ANNEX 2

Quotations taken from ethnographic case studies

Annex 2: Quotations taken from ethnographic case studies

The following list of quotations are excerpts from qualitative interviews conducted by REELER researchers. We have not changed the content of the quotations, but they have been edited for clarity, brevity, and anonymity. Furthermore, we have opted to remove filler words and left out repetitions of the same word in most cases, for ease of reading. Finally, some of the people interviewed are not native English speakers. In these cases, we have either translated the interview or conducted them in English. In the latter case, we have chosen to edit these interviews for proper grammar in order to preserve the meaning of the quotation and the dignity of the interviewee.
Quatations are sorted by chapter. Chapters 6 and 9 build on economic data, and do not build directly on ethnographic data, and thus have no associated quotations here – *see Annex 1 Methods and Methodology* for more on these chapters. Chapter 12 is the culmination of the preceding chapters and draws primarily on the findings presented in these. Therefore, there are no supplementary quotations for this chapter.

Introduction

"When I think, when I hear the word ethics, I cannot couple it to anything that I work with on a daily basis. It's a word that is far away from my daily, daily thinking."
(Mathias, system integrator, robot maker, SPECTRUS)

"The more you are asked to think about it, I think your mind broadens a little bit every time."
(Inge, hospital cleaning department manager, affected stakeholder, SPECTRUS)

"Remember I'm a technician and my kind of thinking is square. For me two plus two is four. For me to engage with sociology or philosophy is very interesting, good."
(Hugo, mechanical engineer, robot developer, HERBIE)

"Being an engineer its always difficult to see through other aspects such as ethics, societal issues, etc. Definitely working as a designer and visionary of new types of robots this really helped me a lot to see some other aspects relates to ethics and society 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, robot developer, at a REELER outreach event)

"At first, they were involved in developing the concept, then we had a user liaison, who took part in the early testing and made some comments on that. Since then, we've expanded the circle to include a few people, whom we call from time to time; either they come here or we visit them".
(Valdemar, engineer and CEO, robot developer, WIPER)

"I've involved two therapists from that place that need to help us train this citizen alongside the exo skeleton, according to her, like her development, this citizen's development, you can say, alright, before we start, you have therapeutic knowledge that I don't, so if you think about what you've learned or what you know as therapists, do you see any advantages or gains or anything that I haven't thought of because I don't deal directly with the citizen."
(Nikoline, rehab center staff, affected stakeholder, REGAIN)

Chapter 2 Robot Beginnings

Interviewer: "How do you involve clients in the design process?
Ali: "We don't involve [them] in the design process. We involve users in the requirement process."
(Ali, start-up founder, robot developer, WAREHOUSE)

"It would have to be a robot that managed to get up very high, because we don't manage to take away the spider webs. Or some arms that are removeable, that raise the hands."
(Veronica, hotel cleaning staff, affected stakeholder, SPECTRUS)

""That robot there looks bloody interesting. That is a great business case to us. We almost cannot live without it."" So, we better start making it. So that is another way, along with partners, to create some new robotic solutions. So it is about us being attentive to things ourselves. We bring some things along with us from our EU projects, people start calling us more and more, it also has to do with the fact that we have seen a demand for [the product]. But moreover, by making it, it hopefully also creates a pipeline forward."
(Villads, CEO of robotics company, robot maker, WIPER)

"On the one hand, competitions are so time-consuming … But the undoubted advantage is that in many competitions there are media that try to look for more interesting projects, especially those that win, and this results in the greater solution

promotion in the media, ranging from local to nationwide. So, it largely allowed us to build this recognisable brand when it comes to our country."
(Matis, engineer and marketing expert at robotic start-up, robot maker, ATOM)

"So, I did not want to go into the industry right away because, so, that is why I also wrote my Master thesis at an institute, because I simply wanted to do this scholarly work again. And that was so much fun for me that I thought 'You cannot fully, I don't know, go into the industry for the rest of your life and work on some kinds of projects.' And also the time that I had already spent here at COBOTICS was, because it is not so easy to find such a job where you can be pretty free as a developer. So, sometimes you have pretty narrow requirements and you only hear 'Optimize this in this and that direction.' And here you can come up with a new concept, build that up and figure out does it work, does it not work. And yes, that is exciting."
(Valerie, mechanical engineer, robot developer, COBOT)

"Nowadays you can Skype and whatever, right? It's easy to communicate with people who are in other places in the world, but I think the eye contact is important and – in the sense, I guess it has been a fundamental issue in taking this decision; to be able to work with them directly and not have to travel. For example, we have a haptic device since many years ago and they are located in Southern Europe, and it's always a problem. And when something is broken, we have to send it there and wait for weeks that it comes back and customs, because it's Southern Europe and it's complicated. So, if you have them here, it's marvellous."
(Dieter, head of robotics lab, robot developer, BUDDY)

Interviewer: "Did they come to ask you to develop this robot?"
Bart: "Yes. To develop a solution because a customer doesn't know the – the solution; he has only a problem."
(Bart, business developer, robot maker, OTTO)

Interviewer: "Did you involve users in the design process?"
Carmela: "If you say the users now the patients, then definitely yes. Because there was a study or questionnaire. I think the clinical partners did with patients and they tried to find out what's most important for them. That was also one of the first steps actually with them."
Interviewer: "And did that sort of play an active part in how you were designing [robots]?"
Carmela: "Yes, of course because [we] built upon that, the clinical specifications and then from that, the technological specifications."
(Carmela, robot maker, REGAIN)

Samuel: "It was not like the same people involved in the same project from start to end. It was different kind of cleaning assistants, different kind of IT nurses and so on, so that was not ideal. It is something that we really try to do now in the projects that we are doing, that we set this project team, also from the partner's side to make sure that they are committed and they are the right people that we have involved in the project."

