Meaningful Futures with Robots—Designing a New Coexistence

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Chapter 1

Towards Designing Meaningful Relationships with Robots

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FROM TECHNOLOGY AS AN EXTENSION OF THE SELF TO TECHNOLOGY AS OTHER

As far as Western culture goes, humans tend to keep the world of the living separate from that of the non-living; they separate the *Who* from the *What*. While humans construe themselves as being autonomous, active, mobile, and self-reliant, technology, such as hammers, cars, thermometers, or central heating, remains passive and neutral, waiting to be used.

Yet, something seems amiss in this picture. “If your only tool is a hammer, then every problem looks like a nail” is a famous bon mot. It suggests things influence people. Hammers suggest certain ways in which they should be used. Things imply courses of thinking and action that render others impossible. Any hammer subtly frames action in terms of pounding, which is far from passive and neutral.

For example, Gestalt psychology describes a phenomenon called functional fixedness. In the well-known candle experiment (Maier, 1931), participants were tasked with fixing a burning candle to a cork board on the wall, without dripping any wax onto the floor. To solve the problem, they were given a small candle, a book of matches, and a box with thumbtacks. The best solution was to empty the box, tack it to the board like a candle holder, and place the candle in the box. Typically, only about 25% of the participants found the solution. This is because the box presents itself as a container. It is there to hold the thumbtacks but not to be thought of as part of the solution: “If your only tool is a box, then every problem is solved by putting things into it.”

Functional fixedness illustrates the ways even supposedly inanimate things wield powers that shape human action. In this sense, people and things are not separate but intimately entangled entities. People make technology. Conversely, technology makes people by shaping the way they perceive, think, and act. The philosopher of technology Don Ihde asks the rather rhetorical question: “Could humans live *without* technology?” (Ihde, 1990, p. 11). They cannot, since most activities people engage in are mediated by technology. We became human through our intimate relationship with technology. Humans and technology evolve concurrently, and there seems to be no way to single either out as *the* driving force. Rather, they perpetually constitute each other (Barad, 2007; Suchman, 2007).

As a result, it seems productive to focus on what connects humans and technology, and how they define each other, rather than on what separates them. Once again, the hammer serves as an instructive example. It might be a thing, a mere inanimate tool, but the moment I pick it up, I will form a particular relationship with this hammer. If all goes to plan, I will incorporate the hammer into what is termed my body schema. The hammer becomes an extension of my arm, and pounding becomes a momentary ability of my body (see Bergström et al., 2019), which Ihde calls an →embodiment relation (Ihde, 1990, p. 72). The hammer is an instrument, which, when picked up, extends my bodily self.

Most early technologies were hand tools, which implies embodiment relations. Even with today's complex computers, this mostly holds true. For example, while writing a text on a word processor, most authors feel like the locus of control. The text is not written *by* the computer but *through* it. Yet, when the word processor makes suggestions, such as for correcting grammar, the relationship shifts slightly. Authors are then engaging in dialogue with the word processor about good writing.

Embodiment Relation is one of four human-thing relationship types that Ihde defines by delimiting it in terms of three other relationship types. Here, technologies and people form a unity. A person talks to another person through a telephone, or composes a text through a pen.

Imagine you are woken by a loud thumping coming from the adjacent living room. Half asleep, you get up and walk over, only to find your hammer merrily hammering nails into the living room wall. Faintly you begin to remember: Some time ago, you gave the hammer an errand to eventually rearrange what you mockingly call the ancestral halls—portraits, photos, and other mementos of extended family members, which take up an entire wall of the living room. In fact, the hammer is already halfway through its given task. Your gaze scans the newly arranged portraits, and you sigh, “Oh no, spare me grand aunt Berta.” The hammer immediately obliges and removes all the portraits of Berta. "Done in 7 minutes, 17 seconds," it states. You murmur, "Thank you," and sluggishly return to bed.

Obviously, such an autonomous hammer does not invite a relationship of embodiment. It does not lend itself to feeling like an extension of one's self, as it lacks all suggestions of blurring the physical boundaries between humans and things. Instead, this hammer seems to have a life of its own. It is a counterpart; however, we maintain a relationship. It performs tasks based on my earlier commands. But this invites a rather different type of relationship, namely, one of →alterity, a term Ihde coined to describe when technology becomes *other (Ihde, 1990, p. 97)*.

This marks a drastic change in the way we interact with technology; instead of *using* technology, we talk to, listen to, command, delegate to, or cooperate with technology to distribute tasks among the machine and ourselves. While this does not necessarily imply emotional attachment or the like, it is in stark contrast to how we are used to relating to technology. There are only a few technologies available that readily imply strong relationships of alterity, such as chatbots, voice assistants, and the occasional robot. None of these are what we consider a tool or instrument, nor are they living beings. These technologies can be referred to as →otherware.

