baby such that you will end up crushing him to death,” one would not be demanded to sacrifice one’s own life, “for one did not do an action.”

This brings us to another Talmudic scenario (*Baba Metzia 62a*) that pits one individual’s life against another:

שנים שהיו מהלכין בדרך וביד אחד מהן קיתון של מים אם שותין שניהם מתים ואם שותה אחד מהן מגיע לשוב דרש בן פטורא מוטב שישתו שניהם וימותו ואל יראה אחד מהם במיתתו של חבירו עד שבא רבי עקיבא ולימד וחי אחיך עמך חייך קודמים לחיי חבירך.

*Two people are walking in the desert and only one of them has a canteen of water. If both drink, they will [both] die, but if only one drinks, he can reach civilization. Ben Petora taught: It is better that both should drink and die, rather than that one should behold his companion’s death. [And so it was] until R. Akiva came and taught: “that your brother may live with you” [means] your life takes precedence over his life.*

R. Yosef Babad (*Minhat Hinuch*, 295-296, #1) writes that R. Akiva’s position reflects the conclusion of the Tosafot,

namely, that one is not required to save his friend at the expense of his own life. R. Babad claims this is also the position of the Rambam. These assumptions, however, are roundly rejected by R. Haim of Brisk (*Hidushei R. Haim, Hil. Yesodei HaTorah*, Ch. 5). First, R. Akiva did not here allow for passive killing but simply removed the obligation to actively save a life at the expense of one’s own life. Second, while the Tosafot argue that since all people are equal, one can simply remain passive (*shev v’al taseh*) in effecting the other’s death, the Rambam uses the same argument to come the opposite conclusion. That is, precisely because all people are equal there is no justification to set aside one life for another (*ain ba din dehiyah*) and, as such, there is no difference between actively killing or passively killing — in all cases one must sacrifice oneself. That being said, one is not obligated to actively kill himself (i.e., commit suicide) to avoid passively killing someone else.

With these sources in mind we can now return to the Tunnel Dilemma, which has two sub-cases to be considered: (1) passive and (2) active. (1) If the street is perfectly straight and the driver is holding the steering wheel straight, this is considered passive killing and the driver would not be obligated to actively take his own life. (2) If, on the other hand, the street is curved such that the driver must actively turn the wheel into the

curve, this would be considered active killing and the driver would have to give his own life (passively driving the car straight) to avoid running over the pedestrian.

The above scenarios were originally discussed in a soon-to-be-published book in Hebrew: “Halachic, Ethical and Governmental Challenges in the Development of the Autonomous Vehicle” (Editor: R. Y. Sprung, Kollel R. Asher Weiss). There, the authors also note an important mitigating factor: the legality of the pedestrian. That is, if the pedestrian is not legally permitted to be in the street, for whatever reason, he then has no right to cause another person (i.e., the driver) to give his life and thus all would agree that the driver need not sacrifice his own life.

Having gained a better understanding of the value of the individual via the “one against one” Tunnel Dilemma, let us now approach the “one against many” Trolley Dilemma. The primary source for this discussion is the Jerusalem Talmud (*Terumot 8:4*):

סיעות בני אדם שהיו מהלכין בדרך פגעו להם גוים ואמרו תנו לנו אחד מכם ונהרוג אותו ואם לאו הרי אנו הורגים את כולכם אפילו כולם נהרגים לא ימסרו נפש אחת מישראל.  
*A group of people were traveling, and marauders chanced upon them saying, “Hand over one of your group or we will kill you all.” Even if all will be killed, they may not hand over one soul.*

This source unequivocally rejects utilitarianism, which leads to uncomfortable implications when applied to a driver on the road confronted with the Trolley Dilemma. In grappling with this issue, the *Hazon Ish* (*San. 25*) says that utilitarianism could possibly be applied if we could frame the dilemma as “saving” people as opposed to “killing” people.





In the end, he himself remains unconvinced that it is possible to reframe the Trolley Dilemma and thus concludes that the issue needs more investigation (*tzarich iyun*). R. Asher Weiss (*Minhat Asher*, Pes. 28) discusses the Hazon Ish's proposal and, noting that there can be no justification for killing an individual, concludes that the issue needs more investigation (*tzarich iyun*). Finally, the *Tzitz Eliezer* (15:70) rejects outright the Hazon Ish's suggestion and, referring explicitly to a car driver caught in the Trolley Dilemma, states that "in a case of definite killing we ... do not say that the many are preferred."

The weight of halachic opinion, then, is clearly deontological, demanding that one drive straight over the many to avoid actively killing even only one person. While this may be hard for us to swallow, perhaps it helps to know that underpinning this deontological approach is the inviolable and inestimable value of the individual. Indeed, attributing infinite value to the individual is one of the great gifts that Jewish thought brought to a pagan world that was literally sacrificing individuals for the sake of the many. And so Rav Kook explains, "We do

not have the wherewithal to estimate the infinite value of the individual against the infinite value of many individuals" (*Mishpat Cohen* 143).

Before we jump to conclusions and apply the above understanding to the programming of the autonomous vehicle, we must ask if there is not some difference between a human driver and a computerized driver. Initially most would be inclined to say that there is certainly no difference. However, if we take a step back, as did the rabbis who wrote the above-mentioned "Halachic, Ethical and Governmental Challenges in the Development of the Autonomous Vehicle," we will notice an important difference between the two cases. In the case of a human driver, the person is faced with the life and death decision to either passively run over, say, five people in his current lane, or actively switch lanes and run over, say, a single person. On the other hand, in the case of the autonomous vehicle, there is no driver, there is a program that is being executed according to some predetermined code. That code was written, days, months, or, in all likelihood, years before it encountered this Trolley Dilemma. When the programmer sat in front of

his computer, was he facing a decision to kill five versus one? Could we not say that the *modus operandi* of the programmer of an autonomous vehicle, in all scenarios, is to *save lives*? Could we not say that even in this extreme Trolley Dilemma case the *modus operandi* remains to save lives and thus he is facing a decision to *save five versus save one*? Could we not say that this is the legitimate reframing of the dilemma that the Hazon Ish was looking for?

The final word on this issue is still being debated and much is left to be said. However, without diminishing the importance of arriving at a decision on how to ethically program autonomous vehicles, two points must be stressed. One, the occurrences of the Trolley Dilemma, the Tunnel Dilemma or other ethical dilemmas will, in reality, be few and far between. Two, the autonomous vehicle will undoubtedly save millions of lives, improve the quality of life, and serve, along with all the other phenomenal advances in artificial intelligence, to fix the world and set the stage for the very redemption of creation.

*On that day He and His name will be one.*

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