Chapter 12

Human Proximity

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Being an engineer, it is always difficult to see through other aspects such as ethics, societal issues, etc. – definitely when working as a designer and visionary of new types of robots. This [social drama experiment with social scientists] really helped me a lot to see some other aspects related to ethics and society that I haven't experienced before. So, designers of new androids, robots, or humanoids must take these into consideration while at the same time not withholding their imagination for revolutionizing the field of robotics.

(Yannis, at a REELER outreach event, robot developer, SPECTRUS)

◀ Physical distances between robot makers and affected stakeholders, and their different understandings, values, or motives can result in a human proximity gap in robot design.

12. Human Proximity

Bridging the gap between robot makers and affected stakeholders through ethnographic inquiry

You will find here

- The ethnographers' self-reflective process
- Overview of human proximity gaps in robotics according to REELER data
- REELER findings on how current efforts to collaborate fall short
- Definitions of collaborative learning, core- and relational- expertise, proximity gaps, common language, and cultural brokerage
- Empirical examples of proximity gaps and possible solutions involving alignment experts
- Discussion of the potential contributions alignment experts could offer
- Recommendations and tools for building relational expertise

You will acquire

- Awareness of how alignment experts can help to uncover stakeholders, 'unforeseen' problems, motives, & the situated context
- Awareness of problems to be solved with robotics vs problems to be solved by other means
- Awareness of how to develop relational expertise and agency
- Awareness of how the social sciences might contribute to design and development processes through the involvement of alignment experts
- Awareness of the need for a new type of educated alignment experts that do not exist today

In the Introduction we introduce *The Human Proximity Model* (HPM), developed by the REELER project to illustrate how changes in collaboration practices may contribute to more responsible and ethical design of robotics. A central assumption of HPM is that human proximity is a requirement for collaboration. This means that collaborative learning requires humans to be physically (or virtually) in each other's presence.

> **Proximity gap:** *Physical and conceptual distance between persons, including differences in understandings, values, or motives (as illustrated in the Human Proximity Model).*

In this chapter, we present collaboration as it takes place in the bubble, and identify the gaps in motives and interests between robot makers and affected stakeholders. We then suggest an expansion of this model by introducing a version of collaborative learning that is attentive to affected stakeholder's motives for collaborating.

We argue that robot makers have ethical and financial incentives to further develop their collaboration skills as well as the scope of their collaborations. This will help create robots, which are useful to end users, have increased uptake, and avoid the pitfalls that result in sabotage and misuse, as identified in 10.6. We first introduce a novel way of facilitating collaborative learning through the help of alignment experts. Then we take a closer look at how robot makers collaborate with each other and end-users – and finally we discuss how our novel way of understanding collaborative learning may lead to closer proximity between robot developers and affected stakeholders. Lastly, we briefly present some of the REELER tools developed to enhance collaborative learning.

