

On the Topic of Autonomous Robots:
Ethics, Law and Enquiry

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Introduction:

The purpose of the Metalab is to help businesses and society understand and use artificial intelligence and the power of data to enable individuals and citizens to make well-informed decisions in an ethical and fair manner. Created under the École Supérieure des Sciences Economiques et Commerciales (ESSEC), the Metalab is a unique multidisciplinary ecosystem that combines expertise in hard sciences and social sciences to inform practices at the intersection of “Data, technology and society” and put people at the core of all decision-making processes.

At Metalab, our objective is to help businesses move from data-based decision-making to new decision-making models that combine the power of AI and human judgment. Many routine decisions based on structured data and subject to cognitive bias can be automated with the help of prescriptive analytics tools and AI. With other more strategic decisions, AI takes advantage of human judgment by generating various possibilities, the best of which is chosen by the decision-makers themselves. Hence, we believe that the biggest obstacle to the implementation of AI in businesses is not the lack of data scientists, but the lack of leaders trained in AI.

In this way, ESSEC intends to build new bridges but also question the interactions between science and society, as well as the challenges linked to the governance of Artificial Intelligence and data ethics. By integrating the human factor into AI, we can produce commercial decision-making models guided by concern for their impact on society but also with clear objectives, understandable criteria and actionable processes.

Abstract:

Many companies are rushing to create Autonomous Robots that can supplement their respective fields. Be it Amazon’s heavy equipment machines, autonomous military weapon systems, the Roomba vacuum cleaners, or the widely controversial self-driving vehicles. We will focus primarily on Automated Driving Systems (ADS) – specifically airplanes and automobiles – moving forward, but the questions posed and ethical concerns can be extrapolated to all Autonomous Robots.

The main questions we ask are:

1. Are Automated Driving Systems (ADS) truly autonomous actors with agency?
2. Who is liable in the case of damage done to humans?
- 3.

Definitions:

1. Defined for the European Parliament’s Committee on Legal Affairs, Section 2.1 of [European Civil Law Rules in Robotics](#) defines of the broad umbrella of smart

autonomous robots and their subcategories by taking into consideration the following characteristics of an intelligent robot:

- acquires autonomy through sensors and/or by exchanging data with its environment (inter-connectivity) and trades and analyses data;
 - is self-learning (optional criterion);
 - has a physical support;
 - the ability to take decisions, adapt its behaviours and actions to its environment, and implement them in the outside world, independently of external control or influence.
2. Defined by the U.S. National Highway Traffic Safety Administration (NHTSA), an Automated Driving System (ADS) is defined as the “hardware and software that are collectively capable of performing the entire [dynamic driving task] on a sustained basis, regardless of whether it is limited to a specific operational design domain (ODD); this term is used specifically to describe a Level 3, 4, or 5 driving automation system.” The levels can be found in the [SAE International J3016_201806 Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles](#).
 3. **Domain-specific basic agency:** pursuing goals on the basis of representations, within certain limited domains ([Sven Nyholm](#))
 4. **Domain-specific principled agency:** pursuing goals on the basis of representations in a way that is regulated and constrained by certain rules or principles, within certain limited domains. (Ibid)
 5. **Domain-specific supervised and deferential principled agency:** pursuing a goal on the basis of representations in a way that is regulated by certain rules or principles, while being supervised by some authority who can stop us or to whom control can be ceded, at least within certain limited domains. (Ibid)
 6. **Domain-specific responsible agency:** pursuing goals in a way that is sensitive to representations of the environment and regulated by certain rules/principles for what to do/not to do (within certain limited domains), while having the ability to understand criticism of one’s agency, along with the ability to defend or alter one’s actions based on one’s principles or principled criticism of one’s agency. (Ibid)
 - 7.

Discussion:

Below we look at 3 questions that are essential to the development of an ethical framework when dealing with Automated Driving Systems (ADS).

1. Are Automated Driving Systems (ADS) truly autonomous actors with agency?

To answer this, it is a good idea to first zoom out to a slightly more abstract level and distinguish among various different more or less advanced forms of agency. We can then ask: (a) which of these forms of agency are automated systems able to exercise, and (b) are those forms of individual and independent agency, or are they rather best thought of as distinctive types of cooperative or collaborative agency?

Returning to the definition of an Autonomous Robot above, notice one sub-requirement given by European parliament:

the ability to take decisions, adapt its behaviours and actions to its environment, and implement them in the outside world, independently of external control or influence.

If an ADS is no longer controlled by another actor, it becomes the actor itself. Yet how can a mere machine, a carcass devoid of consciousness, feelings, thoughts or its own will, become an autonomous legal actor? Does it deserve rights? Does it have agency?

