3. Making Robots: In/Animacy Attributions in Robotics Research and Development

3.1. Complex Epistemic Practices in Long-Term HRI

Contrary to what countless headlines in the news suggest, robots are not coming to us from the future or stepping out of science fiction movies (cf. Chapter 5). All real-life robots – from the huge industrial robot arms hidden in factories to the small vacuum cleaning robots in our households – were developed and constructed by human researchers, engineers, and workers.

Robotics research and development (R&D) takes place along a spectrum of private, academic, and commercial contexts: From small-scale development projects run by one person to huge robotics institutes with hundreds of employees; from tiny startups to big industrial players with dedicated robotics R&D departments; from hobby inventors and nonprofit organizations, academic research institutions and public-private partnerships, to purely profit-oriented businesses. In these environments, roboticists build robotic hard- and software from scratch or by combining existing components. They develop new robots, assess and improve features of existing robots, and deploy them in new application scenarios.

This chapter makes an empirical stop on our tour along the life cycle of robots at one specific section of this spectrum of robotics R&D: the academic context. Without presuming that observations made in this one particular context can be generalized to the whole spectrum, this chapter's observations will nonetheless be able to give crucial insight in the unique relationship that robotics professionals have with the robots they develop, build, and work with.

The special focus of our interest is, of course, on whether and how robots are perceived and represented as quasi-animate entities in this particular context. One could assume that, due to their expert insight, roboticists would

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - [CC BY-NC-ND]

be less susceptible than non-experts to attributing characteristics of living beings to a robot. After all, contrary to lay users of robot technology, roboticists usually have expert technical knowledge about a robot's hardware setup, and know exactly which control algorithms are responsible for the robot's performance. The present chapter will counter this assumption by drawing on observations made in interviews with roboticists working in university robotics laboratories. It will show that these roboticists do in fact routinely attribute animacy to their robots. Crucially, they do not do this in the form of an inflexible, one-sided attribution, but by constantly switching between attributive perspectives on the robot. We will see that this practice of representing the robot as both an inanimate object and an animate being is an integral and constructive aspect of roboticists' work.

As discussed in Chapter 1, our question is not whether humans (here: roboticists) are correct in attributing inanimacy or animacy to robots. Instead, we will explore how, and with which discursive and material consequences, these attributions are enacted (cf. Suchman, 2007, p. 2). In this, we follow the academic tradition of the science and technology studies (STS), as well as ethnographic and discourse analytic "laboratory studies". It is not a surprising insight per se that the professional environment of robotics research and development is a setting for complex epistemic practices. We know from existing research in STS that scientists' interactions with technical artifacts are a crucial and constructive aspect of the knowledge production process. As discussed in Chapter 2 (Sections 2.2 and 2.3), it was on the basis of their observations of professional practices in scientific laboratories that STS scholars first articulated the crucial impact of technological and other nonhuman artifacts on practices of scientific knowledge production (e.g. Knorr-Cetina, 1981; Latour & Woolgar, 1986; Lynch, 1985). One central observation of this research was that the process of knowledge production is not a smooth, controlled process. On the contrary, everyday academic work was shown to be a mess of trial-and-error and tinkering (Knorr, 1979). With this in mind, we will approach the context of robotics R&D practices as an opportunity to learn how roboticists' interactions with the robot technology they employ and construct not only shapes the technology itself, but also the discourse about the technology – both within and outside of the R&D context.

This chapter will show how a R&D process dominated by constant experimenting, tweaking, customizing, and being confronted with unplanned results, contributes to roboticists' attributions of animacy to the robots they work with; how the constantly changing demands and challenges of roboti-

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - [CC BY-NC-ND]

cists' professional lives make their ability to playfully balance and switch between seemingly contradictory perspectives on a robot crucial and constructive.

A connection of the discussion of technical agency (via laboratory studies) to the laboratories where robots are developed appears to be quite obvious. After all, robotics is a technology featured heavily on the stage of the technical agency discussion (cf. Chapter 2, Section 2.2). Nonetheless, the particular case of roboticists' research and development practice has received little academic attention so far. One of the few studies looking explicitly at roboticists' work from an STS perspective is Andreas Bischof's (2015, 2017a) work on epistemic practices in social robotics. Bischof analyzes the practices and strategies employed by social robotics researchers and engineers in solving the "wicked problem" (Rittel & Webber, 1973) of deploying socially interactive robot technology into everyday contexts. The specific question of whether roboticists attribute animacy to their robots is only touched indirectly, however, insofar as Bischof observes roboticists' staging practices in the context of demonstrations and science communication efforts (which we will explore in Chapter 4).