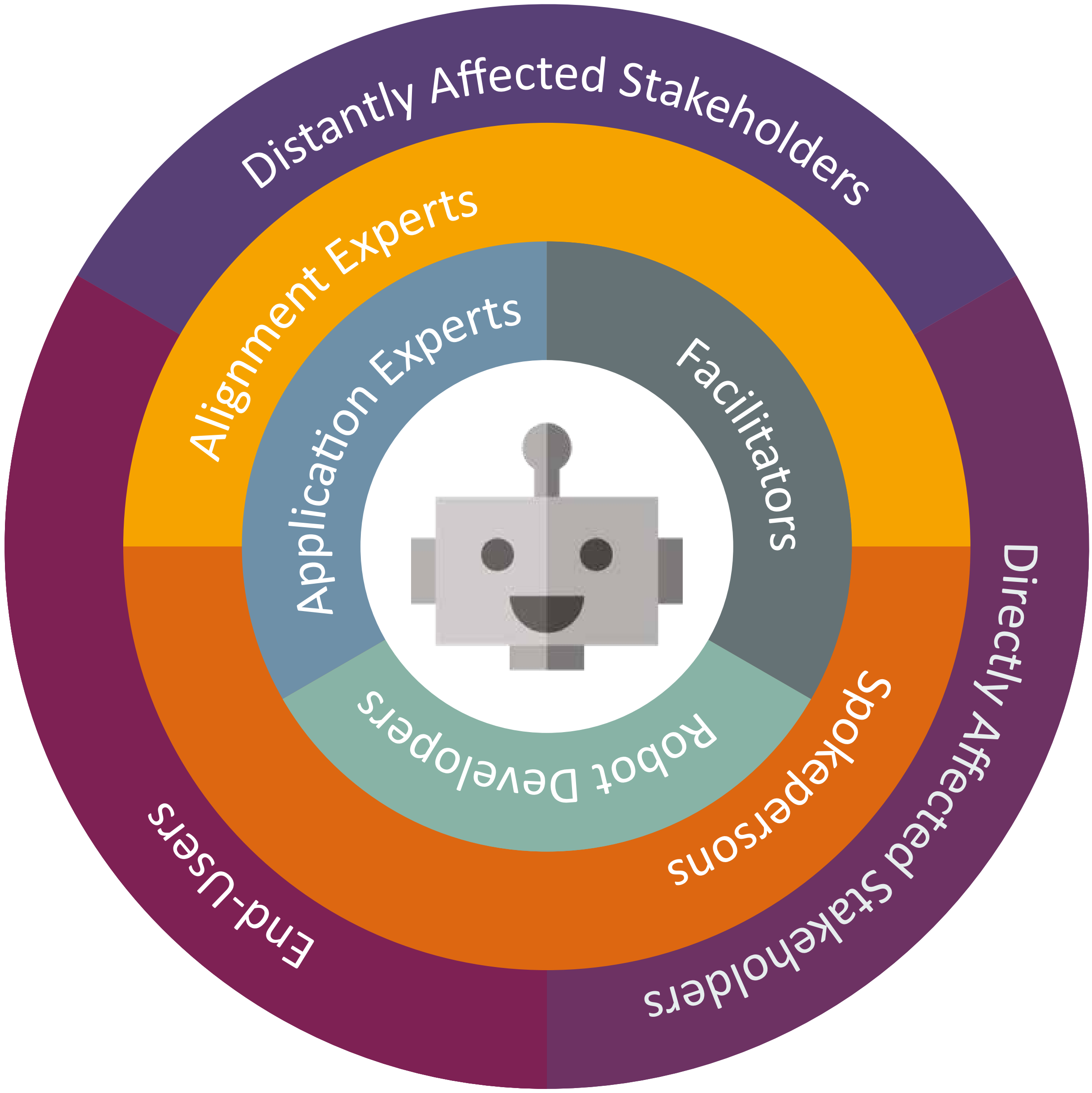


Figure 12.1. Alignment experts may bridge the proximity gaps between robot makers and affected stakeholders in robot development.

This chapter reflects on the needs discovered through ethnographic methods, and our own present-day inability to act as 'gap-fillers'. The previous chapters have presented a range of ethical issues emerging from a disconnection between robot makers responsible for the development of new robots and the affected stakeholders whose lives will be changed by these robots. This disconnection, or *proximity gap*, entails a physical distance between robot makers and affected stakeholders, but also differences in understandings, values, or motives. In the previous chapters, we presented some of the general proximity gaps disclosed by our ethnographic research. In this chapter, we discuss, from an etnographic point of view, how these gaps could be closed.

Through our research, we have acquired knowledge of robot makers' and affected stakeholders' different socio-material worlds and separate core expertise, including the understandings and values that influence their different motives in robot development (*see 2.0 Robot Beginnings*).[1] We hope that our findings can help serve as a first step towards increased proximity between robot makers and affected stakeholders, paving the way for aligning motives through **collaborative learning.**

Collaborative learning: *A process of alignment of different motives and expectations in working toward a common goal.*

1 *Robot Beginnings* (as well as *Collaboration in the Inner Circle* and *Gender Matters*) are for reasons of space not included in this printed version, but can be found in the extended online version of *Perspectives on Robots* at: www.responsiblerobotics.eu

It is essential to point out that collaborative learning occurs between people. It is thus important to identify the proximity gaps between people – i.e. robot makers and stakerholders – affected by their robots in question, and to close these context-specific gaps with increased alignment. Reflecting on the different core expertise the ethnographers, economists and robot developers brought to bear in the REELER project, we identify the need for a new type of education/profession which combines an etnographically informed understanding of affected stakeholders with knowledge of the technical and financial aspects of robot development. For this task, REELER proposes a new role in robot development – that of **alignment experts**. These experts must be educated in the social sciences (e.g., Anthropology, Sociology, or Science and Technology Studies (STS)) which emphasize methods for studying 'the other' However, while their core expertise is the understanding and translation of different motives and values between groups, alignment experts need a solid grasp of engineering and economics. This is necessary, if alignment experts are to facilitate collaborative learning btween actors with different core expertises (*see 1.0 introduction*).

Alignment experts: *Intermediaries working to align robot makers' and affected stakeholders' motives, based on empirical knowledge of both.*

This is not to say that alignment experts are the *only* solution. A lot of efforts have been made in the past and in recent years to close this gap and to ensure responsible ethical robotics by, for instance, introducing user- or human-centered design, by using application experts to understand a robot's context, by instituting codes of ethics for engineers, and by making policies and regulations.

Yet, we argue that experts in qualitative methods such as ethnography bring something new to the table, which helps robot makers lift the burden of their ethical responsibility. Instead of entering the robotic bubble as social scientists just helping robot makers in the inner circle (effectively acting as application experts), alignment experts would act as *cultural brokers* (*see section 12.3*) identifying values and motives in the spaces between robot makers and affected stakeholders to dispell assumptions about the other and increase mutual awareness.

In the following, we present examples from REELER's cases where ethical issues emerged, from an ethnographic point of view, in relation to the decisions made in design and development. Through these examples, we justify the role of alignment experts by presenting how we think they could have made a difference in these cases by increasing human proximity between actors in the inner and outer circles of the Human Proximity Model. This will entail identifying the separate motives, acting as cultural brokers to build a common language, and aligning these motives by facilitating collaborative learning. However, we are also aware that our present-day education as ethnographers may not have equipped us sufficiently for understanding the wider issues of how our findings affect business models, economy and technical engineering.

12.1 Identified proximity gaps

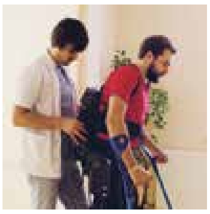
Across all eleven REELER cases, and the many robots represented in these cases, REELER identifies ethical and practical challenges occurring in the design and development stages, as well as during implementation of various robots. Here, we present a selection of these challenges to demonstrate the potential for involving alignment experts. Though some issues are tied to particular cases, many of the issues also go across cases (for instance the issue of normative understandings of end-user's body size and motives).