Interviewer: "Yeah, that has changed your approach a bit then?"
Samuel: "Yeah. Definitely."
Interviewer: "And they, why is it so important that they are the same people?"
Samuel: "I think it's also something like, satisfaction for them that they see that the value of their input and insights is something we actually use eventually. it's not something that they just have to participate in in a two hours meeting and they don't hear anything about the project until maybe there's a product in three years. So, I think it's good for them and it sort of motivates them a bit more to be more involved in this process I think. So, I think it's good for them, but of course it's also good for us because then we have sources on all our data fragments from the projects and who gave that knowledge and then we can call that person again and ask again and they are well informed about the project and it saves time also for us, I think. So, it's just a matter of finding the right people and that's always a bit of a challenge, I think, for us."
(Samuel, product innovation manager, robot maker, SPECTRUS)

Interviewer: "Which of the challenges could be solved by robot makers alone and which of them require collaborations outside the robotics community?"
Maryse: "The growers, they want to keep the same system like they have now, and roboticists they like to have another kind of system that the plants would grow [in]. (…) A roboticist is looking from another kind of view, and they say: "We have this kind of robot, so we don't need a more adjusted crop". (…) Roboticists would like to have plants growing in one line, and now we have in the system, that is actually two lines. But for the robot it is more difficult to take plants at the back of the one row. But then you have the moving systems, where you have one fixed row, lateral, and then you have to go to moving plant rows, but that costs a lot, and you need to adjust the space a lot. It costs a lot."
(Maryse, green house application expert, robot maker, SANDY)

"We always had the vision that if you make a robot to do something in the plants, for example harvesting something, then you should not only try to imitate what humans are doing nowadays, but you also have to look to the plant. And you maybe have to change the way they grow the plants or the plant system. And maybe it is also very helpful to change the plant architecture. So, for example, if you have fruits with a longer stem, maybe it is easier for a robot to pick [them]."
(Espen, senior researcher, robot maker, SANDY)

"It might be you don't have to do anything. You know, it might be the robots just fit into your existing infrastructure and require no modifications or it may require that there are certain parts of your facility where things need to be moved or more space needs to be generated. It really just depends on the application."
(Danny, sales manager, affected stakeholder, WAREHOUSE)

"Yeah, with this move to more social areas, there are more and more women entering robotics and at this conference for instance when the presenters are on more industrial robotics

or mechanical engineering and so on, still there are 90 percent more men. But in the sessions on social robotics or service robotics, there are like 50 percent women."
(Carla, robot developer, BUDDY)

"What I think will happen, in the long term, is that we will see a different type of worker; for example, drifting slightly into gender politics, there are many female painters, I don't know how long that's been going on, to me, it's somewhat new, and when you visit a site, it's quite clear that the women there are painters. I think that will change. That's why it's entirely intentional when we show little girls alongside the machine [at our website]. We will actually also do it in some of our future user videos. The reason there's a man there now [operating the robot] is that he is the one who could operate the machine at the time we were making it. It was a practical concern. The idea, though, is that if we can involve small, out-of-shape people, I don't know how to put that any nicer, then we will do it, but I do think that it is something that will happen, no less because it is my impression that, among construction workers, they are aware of the problem with repetitive work and heavy lifting, and they learn that quickly."
(Valdemar, engineer and CEO, robot developer, WIPER)

"One of my main tasks has been to deliver proposals concerning the design of the remote control. I developed a prototype, which in principle met the requirements, but there were some problems: It easily becomes strenuous to activate the button for a longer time; the remote's placement in regards to the thumb could be optimized, and the prototype fits some hand sizes much better than other. The challenge is, therefore, to improve the ergonomics. It is also a declared goal to make the remote more flexible, so that it can be used by humans with different hand shapes and sizes."
(Liva, production technologist, robot maker, WIPER)

"The remote is supposed to be used by construction workers in the construction industry. Since construction workers do not have the same hand size, it is important that the remote is designed flexible and can be used by humans with different hands. Even if the operators are mostly men with big hands, the remote nevertheless has to be designed so that it can be used also by men with smaller hands and women."
(Liva, production technologist, robot maker, WIPER)

"Because, well, our collaborators are here, so it – it's important to – I mean nowadays you can Skype and whatever, yeah? It's easy to communicate with people who are in other places in the world, but I think the eye contact is important and – in the sense that I guess it has been a fundamental issue in taking this decision to be able to work with them directly and not have to travel.
For example, we have a haptic device since many years ago and they are located in Southern Europe, and it's always a problem. And when there's some – something is broken and so we have to send it there and wait for weeks that it comes back and customs, because it's Southern Europe and it's complicated. So, when – if you have them here, it's marvellous."
(Dieter, head of robotics lab, robot developer, BUDDY)