Most other research with an interest in animacy attributions to robots – predominantly in the field of human-robot interaction (HRI) studies – focuses mainly on the interaction of lay users with robot technology (cf. Chapter 2, Section 2.1). Moreover, the empirical studies in the context of these research efforts usually take place in rather artificial laboratory environments, instead of observing spontaneous human-robot interaction in the field, and only look at very short periods of interaction. These constraints are primarily owed to the limited spread of robot technology in everyday environments. This means that there are only few opportunities for field research on long-term human-robot interaction. Interactions with the consumer robot applications available on the mass market today (mainly cleaning robots) could provide the opportunity to study long-term interactions in customers' everyday environment. Also the everyday work of machine operators working with large industrial robots, for example in the manufacturing industry, could serve as fields of research. However, the robots employed in these specific contexts are usually not considered socially complex enough to be of interest to HRI researchers. The underlying assumption being that non-socially interactive and non-humanoid robots do not provide enough opportunity for research-worthy interactions.

The widespread approach of researching only short-term interactions with non-expert users in controlled laboratory settings disregards a whole

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - CC BY-NC-ND

group of users, who do in fact have long-term and hands-on experience with robots: Roboticists – the engineers and researchers who develop the very object of interest. After all, with complex and interactive robot technology not yet being freely and affordably available to the average consumer, robotics laboratories are one of the few contexts where intensive long term-interaction with robots can be observed today.

An additional reason for the lack of scholarly attention to the robotics R&D context might be that "roboticist" is a relatively new profession. Few researchers and engineers who identify as roboticists today have a degree in robotics, as degree programs offering dedicated robotics training are a relatively new development. Most who work in robotics R&D today have an electrical or mechanical engineering, or computer science background. The heterogeneity of the whole discipline is also reflected in the composition of R&D teams, each roboticist bringing with them the practices of their original field(s) of training. At the same time, not every researcher or engineer working on robots will call themselves a roboticist. Reasons for this are the lack of consensus of what a robot actually is (cf. Chapter 1, Section 1.5) and the fields' wide overlaps with other disciplines, such as artificial intelligence and automation engineering.

3.2. Approach

Cases and Method

The focus of this chapter will be on observations made during semi-structured narrative interviews with eight roboticists (referred to in the text as R1–R8). The interviewees were employed as doctoral and postdoctoral researchers at robotics laboratories at the computer science, electrical engineering, and computer engineering departments of a large technical university in Germany. Despite its small size, this sample of cases was able to provide a range of perspectives and valuable insights into roboticists' R&D work in an academic context. At the time of the interview, half of the interviewees worked with robots that had some vague humanoid features, such as arm-like manipulators or a "head" at the highest position of the robot body. Two worked with "mechanical" looking robots like drones or small industrial robot arms. However, all of the interviewed roboticists had experience with more than just the robot type they currently worked with. They had encountered a range of

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - [cc] BY-NC-ND

robots in their earlier work, at conferences and trade fairs, and in their private lives. Their experiences with robotics R&D were not only based on the work at their current workplace, but also on their experiences at the various international robotics research institutions they worked at during earlier stages of their career.

All participants signed a standard declaration of consent and received no compensation for their participation. The interview sessions entailed relatively focused questions about the roboticists' everyday work practices with robot technology in general and specific robotic artifacts, as well as the discursive practices within their teams. Furthermore, the interviewees were encouraged to narrate freely about the relationship with "their" robots and to reflect on which role robot technology played for their professional lives. Four of the interviews were conducted in German; quotes from these interviews have been translated into English by the author of this book. The other four interviews were conducted in English. However, as English was not the first language of these interviewees, it was, in some cases, necessary to slightly edit direct quotes for the sake of comprehensibility. All edits are indicated by square brackets.

All interview transcripts were analyzed following a qualitative content-analytic approach (Mayring, 2010). Analytical categories were developed inductively and iteratively from the material, the central criterion being instances of discursive and non-discursive animacy attribution to robots in the wider sense (including attributions of physiology, sensory experience, cognitive processes, intentionality, sociality, personality, emotion), as well as hints to practices of staging robot agency and animacy (e.g. in the form of a purposeful backgrounding of remote controlling of robot activity).

Chapter Structure

The present chapter is structured along its main conclusions. First, it will focus on the central, cohesive role of the physical robot platform for robotics R&D teams (Section 3.3). Second, the chapter will show how robots' crucial role as feedback-givers in the R&D process contributes to them being perceived as valuable team members (Section 3.4). Third, we will see how robot's often unpredictable behavior during experimental periods of the R&D process act as a perceptive trigger for attributions of animacy (Section 3.5). Finally, the chapter will show that a constant switching of perspectives and attributions

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access -

of in/animacy to robots is an integral and constructive aspect of roboticists' work (Section 3.6).

3.3. The Robot Body in the Center of Attention

Robotics researchers and engineers are often depicted in the media next to a robotic platform, sometimes with their arm draped around it in a companionable manner. In their actual work life, many roboticists spend the majority of their time in front of a computer. Most roboticists interviewed for this book pointed out that working with and on a physical robot platform is only one aspect of their work. Usually, a lengthy period of working in a software environment precedes any practical work with robot hardware. Only after a control algorithm has been developed to a certain point can it be implemented and tested on a physical robot platform. However, even during the period spent mostly at a computer and not (yet) physically near the actual platform, the embodied robot is always in a roboticist's focus of attention.