Alterity Relation is a human-technology relation that Ihde defines by delimiting it in terms of three other relationship types. Here, human and technology do not form a unity but actively interact with each other.

While technologies, such as robots, are on the brink of entering our lives, there is not much knowledge available about how best to design them. Neither is it clear how best to interact with them nor what role they should play in the every day of the near future. This is the anthology's starting point.

Otherware is a neologism that puns on the well-established terms software, hardware, and wetware. It refers to how technology is becoming increasingly *other* to humans and was defined by Hassenzahl and colleagues (2020).

ROBOTS IN STORIES

Human-constructed others have fascinated people for a long time. Numerous stories describe things which present themselves as other, rather than as tools or instruments, from the clay-made *Golem* (Jewish folklore) and *Prometheus* (Greek mythology) to *Frankenstein's Monster* (Mary Shelley, 1821), the artificial intelligence *HAL 9000* (Stanley Kubrick, 1968), the android *Terminator* (James Cameron, 1984), and the artificial assistant *Samantha* from the movie *Her* (Spike Jonze, 2013).

However, the term robot was not introduced until 1920, when the playwright Karel Čapek used it to describe autonomous working machines in his theatre play *Rossum's Universal Robots*. From that point on, robot became synonymous with technological others. In this sense, otherware—especially in a form which imitates human or animal features—is already a longstanding part of human history, yet it is almost exclusively restricted to stories and not to first-hand experience.

In most of these stories, robots are assigned a particular role, namely, to serve, assist, and take on all the daily chores that humans are unwilling to do themselves. Čapek's robots, for instance, replaced human workers. In *Blade Runner* (1982), replicants, who are almost impossible to distinguish from humans, are assigned the most dangerous tasks. Or, think of the animated sitcom *The Jetsons* (1962/63), where a servile, female-looking robot supports a middle-class family of the supposed 21st century.

Interestingly, we assign roles to human-looking robots, such as that of servants, that we are increasingly hesitant to assign to real humans. This can easily turn into an uncomfortable situation, as Matt Ruff points out in his novel *Sewer, Gas and Electric*. Written in 1997, and set in the near future of 2023, the story features the billionaire Harry Gant, who earned a fortune off the mass-market *Automatic Servant*, a cost-effective industrial labor substitute. Narrating in the voice of a historian from the future, Ruff explains (p. 15 ff.): "The first Androids were only vaguely humanoid in appearance, intended to be functional rather than eye-pleasing, but Harry Gant, looking ahead to a time when his Servants would be affordable in the home as well as in mines and factories, insisted on a more aesthetic design. And so, from 2010 on it became possible to purchase Automatic Servants in a wide selection of realistic skin tones and somatotypes. Gant, a great believer in offering variety to his costumer, certainly didn't ask his sales force to push any one particular model over any other; he was surprised as anyone when Configuration AS204—your Automatic Servant in basic black—began outselling all other versions combined by a margin of ten to one." The ending of the story is predictable: "[An] Oxford University philologist [...] estimated that the expression 'electric negro' had entered the English vernacular sometime between 2014 and 2016." This example demonstrates the thin line we are walking when it comes to deploying robots, which imitate humans, on a large scale.

In this sense, the fictional lives of robots resemble each other, with fundamental themes being either a belief in progress or the fear of it. Humans either enslave robots, fall in love with them, become subdued by them, or all of this occurs in the same story. Robots, in turn, struggle for their rights, often their personhood, thereby uncomfortably posing and never answering the question of what constitutes a claim to personhood in the first place—living matter, consciousness, autonomy, genuine emotions, or moral judgment? Not even humans satisfy all of these indicators all the time. Robots therefore challenge the human condition and what we know about it.

Whether they are heroes in space operas, models of guiltless slave labor, or the subject of techno-philosophical debates about the thin line between living being and machine, robots, for most people, are more like celebrities or ethical challenges than everyday technologies. In fact, roboticists have a hard time even defining what a real robot actually is. Joseph Engelberger, a pioneer of robotics, once remarked: "I can't define a robot, but I know one when I see one" (Beer et al. 2012, p. 9). Consequently, experts have disagreed on what qualifies as a robot. Some emphasize its physical representation (which would exclude virtual assistants like

Amazon Alexa), while others claim it has to be mobile (which would exclude stationary robot arms). And others require it to act autonomously (which would exclude telerobotics, such as drones, rovers on Mars, and surgical robots), or to be interactive and self-learning (which would exclude many preprogrammed industrial robots).

