


# Rules for robots

Artificial intelligence is gaining in importance and advancing rapidly – literally as well as figuratively: robotic nurses could soon be moving into our homes. However, their behavior is still open to negotiation. At the **Max Planck Institute for Innovation and Competition** in Munich, **Axel Walz** is investigating how legal means can be employed to help ensure that artificial intelligence adheres to human values.



Ready for use: "iPal" robots by the Chinese-American company AvatarMind have been developed as electronic babysitters and companions for older people. Whether or not they will be accepted in these roles remains to be seen.

TEXT SARAH MÜHLBERGER

**T**hey bring food and remind patients to take their medication, help out in the shower and fold back the bed covers. Some of them tell jokes, while others sing or play memory card games. They are called Pepper, Justin, Riba or Garmi – and may be the future of German nursing homes: the robots being tested up and down the country.

### A SMART FRIDGE ORDERS KOSHER FOOD

As yet, nobody knows whether these robots will really be able to significantly relieve the strain on the nursing care system – after all, there is already a shortfall of more than 36,000 nurses. At the same time, there are more problematic areas that need to be addressed. Who will the robotic nurse ultimately obey? Will it incapacitate the patient, or will individual human ideas take precedence? How can robotic nurses be protected from hackers? After all, they will have access to the most sensitive of all personal data and know all about the patient's health and habits.

Questions like these require urgent answers, says Axel Walz, Senior Research Fellow at the Max Planck Insti-

tute for Innovation and Competition. As a legal expert, he has always been driven by the question of what the consequences of innovation are for consumers. "In a time in which artificial intelligence and autonomous systems are gaining in importance, I am particularly concerned with how jurists can help ensure that artificial intelligence adheres to ethical standards."

"Ethics" is a complex term that means many things, from individual morals, religious norms and values anchored in law to the protection of human dignity. "It's all about the principle of ethical plurality," says Walz.

This is why a whole amalgam of measures is needed. A graduated regulatory model has to be employed and each case analyzed in close detail to establish how far the legal system can employ regulatory measures or other incentives to uphold ethical considerations. The protection of human life and human dignity is the exigent duty of the legislator. Existing laws have to be reviewed and adapted to the particularities of artificial intelligence whenever necessary. "And if I want to set specific individual standards for a technological product, a contract between two partners is typically the ideal regulatory instrument. I can use it to define a list of stringent conditions that match my ideas."

Certificates are a good solution when it comes to making sure that technological products give particular consideration to the values of a specific group of people – here Walz is thinking of religious communities, for example. This would reassure Jewish consumers that their smart fridge will only order groceries from kosher supermarkets and Muslim patients that the robot will only give them halal medication.

### CERTIFICATES COULD BE INSPECTED BY TUEV

Certificate solutions of this type could for example be inspected by facilities such as TUEV, the German technical control board, "something that is already happening today, for example in the case of data protection standards," explains Walz. Appreciable legal consequences would also be a way of disciplining manufacturers if their systems were hacked.

During the course of his research, Axel Walz has been talking to developers of new technologies and potential users. For the next step, he will be reviewing the current legal situation. "With this in mind, we will then attempt a kind of risk analysis: what are the advantages of new technology, and what are the possible negative effects



**Left** The cuddle factor: electronic sensors enable Japanese therapy seal "Paro" to move its head and react to stroking with sounds of pleasure. Japan is a pioneer in the development of robots for nursing care.

**Right-hand page** Bearing the burden: "Robear" was also constructed in Japan and is intended to help frail people get out of bed or go to the bathroom.

that could offset them?" It will then be possible to assess whether regulatory measures are needed.

Robotic nurses are a particularly vivid example of the importance of ethical discussion – after all, technology of this kind comes particularly close to human beings and affects their most private spheres. Some people are already trying to fight back against the use of robotic nurses by drawing up special patient directives.

However, these robots are still visions for the future, at least when they are imagined as intelligent helpers that could largely replace nurses. Robotic assistance systems that are each only capable of single functions are currently being used on a trial basis, for example to help disabled people cook, clean or go shopping, or to help nursing staff lift and shower patients.