One reason for this is the robot's unifying role within a roboticist team. The term "robot platform" reflects this role: The robot serves as a shared platform for the team members' different tasks. As robotics is not a homogenous discipline with standardized terminology and methodology, researchers and engineers working in robotics laboratories usually come from a range of different backgrounds. Most trained as electrical, mechanical, or computer engineers. Increasingly there are also roboticists with a background in more "exotic" disciplines, such as cognitive psychology or user interaction design. Frequently, researchers from different academic backgrounds and with slightly different research interests cooperate in a robotics project. Therefore, "roboticists teams can have as many scientific and non-scientific goals as a robotic system has relevant components" (Bischof, 2015, p. 38; cf. Meister, 2011, p. 109), which can make cooperation and communication among the different team members a challenge. In this context, the robot platform provides a shared focus of attention and action – taking the role of what STS calls a "boundary object" (Star & Griesemer, 1989; cf. Bischof, 2015, p. 38). For example, R4's research project had dedicated roboticists working on separate components of one robot, "because everyone has their sub-field for which they are

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - [cc] BY-NC-ND

the expert" (R4.3-00:03:24-4[1]). Some developed pressure sensors for its "skin" surface, some worked on its navigation system, some on the control of its manipulators ("arms"), and some on the user interface. The common goal of developing separate robot components or algorithms and integrating them in a complex robot platform brought all team members together.

This is a typical situation for academic robotics R&D. In contrast to commercial robotics R&D, the majority of robotics projects in academia do not produce a finished, marketable robot platform. Instead, the goal is usually to either incrementally improve certain technical features, or to apply existing technological solutions in novel ways. Either way, there is usually an expectation to present the results in a way that highlights the platform's applicability to a real life problem. As discussed in Chapter 1 (Section 1.2), there is a strong, mainly politically driven, expectation to deploy robot technology in as many contexts as possible. This is in part fueled by an international "arms race" for shares in the rapidly expanding robotic market (Bischof, 2017a, p. 138): "Each time a robot acquires a new capability, a search for applications that can take advantage of that new capability follows" (E. S. Kim et al., 2012, p. 3). One consequence of this race is that the enormous funding sums poured into robotics research on the national and international level are often contractually tied to the development of demonstrable, preferably even marketable, robotic applications. In practice, this challenge of finding an impressive application is another factor keeping the physical robot at the team's center of attention.

Theoretically, it would be possible to develop and test robot control algorithms with a simulation of a robot in a virtual environment. However, this is only possible up to a certain point of complexity. For most roboticists, the final objective is to apply their work in the real world, to modify the physical environment with their robot. If this is the goal, then working with a physical robot platform is basically inevitable. R3 explained: "I use [the robot platform] because I need [it] to test the algorithms. I can test with synthetic data, but it's not the same" (R3.3-00:07:07-1). Even when the expected end result is not a fully marketable, deployable robotic platform, an underlying expectation remains that roboticists prove the success of their work with a physical demonstrator. For many, especially high-level, robotics conferences and journals experimental proof is even a prerequisite for publication. Here, demonstrations – usually in the form of laboratory experiments documented on video – are

1 The numbers after this and the following quotes refer to the position in the audio transcript of the interview.

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - [cc]

required to show that the theoretical work described in a publication actually works in the real world. R3 explained that their institute's director insisted that "if [he] do[es]n't see it working he do[es]n't believe it" (R3.5-00:08:09-9). In Chapter 4, we will dive deeper into the context of robotics demonstrations, and explore how they employ attributions of animacy not only to prove a robots' functionality, but also to illustrate its applicability to desired use scenarios. For now, our focus shall remain on the work that roboticists do long before a demonstration.

In spite of the general expectation to produce demonstrable results, not all roboticists work with a physical robot. Two of the interviewed roboticists reported that in their specific sub-field it was acceptable to publish results of just a simulation study. However, they themselves were critical of this practice. R3 pointed out that "testing with synthetic data [is] not the same. [It] seems kind of fake, because you can tweak the data" (R3.3-00:07:07-1). Taking the step from a simulation environment into the real world poses a completely new set of challenges. R7 reported that their research group's simulation-only approach and avoidance of real-world experimental testing resulted in their robots not being ready to use by the end of the project (R7.1-00:07:52-9). While in a simulation the environment is controllable, physical reality comes with all kinds of interferences which can disrupt a robot's performance. We will come back to this phenomenon in Section 3.5.