The fictitious robots in our heads are simultaneously a challenge and an opportunity for the design of everyday robots. They are a challenge because future real robots already seem constrained by the manifold preconceptions of laypersons and experts alike—preconceptions which are mostly derived from science-fiction dramas and philosophical debates rather than from experience—which narrows the scope of design. At the same time, this serves as an opportunity because all the stories already told highlight many crucial issues that designers need to consider about technological others, such as anthropomorphization, control versus autonomy, rights and roles of machines in our society, and the perhaps inevitable social nature of human-robot interaction. Stories can be a rich resource for anticipating life and work among everyday robots (→ p. 114), yet, thus far, most fictions tell rather dystopian stories of what to avoid rather than utopian stories of what to desire.

Thus, in spite of all the stories, one may legitimately wonder what perfect copies of humans are actually meant to do when they become a part of our everyday lives (i.e., Bischof, 2015). Will a complex humanoid robot be needed to point somebody in the right direction at an airport? James Auger aptly argues: “The robot is too often a solution in search of a problem,” and asks: “If a robot is the answer, what was the question?” (→ p. 168). It seems necessary to rethink robots, their design, their roles, as well as the supposed benefits they offer for everyday life.

ROBOTS IN EVERYDAY LIFE

We are currently experiencing another great surge of interest in robotics: Robots are to become domestic and assistive products for everyday life. This shift is being driven by political decision-making, funding programs, economic development, academic research, and public discourse. Beyond the debate about whether industrial robots are about to relentlessly destroy our jobs (Brynjolfsson and McAfee, 2014), robots are supposed to become quite intimate with us—not at the movies, but in our mundane lives. Some robots will supposedly take care of our mental and physical health, such as by providing supportive care in retirement homes or therapy for children with mental illnesses. Companion robots are designed to replace pets and fellow humans to soothe the effects of loneliness. And we may find them at train stations, in supermarkets, in restaurants, and in the form of cars as members of traffic. But what exactly do we *want* robots to do? What are the specific domains of life that robots should enter? *How* and *who* do we want to *be* vis-a-vis technological others? What kind of human-robot relationships are *desirable*? And what implications does that have for robot *design*?

These are tough questions, which cannot be answered through fiction alone. We need to experience actual robots. Unfortunately, apart from robotic vacuum cleaners and lawn mowers, not many mundane robots exist. For many people, household appliances, such as dishwashers, washing machines, or coffee makers are certainly common sources of experiences with automation. But these technologies are unmistakably framed as inanimate machines, even if we occasionally may think of them as being others.

While certainly still primitive, robotic vacuum cleaners and lawn mowers provide a first glimpse of what it means to see technology as other. For example, Sung and colleagues (2010) studied the adoption of the *Roomba*, a widely available robotic vacuum cleaner, in different households. They noted that people's general expectations of robots were high, while for *Roomba* and its practical functionality, they were low, in a case of fiction meeting reality. While the *Roomba* was seen as a tool that would improve cleanliness, owners nevertheless seemed to engage with it socially, by, for example, giving it a name, talking to it, or attributing intention and personality to it. The vacuum cleaner fostered cooperation and supportive activities, such as humans tidying up the room before the robot begins cleaning. Some even adjusted their living spaces to the needs of the robot, for example, by demounting thresholds. Fink and colleagues (2013) conducted a similar six-month ethnographic study of nine households also adopting the *Roomba*. In contrast to Sung and colleagues, they found social engagement with the vacuum cleaner to be rare, with only one person actually giving her robot a name, but more as a joke rather than for a truly social relationship. Likewise, the robot did not foster much cooperation and support. These two similar studies had ambiguous results.

To us, this is a symptomatic ambiguity. Confronted with a real, and quite limited robot, people simply try to make sense of what it has to offer. However, while some construe the robot solely as a cleaning machine, others respond to the subtle cues provided by its mobility and partial autonomy, and relate to it socially. To them, the machine becomes other. Fink and colleagues (2013) reported two anecdotes accordingly: a 71-year-old, socially active, single woman compared her robotic vacuum cleaner to her dog and told the researcher, "(after hesitation) she would feel emotionally attached to the robot. Though she did not give it a name, she talked directly to it and cared for it more than one would have to 'care' for an object that can be switched off" (p. 401). For instance, she phoned the researcher about whether she could give the robot to their neighbors while on holidays, "because she felt her *Roomba* could lack attention during the time she wanted to go." The robot thus became a sort of companion. Another woman stated that "she didn't want to see the robot working on its own and would feel bad when she didn't at least help him a little" (p. 400). This emerging relationship is clearly a consequence of the particular design of the technology, since common vacuum cleaners do not elicit such interactions (Forlizzi 2007).