"In general, the tasks that could currently be performed by robotic systems only make up a very small part of the nursing process," says Patrick Jahn, Director of Nursing Research at the University Hospital in Halle. "They would

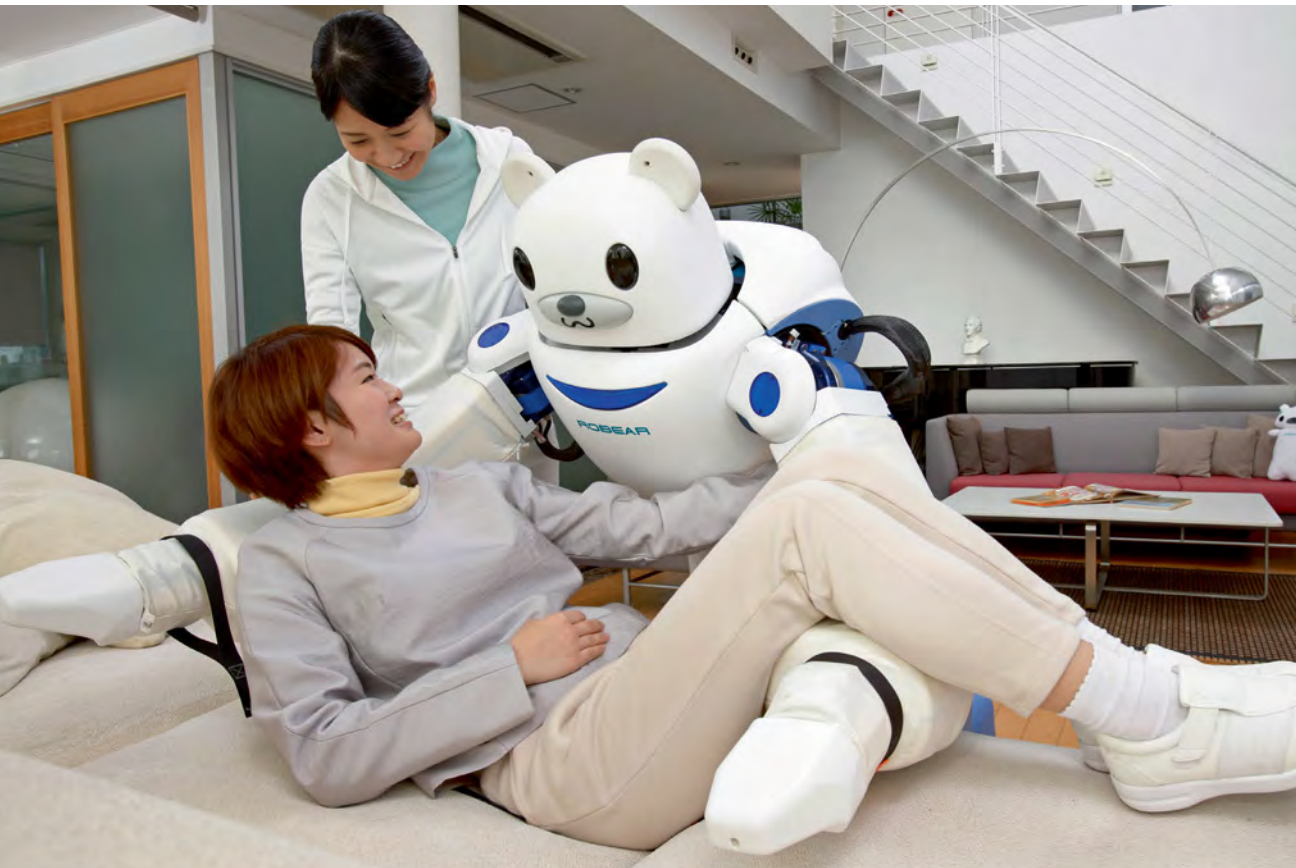
not yet be able to relieve the strain on nurses in the way that is generally expected." To date, most models have merely had the character of projects and are far from ready to be launched on the market.