The robot's status as a boundary object for the team is further amplified by the amount of physical work going into it. Affordable standardized robotics hard- and software has only relatively recently become available. Consequently, most roboticists are required to customize existing hard- and software, or even to create it from scratch. As Andreas Bischof (2015, p. 62) points out, the required time- and labor-intensive tinkering work (cf. Knorr, 1979) sometimes makes the final result somewhat of a bricolage (cf. Lévi-Strauss, Weightman, & Weightman, 1966). Indeed, also the robots used and built by the roboticists interviewed for this book were a conglomerate of commercially available modules and homemade components. Almost all of the interviewed roboticists reported to be involved in this building or customization process. While none of their platforms were built completely from scratch, all were in some way custom built from off-the-shelf modular parts. This modular approach is a fairly typical practice. Building a robot from scratch would consume too much time and individual modules are readily available from various manufacturers. These materials are costly, however, so their use depends on how much funding is available to the individual project. In order to

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - (cc) BY-NC-ND

save money, nonfunctional or unused platforms are often dismantled and the parts reused for new projects. R3, for example, described how budget restrictions in a former project forced them to laboriously build their hardware from scratch, resulting in less time being available for the actual scientific work.

It is here, with the roboticists' tinkering practices, where we encounter the first obvious instances of animacy attributions in the present chapter. When speaking about the construction process – be it building a robot from scratch or combining existing modular parts – the interviewed roboticists frequently referred to their robot platforms with terms usually reserved for living bodies. Even when the robots in question did not have a humanoid design, their individual parts were discussed as if they were biological body parts. R4 was quite aware of this, describing it as "projecting the [robot's] form on a humanoid form" (R4.3-00:07:43-4). The practice is partly rooted in a need for easy communication. When referring to the topmost part of a robot, the term most easily understood by everyone is simply "the head" – even when the robot does not have an explicitly humanoid design.

However, the practice goes beyond just communicative ease. By choosing the placement of components on the robot, roboticist can influence its final shape – and its resemblance to an animate being. One of the interviewed roboticists explained with obvious joy how they and their colleagues decided to make their – quite "mechanical" looking robot – more animate-appearing: When they had to place three antennas on the robot, they decided to install two of them on the sides of its "head", and one on the very back of its chassis. This ended up giving the robot "ears" and a "tail".

Projections of human physiology on the robot were also reflected in roboticist's discursive practices. Not only body parts, also physiological processes were attributed to robot platforms. Especially situations in which a robot did not function as intended were described with terms of illness and injury. R4 vividly described how their robot had a "heat stroke" (R4.2-00:00:55-3) due to its cooling system failing. The robot also suffered a "fracture[d bone]" when one of its wheels broke, causing it to "need a doctor" (R4.3-00:05:22-5). As we will explore in depth in Section 3.5 of this chapter, situations like these, in which the robot behaved in an unexpected way, were among the strongest triggers for animacy attributions to robots in this particular context.

The practice of customizing robot hardware, as described above, is another typical context for the attribution of physiological processes. When R1 explained how they used components of an older platform to improve a newer

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - [CC BY-NC-ND]

one, they described it as "cannibalizing" the old robot. It had to "offer its health for the good of the other" robot (R1.3-00:04:15-9). In one of the robotics laboratories visited for this book, there even was a communal robot "cemetery". On a dedicated shelf labeled "Nao[2] Cemetery", nonfunctioning robots and robot parts waited to be "dismembered" and "revitalized" as spare parts for newer robots.

3.4. The Robot as Tool and Team Member

In contrast to the references to the robot as a biological body described in the previous section, when asked directly which role the robot played for their work most interviewees spontaneously referred to it as a technical object. Several called it a research tool, explaining that it was used "for developing … ideas" (R3.8-00:00:06-0) or "to evaluate … computer models" (R2.2-00:01:54-0). A robot used as a demonstrator was a tool "to show … research" (R8.1-00:06:38-8). Some roboticists – who might have sensed the interviewer's intention of feeling for hints of animacy attribution – stressed that for them, the robot was "a pure tool" (i.e. "nothing but a tool"; R7.4-00:06:38-1), that "it stay[ed] a tool" (R2.3-00:02:47-1).

Interestingly, it is exactly this function as an important research tool that also appears to trigger quite a different perspective on the robot. R1 described the robot as a client. They explained that the robot is "the first user of what [the roboticist is] thinking" (R1.2-00:01:08-6): "I work on … algorithmic functionalities [… which …] enhance the robot's capabilities, so … I'm working for the robot" (R1.2-00:02:44-1). This relationship was perceived as reciprocal: not only is the roboticist working for the robot, the robot is also working for the roboticist. When serving as a test platform for new control algorithms the robot acts as a feedback-giver. When a robot is tested with a new version of a control algorithm, its performance is observed and behavioral data recorded. For example, a log of the executed program can be saved, or the robot's behavior can be recorded on video. This documentation of the robot's performance is then used to improve the control algorithm. In order to be able to progress in their work, roboticists therefore depend on the robot's behavioral feedback – roboticist and robot working together in a reciprocal relationship. As R1

2 Nao is the name of the robot model.

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access -

explained: "If I work for the robot to enhance its capabilities, then the robot uses these capabilities to help me" (R1.2-00:03:18-6).