"Robotics is a very little world right now"
(Salome, communications director at a robotics company, robot maker, BUDDY)

Mathias: "All of them are meant to be used by cleaning staff that doesn't necessarily speak any language very well – for example English, they could have problems with that. We aim to be able to have them use the robots. (…)"
Interviewer: "And they don't need to be able to read to use the...?"
Mathias: "We try to make interfaces very, very simple. And it's our aim that they would be able to, to use them without // they need to be able to read some simple like, start, continue, stop, room one, room two. I believe also that they need to know these things to be able to do their jobs."
(Mathias, system integrator, robot maker, SPECTRUS)

"For example, when designing an interface, the programmers as adults have bigger thumbs than children do, right? It is such a silly thing. And they [programmers] just design it to make it comfortable for themselves. And then we go to the kindergarten and it turns out that a 4-5-year-old kid has thumbs that are so small that he/she cannot reach to the left, right? For example, to make the robot turn left. And such things just had to be done, what the child would do, what limitations he/she has."
(Leon, robotics start-up co-founder, robot developer, ATOM)

Interviewer: "Did you see some resistance?"
Bart: "Of course. We see of course there are – the older operator that are not used to take a laptop in the hand, they want only to finish their career in the company using manual tools but without any informatics stuff. With the younger one, they are more, okay, useful to use smartphones and the new technologies and they took immediately the opportunity to empower themselves using this robot."
(Bart, business developer, robot maker, OTTO)

"It's been changing because not only our company, but also other companies are developing so many robots, so many automatic robots that can help people, and also there are younger people in also company, public companies, in the metro management – also the mind, the approach of these guys are a little bit open. More open than the other people, than the oldest people."
(Charles, engineer, robot developer, OTTO)

"It is a question of habbits and it is related to the issue of changing one's old habbits and that also means, that the younger workers are much better to do so because they are not afraid of new technology. The older ones are a bit afraid. I would say they are. They are a bit, argh, does this actually work? We have done the job in this way for the last 30 years and that is much faster. It is the thing about changing one's habits."
(Agnes, regional manager, affected stakeholder, WIPER)

"and then there is also the fact that children have a little more knowledge, know what they are talking about, and here as if

the roles changed, that the children are teaching adults, get adults interested, and the adults must look for that knowledge, right? If they want to have a discussion with their child."
(Amelia, head of orphanage, affected stakeholder, ATOM)

"Right now, a teacher is only a guide [for kids] while a pupil is supposed to acquire knowledge on his/her own. He/she shall show the results of his work to the teacher. It is very good to learn from kids. For example, we switch roles."
(Anna, private school teacher, affected stakeholder, ATOM)

"In the case of our robot I hope to introduce even a multiplayer task where two robots are needed. This way we do not just do it on the tablet, but we have to find a partner who also has a robot to complete the task. The second type of task that we considered really important is one task that requires interaction with an older person. So, the difficulty of the task will be set so that the child is not able to do it himself/herself and must go to ask for help, I do not know - mom, dad, brother, sister, anyone. They will not stop the story itself, but they will be given special rewards."
(Erwin, university psychologist, robot maker, ATOM)

"A construction robot requires an instruction and according to the law it is required that we provide such an instruction whenever we introduce a new tool. And we do that. Well, in theory because actually it is the technical equipment rental business which distribute them, who have to provide a manual for each tool. So, they describe how it should be used. The craftsmen then have to read it and at that point it is important to remember that there is actually some of them who cannot read! That is an issue. We have some craftsmen who are extremely dyslexic. They get along, of course they do, but you tend to forget that they cannot read a huge manual. They just can't read it."
(Agnes, regional manager, affected stakeholder, WIPER)

"When you're selling a robotic application or system, you're selling a solution to a customer because the way they operate is going to be different, the way they plan will be different, the way they control their environment will be different and the way their people interact within the facility will be different. So, when you're selling to a customer for automation, you're selling a solution and you're selling something that will cut across the whole organization rather than just putting a truck in for a specific task."
(Danny, sales manager, affected stakeholder, WAREHOUSE)

"For what I know they [operators] are very happy, if they know the potentiality of the system and the potentiality that the system brings to the entire process. The operators that don't see this aspect, that think only the time of work, the time when they finish work, probably prefer to use a manual tool, because it's more simple. [laughs]"
(Cristiano, mechanical engineer, robot developer, OTTO)

"Using an autonomous robot is a big innovation in their [operators'] minds. So, we need also to invest a lot of time speaking about the advantages of this technology, the way you can use this technology, the added know-how that they could have using these technologies. It's all a sort of philosophical approach."
(Bart, business developer, robot maker, OTTO)

"For some people they might find that 'I'm not very good at operating robots and really when I'm at work I just want to do something physical and not think too much about it, and then in my spare time that's when I want to use my brain'. I think some people have that attitude, whereas others might welcome this and say, 'You know, it was so boring to just move boxes around. Now I'm doing all sorts of things and it's actually fun.'"
(Nils, university lecturer, affected stakeholder, WAREHOUSE)