### ROBOTS HAVE MAINLY BEEN USED FOR ENTERTAINMENT

According to Jahn, the most advanced robots are the humanoids that specialize in communication, entertainment and information. In North Rhine-Westphalia, "Robbie" and "Paula" play with the residents of a nursing home or encourage them to take exercise. In other places, "Paro", a robotic seal that reacts to being stroked, is used in the care of patients with dementia. Moreover, the robotic nurses "Justin" and "Edan" will be moving into a home for the aged in Garmisch-Partenkirchen this year, where they will hand the residents drinks or medication, fold back their bed covers, press the elevator button, and also raise the alarm if a patient falls.

For the FORMAT project, specialists in nursing science, doctors and computer scientists in Halle are seeking and developing application scenarios for robotic systems that are already able to offer added value. After all, even robots that are "only" able to entertain elderly people can be of use to nursing staff if they make nervous, aggressive patients more relaxed, says FORMAT Project Leader Patrick Jahn.

One example is "Pepper". The 1.20-meter character with big black eyes and a monitor in its chest is currently being used to give informative talks preparing patients for MRI scans. This saves time for the doctors and nurses. The current developments in technology would also enable robots to notify patients of medical appointments and take relatives to the patient's room, i.e. they could serve as robotic ward assistants. Both of these functions were developed during workshops with nurses. "Application scenarios of this kind are also important because there has so far been a lack of specific, convincing examples of use," says Jahn.



»» When we have the feeling that things are too complex to understand, we tend to trust in them blindly.

There are still numerous restrictions, and the system is still not stable. An environment that is too loud can disrupt communication because “Pepper” is insufficiently able to understand its human counterpart. Robots are also confused by the dynamic hospital environment; “Pepper” becomes disoriented if beds suddenly appear in a ward hallway where there were none the day before, for example.

FORMAT follows the “Bertha Benz principle,” explains Patrick Jahn: the automobile pioneer got started right away rather than waiting until the new mode of transport was able to travel without difficulty at 100 kilometers an hour. Benz discovered other important requirements such as the importance of filling stations during her first overland journey; not until her

practical test was she able to help the new technology make a breakthrough.

### **ALGORITHMS ARE NOT ALWAYS OBJECTIVE**

Jahn believes that this approach could also be effectively transferred to the utilization of robotic systems in nursing care: “Even though we are still far away from the vision we all have in our minds – of the intelligent helper that significantly relieves the strain on nursing staff – we have to work with our limitations so that these robotic systems can be quickly integrated into practical scenarios. Otherwise the development dynamic cannot gather momentum.”

Axel Walz believes that Germany should be involved in the develop-

ment of artificial intelligence. “At the same time, we have to make sure that we develop a qualitatively sustainable, high-quality intelligence that meets the appropriate ethical criteria.” In his view, the normative goal should be a humane society that stands by its established values and that uses technology to continue supporting them – without being allowed to dehumanize them under any circumstances.

Walz calls for open debate that also addresses the question of “whether and where there are red lines that should not be crossed. In other words, how far should I actually be allowed to furnish products with artificial intelligence?” According to Walz, such questions are only rarely made the subject of wider discussion due to people’s faith in technology. “When we have the feeling that

» Artificial intelligence is developing itself – that makes it a black box. It should always be possible to comprehend why a certain result is generated.

things are too complex to understand, our psychological response tends to be to trust them blindly and rank them above our own decision-making competence. In this respect, we have too little confidence and believe that algorithms are more objective and neutral than humans.” In fact, the opposite is true, “because algorithms are trained with data, and the selection of this data is influenced by the programmer’s bias,” explains Walz.

### NURSES LOCKED ROBOTS IN A CUPBOARD

In the case of artificial intelligence, matters are made more difficult by the black box phenomenon. A traditional algorithm functions inasmuch as data is entered and a result is produced at the end, typically in accordance with the so-called “if...then” principle. This is not the case with artificial intelligence: these algorithms are capable of learning, i.e. they can assimilate information, evaluate it, and draw conclusions. This means that they are in a sense able to learn from their own experiences. “Rather than being static, algorithms are therefore continually developing themselves. However, it seems that not even the programmers have a clear idea of what exactly happens while they are doing so,” concludes Axel Walz.