Karin Knorr-Cetina (1997) diagnosed a similar reciprocity in her research on sociality with objects. She observed a "mutual providing of self and object", for example in situations where "a scientist tries 'to make sense' of the signs given off by an object to determine what is further lacking, and what she should therefore be wanting to do next" (ibid., p. 23). Knorr-Cetina goes so far as to argue that this kind of human-object mutuality and solidarity, "through the interweaving of wants and lacks specifies a kind of backbone of reciprocity for an object-centered sociality" (ibid., p. 22).

This reciprocity is also reflected in how the interviewed roboticists perceived the distribution of agency between themselves and the robot. They described the robot's performance as a reflection of both their agency and the robot's own agency, both perspectives contributing to the robot being perceived as an animate entity. On the one hand, several interviewees explained that their robot's behavior was always a representation, or even embodiment, of their and their (human) colleagues' work. It was clear that "there is a lot of the programmer … in the robot" (R3.2-00:03:07-6). Here, the driving force for the robot's actions was perceived to be the roboticist responsible for the program the robot was executing: "You do always know that [the robot's behavior] is caused by me, and it's not like the robot made a rational decision independently"[3] (R7.5-00:02:22-9).

A similar perceived extension of the self, or of other humans, into a robot was observed in earlier research. Thomas Fincannon and colleagues (2004) described how members of search and rescue teams perceived their non-humanoid remote-controlled robot both as an embodiment of the other human team members controlling the robot from a distance and as a team member in itself. This perception was even reflected in their behavior. They treated the robot with similar social rules as other humans, for example by keeping a certain spatial distance, holding eye contact with the robots' camera, and preferring when the robot faced in the appropriate direction.

In the present study, despite the perceived presence of the roboticist in the robot, robots were also perceived to be their own source of agency. This was especially the case for situations in which a robot behaved in an unexpected way, for example, when it malfunctioned. R1 noted that "[a malfunction] is

3 Translated from German by the author.

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access -

[the] fault of the machine, but also of the humans" (R1.3-00:01:08-5). They explained further:

> "When the robot deals with some situations … you are all happy, 'Ohh, he can make, she can make it', 'it worked'. Okay, from one side, [it] can also be kind of [a] cheer for our own work, if it works. But also it is kind of part on the robot [laughs]. So, some of the credit goes to the robot [laughs]." (R1.4-00:03:03-0)

Here, we can observe a perceived distribution of agency between the roboticist and the robot (cf. Rammert & Schulz-Schaeffer, 2002b). One could even interpret it as a distribution between two equally important actants, in the sense of Actor-Network Theory's generalized symmetry (ANT; e.g. Latour, 2005; cf. Chapter 2, Section 2.3). In any case, the quote above illustrates nicely how this distribution is often enacted: By a constant switching of attributions on a discursive level. This switching was also observable with R2, who changed the subject of one sentence between themselves and the robot several times: "The robot can do, … you can do dozens and dozens of things, it can do" (R2.3-00:08:38-1).

The unique collaborative relationship between roboticists and their robots was, however, most obvious when several of the interviewed roboticists explicitly called the robot a research companion, or even a member of their research team:

> "It's kind of part of [the] family." (R1.3-00:00:03-0)
> "It is a part of the team, it's a fact!" (R1)[4]
> "It's more of a team member." (R4.1-00:07:14-9)
> "They are team members in some sense." (R8.4-00:05:08-8)
> "… some kind of research companion." (R2.3-00:02:47-1)

Interestingly, the robots' role as team members was not obviously reflected in their given names. Only few robots were referred to by a human name. Some were named with an acronym, often involving a pun. Some were not given an individual name at all, but instead were referred to by the brand or model name, or an identifying inventory number. This was in spite of the robots being perceived not as any other team member, but as one making a significant contribution to the R&D process. After all, without the robot's

4 No audio recording timestamp available as the statement was made by R1 after the end of the official interview.

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - [cc] BY-NC-ND

constructive feedback, the roboticist would not be able to continue improving their control algorithms. R3 explained:

> "It's really important to have the robot as a member of the team because it's actually a really valuable asset. … In robotics, there is something that happens that if you don't have [the robot] you can't work." (R3.5-00:07:00-7)

This dependency on the robot coworker and its influence on the robot's perceived value as a team member was similarly observed by Julie Carpenter (2013). In a study on military personnel employing robots for explosive ordnance disposal (EOD) Carpenter observed that the (non-humanoid and non-autonomous, i.e. remote controlled) robots were sometimes perceived as valuable team members. Also in this specific life-and-death field of application, there was a strong dependency on the robot's performance. Deploying a robot to remove explosive ordnance, and to potentially be destroyed in an explosion, palpably saves the lives of those soldiers who without the robot would have to approach the ordnance themselves (Sandry, 2015b). This lifesaver role of EOD robots is such a strong narrative that even the US Department of Defense's press department regularly uses it in the context of their public relations efforts (Roderick, 2010; cf. Chapter 4, Sections 4.3 and 4.4).

