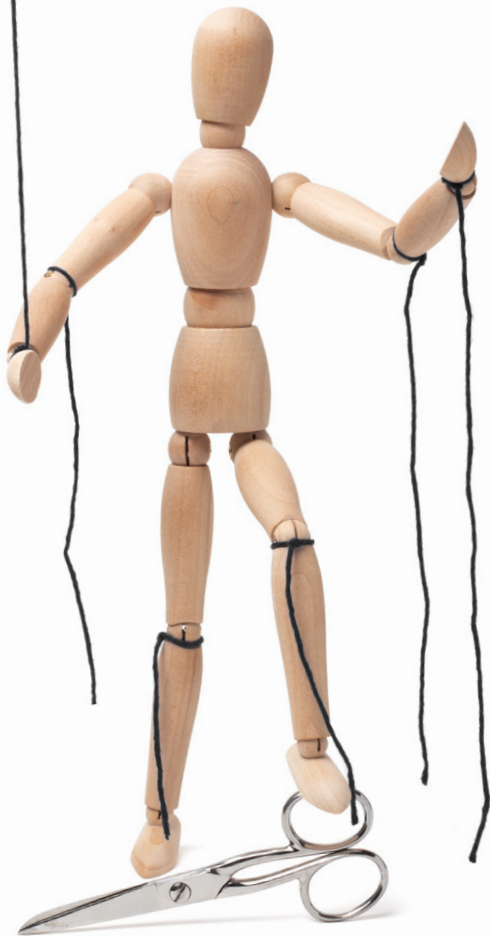


ethix

Innovation Brief #01



Autonomous Systems

The issue →

What is an autonomous system –
and what does it have to do with innovation ethics?

Future scenarios & industries →

Autonomous systems in the world of tomorrow.

Ethical risk zones →

Responsibility, security, control, and decision.

Focus →

Autonomy and responsibility.

Looking forward →

Opportunities for the future of autonomous systems.

ethix resources →

Discover opportunities and risks with ethix.





Self-driving cars picking us up from the station.

Algorithms that determine the perfect delivery time and send parcel drones to their destinations.

Fridges that fill themselves, learn our preferences, and order sweets on their own.

Fully autonomous home electronics and out-of-control robot wars.

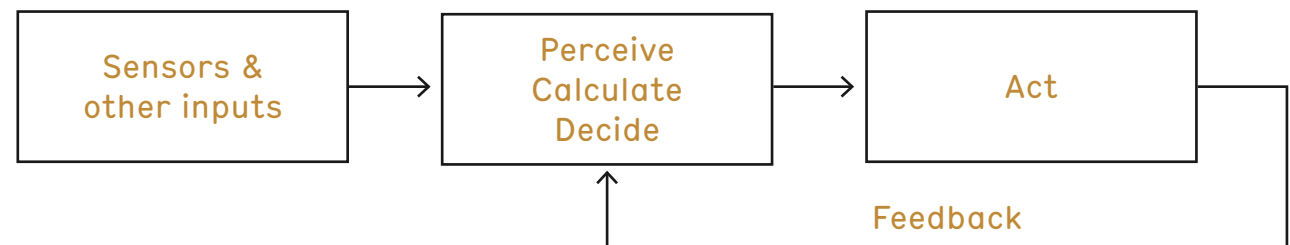
This could be the world of the future, populated by autonomous systems. Things that used to seem beyond the bounds of possibility are now a concretely discussed scenario for the future.

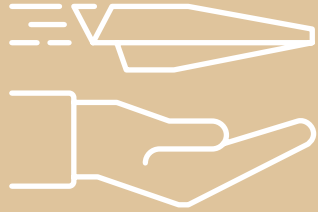
The issue

What is an autonomous system?

Humans are autonomous systems. We perceive the world around us, think about what needs to be done to achieve our goals, and act accordingly. Autonomous systems like self-driving cars are very similar. They perceive the environment through sensors and other inputs. They recognize objects, calculate different possible actions and choose one of them. They use perception and predefined or self-learned goals as a basis. In the end, they influence the environment independently by for example driving from A to B. A truly autonomous system can therefore move and act in the world without the help of anyone else.

How does an autonomous system come to a decision?





Affected industries

Robotics
Drones
Vehicles
Dual-Use
Sensors
Machine Learning
Mobility
Infrastructure
Public transport
Private transport
Logistics
Warehouse management
Autonomous vehicles
Drone deliveries
Personal care
Nursing Robots
Automated Diagnostics

Future scenarios

The company Oberholzer produces motors for electric toothbrushes.

An arms manufacturer would like to buy these motors as they are perfect for the fine control of an automatic machine gun. After a survey among the employees, the company doesn't accept the request. Is it doing the only possible right thing?

The start-up Mapfly produces autonomous drones that can independently fly over an area and map it.

Upon request, they deliver a hundred drones to a country in which a civil war is raging. Can such deliveries be justified?

A car manufacturer has designed a self-driving truck that pays for a driver's salary within 5 years.

After 10 years there are only self-driving trucks left in the USA and in most European countries. Who is responsible for ensuring that the affected employees can find qualified work elsewhere?





Test your risk zones with the [ethix survey](#).

Ethical risk zones

The question of responsibility

Who is responsible for the decisions of a self-driving vehicle? The driver, the manufacturer, the provider of a mobility service, the programmer, the registration office, or perhaps even the vehicle itself?