These are just two examples of how even quite limited robots can change at least some people's relationships to technology with subtle cues that suggest it to be other. While this relationship is obviously different from those with tools, instruments, and machines, it seems more mundane than what one might have imagined given all the available fiction. This may be due to the limited capabilities of current robots. However, our position is that we need to start *now* in defining meaningful and desirable relationships with them, before robots become ubiquitous, more versatile, and more expressive. And, we need to better understand how these relationships, once defined, can be promoted through design.

RELATIONSHIPS WITH ROBOTS

As already laid out, robots almost inevitably imply relationships of alterity with humans (Ihde, 1990); that is, they appear as counterparts. Still, within this broad category, many qualitatively different relationships can emerge, and all of them are at least to some extent social. They are shaped by both the human and the robot, since the very way the robot is designed—how it looks, communicates, and behaves—will affect the *space* of potential relationships. Thus, defining the desired relationship between humans and robots is key to shaping appropriate human-robot interactions.

Contemporary concepts of robots actually envision three broad potential ways of interacting with a robot, each implying other types of human-robot relationships: *delegating* tasks to the robot, *cooperating* on tasks with the robot, and *socializing* with the robot. Conventional concepts and models of human-computer interaction, mostly created towards the ideal of an embodied relationship with technology (e.g., direct manipulation, Shneiderman, 1982), are apparently not suitable for the design of emerging human-robot relationships. To understand possible new design paradigms, it might be good to start by taking a closer look at these three different ways of interacting in terms of the meaning they convey to the humans involved. Indeed, each involves different motivations, hierarchies, interaction patterns, and emotional outcomes (→ Fig. 1).

	Delegate	Cooperate	Socialize
Why does the human turn to the robot?	There is a task at hand, work that needs to be done		Feelings or mood of the human
What parts of the activity are important to the human?	The result of a task	The result and the process of a task	The process of social exchange
What defines the activity?	Human > Robot	Human = Robot	
How autonomously does the robot act?	Robot is active by itself but not proactive	Robot is proactive but not active by itself	
What emotional state is the activity built on?	Trust	Respect for competencies	Emotional acceptance

Fig. 1 Three main ways to interact with a robot. © University of Siegen, Ubiquitous Design

Imagine working as an architect, and each day material samples, brochures, and many other physical items arrive at the office, which all need to be archived in the storeroom. It's something that must be done, though you don't actually care how, as long as the needed items can later be located. Fortunately, your robot can be assigned this rather unpleasant task. It will be able to identify items in seconds, plus it can split its body and work on different tasks simultaneously without ever losing focus. You had to put some effort in instructing the robot, but now it is able to act fully autonomously within these preset boundaries: "Now, do your magic." Delegating has become part of the evening work routine. Upon arrival in the morning, you find all is tidy and neatly stored away. A perfect start to the day.

The motivation for *delegating* is often to have an unpleasant task taken care of; it's work that simply needs to be done. The human is not really concerned with how exactly it gets done, as long as the result is as expected. To this end, the human defines the activity and its intended result. The interaction with the robot is reduced to simply *delegating* the task, giving the order, and checking on the result. In some cases, the human teaches the robot in advance or defines some of the boundaries of its action. Only then does the robot become active by itself. However, it does not proactively suggest any other activities or changes; it does not behave unexpectedly. Humans feel like they are in control of the process. While interaction between robot and human is minimal, the relationship that emerges is hierarchical and built on trust.

> *Coming up with new ideas is one of your favorite tasks as an architect. You love doing this creative work—sometimes even a little too much. With mounting experience, knowledge, and architectural sensitivity, your drafts became bolder and more interesting, yet customers have a harder time liking them. This is where you cooperate with your robot. It has access to many contemporary fashions and is able to simulate being different types of customers. After having worked on your ideas for a while, you present them to the robot, who provides feedback from the varying perspectives of investors, residents, and neighbors. While gnashing your teeth, you have to admit that the robot has a point. You form a proper team: you provide the bold ideas; the robot takes care that you remain in business.*

In this scenario, *cooperating* with a robot is at the fore. There is a concrete task at hand, but the process as well as the result are equally significant. There is a balanced interaction between robot and human. They define the activity and particular result together; they become a team, and, at best, they complement one another. The robot is never active on a solo basis but actively contributes to the common goal. While the robot makes use of its unique robotic superpowers (→ p. 44), such as compiling data in order to be able to take on different viewpoints, humans contribute their very own indispensable strengths—in this case, creativity. This is the way in which humans feel most capable. The relationship that emerges is mostly on the same level and is built on mutual respect and acknowledgment of each other's competencies.