WIPER


WAREHOUSE


SPECTRUS


SANDY


REGAIN

Case	Problem	Role of alignment experts
WIPER	The technology repeats same mistakes as past technologies by not taking account of the workers' piece work situation. For the workers, time is more important to them than their own safety, therefore they will not use the robot if it is slow.	Observe the role of tools in the existing workflows of end-users and directly affected stakeholders, identify workers' motives (working quickly to earn a high piece rate), and thus foreseeing problems with the proposed solution. Save money by not repeating past mistakes.
WAREHOUSE	Task complexity is reduced by robotization, making already unappealing work even less engaging. There may be issues of sabotage of resistance. The work is more efficient and costumers can get their consumptions without human involvement. However, a lack of people may cause costumers frustration if something goes wrong.	Identify actual end-users (the few people left to operate robots), directly affected stakeholders (the few people left to work in the warehouse) and distantly affected stakeholders (who include costumers). Work on aligning motives to ensure the best result for all.
SPECTRUS	In hospitals, new automated robotic vehicles (e.g. delivering equipment or blood work) are shut off by patients or nurses, because they block elevators.	Identify end-users (e.g. nurses who benefit from not having to run after equipment) and directly affected stakeholders that are not intended as end-users and have their pathways blocked (patients, other nurses, e.g.) and take into consideration their training needs in the implementation phase.
	Implementation was complicated by differences in door types and worker body height in different regions and countries.	Investigate application sites with regard to physical environment in relation to culture.
SANDY	One robot, 15 years in development, could only work in very particular environments in Northern Europe, thus excluding other potential areas of application. Furthermore, it was developed in a place, where farmers where educated in the use of complex farming technology.	Identify different types of affected stakeholders who may benefit from a farming robot and help adjust the robot to other local needs (for instance small scale farmers in Africa). Identify affected stakeholders' need for re-education.
REGAIN	Overfitting to home layouts common to particular European regions hampered international dispersion. Furthermore, if the end-user is a patient, there is a tendency to overlook the nurses or physiotherapists as directly affected stakeholders, or a patients' partners', who would be involved in the patient's use of the robot at home (e.g. mounting a exoskeleton), in the development process.	Identify cultural integration challenges, like differences in environments (e.g. thresholds, tables, children's toys, pets). Identify directly affected stakeholders (e.g. nurses and/other patient's partner, e.g.) that might be essential to the robot's use – and help make a more inclusive design.

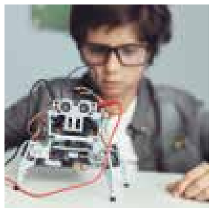

OTTO


HERBIE


COOP


COBOT


BUDDY


ATOM

Case	Problem	Role of alignment experts
OTTO	In this case the robot developers worked extensively directly with end-users. However, even here some issues arose because the robot was heavy and had to be re-assembled from parts. Working too closely with particular end-users may make them less likely to be outspoken and critical till it's too late.	Identify the 'real' motives for working on and with robots and help going beyond the working group to identify how a robot would work also when the project and attention to the workers is over. Too many robots are put aside after a while when implemented in everyday life.
HERBIE	Self-driving vehicles are often presented in unrealistic ways in public media. In reality they will involve a lot of adjustment on the part of the end-users, but also of all other affected stakeholders.	Help align expectations so both end-users (those in the car) and directly affected stakeholders (pedestrians, bicyclist) and distantly affected stakeholders (traffic planners) understand that self-driving cars are not intelligent in a human way and possibly will need a separate space to operate.
COOP	By focusing solely on effiency, companies run the risk of sabotage, when moving robots from cages to work lines. Also, the efficiency may counter other issues for instance climate change.	Help situate the need for higher effiency in a network of other needs, e.g. a meaningful worklife or a safe work environment. Help indentify motives for sabotage. Help identify needs for re-skilling.
COBOT	As robots are expected to work in close proximity to humans, new ethical and practical issues arise e.g. of workplace rhythms. Some concern sabotage, like in COOP, others the importance of having workplace colleagues, and feeling pride in your work.	Help identify specific end-user-robot interaction issues (such as humans being too slow or too fast). Help identify social issues, e.g. the how relationships between colleagues change and potential needs for re-skilling.
BUDDY	Humanoid robots are often presented in the media in ways that may be misleading. People automatically antropomorphize robots; e.g. thinking they have feelings, wants or needs.	Help identify and align imaginaries. Help the general public and politicians get a reality check on what robots really are and what they can do.
ATOM	Robot developers built a controller for children that could only fit adult-sized hands.	Help identify different bodily features of end-users, and explore a wider range of issues tied to end-users including how they learn to operate robots, and how robots' fit environments and are affordable.

While this list is not exhaustive, it exemplifies the diversity of the issues arising in the different robots across cases. We can see that there are conceptual and physical gaps between robot makers and affected stakeholders, related to robot makers' normative notions of users and stakeholders' lived experiences; between the ethics practiced by robot makers and the ethical concerns affected stakeholders' situations elicit; between rhetoric of relief and everyday work lives; between the robotic solutions proposed and the problems they are meant to solve; and between shared cultural conceptions of robots and real material engagements with robots. These gaps in normativity, ethics, relief, problem-solving and imaginaries are prevalent across cases and have real consequences for robot makers, for affected stakeholders, and for society. Through empirical case examples, we explore (in section 12.4) how alignment experts might bridge these gaps to facilitate collaborative learning between robot makers and affected stakeholders.

12.2 Bridging the gaps?

In the following, we look at some of the ethical gaps identified and discuss how, from our ethnographic perspective, alignment experts may have been helpful in bridging the gaps between robot makers and affected stakeholders. However, Non disclosure agreements (NDA's) keep us from providing explicit real world examples. Furthermore, while we often refer to specific case-studies where some topics were particularly salient, the issues most often go across cases (*see also Annex 1 Methods and Methodology*).[2] We also realize that robot developers may not always welcome our contributions as they may interfere with their work and increase costs.

In exploring the ethics as safety gap through the WAREHOUSE and COBOT cases, we show how alignment experts could contribute by identifying stakeholders and investigating motives of persons across the Human Proximity Model.

In exploring the normativity gap through the ATOM and REGAIN cases, we show how alignment experts could contribute by explicating situated cultural contexts and foreseeing 'unforeseen' problems.