The duty for safety

Autonomous systems could make road traffic, air traffic control, or other areas of life more secure. At the same time, the question arises as to whether we want to entrust an emotionless algorithm with decisions in which human lives are at stake. And above all, the sensors and algorithms must function correctly in all possible climatic and social conditions.

The Trolley Problem

Is it ethically permissible to actively harm a person in order to protect a group of others? This conundrum reveals the profound disagreement between different ethical principles. The programming of a decision-making, and possibly self-learning, algorithm strongly depends on the ethical principles we choose. How can we program machines that make good decisions on a regular basis?

Dual-Use

The army and defence companies have a great interest in autonomous systems. At the same time, many civilian technologies such as software, electronics and drones regularly find their way into war zones. Producers have to take tough decisions here.

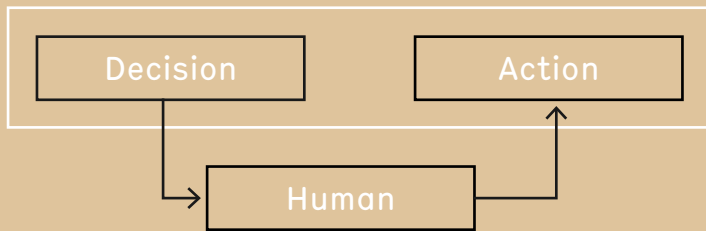
Negative side effects

Without careful planning, machine learning could quickly lead to undesirable and unexpected side effects. The possibilities range from the complete automation of an industry to an unstoppable dehumanized arms race, out-of-control robotic wars, and even to the extinction of mankind.

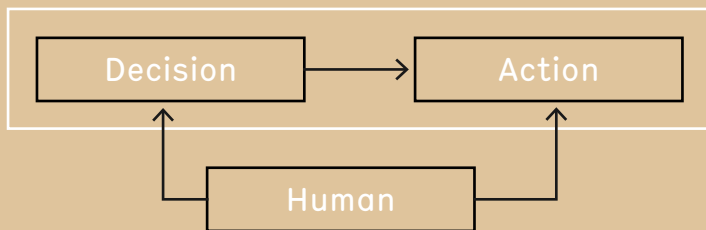




In autonomous systems with a «Human in the Loop» strategy, a human triggers the action.



In autonomous systems with a «Human on the Loop» strategy, a human observes and intervenes if necessary.



Focus

Who is responsible if a self-driving car is involved in an accident? Do we want to leave decisions about life and death to autonomous weapon systems? And how should these systems decide in ethically charged situations?

The question of responsibility is particularly striking in autonomous systems. After all, whoever can decide autonomously is in principle also responsible for their decision making.

With programmed machines, this relationship is particularly precarious. The reason is that a programmer cannot anticipate every situation in advance. The result of a decision is therefore not predictable in most cases. That's why well-chosen ethical principles are needed to guide an autonomous system.

But anyone who wants to program a moral machine automatically makes serious ethical decisions. Research on this subject is still not fully developed. Some try to determine how humans behave in ethical dilemmas in order to derive principles empirically. But the Ethics Commission of the Federal Ministry of Transport and Digital Infrastructure comes to the conclusion that “genuine dilemmatic decisions can't be programmed ethically free of doubt”.

Because no such moral machine exists yet, most autonomous systems are subject to human control. Armed drones, for example, can take off and land, search areas and identify targets largely independently. But there is still a person at the lever who has to make the far-reaching decisions. This strategy is called «Human in the loop», because a person interferes in the decision loop.

Other systems go one step further and merely give humans a monitoring function. This «Human on the loop» strategy is applied to many self-driving cars, which can already make decisions independently, but are still monitored by the driver.





How do we want to share the world with autonomous systems? As with any technology, there are bright spots and dark sides. When machines and algorithms make decisions independently, it's especially important that we don't lose control and understand how a specific decision is made. But we should also use the potential to make real progress.

Looking forward

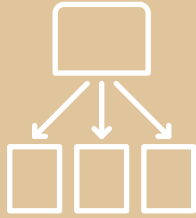
Autonomous systems are particularly well suited to making processes simpler, safer and more efficient. Innovation should focus on these areas and identify new opportunities to improve and facilitate people's lives.

For example, adaptive algorithms could discover connections that remain hidden to us humans. This allows them to focus human attention and resources on those areas where our unique capabilities can shine. Autonomous systems can provide support, structure data and improve oversight in complex areas.

Autonomous systems are very helpful and often superior to humans when it comes to security. This is because they make fewer mistakes and are better at performing dangerous routine or assembly line work. This means that people in dangerous work areas could be relieved and protected.

Finally, adaptive systems offer the potential to use and distribute limited resources particularly efficiently. Be it in the area of smart grids and energy production or anywhere else where scarce resources are used. With autonomous systems, unnecessary losses can be detected and prevented.





Using instruments from ethix and other partners, opportunities and risks of autonomous systems can be analysed and, if necessary, improved during the development phase and the design process.

ethix resources

ethix Mapping and ethix Canvas

To clarify questions of responsibility and ethical risk areas of innovations in the field of autonomous systems.

ethix Workshop

For an in-depth examination of ethical opportunities and risks of autonomous systems and possible implementation of checklists and other tools in the innovation process.

Internal training

Training and sensitization of employees involved in the innovation process of an autonomous system for ethical opportunities and risk zones.

Labels

For example, use of an existing label for responsible autonomous systems. ethix accompanies the implementation of such standards in everyday business.