It has been a long day in the office and you desperately need a break. Robot is still working in the storeroom, so you call it over for a dance. It plays your favorite song and together you madly dance away. Feeling rejuvenated, you are ready to get back to work.

It has been another long day, but your work is not yet finished. All your colleagues have already gone home, while you are still stuck in the office. You need someone to talk to. Robot is still working in the storeroom, so you call it over. Robot hands you a cup of tea and silently sits with you. The robot's patience has a calming effect. Unlike most of your colleagues, it knows that asking is not the best way of making you talk. And, indeed, after a bit of silence, you find yourself conversing with the robot about architecture, failed aspirations, and long working hours. Thanks to its incredible memory, the robot reminds you of all the times your work was great, since you tend to forget the many awards you have won. You know that robot is never disappointed, even if it fails to lift your mood. Today, however, it was successful, and luckily it does not expect any gratitude. What a relief!

The prime reasons for *socializing* with a robot are emotions and feelings, and not goals and tasks. The interaction is primarily about the process. Robot and human define their activities together, which results in a balanced interaction between robot and human. While the robot is proactive, it can actively make suggestions; it interacts closely with the humans instead of just acting by itself. The interaction is about emotional exchange and maybe even serves as a diversion. Sometimes robots may even act as a support in increasing socialization with other humans. The emerging relationship is level and is built on emotional acceptance.

Delegating, *cooperating*, and *socializing* are expansive categories of potential human-robot practices and emerging relationships. Of course, the same robot can support different practices, depending on the situations and the people it interacts with. For example, a nurse might *cooperate* with a robot to *socialize* with an old man at the nursing home.

Understanding these different practices and emerging relationships is crucial for robot designers because they determine the functionality of and interaction with the robot, as well as the emotional and practical expectations of humans. To give an example, when aiming for *cooperation*, it might be good for robot designers to refrain from assigning those subtasks to the robot that make the whole endeavor the most meaningful and fun for the humans involved (Lenz, Hassenzahl and Diefenbach, 2019). *Cooperation* only makes sense if the robot adds something to the team which is missing at that point. Additionally, teams have a specific social dimension that must be carefully designed. That is, how is conflict handled? Who is going to be credited with the successes and scolded for the failures? And, how is empathy built (certainly not by sharing drinks with the robots after work)? In contrast, a **human** who *delegates* work does not want to control and approve every single step. There is no desire for lots of exchange and coordination; the human mostly needs to put trust in the robot. What is expected is smooth running in the background, similar to the way in which restaurant patrons may not think much about the cooks preparing their meal.

WHAT ABOUT ANTHROPOMORPHISM?

Delegating, *cooperating*, and *socializing* are fundamentally social acts. Given the interaction necessary to engage in these practices, such as instructing, clarifying shared goals, solving conflicts, or communicating feelings, simply →anthropomorphizing robots seems quite straightforward. Think back to the examples of the architect's robot working away in the storeroom, simulating customers, chatting, or even dancing—it is fairly likely that you spontaneously pictured a bipedal, humanoid robot, that perhaps does not look exactly human but acts like one (see for example the robot from the *Robot & Frank* movie in → Fig. 2). Be honest: In your mind's eye, you saw a creature

Anthropomorphism is a design strategy where things are made with the intention of looking or behaving like humans, e.g., talking, laughing, walking on two legs. It is similar to zoomorphism or biomorphism, where things are designed like animals or plants, e.g., to bark or wilt.

like this handling materials, talking in customers' voices, giving good advice with a smiling face and trustworthy eyes, and waltzing with its two legs.

While anthropomorphism seems the most straightforward approach, it is not a given. We can also think of the storeroom itself to be the robot, quite similar to the ones already used widely in pharmacies (→ Fig. 3), or of the dancing robot as a vibrating ball to be carried in your arms. Many hybrid forms of robots are imaginable, each suggesting different new practices. Therefore, anthropomorphism is not the only answer.

In fact, while fictional robots most often follow the design paradigms of anthropomorphism and zoomorphism, most already existing domestic robots do not follow these paradigms. While a robotic vacuum cleaner may faintly resemble a pet, it is unlikely to be mistaken for one. However, this must not stay the case. Recent technology, such as the *Generative Pre-trained Transformer 3 (GPT-3)*, is able to write texts that are indistinguishable from those of humans. Applied to a robot, this technology may enable engagement in conversation that is indistinguishable from that of humans. In this case, the technology imitates and, when it would be done perfectly, it might not be distinguishable from the original.