One possible answer could lie in the approach adopted by the interna-

tional engineering society IEEE, which has established a global initiative addressing ethical considerations when developing autonomous systems. Besides laying a theoretical foundation, the initiative also aims to develop concrete ethical standards for technology. One of the objectives is a so-called transparency standard. “It is intended to ensure that algorithms for artificial intelligence are programmed in such a way that it is always clear which data were used and why a specific result was generated,” explains Axel Walz, who was in regular contact with the IEEE initiative.

The human factor has also by no means been adequately researched to date. How does working with or alongside robots affect employees?

The effects on nursing staff are the focus of the interdisciplinary project “Orient”, which is funded by the EU initiative “More years, better lives”, and in which economists are involved along with innovation researchers from Finland and nurse scientists from Sweden. “We are investigating the preconditions that have to be met before assistance systems can be used and accepted in the nursing field,” explains Kirsten Thommes, Professor of Organizational Behavior at the University of Paderborn.

In future, much more attention will have to be paid to the needs and demands of those directly affected by

the use of robotic systems: the nurses and patients. “Until now, robotics have mainly been the domain of engineers,” says Kirsten Thommes. The scientists in Paderborn are studying the needs and attitudes of nursing staff: what do they need to know about the robots beforehand, and what not? Will the content of training courses have to change, and will future nurses have to learn programming? In which areas could robots relieve workloads? Where might there be areas of friction? An assistance system that tells the nurse which patient she should attend to first, regardless of her routine, is clearly encroaching upon her area of competence. Moreover, studies of individual cases in Japan in which nurses switched off the robots or locked them in a cupboard showed that the constant recording of data by the systems can easily lead to a feeling of being under surveillance.

“As yet, there are no studies of the attitudes of average nurses towards assistance systems and the concerns that are widespread among them,” says Thommes. However, there are certain reservations among the general population about the use of robots. A survey showed that when asked what they associate with the word “robot”, more than 70 percent of Germans think of the “Terminator” – the humanoid machine played by Arnold Schwarzenegger in the eponymous



movie of 1984. “This kind of negative image naturally reduces people’s willingness to engage seriously with the concept that robotic systems could one day be a great help and relief,” says Kirsten Thommes. “This is not wholly, but at least partly due to the shortfall in nursing staff.”

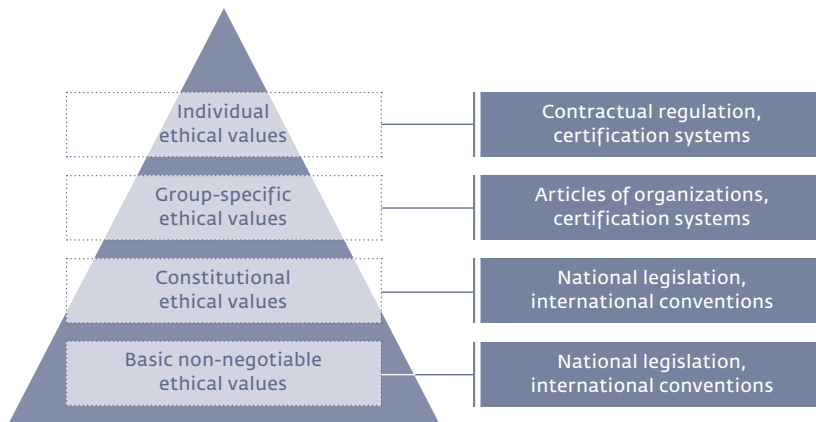
### MIDDLE GROUND BETWEEN AUTONOMY AND ASSISTANCE

Researchers at the Charité Hospital in Berlin are also studying how robots and other technologies could be of assistance in the future. The “Age and Technology” working group sees itself as an interface between target group and technology, patients and manufacturers, explains working group leader Anika Steinert: “We translate the respective requirements and evaluate the added value of a technology, how it is accepted, and how it can be utilized.”

Scientists working on project “Robina” are currently developing a robotic arm for ALS patients whose cognitive functions are unimpaired but who are suffering from muscle wasting. >

At hand: robotic arm “Robina” can be controlled by gestures, language, or with the eyes. It was designed for patients with ALS whose cognitive faculties are unimpaired but are suffering from muscle wasting. The arm can give the patient drinks or scratch itches.