Different Types of Agency

To understand if ADS have agency we can approach such a question in two ways. The first would be to investigate what sorts of functions the systems can perform and compare them to agency in humans. Alternatively, we could look at the idea of intentionality. But this requires we define what actions can be described as intentional, and for what reasons the agent might be interpreted as acting. Kantians, for example, would probably want us to add agency involving the ability to act on self-adopted principles that we choose on the basis of thinking that the principles could be elevated to universal laws for all. But that is beyond the scope of this paper and we can proceed by understanding ADS agency through a functional lens.

Let us start with the most basic type of agency: pursuing a goal in a way that is sensitive or responsive to the environment, defined above as [domain-specific basic agency](#). This is the most common definition of agency, but can be easily exploited. A good example would be the Roomba, which has one goal (to clean a floor), and can react to its environment by bumping around until the goal is achieved. Roombas are therefore agents that make decisions in pursuit of a goal by reacting to its environment.

So now, we can ask, does an ADS exercise domain-specific basic agency? That is, does it pursue goals (“desires”) in a way that is sensitive to representations of the environments, at least within certain specific domains of activity? If we return to definition rewritten above from the European Parliament: *adapt its behaviours and actions to its environment*. An ADS is indeed able to navigate its surroundings in the pursuit of traffic-goals: getting to its intended destination. So yes, it seems that we can attribute domain-specific basic agency to an automated car. But can we go further?

The next level would be those who can pursue different types of goals on the basis of their environment and perception, but **across different domains**. These advanced agents would also be able to follow (but not necessarily “understand”) certain rules. These would be the dos and don’ts specific to the respective domains. This type of agency is constrained by rules is defined above as [domain-specific principled agency](#).

To explain this, consider a game of football. An agent with domain-specific basic agency would relentlessly charge forward trying to accomplish its goal (to score a goal). But an agent with domain-specific principled agency understands the rules of the game (no hands, offsides, etc.) and plays with them in mind.

Since we know that ADS are restricted by the traffic rules, and still can pursue its goals we can indeed also attribute principled agency to an automated car..

Sticking with the sports-example, our principled agency may be undertaken under the watch of some authority (e.g. a referee) who makes sure that we stick to the rules and who might otherwise step in and stop us when we headbutt another player. This is defined as [domain-specific supervised and deferential principled agency](#). Note, however, that by conceding control to a higher power and allowing them to step in implies there is still not complete autonomy. Additionally, such agency can be called non-solipsistic or social, since it is partly defined in terms of a relation to other agents.

This is pretty clearly attributable to modern ADS, as there are still human passengers who can override control if they decide the ADS is making incorrect decisions. Yet again ADS reaches another level of agency.

What the ADS cannot do is to exercise [domain-specific responsible agency](#). Even if other agents criticize your agency and try to force you to abort your goal, a responsible agent can still “stand one’s ground”, by justifying their own decisions that others can recognize as a valid basis for acting. Although this is also a social embedded form of agency, similar to domain-specific supervised and deferential principled agency, the difference stems in through the practice of discussing for and against our own or others’ conduct we are not governed nor governing. An ADS is not justifiable due to the black-box of recurrent neural networks, nor are they malleable to the opinions of others.

In summary, we can attribute basic, supervised and deferential principled agency to an ADS, but not responsible agency. Note, though, that all of these are domain specific -- these ADS “agents” are incapable of working across a different domain (e.g. mixed martial arts).

Automated Cars versus Small Children, and Individual Versus Collaborative Agency

Going a bit further in the understanding of agency, let us look at the distinction between individual agency and collaborative agency. An agent, acting individually, would take decisions and do things in pursuit of their goals on their own, without external influence. A collaborative agent does things together with another agent or set of agents. We can consider these as two different subtypes of deferential and supervised agency.

To reiterate: an deferential/supervised agent pursues their goal while being supervised by some authority who can stop us or to whom control can be ceded. Where we can make a subdistinction is whether this agency was (a) initiated by the acting agent, based on their own goals/wishes or (b) initiated by the other party, based on that other party's goals or wishes.

Using the example of a small child, imagine a scenario where they are drawing a cartoon with parents' supervision. If the child picked its colors and the content of the drawing themselves, this would be an instance of individual agency. But if their parent instructs them to draw a monkey, and is then watching over the child to verify the colors/shape is done in a way that conforms to the expectations of the parent, then this is now an example of collaborative agency. The child is pursuing a goal (drawing a monkey), set by the parent (supervisor), who monitors and regulates the actions of the child, even if the child is doing "most of the work".

Let us return to the main enquiry with the question: does an ADS exhibit individual or collaborative agency. Otherwise put, is their decision making self-initiated or other-initiated.