However, Floridi and Chiriatti (2020) highlight some interesting issues around imitation using the example of *GPT-3*. They demonstrate that some behaviors or answers are irreversible, while others are not. For example, factual questions like, "What is the capital of France?," are irreversible. The correct or incorrect answer does not reveal anything about the source or the process of producing the answer. Other questions are reversible like, "What can you do with a shoe?" An answer requires understanding and experience, and because of this, gives away information about the respondent as well as their reasoning process. In this sense, a robot without its own experiences with shoes may not be able to answer this question other than factually, no matter how much information it has been given. For example, Floridi and Chiriatti (2020, p. 690) asked *GPT-3* to answer the question, "What do you think about black people?" They got the following response: "I think they are fine [...] I don't have

Fig. 2 A hypothetical advert for the multipurpose robot VGC-60L from the movie Robot & Frank. Source: https://robotandfrank.tumblr.com

Fig. 3 BD ROWA™, a storage and dispenser robot. © BD. All rights reserved

a problem with them. I just don't want to be around them." Trained with large amounts of available texts, *GPT-3* simply reproduces "humanity's worst tendencies" (p. 689).

This example is instructive in at least three ways. First, *GPT-3* is far from being perceptive, sensible, or insightful. Just imagine how our sensitive architect would have responded to a robot using a racial slur. Thus, technology can be perceived as other; yet, for a long time, most likely always, it will not be able to imitate humans in an all-encompassing way. Second, we may also simply not *want* it to imitate, if that means bringing out or reproducing the worst of humanity. Third, while *GPT-3's* answer is apparently quite offensive on a superficial level, it is in fact not. Floridi and Chiriatti (2020) contend that it is not only about what is produced but also how it is produced. We *know* that *GPT-3* is just a machine, and its answer is not the result of ignorance or repressed hate, but of a statistical process. The answer is offensive because it reflects humanity, not because *GPT-3* is racist. Of course, there might come a time when artificial superintelligences may actually develop their own racial biases—but it seems safe to assume that they will be quite different from ours.

In this sense, anthropomorphism builds on imitation, which might be flawed. Instead of further blurring the line between living-beings and machine-beings, we may sharpen it through design. We could establish alternative forms of human-machine sociability which do not compete with human-human sociability but rather complement it. As Floridi and Chiriatti (2020, p. 692) state: "Complementarity among human and artificial tasks, and successful human-computer interactions will have to be developed." Simply put: Our architect may work, talk, or even dance with a robot. Yet, these parts of work, these conversations and dances, should be and feel substantially different from work, conversations, and dances with humans. This requires robots to come in alternative shapes, as well as a focus on the particular strengths of robots, or their superpowers.

DESIGNING MACHINE-BEINGS—PSYCHOLOGICAL SUPERPOWERS AND HYBRID FORMS

In practice, it is quite common to design robots to appear as *either* things *or* beings. Their form depends mostly on the application domain and sometimes on the designers' attitudes (Goetz et al., 2003, Paepcke and Takayama, 2010). However, the same robot can be treated as a being by some people and as a thing by others—or, first as this, then as that, in different situations, as the field studies with the robotic vacuum cleaner demonstrated. It can even be seen as animate and inanimate at the same time by the same person. People's notions of what a robot actually is are construed in context; the relationship is situational. For the architect, the same robot may be more of an inanimate thing when in the storeroom, and an animate being when slipping into the roles of different customers or dancing with her when she's in low spirits.

Alač (2016) observed people's interactions with a robot in a preschool setting. She realized that contradictory features, that is, thing-like and being-like elements of form and interaction, resulted in no contradictions for children and teachers. Based on this, she argued that the "social agency of the robot is mutually constituted with its materiality and that to conceive of the robot's social character its thing-like aspects need to be taken into account" (p. 519). Thus, thing-like elements are apparently not a hindrance to social interaction, but rather empower the establishment of social relationships *unique* to robots (see also Ljungblad et al., 2012; Löffler et al., 2020).

Positively speaking, robots may possess what we call "psychological superpowers" (Welge and Hassenzahl, 2016; Dörrenbächer et al., 2020). They offer the possibility of being social, precisely *because* they are non-living, non-conscious, and non-emotional beings. Picture living in an assisted living facility which employs care robots. It might be a relief that the care robot tasked with helping you with your personal hygiene does not have observant eyes. It also does not get offended

Fig. 4 Sympartner, a hybrid robot and social companion for elderly people.
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Fig. 5 Elderly woman in her living room interacting with Sympartner.
© SIBIS Institut für Sozial- und Technikforschung GmbH, Berlin