**Left** Legally sound: ethical and legal requirements relating to robots, particularly in the nursing sector, range from general principles such as human rights to individual needs, for example due to religious laws. They therefore have to be regulated on various levels.

**Right-hand page** Close links: legal expert Axel Walz regularly compares notes with developers and engineers with the aim of applying ethical standards in practice.

While defining how the arm should be supported during the run-up to the project, the wishes expressed by participating patients were relatively modest: “scratching”, for example, trivial activities for which the ALS patients would sooner not have to call for help every time.

Numerous questions have to be answered before the development work can begin: what should this arm look like? Should it be mobile or a fixed installation? How should it be controlled, what design should it have, and what should it feel like? However, there are also ethical and legal questions, “as even scratching is a very complex requirement,” explains Anika Steinert. How can patient and nurse safety be guaranteed in view of the fact that the arm has to come very close while performing its task? What should the arm be allowed to do, and what not? Should it be permitted to store information on how often it has scratched the patient? Or how often it has given the patient water? Furthermore, should it be able to take the initiative and give the patient a glass of water if he or she has not

drunk anything for three hours? Or should it only react when it is spoken to or controlled? “It’s always important to find middle ground between the patient’s need for autonomy and the assistance provided by the technology,” says Steinert.

### INTEREST IN ETHICAL STANDARDS IS GROWING

Only a few concerns were expressed beforehand. ALS patients are after all accustomed to being dependent on aids in their everyday lives. They are typically somewhat younger than geriatric patients. “However, the results of the project can be applied to many different target groups.” Often it is the nursing staff who express reservations during the project, for example because certain safety aspects are weighted more heavily from their perspective. When cooperating with manufacturers, the scientists in Berlin often find how little grasp there is of the ethical considerations relating to the product. All the same, “the subject has clearly gained in importance in recent years,”

says Anika Steinert. “People make fun of questions like these much less often than before.” This is apparently also due to the increased interest being shown by politics in ethical standards for artificial intelligence.

Axel Walz from the Max Planck Institute for Innovation and Competition sees these standards as an important potential determining factor on the way to a humane digital society oriented on the established fundamental values of humanity. “One very simple way to influence the development of a new technology right from the start is only to promote projects that conform to the corresponding ethical value set.”

The legal expert finds it important to emphasize that the intention is not to inhibit innovation by regulatory means; on the contrary: “Regulatory instruments can help show that the fears and concerns of the general population are taken seriously and can even assuage them if our existing standards are transferred to new technologies. We are in the midst of a massive revolution and have to take society along with us



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when faced with such far-reaching technological developments.”

Walz himself does not see any reason for humanoid robots, i.e. robots that have as many human attributes as possible. The ban on cloning primarily refers to biological reproduction. “However, the meaning and purpose of the ban is to protect the singularity of human life, and I believe this is just as much at risk if someone makes a bio-mechanical copy.” The associated objectification of humanity would clearly violate Article 1 of the Basic Law.

Particularly in the nursing sector, there is no reason to use android robots, says Walz. Robotic nurses should not replace human workers; instead, they should at most provide support. “As support in the everyday nursing routine, particularly in the case of repetitive mechanical activities, robots are a great opportunity in view of the problem of nursing staff shortages, and they could

also help improve the quality of nursing services.” However, this would require robots in nursing homes to be used in such a way that the staff have more time to give patients their personal attention, to take better care of them from a humane perspective. “It would be an admission of human defeat if one day we were actually to try to transmit affection

and empathy through robots,” says Axel Walz. “Respect for human dignity should therefore be the paramount principle guiding the development and use of robotic nurses.” ◀

 [www.mpg.de/podcasts/digitale-gesellschaft](http://www.mpg.de/podcasts/digitale-gesellschaft)  
(in German)

#### SUMMARY

- When developing robotic nurses, legal and ethical aspects should be taken into account right from the start in order to meet the needs of patients and nursing staff.
- Patients must be certain that the robots will not collect more data than is absolutely necessary, and that this data is protected. Moreover, the robots should not be allowed to incapacitate the patients.
- The nurses also have to be protected from surveillance; the use of robotic systems should be restricted to repetitive mechanical activities.
- A legal framework could help strengthen the acceptance of robotic nurses.