In exploring the relief gap through the SPECTRUS and WIPER cases, we show how alignment experts could contribute by balancing stated aims with lived experiences and developing a common language between robot makers and affected stakeholders.

In exploring the problem-solving gap through the OTTO and SANDY cases, we show how alignment experts could contribute by distinguishing problems to be solved with robotics from those problems better solved by other means (e.g., policies).

And finally, in exploring the imaginaries gap through the HERBIE and BUDDY cases, we show how alignment experts could contribute by confronting cultural imaginaries with material experiences.

12.2.1 Ethics gap: identifying stakeholders and investigating motives

The WAREHOUSE and COBOT cases demonstrate a gap between a holistic approach needed for understanding ethics in an everyday warehouse setting and the narrow ethics-as-safety perceptions found in the inner circle (*see 4.0 Ethics Beyond Safety*). One of the findings from these cases is that robotization may be decreasing task complexity for warehouse and factory workers. Motivation matters for workers across all cases but is salient in the case of warehouses. Engagement is already a problem in warehouses to the extent that some warehouse managers employ strategies for maintaining a dynamic and changing workflow, by switching between 'wave' and 'batch' picking, and creating picking competitions to keep up worker motivation and productivity. Still, worker turnover is high.

> *A good worker should have a normal head on their shoulders and a willingness to work [laughs]. They're the two biggest skills that are required. And somebody who enjoys it. Somebody just putting in the hours is no good. You need a bit of 'get up and go'. I think they would have a section that they look after themselves. So that somebody can take pride in their work and try and make it look good.*
>
> (Brian, wholesale store owner, affected stakeholder, WAREHOUSE)

Meanwhile, emerging robotic solutions in logistics and manufacturing/production are often reducing task complexity. One particular robot used for shipyard welding was tasked with complicated welds, which, when performed manually by human workers, required more skill than ordinary welds and thus entailed higher compensation. Workers sabotaged this robot – presumably because it ruined their sense of pride in doing a good job. Similarly, software was introduced in a sheet-metal factory that diminished workers' task complexity and feeling of ownership by reducing their task from manually programming bending coordinates, to scanning a specification sheet and placing and removing the sheet metal from the machine. The software was abandoned after workers ignored the new feature and continued with manual inputs. In warehouses, a new robot would change the work so that workers no longer drove around, getting on and off of the vehicle to pick items, and talk to colleagues, but instead walked ahead of an automated cart to pick the item from the shelf and place it on the cart. The robot's developer presented this simplification at a robotics conference in Europe as a benefit to the human. In

2 see responsiblerobotics.eu/annex-1

REELER, however, we have seen that human workers require more agency and complexity in their work for both satisfaction and productivity (*see also 10.0 Meaningful Work*).

In the WAREHOUSE and COBOT cases, REELER researchers interviewed participants inside and outside of the robotic inner circle. In speaking with warehouse and factory workers meant to operate robots (i.e., the real end-users), we found out what mattered to them, in their workflows and in relation to robotization. Talking with their managers (i.e., directly affected stakeholders and spokespersons) led to more insight into the challenging decisions SME owners face in balancing productivity needs with worker satisfaction. Involving recruiters and union representatives (i.e., distantly affected stakeholders) brought a broader perspective to the skills and employment challenges that robotization might bring to the sector. Finally, interviews with CEOs, engineers, and salespersons (i.e., robot makers) led to the realization that developers of warehouse logistics and manufacturing solutions are primarily focused on productivity (increasing efficiency and solving staffing problems), but less so on the problems or needs of the workers. While not within the scope of the REELER project itself, this case demonstrates the potential of alignment experts in identifying stakeholders across the Human Proximity Model, and in investigating the motives and values of each.

12.2.2 Normativity gap: filling in situated cultural contexts and foreseeing 'unforeseen' problems

In exploring the normativity gap through the ATOM and REGAIN cases, we show how alignment experts could contribute by presenting situated cultural contexts and foreseeing 'unforeseen' problems. Normativity is as argued in *5.0 Inclusive Design*, a lack of awareness of others' bodies, experiences, or life worlds. In the ATOM case, the developers were surprised by the much smaller hand size of their actual end-users. A necessary adjustment was thus made to fit the size of children's hands. In the REGAIN case, developers of one robot ran into problems because the robot's language was culturally inappropriate (i.e., too harsh) when transferred from the country of development to another country for implementation. Alignment experts would help with an attentiveness to nuanced cultural barriers and an ability to traverse them.

12.2.3 Relief gap: weighing rhetoric with lived experiences and developing a common language

In exploring the relief gap through the SPECTRUS and WIPER cases, we show how alignment experts could contribute by balancing stated aims with lived experiences and developing a common language between robot makers and affected stakeholders. When the explicit motive of robot makers is to relieve workers of menial work, heavy lifts etc. they should know how works experience these issues before the make a robot that is meant to be a relief. In the SPECTRUS and WIPER cases, we have seen how work is talked about and perceived differently by robot makers and affected stakeholders. Here, alignment experts could help develop a common language, around manual labor, e.g., that is not so unevenly value-laden (e.g., menial, tedious). Conceptualizations are very distant from lived experiences.

12.2.4 Problem-solving gap: distinguishing problems to be solved with robotics from those problems better solved by other means

In exploring the problem-solving gap through the OTTO and SANDY cases, we can discuss how problems are identified and by whom robot development is initiated. Alignment experts could contribute by distinguishing problems to be solved with robotics working closely with end-users (OTTO) from those problems better solved by other means (SANDY). They could also help finding a wider group of stakeholders in need of the robot developed if the problems were formulated in slightly different ways (SANDY). For instance, the problem of making a good harvesting robot could be connected to both big, linear farming environments and small, curvy farming areas. This may even benefit small farmers in Africa if this type of small, agile farming robots were developed (*see Annex 5 REELER Outreach tools* [3] and the REELER homepage for debates on these issues in our MiniPublic at Hohenheim University).