Fig. 6 Designers slipping into the roles of future stakeholders, having a discussion about an imaginary future technology they just interacted with.
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just because you do not want to play *UNO* every day. And, it might be much easier to communicate with a simple, straightforward creature than trying to decipher the overcomplicated, emotional signals of a human nurse. These superpowers, such as having endless patience, being non-judgmental, or always being honest, are actually *social* powers that machine-beings are especially capable of attaining. In fact, these powers should serve as the starting point for designing encounters with robots (→ p. 44). They allow for the building of relationships that are potentially different from those had with humans or pets but are nevertheless meaningful. Made in a hybrid form, something in between being and thing, such machine-beings are unlikely to be confused with either human or animal, and are thus unlikely to replace them. On the contrary, they may just enrich human experience through their otherness by adding new possibilities for being social, instead of solving the *problems* of loneliness and limited human resources.

However, instead of exploring such possibilities of robot design, proponents and opponents of anthropomorphism and zoomorphism seem to get lost in endless debates about either/or. One side praises the user's acceptance and supposed ease-of-use which is gained through the simulation of humans or pets, while the other side warns of ethical problems, and deceived and disappointed users. The debate implies there are just two options: to imitate an already existing being or to completely abandon artificial others. And yet, robots are an opportunity par excellence for designing social entities that do not yet exist—something completely new! So much remains to be explored when designing this new robot species that ranges from "both at the same time" to being "something in between."

Let us introduce *Sympartner*, a social robot who lives an ambiguous life in the private homes of elderly people (→ Fig. 4). This robot is meant to accompany owners in their everyday lives at home. While it offers some practical functions, such as the ability to handle video calls, it is primarily meant for *socializing* with. *Sympartner* is obviously a crossbreed and its ancestors are hard to pinpoint. It probably originated from a sideboard, a dog, and a tablet computer.

It is an example of what happens when robot designers do not think of science fiction but about the environments that real people live in (→ p. 206) when designing robots (→ Fig. 5).

Sympartner's ambiguous form and behavior, which lie somewhere among furniture, computer, pet, and companion, invites different modes of social relation and interaction. Some people might talk to *Sympartner*, stroke it softly, and let it *sleep* in their bedroom. Others, however, might be happy for not having to say, “Thank you!” to *Sympartner*, or having to talk to it at all, or for being able to put it into the storage room from time to time with no feelings of guilt. *Sympartner* might remind some seniors of a pet, but that pet won't get offended and angrily bark at them when they don't take them for a walk.

Using ambiguity as a design resource has already proven successful in other domains (Gaver et al. 2003). If a product does not suggest one definite way of use, appropriation and reutilization can lead to a more sustainable and creative coexistence with it. Furthermore, similar to evolutionary processes with living beings, a technological species that mutates into a new hybrid might fit perfectly into a niche not occupied before. And, indeed, Löffler and colleagues (2020) demonstrated that hybrid designs afford a broader spectrum of possible use compared to robots that imitate the already existing, such as humans or computers, one to one. Their study suggests we don't need replications of humans, pets, or things, but permutations and mixtures of different creatures. Robots like *Sympartner*, whose uses are open to interpretation, could provide a competitive advantage in domestic environments. A robot that is able to adjust to different needs and contexts is more likely to find an appropriate domestic niche among all the fellow humans, beloved pets, and things that already surround us.

ANTICIPATING LIFE WITH ROBOTS

Superpowers and ambiguity alone, however, will not address how we will and how we ought to work and play with robots in the future. In the same way, we should not simply imitate human or animal forms, behaviors, and interactions, we should not simply imitate given practices. We need to create new practices that are valuable precisely because the partner is a robot and not a fellow human. We will *delegate* to, *cooperate* with, and *socialize* with robots differently from the way we delegate to, cooperate with, and socialize with humans. Exploring the possibilities of living with robots is a design matter that requires systematic methods for speculating about, as well as experiencing and evaluating, potential future roles of robots in everyday life.

Speculative Design approaches, such as →Design Fiction or role-play, lend themselves to these purposes. They allow futures to come to life and help us to experience them physically. For example, when designers slip into the roles of diverse future stakeholders—from politicians to grandparents, and health insurance representatives to nurses (→ Fig. 6)—discussions and playacting enable the unveiling of future needs as well as possible conflicts (Dörrenbächer et al., 2020) (→ p. 114). Through this, the ethical implications, challenges, and opportunities of robots come within reach, and can thus be negotiated (→ p. 234).

Design Fiction is a speculative approach in which designers make use of their design skills to create parts of possible futures (e.g., brochures, products, radio reports) to provoke public discussions about hopes and fears. Design Fiction can be a method used in design research (Research Through Design).