"It's not just working for giant companies who really can spend millions on automation. Our idea is affordable robotics for people."
(Alph, robotics start-up founder & CEO, robot developer, WAREHOUSE)

"For most of the solutions, you don't need the full humanoid, so then they [the company] started to, in some cases, just remove legs. So, the thing is they start with the full humanoid. After the full humanoid, they have the humanoid without legs. After the humanoid without legs, they have the humanlike mobile platform. That it's trying to keep it as simple, with only one arm, with everything to try to reduce the cost. For different applications, so also to try to achieve an affordable solution to the market."
(Pedro, HRI researcher at a data company, robot maker, BUDDY)

"It depends on the school, how it wants to conduct classes. Recently, I have been working a scenario designed for a larger group of children, so that every child has his or her own robot. It was more probable that the school would buy, I do not know, 2-3 robots per class, than that it would buy for robots for the entire class, like 25 or 30 robots. Our assumption was to develop most of the scenarios for groups, that is there would be 3 robots used in the class [but] we came across several schools that bought robots for every child."
(Monika, scenario developer at robotics start-up, robot maker, ATOM)

*Robert: "*So the introduction of equipment always brings there some bad ethics side, but the world moves in this direction, as if it is not something we can avoid, there is no chance to avoid it."
Interviewer: "Right, why cannot we avoid it? Technology, because we talk about technology, yes? That the world is moving in this direction. As it is such a common, popular belief."
Robert: "Because the human has been driven by inventiveness and it always was the case. Since I remember it, I do not know, as it is described in some ancient myths or in prehistory, a human has always been looking for a tool. And technology is a tool to do, only now we are higher, faster, further, and we want to travel, we want to explore the world, so we construct

planes, we construct cars, etc. And that it cannot be avoided, that is simply a human nature."
(Robert, robotics start-up co-founder, robot developer, ATOM)

Erwin: "We live in the twenty-first century, technology surrounds us either side, we can not avoid [it]. The way we use it depends only on us. And in the case of Atom, so children, how to use it wisely. So robots will be [there], they will evolve even faster, they will come along more and more in our homes, they will be cheaper, they will be better and cheaper labour force, so surely also when it comes to the labour market, they will come out and oust people, and we just have to adapt to it. We will not avoid it [laughs]. If we wanted maybe we could avoid [it], change history suddenly, it means development, right?"
Interviewer: "If we wanted maybe we could avoid [it], change history suddenly, it means development, right?"
Erwin: "Probably yes, but they bring too many conveniences, they entertain us so well, so I don't think the society all of the sudden switches to not using it."
(Erwin, university psychologist, robot maker, ATOM)

"The need of higher productivity is a reality for different sectors. So, this increase of productivity and the cost of the human operator is higher, higher in particular in Europe. So, there is not the choice of the robot versus the operator: It's no work in Europe versus having the work in Europe, or working with the robot and the operator, not increasing the number of operators. I think it's not trivial. We have to be able to understand this. So, the option is not to, is also lose all the jobs because, otherwise, in Europe, we will not have just no production."
(Emilia, director of research and innovation, robot maker, COOP)

"Well, we have to respect that you can have different opinions. We need to respect the fact that some people want to crawl up and down a lift, a scaffold, and who doesn't want to use a robot. It is the individual's choice. Some people want to dig the hole with their shovel and their wheel barrow instead of using a mechanical digger."
(Jens, CEO at technical equipment rental business, affected stakeholder, WIPER)

"Nor do I believe we have a responsibility in relation to whether or not people keep their jobs, which must be someone else's concern. In some ways, I like to relate to history; there are more jobs than ever before, and we work more than ever before, in spite of reduced working weeks. We've probably also gotten better at registering how much we work. A lot of jobs have disappeared, in my lifetime alone, and a lot of professions have gone from being worker jobs to being artistic skills, in the sense that they are now increasingly rare. None of this, however, is something we can take responsibility for, that's got to be someone else's concern. We work with the tools we are given, if you might say that."
(Valdemar, engineer and CEO, robot developer, WIPER)

Chapter 3 Collaboration in the Inner Circle

Daniel: "It's something we collaborate quite a lot with, but it's just part of it. I do a little bit of everything. There's one specific European project that I'm collaborating a lot with and then some other projects that ultimately I may have to do something but it's just a specific time task that I do at one point and then it's done"
Interviewer: "And could you describe a design process, your in collaboration with your colleagues, the design process like from the – in short, from the beginning to the end? And how long does it last?"
Daniel: "Ooh, that may last – easily it will last a year or even more. Usually way before we decide we are gonna build a new robot, there's something we are already thinking of. So right now, the same moment we unveil the CRYT, the newest robot we are already thinking on [the next project]. We are already thinking on what would the next big thing be. But in the beginning we start having all the – noting down all these ideas that we see, both from the mechanical, electronical, software, business part, what people want, what do we need or what's going to be easier for us to handle in the future. So, one with these we just are pulling ideas. The design process will start mostly from, it starts first from the mechanical side, to start setting up all these ideas, transforming them into an actual mechanism that works. There will be a lot of testing on the space, mechanical and electronical side, up until they have decided what we could call the basic framework. And from there then we will start from the software side to start seeing what we need to control that thing. And then all the different systems that this will spawn. At the same time from the software side, we don't really deal so much with new robots but as a continually improving process. So, on this year I have released maybe ten, twelve, thirteen new features. For different robots, for different things. Some things that one person asked or a customer asked or we realise is missing."
(Daniel, software developer, robot developer, BUDDY)

