



What will be the social and legal consequences of advancing automation? Jürgen Taeger (left) and Markus Tepe believe that as scientists they bear responsibility.

For the Good of Humankind

When the real world and the virtual world merge, everyday life can be a lot easier. But who bears responsibility for the computer systems that are becoming an ever more integral part of our lives? Jürgen Taeger and Markus Tepe are seeking answers, both legislative and political

An autonomous car avoids an obstacle. So far, so good. But what if the evasive manoeuvre was triggered by faulty data? What if there was no obstacle and the car's sudden swerve endangers other road users? "If we give computers more and more responsibility, we need to keep the consequences in mind – for each individual and for

society as a whole," says Prof. Dr. Jürgen Taeger, a jurist. His research partner Prof. Dr. Markus Tepe, a political scientist, elaborates: "Making continuous technological progress is only one side of the coin. We must not lose sight of human beings in the process. This is the contribution we want to make with our research." The jurist and the

political scientist are working in close collaboration with computer scientists, philosophers, psychologists and sociologists. Their objective: to analyse the social, legal and ethical implications of cyber-physical systems (CPS) – with an eye to ensuring that humans are always able to intervene in time. CPS is a neologism that describes

the integration of the physical world of machines, systems and devices with the virtual world of the Internet and cyberspace to create an autonomous and intelligent, self-organizing network. The first applications are already in operation today, for example in navigation devices that analyse traffic data as well as the movement profiles of road users in order to suggest alternative routes. The cyber-physical systems of the future will go far beyond this and lead for example to highly efficient "smart factories". As part of an intelligent power grid, a CPS can control energy networks or connect doctors and patients to enable remote diagnoses and home medical care.

A brave new world

For Taeger and Tepe these are fundamentally positive advances because of the huge potential of automation and networking processes to increase social prosperity. This sounds like a brave new world. "But as scientists," Taeger points out, "we can't simply let things happen. Someone has to deal with the question of responsibility." He notes that the first signs that this is being taken seriously are beginning to emerge, for example the Federal Government has set up various panels of experts – including a "high-tech forum" where representatives from business, science and social groups discuss the issue, as well as an ethics committee appointed by the Federal Ministry of Transport. However, so far, Taeger says, the reports of these committees have been very vague about the social consequences and legal implications of the new technologies.

For jurist Taeger the main question is whether our legal system is ready for CPS in everyday use. "The legislators may have to adjust existing laws and create new regulations." The traffic laws have been adapted for the semi-autonomous driving that is already possible (see the interview on p.16). But

this was merely a first step and hasn't been successful, says Taeger. He sees advancing automation affecting several legal areas – liability, data protection, civil law and even constitutional law. For one thing is clear: with the advance of self-learning Artificial Intelligence Systems, human decisions will play less of a role. "This will have a crucial consequence for liability questions, namely that drivers can no longer be held responsible as they are today. Because there is no driver behind the wheel who could be at fault," Taeger explains. Potentially, he says, the insured owner of the car who puts such a risky vehicle on the road could be liable, or in the case of faulty algorithms, the manufacturer and its supplier. "There is an open question as to who pays damages. We need to clarify who bears responsibility and can be held liable for damage in this interaction between humans and technology."

Another challenge in the field of liability law arises when autonomous vehicles communicate with each other. As Taeger explains, this can result in one vehicle influencing the behaviour of another, for example by warning it about a dangerous situation and causing it to apply the brakes: "If this leads to an accident it will be difficult to pinpoint the cause." Telecommunications companies could potentially come into play if the data proves to be faulty or lacking, says Taeger. "After all, these networks are critical systems in which IT security against attacks must be guaranteed," he adds, concluding: "We will conduct an intensive discussion about these liability issues in the coming years."

Another question that arises when cars exchange data is how this information should be handled – the keywords here being privacy and data protection. According to Taeger the legislators have already taken action here, and the Road Transport Law now stipulates which data can be sent to whom, and for what purpose.

More problematic for the jurists are the challenges that arise in the area of

civil law. "When we talk about autonomous systems we're talking about computer systems that act independently," Taeger explains, taking as an example the robots used in manufacturing that can detect when one of their parts is worn out: "These robots could then issue tenders on their own, and even decide who gets the contract. So it's no longer people who are concluding contracts, but autonomous cyber-physical systems." This is why in legal circles the idea of creating a third legal entity – an electronic person (ePerson) – in addition to the natural person and the legal person (a joint-stock company for example) is under consideration, he says. This "ePerson" would then logically have to be able to conclude legal transactions and be endowed with liable capital.

Who should be allowed to create the algorithms?

"This is where things also get interesting for me as a political scientist," Tepe continues. "Because naturally a society in which robots act independently will be very different to today's society. So the time has come to start thinking about how the state can make sensible regulations here. The key questions are: Who is allowed to create algorithms that are able to make decisions, and on what basis?" Here Tepe's focus is more on ethical issues than the conclusion of maintenance agreements. In this context researchers on decision-making typically bring up the "dilemma situation": a car has to swerve suddenly – on its right is a mother pushing a pram, on its left an old man walking down the street. Which person should it swerve to avoid if it means hitting the other? "A human being behind the wheel would react instinctively in such a situation," Taeger continues. Allowing a computer programme in advance to weigh up the legal interests in such a situation would be inadmissible under the rulings of Germany's Federal Constitution

nal Court. “Weighing up human lives against one another would be incompatible with our legal system,” he says.

So how should the algorithms be designed? In Tepe’s view, technology poses a challenge here that requires a normative decision – making this above all a task for the politicians. But so far, he says, they have been very slow to react. “There is no broad political discourse on this issue at

the moment,” the researcher says. He adds that the Pirate Party tried to put the topic of how to deal with artificial intelligence on the political agenda, but the discussion, like the Pirate Party itself, has disappeared almost entirely from public debate. “So far this is just not an issue you can win elections with,” Tepe observes.

According to Taeger the situation becomes particularly tricky once autonomous robots start evolving on their own, as self-learning systems. Could these systems one day become so independent that we no longer understand how they work?

Algorithms are generally anything but transparent, he notes, and if in doubt are even treated as trade secrets. “In my opinion,” he says, “we need independent institutions to scientifically assess whether or not these algorithms comply with ethical principles or are potentially anti-democratic.”

Tepe has similar fears. He explains that if on the one hand technological advances radically change society, but on the other many people no longer understand them, the result could be a kind of “expert democracy” – in other words a political system in which a large part of the population is excluded from decision-making processes. At the same time, however, cyber-physical systems is a highly complex field, and this, he explains, poses the question of how to generate a meaningful discussion among the general public about the critical issues at stake. “It’s a balancing act,” says the scientist, “and I would like to analyse how the political parties and public interest representatives position themselves here.”

Tepe also wants to find out more about the public’s views on the new technologies and their social repercussions. He cites the example of ride-sharing service Uber: “In terms of creating a shared economy this is a sensible idea because it puts unused resources – like the empty passenger seat of a car on its way to the city – at the public’s disposal.” But what a first glance appears to fulfil a social purpose is currently undermining working standards in the taxi sector, Tepe points out. Do users see it this way, too? Or are they just happy to get a cheap ride? He plans to examine these aspects more closely with the help of surveys and decision-making experiments.

Even if Markus Tepe and Jürgen Taeger cannot yet predict how the rapid technological advances will change the laws and society over the next few years, they are confident that their research can help to make the process of automation more socially compatible. Technology that truly benefits mankind – based on scientific research. (bb)

And now, Lady Justice? Cyber-physical systems raise new questions – from liability issues to data protection and challenges in civil and constitutional law.