12.2.5 Imaginaries gap: confronting cultural imaginaries with material experiences

Across all cases we find gaps in how robot makers (including developers), affected stakeholders and policy makers imagine robots. Alignment experts could help in providing reality checks to public media and policymakers, and they could help application experts (who for instance 'sell' robots in public media) depict robots more realistically (but equally appealing). In exploring the imaginaries gaps around self-driving cars and humanoid robots in the HERBIE and BUDDY cases, alignment experts could contribute by contrasting cultural imaginaries with material experiences; not least in relation to the concepts tied to robots such as 'autonomous' and how humans need to change to adapt to robots (*see 8.0 Imaginaries and 4.0 Ethics Beyond Safety*).

12.3 Increasing human proximity and identifying motives

If these human proximity gaps are problematic for robot makers, and if collaboration might solve these problems, it seems obvious that robot makers should address the gaps in their own by collaborating with affected stakeholders. In fact, REELER began with the hypothesis that increased collaboration might solve some of the ethical challenges in design. However, we found that robot makers find it challenging to address these identified proximity gaps on their own. First of all, there are many structural, economic and social issues that

3 see responsiblerobotics.eu/annex-5

make it difficult for them to collaborate directly with end-users and affected stakeholders.

1. **Resources**. It is very time consuming (and thus expensive) to collaborate with people with whom you do not share common language or motives. It takes time to recruit participants, to help them to understand the proposed project, and to become familiar with their everyday work.

2. **Distributed development**. Robot development is often distributed, both geographically and in terms of tasks. One person or organization might be responsible for developing the user interface while another works on movement and navigation. It is unclear who should be responsible for collaborating with the end-users and affected stakeholders.

3. **Access**. Legal/regulatory and practical limitations may also impede access to real-sites during development. Many safety and occupational hazard regulations inhibit testing of prototypes in workplace settings. Further, many affected stakeholders do not have the agency to participate in development processes related to their work, which often leads instead to spokespersons (management) being involved.

4. **Changes**. Sometimes, the involvement of end-users may precipitate changes which complicate the development process. If an end-user's experiences disrupt the normative perceptions of use/users, they may necessitate costly or time-consuming changes to the robot's design. This is especially true of robots beginning from familiar technologies, applications, and collaborations.

5. **Disciplinary blinders**. Robot makers often do not recognize affected stakeholders as relevant to the development process. Moreover, the end-users that are identified as relevant are often used instrumentally as testers as it can be difficult to step outside one's own experiences to recognize the potential contributions that end-users and affected stakeholders can offer.

6. **Relational expertise**. Even if robot makers do engage with end-users and more distantly affected stakeholders, it can be difficult to find out what matters to them – and how to extract what really matters across a group of diverse end-users that all come up with different ideas. Without sufficient relational expertise, collaboration remains cooperation without any alignment of motives.

Core expertise: *The skillset and knowledge base one has developed through education and/or experience.*

REELER's findings show that problems often arise in development because of these six challenges in collaboration. In the ATOM case, for example, a social robot was designed for consumer use. The robot developers demonstrated very proficient skills in collaborating. They collaborated effectively with persons within the robotic inner circle with proximal **core expertise** – that is, a skillset and knowledge base born out of similar disciplinary backgrounds and experiences. They worked with a design company for the robot's aesthetic design and with another company to develop story content for the robot. Furthermore, they collaborated with and learned from persons outside of the inner circle with more distant core expertise, including investors, public institutions, media people, but also potential consumers (school children) and local experts (teachers).

Even in this best of cases, the developers ran into trouble in leaving their technical comfort zone and venturing into the unknown land of other people's everyday lives. The robot project started with product-oriented beginnings, from familiar technologies and familiar collaborators. It did not start with a clearly defined problem (i.e., how to teach kids programming skills) and did not involve calling in experts for how this best could be done. Although the robot developers were able to effectively collaborate with persons across disciplines, they did not fully exploit their engagements with persons whose core expertise was farther from their own. They, like in a couple of other cases (REGAIN, WIPER e.g.) really tried to involve teachers but as education was a new field to them, they did not fully capitalize on teachers' expertise in knowing how difficult it is to teach.

Thus, even the best of efforts by robot developers might not be enough -- and perhaps it is not within their ability (or responsibility) to close these gaps on their own. Often, robot developers themselves make user studies, but they are not educated to understand the motives and everyday concerns of the affected stakeholders. Here, the robot developer Valdemar explains the group behavior of workers, they (the developers) have studied (but not collaborated with directly) to develop their robot.

I think it's a mix of workplace culture and the physical requirements of the job. I think it stems from, well, try chopping firewood; once you've chopped for 15 minutes, you'll need a break too. There's also what you might call an old-fashioned style; they smoke a lot, these people. It's one of the few places where I meet a lot of smokers. They need a break for smoking, and a break for coffee, and there's no question about that. It's no business of mine, but it's quite obvious they take their time to fiddle with various things. Some of them don't say anything during these breaks, others have all sorts of more or less insightful comments about what a poor job the people that came before them had been doing. You should try asking a psychologist about these issues, maybe they know more about it than the anthropologists. But it's a common theme. It's always very apparent that they stick together in groups; there might be people from other companies [they engage with], but not much.

(Valdemar, engineer and CEO, robot developer, WIPER)

Valdemar does not (as social scientists are trained to do) get an insight into how these workers would consider their robot once implemented. He gets some indications of how they will be annoyed when routines are changes, but not really how and why. These findings were, however, elicited by REELER researchers who gained insight into what motivates people to sabotage robots.