Interviewer: "So the platform remains the same, but the software changes?"
Daniel: "Software wise it keeps changing quite often. Whereas it's a continuous process of improvement and every time we realise something was missing then we allocate some time, we fix that and we keep moving on. So, even if the platform, the GOTAN platform has two years or three years now, the software from the latest GOTAN doesn't look exactly the same as the software from the first GOTAN."
Interviewer: "So, your client who bought the GOTAN two years ago, can he or she can get updates?"
Daniel: "We give them updates, we give them latest software if they need something new. We prepare it and send it to them, we have some mechanisms for that."
(Daniel, software developer, robot developer, BUDDY)

Interviewer: "So, what are the other elements?"
Felix: "So how things started, basically, in 2013 – and again, Alph, who is the CEO, will tell you a little bit more of the history – it all started back in Eastern Europe. So, the people who were working on the very early prototype. So, here is the video. So most of the start-up started in the— This was not yet in the

garage, it was in the apartment, and that was just the idea of, okay, we saw Kiva robots, and Kiva was acquired by Amazon so they're no longer available, and the guys were trying to test and see if it's difficult to make this kind of robot. What does it take to produce this?"
Interviewer: "But was it an industrial research or university research?"
Felix: "It was probably a hobby. Let's put it this way."
Interviewer: "Ah, a hobby, okay."
Felix: "Yes, I think it started with people in their own spare time. Again, it was in the apartment and then it moved down to the garage because the robot got bigger. So, by any means, it's not industrial. Really, it's more like a kit made of the components available on the market. But even to understand how you control it, how it moves, what it takes to carry a rack, because you'll see the system is actually about bringing racks to people and racks carrying goods, so this is where it started and this was back in Eastern Europe. The idea was to try and see how difficult it is because, when you look at it, it looks simple. Okay, a robot, you see many great things when we watch science fiction videos, but in reality, they were trying to understand what does it take to create something like this. So, the point was you can call it research but it was more like a hobby at this stage.
So, the guys realised – and it was a team of three people at the time – yeah, we can make it work. That was the first conclusion. The second was, yeah, if we can make it work, then we have to actually make it more than just a hobby. Then it becomes part of the foundation of a start-up or foundation of the business. So, then the company actually was created in Western Europe, and again there is a whole story of the CEO was around the world and, as I told you, he had a good friend here and this has all happened here."
Interviewer: "So, you said now you have thirty people."
Felix: "Yeah."
Interviewer: "When you started, how many persons?"
Felix: "Three."
Interviewer: "Three, okay."
Felix: "It started as a hobby of three people. When the company was incorporated, there were four people."
Interviewer: "And you got investment from a European government and some other—?"
Felix: "Later. A bit later."
(Felix, CEO advisor, robot maker, WAREHOUSE)

Interviewer: "We are going to talk about products now?"
Guy: "Absolutely. And to host let's say hundreds or thousands of players or digital retailers they can't connect with. And also, it's an interesting point of view to attract more visitors. Because if a shopping mall will host let's say every two weeks online stuff, they will be more attractive and will bring more visitors, just general visitors, because it's the biggest question to them."
(Guy, robotics start-up product owner, robot maker, WAREHOUSE)

Interviewer: "Because for traditionally the robots that you already have you have quite a good coverage?"
Felix: "Again, we are industrial B to B company, so we try to target. So, we have a LinkedIn page, we now have Twitter, we are in the professional media, so like logistics magazine, warehouse manager, there are some professional or internet retailing survey on fulfilments, we are—"
Guy: "It's professional."
Felix: "Yeah, it's industrial professional media, but it's not general press. I think we recently got some coverage in a national tech magazine, which is again technology, we hardly – hopefully we will make it in an international magazine one day, when this becomes—"
Guy: "We were mentioned in an international magazine."
Felix: "Yeah, but for now it's more like we want to make sure that the people who are the key players in the industry are aware, that's why we keep attending all kinds of industrial exhibitions, trade fairs and so on and so forth. But it's not a mass media, so we are only consumer product. And even this product is a consumer facing product but again we are not selling to the end consumers, so they will see it and hopefully enjoy it but it's more like the shopping mall or it's a real estate and the landlord who can see the opportunity for them to leverage this space that they have."
Interviewer: "It's more targeted."
Felix: "Yeah, and again I think it's for the brands as well to say, well, this is an opportunity for us to build some offline presence, brick and mortar without being too much of a brick and mortar, because like opening a store is a huge capital expense, this is not a capital expense, this is a rental model, you can rent it and it's flexible, and all the signage is digital so today you are selling backpacks, tomorrow you are selling commerce. It's the same space, it's a glass cube so it's relatively agnostic in terms of its look, and thanks to the digital technology you can make it look different. And the robots will keep bringing, so the concept behind it is still the same, it's goods to person, in this case the person is not a warehouse employee but a consumer, still a person."
Interviewer: "Lots of experience then in big companies?"
Felix: "Well, one of the guys used to run his own businesses and still running a couple of them."
Guy: "Yeah, for the last let's say twelve years."
Felix: "I think in the start-up you always get those mixed backgrounds, because you need a little bit of everything, it's not like you've got thousands of people and each specialises in its own zone. You have to order your own flight tickets and make your own coffee and then you develop your own robots and sell to someone."
Interviewer: "A little bit of everything but you also collaborate with social scientists at any point?"
Felix: "No."
(Guy, robotics start-up product owner, robot maker. Felix, CEO advisor, robot maker. Both WAREHOUSE)