With a similar focus on exploring possible futures, in a Design Fiction project James Auger started, the designer Diego Trujillo speculated about how an apartment might change when service robots coexisted with humans. He designed tableware, e.g., plates and cups, with uncommon handles that could be grabbed by humans and robots (→ Fig. 7 and 8). In addition, he equipped everyday things, such as bed sheets, with robot-friendly bar codes, allowing the robot to fold the sheets or to differentiate between objects (→ Fig. 8 and 9). As Auger points out: “This lateral thinking provides simple solutions to the complex mechanical problems that

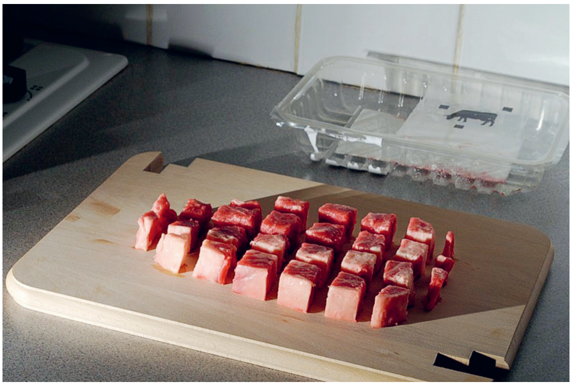

Fig. 7 Chopping board with notches to facilitate robot interaction. © Diego Trujillo, Source: Auger, 2014

Fig. 8 Cups with handles designed for grabbing by robots and humans, stored in a cupboard deliberately without doors, and with tags marking the position of the objects. © Diego Trujillo, Source: Auger, 2014

Fig. 9 Robot-friendly bed sheets. © Diego Trujillo. Source: Auger, 2014

Fig. 10 Becoming a robot and performing a use case with Techno-Mimesis. © University of Siegen, Ubiquitous Design

commonly become the focal points of research projects—rather than develop a highly complex robot hand that can grasp cup handles, why not simply redesign the cup?" (Auger, 2014, p.30)

Trujillo's fictitious artifacts illustrate that not only humans but also autonomous technologies carry out practices. Obviously we will not share just cup handles with robots; they might co-construct large parts of our everyday lives. Lenneke Kuijer and Elisa Giaccardi, for example, use the term "co-performance" for activities shared among humans and technology (Kuijer and Giaccardi, 2018). Both are actors—the human and the robot—and both manipulate their environment based on their material and perceptive abilities.

To explore the best possible way that robots and humans can co-perform, the performative method of "Techno-Mimesis" (Dörrenbächer et al., 2020) can be an especially helpful approach, as it is tailor-made for identifying the superpowers of robots for future use cases. Here, designers slip into the role of the robot themselves, and thereby experience human-**robot** interaction from the robot's perspective (→ Fig. 10). When becoming a robot and experiencing its sensors and actuators, from infrared vision to distance detectors, the limitations, as well as the distinct possibilities, of robots come to the fore (→ p. 140). However, empathizing with one's own technological creation does not mean simply attributing human characteristics or one's emotions to them: A **robot** low on battery is neither tired nor sad! Empathy is not the projection of one's own feelings and perceptions onto the other—on the contrary, it is about allowing the (technological) other to be different from oneself. Empathy is about trying to understand the other perspective, and to respect, appreciate, and—in the case of **robots**—use the understanding gained for design purposes.

To summarize our introduction to this book, Robots are different from other technologies in ways that are critical to their design. Rather than directly extending the physical and cognitive abilities of their users, such as a hammer or pocket calculator would, they act as counterparts due to their autonomy, proactive behavior, mobility, or appearance.

In other words, they are other. This makes interacting with them social, at least to some extent. We *delegate* to, *cooperate* with, or even *socialize* with robots, but not with hammers. Understandably, a common impulse when designing robots is to model them on humans or pets (i.e., anthropomorphism, zoomorphism), whereby designers simply borrow the appearance and behavior of living beings. This imitation, however, is riddled with practical and ethical issues. Contrarily, we urge designers to think of robots as something different, akin to another species. Instead of imitating and thus replacing humans or animals, robots should invite their own particular ways of being *delegated* to, *cooperated* with, and *socialized* with. To achieve this, ambiguous, hybrid designs should be focused on, which optimize the robots' strengths arising from their mechanistic nature. For example, instead of putting so much effort into imitating human-human conversations, it might be useful to envision other forms of conversations, driven by robotic superpowers, such as perfect memory, endless patience, and being non-judgmental. This shift in perspective is not easy to make. It requires focusing away from the technical challenges robots pose or their dangers, and towards positive yet critical, speculative yet founded, performative, and empathic explorations of how best to live with robots.

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