3.5. Testing in the Real World: The Unpredictable Robot

In the context of robotics R&D, a robot's behavior during its crucial job as feedback-giver is one of the strongest perceptual triggers of animacy attribution. After all, the most interesting feedback for a roboticist is when the robot does not what it is supposed to do. This is inevitable, when a system as complex as a robot is let loose in an environment as complex as the real world. Transferring work from simulations to a physical robot is rarely a smooth process, as R3 explained:

> "From the point of view of the experimentation you can test with images, or with data, recorded data. But then, when you go to the actual robot, a lot of things happen. … Things are moving, changing. … We live in an uncertain world. And only when you get to that stage [of experimentation] you realize [that]." (R3.1-00:08:59-0)

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - (cc) BY-NC-ND

> "Working with the platform is … not as comfortable as working with your computer. … There is always something that doesn't work." (R3.1-00:04:14-6)

The frustrating process of dealing with unexpected robot behavior, tweaking and tinkering until the robot does what it is supposed to do, is a central aspect of this particular phase of robotics R&D. Robot platforms can be incredibly complex pieces of hard- and software. This is especially the case in projects where a heterogeneous team of roboticists works together on a shared customized, or even custom-built, platform. Some interviewees explained that their knowledge of the robot's complexity alone, without even observing its behavior, was enough for them to attribute animacy in the robot:

> "[The robot is] something that has different modes, different systems, that is moving around … Something that has some process going on is something lively." (R1.4-00:02:03-5)

> "As the system is so complex it also has some kind of life of its own." (R4.1-00:09:00-0)

Sometimes it is actually not a robot's complexity, but its "dumbness" that causes unexpected and seemingly intentional behavior. R3 described a robot that was supposed to ignore certain light sources in the environment. When this functionality failed, the robot oriented its movements towards lights in the room. The roboticists then explained to visitors that "[it] likes the lights" (R3.2-00:06:15-5). The seemingly intentional behavior of the robot was actually the result of a malfunction. For the interviewed roboticists exactly these "dumb" behaviors acted as the strongest triggers for animacy attribution, by making the robot appear willful. R3 observed: "When [the robot] gets stuck all the time in a particular place … it kind of gives [the robot] a bit of personality" (R8.3-00:06:39-4).

Crucially, a roboticist might have expert knowledge only about one particular component of a robot platform. The technical intricacies of other components – those, which other team members are responsible for – might be partly, or even completely, closed off to them. In practice, this means that when a system as complex as a robot is deployed in the real world – no matter how closely controlled the experimental setting is – its performance can be quite unpredictable. Noisy data transmission, ambient temperature, floor texture, air movement, power fluctuations, spilled coffee, crumbs lodged in

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - (cc) BY-NC-ND

a crease, vibrations from a train passing by outside: countless environmental factors can disrupt the proper functioning of the robot, or at least lead to situations which would have never occurred in a simulation. These challenges apply especially to application scenarios that are typical for "New Robotics", where robots are not confined to structured environments but expected to act and navigate in very complex, frequently changing surroundings (cf. Chapter 1, Section 1.1). R4 described how their robot struggled with the summer heat:

> "It happens frequently that some kind of errors occur which you can't explain. … Sometimes we have problems with heat dissipation. In the summer, when it's quite hot, the computer fans will go faster and faster, and at some point he just doesn't want anymore." (R4.2-00:00:55-3)

The more realistic the experimental setting the more can go wrong. Especially challenging scenarios involve humans – their performance is notoriously uncontrollable. Consequently, working with a physical robot in an experimental setting almost inevitably leads to situations in which the robot does not behave according to any preexisting plan, but simply "does what it wants". Practical roboticist work therefore involves dealing with countless breakdowns and interruptions, as well as hours of troubleshooting and debugging. Even the most experienced roboticists will have to face situations in which they do not know why the robot just did what it did. When working with autonomous robots, a roboticist might have no information at all about what is happening "inside" the robot. It becomes a black box – meaning that what exactly the control algorithm is "doing" at a certain moment can only be inferred from the robots observable behavior.[5] It is these situations in which attributions of animacy are most common. R4 explained how they observed themselves having two competing explanations for a robot's unexpected behavior:

> "At some point [the robot system] gets arbitrarily complex and what you're looking at in the end is the [robot's] behavior. And if you're immersed in the subject matter then maybe you can explain the [robot's] behavior. … If you aren't immersed in the subject matter, then you only see the behavior. Which you then can either explain in a more abstract way: 'Well, the intention was for him to drive from A to B' or something. 'And for some reason this doesn't work that well right now'. Or you see it as 'Well, he has some kind of task and

5 Cf. the concept of the "nontrivial machine" (von Foerster, 1993).

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - [cc] BY-NC-ND

> for that he has to drive from A to B, and he hasn't done this task that well. He must have a bad day." (R4.4-00:02:10-0)

R4's description of their two very different interpretations of the robot's behavior can serve as an example for the final crucial observation of this chapter: For the roboticists interviewed for this study, attributions of animacy and inanimacy were reflections of the changing perspectives they routinely take on their work.