The general process of how an ADS works is: supervisor input → machine processes an output → (optional) supervisor confirmation. For example, the supervisor can be a passenger who wants to take an autonomous taxi ride to the airport. Similarly, how to comply with safety and traffic rules are set by ADS-designers and lawmakers, as we will see in the sections below. Or if someone wants food delivered, they choose the location/price range/etc. In each of these scenarios the ADS takes agency insofar as to pursue a goal in response to somebody else's initiative. This is collaborative agency—even if the car might be doing "most of the work."

One could make the argument that an ADS is choosing GPS routes, distance sensor metrics, etc. but this is still all done in order to satisfy a goal set by the supervisor (passenger). As long as there is this social dynamic reliant on collaboration between passenger and system, an ADS will always exhibit collaborative based domain-specific supervised and deferential principled agency.

To recap this discussion of agency, let us return to the progress through the stages of a child's agency. A child can pursue goals in a way that is responsive to its environment (e.g. going to the other side of the room in order to get to its toys), which would be domain-specific basic agency. Doing so in a way to avoid obstacles would be domain-specific principled agency. When parents declare rules, the small child assumes domain-specific supervised and deferential agency, where the parents become authorities to whom the small child is answerable. If the child moved across the room of their own choice this would be individual agency, but if they were instructed to do so by their parents this would be collaborative agency. Note that, similar to an ADS, the small child is not yet a responsible agent who can articulate arguments, reasons, and principles in favor of or against its actions, and who can debate the merits of different courses of action in the way a responsible adult (e.g. the parents) are able to. It is possible to compare small children to ADS, but children are not constrained to just one domain: they can play, eat, cry and more.

	Automated vehicle	Small child	Adult
Basic (domain-specific) agency?	Yes	Yes	Yes
Principled (domain-specific) agency:	Yes	Yes	Yes
Deferential and supervised, principled (domain-specific) agency:	Yes	Yes	Yes, but also able to perform agency that is not deferential and supervised
Responsible (domain-specific) agency:	No	No	Yes
Capable of performing individual/independent agency:	No	Yes	Yes
Capable of participating in collaborative agency:	Yes	Yes	Yes
Capable of taking on the role of a responsible authority-figure within collaborative agency:	No	No	Yes

Figure 1: A comparison of agency between an ADS, Child and Adult.

2. Who is liable in the case of damage done to humans?

The next biggest question to ask on the topic of Autonomous Robots, and more specifically, Autonomous Driving Systems (ADS) is what happens when the rules are broken. As we well know, the first law of robotics is that a robot may not injure a human being or, through inaction, allow a human being to come to harm.

There are two main routes we can take here: ADS design and ADS implementation.

Machine Defect

An autonomous driving system is the product of many minds. Can we point the finger at just one?

For example, if the AI misinterprets a red light for a green light, do we blame whatever software developer(s) that wrote the AI being used? Or the mathematician(s)/statitistan(s) that came up with the algorithms used to train the model? Or maybe the people and data that trained the model by making split-second human decisions during its trial runs? How about the managers who gave the go-ahead to be first-to-market?

It seems reasonable to think that the common underpinning is that all these agents are employed by the same company. But the people involved with the process may not represent the ADS: the ML library might have been an open-source library in the public domain (pytorch, tf, scikitlearn) and the mathematician(s)/statitistan(s) might have been academics who wrote a paper five or fifty years before this version of a self-driving car was invented and don't even work for the company – just like the “independent contractors” Uber employs.

Yet someone has to be held liable.

According to [The Product Liability Directive 85/374/EEC](#) – created by the EU to formalize the judicial process of defective products – “the producer shall be liable for damage caused by a defect in his product”. Thus, if the damage is derived from a defect in engineering, rather than singling out the worker (now robot) on the assembly line who didn’t screw a bolt in all the way and making them pay the fine, the company producing the ADS will take strict liability.

With this in mind, what company issuing 100k+ ADS would take on that amount of liability? What insurance would support such a thing?

Though there are ways around this, as we’ll explore in the next subsection. To give a concrete example: the very first death involving a ADS occurred in Tempe, Arizona in March 2018. The victim was a pedestrian, Elaine Herzberg, whom the ADS hit while traveling 38 miles per hour. The ADS had a human operator but had been driving itself when it struck Herzberg. Herzberg stepped off a median and jaywalked across the road right before the accident. The courts did not find the company that created the self-driving vehicle, Uber, criminally liable for Herzberg’s death, by using a comparative negligence defense. This defense claims the victim is partially or fully responsible for causing the collision.

It is also possible to see a split in the liability among designers. We can see this in the class action lawsuit against Takata for the defect airbags it was manufacturing. They were held responsible for the defecting merchandise without any liability passed onto the car manufacturer. This can be extrapolated onto ADS through the distinction of hardware defects (vehicle manufacturers) and software defects (AI designers). Both are the respective deferential agents to the ADS tools they enable.