One of the reasons for this difficulty in understanding each other comes from the robot developers and affected stakeholders having very different core expertises and very different life worlds. Often robot developers see the humans affected by their robots as very far from their own (and our) communities – and have difficulties taking their perspectives and understanding their motives. They recognize that many of the people who are to work in the closest proximity of the robot may not be educated as engineers, but they also lack a sense of how these people may have other types of core expertises that matter.

> *Yeah, yeah. It's tested on people, yes. Or basically, on real people that work in the warehouse. And you can even understand the way they speak, the way they [live] is slightly different than yours and my roles. So, they are simple people, let's put it this way.*
>
> (Felix, CEO advisor, robot maker, WAREHOUSE)

Indeed, affected stakeholders who are exposed to robots sometimes feel their core expertise has not been seen or respected by robot developers:

> *Interviewer: "Do you think they know about your life?"*
>
> *Anita: "Sometimes they don't. The people who [develop robots], before they start doing that, they need to go to the places where we work to see what kind of work a human can do. And then they have the responsibility to do good things but sometimes I think that they think 'They [the cleaning staff] do that, but they don't know exactly what the job is'."*
>
> (Anita, hospital cleaning staff, affected stakeholder, SPECTRUS)

> **Relational expertise:** *A capacity to recognize the motives of those with different core expertise, to understand the value of their expertise, and to mutually align motives in joint work.*

Although robot developers sometimes formed particular ideas about end-users as a group, they seldom considered themselves and their developer peers as belonging to a collective culture. Collaborative learning is ideally a process of mutual learning that depends on collaborators being motivated to break out of their individual bubbles. However, to recognize and respect their own and the affected stakeholders' different roles in collaboration requires what the educational psychologist Anne Edwards calls relational expertise. Edwards defines relational expertise as "a matter of recognizing what others can offer a shared enterprise and why they offer it; and being able to work with what others offer while also making visible and accessible what matters for you" (Edwards 2010, 26). REELER defines **relational expertise** as the capacity to recognize the motives of those with different core expertise, to understand the value of their expertise, and to mutually align motives in joint work. Here, alignment experts could act as intermediaries, helping robot developers to recognize their own culture and how, e.g., this culture frames their interpretation of affected stakeholders' needs and motives.

If collaborative learning is to align these *different* groups working towards a common goal, it is necessary to find out what motivated them to begin the collaboration at all. In REELER, we find the best way to define collaborative learning is how one learns to understand what motivates others through an expanded skill of relational expertise, and to communicate these motives to the collaborators so that they might align themselves in working together toward a common goal. Relational expertise is a capacity to work relationally with others on complex problems. It involves knowing how to know who can help. Knowing how to know who is a capability that can be broken down into being able (i) to recognize the standpoints and motives of those who inhabit other practices and (ii) to mutually align motives in joint work. Relational expertise is therefore another form of expertise one can develop in addition to their own core expertise (often tied to one's education/occupation) and makes fluid and responsive collaborations possible.

A basic premise of Edwards' work is that collaborators need to exercise both a core expertise (in one's discipline or work, e.g.) as well as a relational expertise in learning what matters to others when they work together. One example, used by Edwards, is when teachers, psychologists, housing specialists and social workers with different motivations are engaged in helping a vulnerable child. The teacher has a core expertise in helping the child learn in school; while the social worker will focus on the child's family. The educational psychologist and housing specialists will also have their motivated ideas of how the child may be helped. Together they constitute a group engaged in the same problem space, helping the vulnerable child, without being reduced to nodes in a system. They

An alignment expert would act as a cultural brokerage, mediating between groups or persons with different values, understandings, and motives.

are in Edwards' words: "likely to interpret the developmental trajectory of a vulnerable child in slightly different ways because they are located within different practices where the motives for engagement with objects of activity are also different" (Edwards 2010, 7).

Just as the robot developers today learn from funding agencies about their motives (often codified as strategies) in order to apply for funding, and funding agencies learn from robot developers what their technologies are capable of (*see 2.0 Robot Beginnings* and *3.0 Collaborations in the Inner Circle*),[4] so the robot developers could learn from the affected stakeholders about how robots could relieve and improve their everyday lives. The affected stakeholders could, in turn, learn from robot makers what robots really are (rather than relying on public media to convey information about robots).

As described above, many factors make it difficult to exercise relational expertise in practice. This was particularly true in REELER's cases when collaborators' core expertise was very dissimilar (like cleaning and robotics, for example). We propose that alignment experts might be capable of doing this bridging work for the robot developers and affected stakeholders. This alignment task would involve spanning the space between the robot makers' communities of practice and the affected stakeholders' communities of practice to identify their separate motives, and to communicate them to one another in a move toward alignment and collaborative learning.

12.4 Building common language through cultural brokerage

What does it mean to align?

A person's perspectives and engagements with the world are framed by their socio-material worlds, where each is composed of their disciplinary backgrounds, their past experiences, their current material and temporal settings. When they enter a shared problem space, they may be interpreting the problem differently. Without translation, collaborators may be working toward the same shared goal (robot development, e.g.) without recognizing each other's motives.

Alignment experts can draw out these different motives by studying *with* different groups. By drawing on traditions in anthropology, they can mediate between groups or persons with different values, understandings, and motives – effectively acting as *cultural brokers*. Medical anthropologist Mary Ann Jezewski defines **cultural brokerage** as *"The act of bridging, linking, or mediating between groups or persons of differing*

4 To be found in the online version of *Perspectives on Robots* – see www.responsiblerobotics.eu

cultural systems for the purpose of reducing conflict or producing change" (Jezewski 1995, 20). In REELER, the change we aim to produce is to increase human proximity and promote relational expertise.