3.6. Switching Perspectives: In/Animacy Attributions as Constructive Practice

Roboticists in academia do not only work in closed-off laboratories, they do not only talk about their work among like-minded peers with similar expertise. Just as in other disciplines, their work is embedded in the complex environment, practices, and discourses of their field – and sometimes even breaches the border to the realm of entrepreneurship. They present their work in discussions, presentations and publications, to academics of other (sub-)fields, to reviewers, to funding agencies, and to the lay public – be it indirectly through journalists, or directly in science communication contexts (which we will explore further in Chapter 4). Researchers balance the – often contradicting – demands and needs of their academic peers, their disciplines, their funding organizations, potential investors and customers, and the wider public (Möllers, 2015, p. 143; cf. Jasanoff, 2001). In practice, they "shift… from one social world to the other by mobilizing different cultural registers" (Möllers, 2016, p. 19). For the roboticists interviewed for this study, this switching of worlds was also mirrored in their switching of perspectives and of attributions of in/animacy to robots.

A roboticist's perspective on their robot can also change with the stage of the research process. A robot can at first be a tool for the development of a software, which is later used on the same robot, which is then perceived as a demonstrator or a completed creation. R2 described their constant change of perspective:

> "I work with the robot. So, not on the robot. … Eventually, when the work is finished after all the years [laughs] then I actually worked on a robot control system. Only to get there, now, I have to work with the robot." (R2.3-00:01:19-1)

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - [cc] BY-NC-ND

R4 explained that their attributions of animacy differed strongly between the robot they worked on (or with) in the laboratory, and robots they encountered in other professional situations like a conference or trade fair, or in their private life – for example when using a lawnmower robot. They even switched perspectives on the lawnmower robot, viewing it either from what they called a "psychological" perspective, where the robot's behavior would be attributed to some kind of personality ("has a bad day", R4.4-00:01:49-0), or from a "technical" perspective, where the behavior would be explained via the robot's control algorithm and its interaction with the physical environment.

Specific discursive practices were likewise dependent on the social context. In some cases, animacy attribution was reflected in roboticists using gendered pronouns ("he", "she") for their robot. However, some apparently perceived their own behavior as unprofessional. During the interview, they interrupted themselves with self-conscious laughter when talking about gendering the robot. Some automatically used a gendered pronoun when talking about their robot, but quickly corrected themselves, repeating what they said with the neutral pronoun "it". R3 mentioned that they had to take care not to use gendered pronouns in scientific publications – presumably, because that would be considered unprofessional:

> "… something that you put in a robot and he start[s] trying… 'It'. Sorry, I always say 'he' [laughs]. … I have to change all the text I write. [laughs] To write 'it'." (R3.3-00:07:20-1)

The roboticists' constant switching of attributions was most obvious on a linguistic level, their wording frequently reflecting the apparent contradiction of animacy and inanimacy. For example, R4 observed that for them the robot was three things at once: "team member, tool, platform to test things" (R4.1-00:09:00-0).

Phrases like "but still…", "but somehow", "but also…", "or actually…", "but maybe" were uttered by almost every interviewee in this specific context.

> "You are aware that it is a technical object. But still, when the robot deals with some situations and some things you are all happy, 'Oohh, he can make, she can make it', 'it worked'." (R1.4-00:03:03-0)

> "Of course it's a machine. But when it gets stuck all the time in a particular place. I don't know, it kind of gives them a bit of personality or something." (R8.3-00:06:13-3)

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - [cc] BY-NC-ND

> "You never think that the robot is doing something intelligent somehow, because there is a lot of the programmer still in the robot. But somehow you ... sometimes you just think it's doing something you never expected it to do [laughs]." (R3.2-00:03:07-6)

In some cases, the multiplicity of perspectives took on almost absurd dimensions. For example, R2 stated that their robot "is [a] robot companion. Some kind of research companion" (R2.3-00:02:47-1), and then immediately changed their mind: "Actually that goes too far, 'companion', because I would say it is a research tool. So, it is a tool, it stays a tool for me" (ibid.). R8 took the other direction, first stating that they "don't think anyone here feels so much attached to robots ... that they say that they see them as pets or colleagues" (R8.4-00:05:08-8), and then immediately adding that "of course, they are team members in some sense" (ibid.).