"I met my collaboration partners through an exhibition. I lectured in the university. I was invited to give a research lecture. So, next I ended up meeting them at technology exhibitions, and they said: 'Oh would you be interested to collaborate with us?' I said: 'Yeah, I don't have enough on my plate'. So, from the university I started to collaborate with them. And I developed multiple algorithms. I was, because I came from

the industry, I know exactly what the industry wants. So, they invited me to take up on full time, to join them."
(Ali, start-up founder, robot developer, WAREHOUSE)

"I think it was the municipality's decision. [So it's a conscious effort?] Yeah, it's not something that just happened…I think we [HUB Municipial Robotics] are formalizing what happened in Silicon Valley. Because we also have network meetings where the companies are coming and discussing. So I think in Silicon Valley it just happened because the right people were there at the time. Here [in the HUB], it was an active choice. I don't think it would have been so nice if we didn't have that awareness."
Manager of government-backed start-up hub (Sorenson 2018)

Theo: "You get to know these people and then building a European project is finding the right people for the right job."
Interviewer: "Is it because it is better or easier to get founding, if you are more places?"
Theo: "Yes. Yes. Yes [laughs]. […] In principle, we can do a lot at [our own university]. But for European projects, the European Union wants to have European institutes work together.. So you find a consortium which is cable of doing the jobs. Each one has its own task, and trying to bring that together."
(Theo, university researcher, robot developer, SANDY)

Interviewer: "But was it your idea in the beginning? It was with your Southern European colleagues?"
Vincent: "Yes, it was this partner we worked very close with on several projects."
(Vincent, robot developer, SPECTRUS)

Alexander: "Well, it brings a bunch of competences together that one partner might not have on their own. And it gives us different views of the problem, which means you might think of the project in a slightly different way. Most of the projects we have at the university involve several national or international partners, but also private companies. To do an EU project, you need companies-- you can't get the projects without them."
(Alexander, university robotics researcher, affected stakeholder, WIPER)

"You see, we are not at a place where it is, like, these profound ethical considerations, because it is conducted on a completely different level. It is very concrete robotic solutions related to a very concrete business case. Is it technically doable? Is it a good business case? Is there a good market for it? Are we capable of, together with someone, bringing about this robot and putting it out on the market? You see, it is considerations like that we have all the time, and that is more concrete than something with profound ethical considerations, because that is, we are far from that because it is so concrete. We never get to the point where we sit and twist our brain in all directions because we have some profound ethical considerations, because what we work with are very concrete robotic usages, where someone brings a certain requirement."
(Villads, CEO of robotics company, robot maker, WIPER)

"[In] many ways that works. You have a network. So you already know people. That is one possibility. You get to know these people in the science basics in congresses, you know, from papers. You do an internet-search. And if I want to do something in a difficult area, I look at: 'What people do I need?' I think: 'Well, this is the group that works best for this project' and I just call them or send them an e-mail: 'I want you in my European project. Do you want to join?' And then we start this project. But more over, now a days we also need to have [costumers], we need to have companies, because we are not building things, we have companies to build it. So we also look in the market: 'What company do we need?'"
(Theo, university researcher, robot developer, SANDY)

"I wouldn't discourage the use of robots at all. I already work in an industry that unfortunately does see a reduction in staff from their clients as a result of putting in our system, but I wouldn't discourage robots because, at the end of the day, for us, our customer comes first and our customer is the owner of the business, the director, and for them it's about the profitability. And I think from my experience with how the market's going, the demand, I think robots are going to actually help with that. And I think as an individual, I'm guilty to all the stuff that, you know, online within five seconds and expect it to be there the next day and when it doesn't, I'm on the phone to them, you know, 'Why has it not arrived?'"
(Patrick, software company, account manager, affected stakeholder, WAREHOUSE)

Interviewer: "Do you collaborate with social scientists? You as your company?"
Ali: "We have, ok, we are basically requirement-driven. So, our autonomous robotics is not autonomous in a sense of it will go and decide something what the robot needs to do. So, we have a rule-based autonomous. So, we have a layers of safety. Because when the customers comes to us, I will give a very simple example of a fieldbot, ok? We work with a big client, they have vehicles, inside their premises they have over a thousand vehicles, and they have a petrol station inside, and they want automate that. So, we can go there, it has to fill the things up, and a vehicle move away, ok? So, what are the risks in that robot? So, we assess that risk. First of all we analyse how the manual operation happens, ok? And then we have to identify together we the client what are the other risks are."
Interviewer: "How do you do that in practice that you involve clients in the design process?"
Ali: "We don't involve users in the design process. We involve users in the requirement process."
Interviewer: "Ok, so before."
Ali: "Yeah, always users has well-defined hazards, well-defined warnings, well-defined the actual rules and safety for the environments, ok? So, the challenge here is that, ok, these rules are for human operator, ok? And how we can expand that to apply a robot, ok? In which case, in here we don't aim to duplicate human. We aim to address the actual challenge there is to solve the problem."
(Ali, start-up founder, robot developer, WAREHOUSE)

Pix: "We kind of continually have some forms of collaboration.