Human Defect

The current EU regulation declares that until ADS are “safer” than human decision making, “Duty to Intervene” should apply. Put simply, “duty to intervene” states that the human driver must pay attention to the road and traffic and to intervene when necessary to avoid accidents. This **strict liability** of the driver in the case of an accident would be based on his failure to pay attention and intervene.

Of course, this duty to interfere would still have to be limited to cases in which the driver could have been reasonably expected to anticipate the danger and react in time. This is legitimate as long as one can actually expect the person in question to foresee the danger and prevent it, but they may not have time to react, know what the computer is doing, or be constantly aware for 1.6M km. Especially if the appeal of an ADS is to do other tasks without having to worry about the road. Nonetheless, all this can still fall under strict liability, since one is taking the risk of using the vehicle, knowing and accepting that it might cause accidents.

Here, the issue is whether the supervising agent has a duty to continually monitor the behavior of the car, being ready to take over at any moment, or if the operator is only obligated to respond to safety alerts generated by the vehicle. In both cases, criminal

sanctions could arise if a person either fails to override when obligated to, or acts to override in an inappropriate manner, *unless* a specific law makes exceptions for the rule. For instance, Nevada state government amended the texting ban to make an exception, saying in part, “a person shall be deemed not to be operating a motor vehicle if the motor vehicle is driven autonomously.”

Thought experiments

The classic example of why strict liability still applies is the following situation: A person drives slowly and responsibly, keeping to the traffic rules, he is not drunk, he is fully concentrated, but nevertheless a horrible accident takes place because a child he could not have seen in advance runs out into the street from behind a group of parked cars. It is impossible for him to stop before his car hits the child. The child dies. Nagel interprets this situation as follows. *“The driver, [even] if he is entirely without fault, will feel terrible about his role in the event, but will not have to reproach himself. Therefore this example of agent-regret is not yet a case of **moral bad luck**.”*

In some time, there will be an entire age range with “learned incompetence”. This refers to the situation where ADS have been working properly for so long that no one in a malfunctioning vehicle would be competently capable of handling an emergency situation, or there would be no responsible agent in the ADS (i.e., autonomous food delivery, bringing kids home from school, young adults who “don’t need to pass their driving licence anymore”).

ADS can provide a strong service for terrorist attacks, drug trafficking and cyber attacks, because by having no human agent responsible inside the ADS traceable to them, each group can pursue their goals more efficiently.

To summarize: accidents that result in property damage or personal harm currently can have both criminal and civil implications for the driver at fault; victims of accidents caused by the malfunction of an autonomous vehicle could find recourse in civil liability against the manufacturer.

Conclusion:

No matter how good this technology becomes it will never be infallible. Accidents will happen. No matter how large the “big data” set of experience becomes, there will always be a new failure scenario (i.e. a person darting out into the road from behind a barrier; a tree falling on a moving ADS; or a meteorite striking an airplane) that no one has seen or could have reasonably considered. Classic induction vs deduction problem (Hume). In these moments, an ADS may be forced to make impossible ethical choices.

Until the law (and public agreement) catches up with this technology, and creates either strict liability regimes or victim compensation funds, lawyers need to plan for and advise clients as

to how to mitigate these risks. The obvious answer is insurance, even though insurance companies will not have the data to price coverage accurately.

IEEE, the world's largest association of technical professionals, with more than 423,000 members in over 160 countries around the world, asks that company stakeholders adopt an ethical validation and verification process to ensure human control over explainable AI-based decisions. This can be found in their 300 paged manifesto: [Ethically Aligned Design](#), created by the IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems

The US government is working on a Vehicle-to-Vehicle (V2V) framework built on government telecoms. With this, the government can be certain it knows all the data that was supplementary in the agents' decision making process. However, the data transferred raises the obvious question of data privacy. This is another important issue in the ethics of ADS but to put it briefly: Regulation (EU) 2018/858 states that personal data liabilities and responsibilities and all other parameters must be reported and available to government, the data deleted in under 30 days unless there was an accident, in which case it is deleted after 1yr.

An autonomous driving system is:

- A collaborative, domain-specific supervised and deferential agent
- that defers liability to manufacturers in the case of defective hardware (/software)
- and/or humans with strict liability to intervene in emergency situations.

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Agents:

- Ministère de la Transition écologique
 - [LOI n° 2019-1428 du 24 décembre 2019 d'orientation des mobilités, Articles 31-32](#)
- Commission nationale de l'informatique et des libertés (CNIL)
 - [wants an in-in scenerio, but AVs must communicate to traffic lights, etc.](#)
- Le Plan d'Action pour la Croissance et la Transformation des Entreprises (PACTE)
 - [Page 53](#)
- International Working Group on Data Protection in Telecommunications (IWGDPT)
 - [Connected Vehicles](#)
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- As of april 2018, 54 private companies are authorized by France to have level 3+ ADS:
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 - [PSA](#)
 - Easymile

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