While some denied attributing any animacy to their robots, others openly embraced it, and understood it as a natural aspect of their work life. For example, while R2 stressed that the robot was "a pure technical object" (R2.2-00:00:50-0) and "nothing else" (R2.2-00:01:54-0), R5 observed that "[this] does happen when you deal with a robot for such a long time. You do humanize the robot" (R5.3-00:01:37-0). R1 outright stated that their robot "is a part of the team, it's a fact!".[6]

Julie Carpenter (2013) similarly found that the members of military bomb disposal squads she interviewed had contradictory emotions and reaction to their robots, fluctuating between playful affection and awareness of the robots' inanimacy. They described their robots (and not other machines) with anthropomorphic and zoomorphic terms, at first openly admitting to anthropomorphizing their robots, but then immediately downplaying it, explaining it as a joke. Also here, the constant switching of perspectives seemed to be a constructive way of dealing with the complex, sometimes contradicting, challenges of the professional work environment: The soldiers depended on the robot because it spared them from having to approach explosive ordnance – giving it the status of a valuable team members –, but also had to be able to send the robot to its possible "death" without hesitation.

6 No audio recording timestamp available as the statement was made by R1 after the end of the official interview.

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - (cc) BY-NC-ND

Similarly, for our roboticists, while the superficial effect of switching perspectives and attributions is that of an ambiguous animacy, it is not merely a reactive practice. It is not only a way of dealing with the peculiarities of the technological artifacts they are exposed to on a regular basis within the context of their profession. It also is a constructive practice, in the sense that being able to take on different perspectives on the robot enables roboticists to perform adequately in different contexts of their profession. It reflects roboticist's parallel commitments to research, development, science communication, and entrepreneurship. On the one hand, it enables roboticists to see their robot as a tool for, or product of their work, and to be able to and to keep the emotional distance this requires. On the other hand, it enables them to acknowledge the robot's autonomy, the importance of taking its sometimes seemingly erratic behavior serious, and to use it constructively as feedback for the further progress of their work. Within a heterogeneous R&D team, playful references to the robot platform as an animate being reflect its agentic role as a feedback-giver and constructively supports the team's communication and collaboration.

3.7. Summary

Most research on human-robot interactions focuses on short-term encounters of lay users with robots in more or less artificial experimental settings. So far, little attention has been directed towards the context of robotics laboratories, which can provide a unique opportunity to study long-term interactions of humans with robot technology in a professional context. The present chapter explored this context with a small interview study, taking special focus on roboticists' attributions of animacy to their robots.

Despite their expert knowledge of robot technology, and their presumed professional distance, most of the interviewed roboticists regularly attributed animacy to the robots their worked with. They routinely took multiple, sometimes even seemingly contradicting, perspectives on their robots, constantly switching the level of animacy they attribute to them. These attributions were shown to be partly a reaction to the robot's design and behavior itself, and partly a reflection of the roboticist's unique and challenging work environment.

Roboticist teams' focus of attention is directed towards the robot by several interconnected factors: A strong political demand for applicable and mar-

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - [cc BY-NC-ND]

ketable results, as well as demonstrable platforms, and the resulting challenge of experimental work; the typically disciplinary heterogeneous team structure, for which the robot platform serves as a boundary object by providing a shared focus of attention; and finally, the lack of standardized hard- and software infrastructure, and the resulting necessity of customization work.

Robots were shown to have a crucial role as feedback-givers in robotics R&D. The dependence on robots' contribution to the R&D process left the impression of a distribution of agency between the roboticist and the robot. Moreover, in the highly application-driven environment of robotics R&D, testing robotic platforms' performance not only in simulations but also in real life is a central aspect of roboticists' professional work. Through the friction caused by the interaction of complex robot technology and complex physical environment, roboticists are routinely confronted with unexpected, unpredictable robot behaviors. These can serve as a strong perceptive trigger and cause roboticists to attribute a self-will or personality to the robot. These attributions expressed themselves in the form of gendered language, but also in the form of references to the robot platform as a biological-appearing body, with body parts and even physiological processes. The most frequently observed practice was, however, that of regarding the robot platform as a valuable (if often uncooperative) member of the R&D team.

Crucially, we were able to observe that these attributions of animacy are not one-sided or enacted in a static or forceful way. Instead, the enactment of animacy attributions is highly situation specific, roboticists constantly switching between discursive and practical representations of the robot as an inanimate tool and the robot as an animate team member. This switching is not only a playful way of dealing with the unique characteristics of robot technology, but also a reflection of roboticists' professional practice. Attributions of animacy thus are an integral and constructive practice of robotics R&D, in that they allow roboticists to adapt flexibly to the parallel commitments and challenges of research, development, science communication, and entrepreneurship.

In other professional contexts, however – such as written research papers – attributions of animacy would be considered unprofessional, necessitating a different perspective: that of the robot as an inanimate machine. Then again, when promoting their R&D work outside of the immediate circle of academic peers it can be beneficial for roboticists to stage a narrative of the robot as an animate being. The next chapter will explore this context and show

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access - CC BY-NC-ND

that even more explicit attributions of animacy to robots can be observed in demonstrations, science communication, and marketing.

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access -

https://doi.org/10.14361/9783839455609-005 - am 13.02.2026, 14:15:31. https://www.inlibra.com/de/agb - Open Access -