I think it's quite a European ideal for business, collaboration, which, you know, is good. But here is a distinction between partnership on commercial terms versus collaboration, which indicates that – collaboration would indicate that you ultimately have the same common goal, and that is tough because, you know, not all businesses have – they have lots of different goals and, you know, those goals change. And so I mean we definitely found that with some of the partners that we have that frankly what's important to us just isn't as important to them really and therefore it's quite hard to collaborate with them. And how we tend to have dealt with it is to try to find that kind of common commercial – you know, so sometimes that is pure cash incentive, but other times it's about, you know, giving access to intellectual property that they wouldn't otherwise have. Other times it's about, you know, genuinely personal relationships and making people believe that we're capable of doing what we say we're doing and they're capable of what they're doing and believing that they're people that we can actually, on a personal level, enjoy working with, you know. There's all sorts of – you know, that goes for external partnerships as it goes for kind of team members"
Interviewer: "So do you think their collaboration model is better than the partnership model then?"
Pix: "I don't know actually. I don't know. It depends what you're trying to create, doesn't it really? It depends. So, ultimately, if you goal is to create – I know this is a completely unsatisfactory answer, but I think you've got a model which says actually, we don't promote collaboration; what we do is there are, in terms of industrial strategy, there are industries that are important to us and we just give those companies cash. And I think that will just always be open to individual companies abusing that because – and I think the collaboration model gets round that abuse in some ways because it's less likely that you can, you know, as a group, that you would find agreement in kind of, you know, in kind of bad practices and conning the government and stuff."
(Pix, CEO, robot developer, HERBIE)

"I am, for example, on of the board of director in a large interest group in robotics in order to touch all these kind of issues. And so yes, I constantly speaking with the people that are doing this and try to move in this direction, in order to change a little bit when it's possible [laughs] the mind of the person in order to make it better."
(Donovan, CEO, robot developer, BUDDY)

"As an example, to do a EU project you need companies, you can't get the projects without them."
(Alexander, university robotics researcher, robot maker, WIPER)

"We don't have social scientists in the company but in several of the European projects we are participating we do collaborate with psychological – psychology experts, with social scientists and with more people from that part."
(Daniel, software developer, robot developer, BUDDY)

"In the media, etc., so it all translates into some marketing that is hard [difficult] to measure. I.e. it's not that pure marketing that will tell me that 1000 people entered on my Facebook ad, 1000 people 500 clicked on, from those 500, 20 came into the shop and bought the robot, because it can be traced. Nowadays Internet is a mine of knowledge. But on the other hand, it makes us more and more interesting people, increasingly interesting distributors. People hear and know just how it was with rover – wherever I said 'Mars rover' – and I know it is like this in the States. And they all knew it as there was such a buzz."
(Robert, robotics start-up co-founder, robot developer, ATOM)

"In many ways that works. You have a network. So you already know people. That is one possibility. You get to know these people in the science basics in congresses, you know, from papers. You do an internet-search. And if I want to do something in a difficult area, I look at: 'What people do I need?' I think: 'Well, this is the group that works best for this project' and I just call them or send them an e-mail: 'I want you in my European project. Do you want to join?' And then we start this project. But more over, now a days we also need to have [costumers], we need to have companies, because we are not building things, we have companies to build it. So we also look in the market: 'What company do we need?'"
(Theo, university researcher, robot developer, SANDY)

Robert: "Promotion, but we also have funds that are related to our national research and development [I]n addition, there have been trips to the fairs, various events."
Interviewer: "Organised by the ministry?"
Robert: "Yeah, we even opened a fair in central Europe."
(Robert, robotics start-up co-founder, robot developer, ATOM)

"Media is interested in us. I mean, there are certain actions that we force, because we want it to be, but in most situations the whole media noise, some princess visits and meeting the princess or whatever, this is the trigger on the other side. So we are the Sprite and they are. No, we are the thirst and they are Sprite"
(Robert, robotics start-up co-founder, robot developer, ATOM)