Cultural brokerage: *Translating motives, values, and understandings between persons with different cultures and disciplines to increase human proximity and promote relational expertise.*

In bridging these different socio-material worlds, and making each group more aware of the other's motives, values, and understandings, alignment experts can help the groups to build up their own relational expertise. The REELER project has developed some experimental tools for facilitating this learning between groups. Many of these tools involve perspective taking. These tools for collaboration have been tested in REELER with good results and show promise, but are nevertheless still experimental (*see Annex 5 REELER Outreach Tools*).[5]

1. **BuildBot** is a board game that was developed out of interdisciplinary collaboration between REELER's robot developers and anthropologists, using data from ethnographic interviews to simulate a reflective robot design process. In this game, players take on the role of robot developer designing a healthcare robot. The players must manage their resources in interviewing different stakeholder types (patients, care providers, unions, policymakers, e.g.) and spending money on developing robot features. The game includes stakeholder statements from the real REELER case studies. These statements give robot developers some insights into the concerns and needs of others. The game involves a dialogue between players where they can explain their interpretation and consideration of stakeholder statements in the selection of robot features. Players are rewarded for selecting features that best match stakeholder needs. This game raises awareness about the complexity of a robot's context and expands development considerations beyond the inner circle to take in perspectives across the human proximity model.

2. **Social drama** is perspective-taking method developed in REELER, with inspiration from Sociodrama, a method used with groups in psychology and sociology. Social drama entails the creation of use scenarios around an envisioned robot enacted in an improvisational way. Participants take on dual roles in the sketches, performing a character role with an underlying conceptual role. For example, an eldercare robot scenario might include a participant acting as the robot, while representing the perceptions and concerns of a robot developer, while another participant acts as the elderly person representing concerns centering around the concept 'dignity'. Another participant might act as the elderly person's family member, bringing forth concerns around the concept of 'human development'. As the participants enact their scenarios, they embody these concepts to elicit different perspectives around the same situation. In this way, the scenario is a perspective-taking exercise that shows how relational expertise is necessary to understanding the plurality of motives, values, and understandings when different sociomaterial worlds meet in collaboration.

3. **Mini-Public** is an established debate forum method intended for democratic participation in decision-making. In REELER, we have adapted the Mini-Public for use by alignment experts as facilitators of dialogue between groups with asymmetrical power relations. Specifically, we have used the Mini-Publics to give voice to affected stakeholders in conversation with policymakers and experts in specific sectors or fields of robotics. The Mini-Public has three components: expert presentations, democratic participation (e.g., polling), and deliberation. REELER has tested various forms of democratic participation techniques including analog and digital methods like the interactive presentation software Mentimeter. [6] After listening to the expert presentations, participants have the opportunity to voice their opinions through anonymous polling or voting. Then, the results are shared and the experts and citizens engage together in critical discussions. After some deliberation, the polling and voting is repeated to measure how/whether the participants and experts have learned from taking in different perspectives in the interdisciplinary/cross-cultural exercise.

All of these tools are meant to increase human proximity and build up a competency in finding out what matters to the persons one collaborates with. In doing so, one can become aware of their *relational responsibility*. A robot developer might, for instance, better understand the effect of their decisions on an affected stakeholder. Such an understanding comes with a responsibility to mitigate any potentially negative effects (*see 4.0 Ethics Beyond Safety*).

Common language: *A common ground of mutual understanding, knowledge, beliefs, assumptions, pre-suppositions, etc.*

However, even the best of tools cannot by themselves handle the process of cultural brokerage. To progress from perspective-taking to true collaborative learning, the groups would need to develop a **common language**, a common ground of mutual understanding, knowledge, beliefs, assumptions, pre-suppositions, etc., which is necessary for many aspects of communication and collaboration (e.g. Edwards, 2005, 2010, 2012; Baker et al. 1999). However, it has been clear from the REELER data presented in the previous chapters, that developing this common ground is *not* easy.[7] In working towards a common goal, the collabo-

5 see responsiblerobotics.eu/annex-5

6 https://www.mentimeter.com/

7 See Annex 1 Methods and Methodology: responsiblerobotics.eu/annex-1

rators will need to gradually align (but never conflate) initially different motives and expectations.

In order to collaborate today, robot makers have to align not just the material output (the goal of making a physical robot) but also the motives behind the material output with those of affected stakeholders – in this case an alignment of what is meant by a responsible and ethical robot.

"Through the negotiation of goals, agents do not only develop shared goals, but they also become mutually aware of their shared goals" (Dillenbourg 1999, 8). And a general call for researchers to reach out of their own normativity bubbles to expand their knowledge:

"Experts must now extend their knowledge, not simply to be an extension of what they know in their specialist field, but to consist of building links and trying to integrate what they know with what others want to, or should know and do." (Nowotny 2003: 155)

We also see examples in the REELER data that robot-makers themselves are aware of the importance of working together with the people expected to use the robots to make robots that are accepted in the end:

And even in the complete service robotic community, this is a new goal. Because there are many projects focusing how to solve technical problems. But one of the biggest problems is, even if you solve [the technical issues, that], no one will use it. Because the robot is not accepted. So, you need to bring everything together

(Thomas, engineer working on a humanoid service robot, robot developer COBOT)

Thus, the definition we propose for collaborative learning that results in responsible ethical robotics is that collaborative learning is: A process of alignment of different motives and expectations in working toward a common goal.

Specific to robotics, collaborative learning is a process that over time aligns the motives and expectations of robot makers with the motives and expectations of users and affected stakeholders to ensure the creation of the best possible ethical and responsible robotics.

Following Edwards work and combining it with our REELER material, we suggest a new definition for collaborative learning that can be used by alignment experts.

Collaborative learning begins with an identification followed by an alignment of robot makers' and affected stakeholders' motives, when enough common ground is obtained to initiate collaboration (working together) toward a common goal, with these motives in mind.

Robot developers cannot be expected to be experts in how to get to know affected stakeholders and their underlying motives for using or rejecting a robot. This is why we propose a new education to help develop the skills needed to understand the motives and core expertise of both affected stakeholder and robot makers, and cultivate the core expertise, which makes an alignment expert.

Our definition places the responsibility for learning about each other on both robot makers and affected stakeholders/users but with the help of alignment experts. Whereas material goals may be explicated in a collaborative process, we take it that robot makers and affected stakeholders should also explicate their motives for designing and/or using or not using a robot to the alignment experts. There is, however, a built-in asymmetry as this collaborative learning is most likely to be initiated by the robot makers, as affected stakeholders in general know very little about the robots being developed for and around them – and have limited or no access to robot makers and their work.

This concept of collaborative learning has two parts: it is about doing something together, but it is also about learning from each other while you do something together. Collaborative learning describes the situation where people not only attempt to learn from each other, but do so with the aim of collaborating. And they aim to collaborate to learn from each other. Collaborative learning is ideally a reciprocal affair. However, as we have seen throughout the chapters, when we move outside of the inner circle collaborations do not begin with two equal partners learning from each other. In the inner circle the participants have for many years build up common motives and a common language. When they move outside of the circle, they need help from alignment experts to collaborate with (and in some cases even identify) end-users, directly and affected stakeholders, understanding their motives and language.

REELER findings show that the robot makers' design processes, and their community in general, can benefit from a raised awareness of why and how collaboration with end-users, direct and distant affected stakeholders can be a valuable contribution to existing design processes. It will improve the chance of making responsible and ethical robots, because a closer collaboration will give access to valuable everyday life experience.

From the REELER data presented in the previous chapters we see a potential not just for more ethical and responsible robotics, but also for robot makers to cultivate new ideas through a raised awareness of how affected stakeholders could be included in design processes in a lucrative way. As noted, it is difficult to live up the 'holistic' approach presented as the way forward by some robot developers – where inclusive thinking is realized by observing and working with users, where you get to be *"part of their ethic, like, their world"* as it is phrased by one of the robot developers (Elias, robot developer, engineer at the Northern Techno university) (*see also 4.0 Ethics Beyond Safety and 5.0 Inclusive Design*).

Affected stakeholders often worry about how it will be to collaborate with robots, but the reality may prove to be entirely different (*see 8.0 Imaginaries*). We also acknowledge that both ethnographers and affected stakeholders may know too little about business models and technical issues prevalent in the inner circle. However, an awareness of how affected stakeholders view robots may also lead to new ideas. During fieldwork, the ethnographers have observed many areas where people could use robots in their daily lives which have not been developed yet (help to clean houses with many stairs and spider web in the ceiling e.g.). True collaboration with end-users may also ensure that the robot design becomes more inclusive and accepted.

Finally, alignment experts may help identify all the many people around the envisioned end-users, who could also be involved in the design process (e.g. co-workers or relatives to people using exoskeletons), as they will also be directly affected by the robot (and may sabotage or reject it) without being considered end-users.

12.5 Concluding remarks on Human Proximity

Collaborative learning was chosen as a key concept for the REELER project because our main hypothesis was that robot makers need new tools to improve their knowledge of and collaboration with users and affected stakeholders, in order to improve the creation of responsible and ethical robotics in Europe. This is partly due to the robots coming out of their protective cages in industrial settings and directly engaging with people in their everyday lives, partly because robots (combined with AI) are changing the lives and work for most of the European population with the present development of robotics in new fields.

Also, the robot makers themselves begin to see the need to expand their collaborations and increase their awareness. We acknowledge that it is probably not possible to work directly with the most distantly affected stakeholders, but we will carefully suggest that robot makers and robots can benefit ethically and financially when these collaborations occur. Collaboration is a process where you develop something together – and collaborative learning is, in REELER's definition, a matter of aligning motives. In the REELER project, we have developed some experimental tools and suggestions for how robot makers can confront their own normativity and increase their proximity to affected stakeholders and potential end-users, to get to know more about their motives through collaboration with social scientist intermediaries called *alignment experts*.

Thus, REELER proposes a holistic approach to robot ethics that centers on collaboration across the Human Proximity Model, facilitated by alignment experts – rather than the spokespersons and application experts already operating in robotics. Alignment experts differ from spokespersons because they *research* who they 'speak for'. Today, what we define as spokespersons are, for instance, managers who speak on behalf of workers but this does not ensure managers know about everyday problems from a worker's perspective. Application experts work on special local issues (for instance a designer or psychologist who knows what colors work best in a design of robot appearance). Their task is not to see the more holistic aspects of how end-users and directly/distantly affected stakeholders work with robots.

We readily acknowledge that we currently lack an education which combines relational expertise and cultural brokerage with an understanding of business models and technical details. An education which fosters expertise in alignment methods used to study situated practices and cultural phenomena combined with communications training for interdisciplinary collaborations. Newly educated alignment experts could be tasked with identifying proximity gaps and relevant actors. Next, they could work on actual collaborations practicing and advancing the experimental methods of perspective taking (BuildBot, social drama, e.g.) that REELER has developed for building relational expertise. By identifying and communicating the motives across the Human Proximity Model, alignment experts will help robot makers develop a common language with affected stakeholders and will make robot makers aware of their relational responsibility to affected stakeholders. However, their education also needs to emphasis the importance of time, money and market issues that matter for robot developers. In this way, alignment experts may act as intermediaries to draw together affected stakeholders from the periphery and robot makers from the center of development to increase human proximity, expand the locus of decision-making, and initiate collaborative learning for more responsible and ethical robotics in society as a whole.