"There might be some instances at the university, but even there, I doubt it. I think they make a big deal out of trying to understand the problem. The idea that this all happens in a lab because someone had a good idea - I don't buy it. I just don't believe anyone does it. I think it is a false presumption. There might be different degrees of these studies, but at some point, you have to build something and see if it works and if you can sell it, but I don't think people don't try to study it. However what is difficult to understand for robot developers is that reality and people's actions are always more complex than what the robots allow for."
(…)
"I've been surprised that after asking experienced craftsmen what they do, once we saw them at the site, they actually did something entirely different. Not that they told us something wrong, but we look at it with different eyes. Another example is that when we started this, the saying went that 90% of all panels weigh below 90 kg, which was often repeated even nowadays. To date, we've been to one construction site where the weight was less than 90 kg, it was 80-something. Other

than that, they are usually in the 95-110 kg range. Another example is that we officially never install anything that is more than three meter tall, for various reasons. But the last two places we went, we were working 3.1 m and 3.5 m. That sort of thing makes it difficult to set the parameters. But as designers, we have to set them someplace."
(Valdemar, engineer and CEO, robot developer, WIPER)

Valdemar: "At first, we received a general description from an employee, then we were visited by three craftsmen on two or three occasions. We then visited two construction sites, where we took pictures, did measurements and made videos, all in order to understand what was going on. From there on out, we started work on the first machine, once it was complete and positively received, we carried on working on the details. We still work on these minor details. For instance, frames like these. Picture that we have a machine where things are hanging in front of it, giving us a problem with balance. At the same time, we need to tilt it a bit, which doesn't make the problem any smaller. And would you believe it, we met one who was putting in two parallel glass panels, 9 cm in between --"
Interviewer: "Why would they do that?"
Valdemar: "Good question. We haven't found out, but I think it has something to do with sound."
Interviewer: "Of course, that would make sense."
Valdemar: "It could be that. The next issue is the rail, it has a rail that fits into two grooves, which makes that hole 1 mm shorter on both sides. So, instead of a panel that needs to fit a groove, we're now talking about an even smaller groove (…) I know it sounds pointless [laugh]. But those [divergences] can give the control staff headaches."
Interviewer: "But that would still be a problem with manual labour, right? Or wouldn't it?"
Valdemar: "Not necessarily, because those craftsmen know how to fit it. Yes, they can handle it, at least to a certain extent. Sometimes, what they do is that they insert from both sides , but that has other difficulties. The message isn't that it is impossible, rather that we didn't know from the beginning."
(Valdemar, engineer and CEO, robot developer, WIPER)

"We try to collaborate with research, universities, companies around the city that we're connected with that matter. So, we talked with them, but at the end there was not any specific project that could organise."
(Emanuel, exhibition coordinator, affected stakeholder, BUDDY)

"The collaborative robotics is a really new method. So the technology exists I think exists since 2010, or a little bit earlier in some university. And a lot of people now start to do – to think about collaborative robotics, but yet nobody has still already started to think that we can face some kind of problem, because we have facility, could be that the robot has a piece in the hand. And if the robot continues to, to, to handle this piece, maybe a person will die."
(Alessio, robotics start-up founder, robot developer, COOP)

"The most important thing about the users is that they, they're not afraid to use the technology – that's the most, the most challenging thing that we have, because we are not creating any robots here in the building that's difficult to operate. All of them are mean to be used by cleaning staff that doesn't necessarily speak any language very well, so they could have problems with that. We aim to be able to have them use the robots. No problem in that, but if they are afraid to push the button, and if they are afraid, because of the size of the robots, and the size here that we have on the robot is pretty big, then they just -- you really have to learn by trying sometimes, and you don't – I mean, I can tell them as many times, you know, I can keep telling them things, and it's just impossible to remember, if you don't really try to push the buttons yourself. So, that's the main thing, to start with. So, we ask for users that would like to be part of it, sometimes. To get past that."
(Mathias, system integrator, robot maker, SPECTRUS)

"One of the main challenges is also that, when you're at the hospital there's so many different people, and we can't educate all of them, so making people understand why and how the robot works, is more or less impossible. Where, in an industrial site, you can, you can educate people exactly, and you can kind of do whatever you want with the robot, because you can make sure that things are standing exactly the same place. They can make procedures, and people follow these procedures down to high detail, and in hospitals, we need to cope with, with so many people, and people doing really weird things around the robot. If we were able to make people understand why and how they work, it would be much easier for everyone. But it's just impossible. That's a, a really a main challenge in an environment like hospitals. You also, from a more technical side, we don't want to, drive into things, and hospital you will experience so many weird objects that just kind of come, come out of nowhere, and we need to have a higher safety area around the robot, because we know we can meet kind of everything. When at an industrial site, we could potentially lower the safety area, because we know, and we can test the objects, because we know the objects, they are in there, and they, they don't start to, to change their environment in the same way as a hospital. So, it's a very dynamic environment that's a really high challenge, and also, the with the users."
(Mathias, system integrator, robot maker, SPECTRUS)

"It is more about the cooperation between kind of people and sort of like robotics. And I know there's a lot of work recently in robotics that's gone into how the human and the robot – we're talking about a different form of robotics. I mean cobotics is a word that I've heard since I joined kind of like our company, the cooperation between them. And we go through a risk assessment process with any site that we work with and part of that is understanding the risks and the impacts on kind of like people of a project and coming up with an active kind of like plan that you can implement to address those issues."
(Danny, sales manager, affected stakeholder, WAREHOUSE)

"So they needed to, to clean the prototype motor. With a high pressure water. So they thought at the beginning to use an industrial robot, and the human operator has just to teach

all the position. So if this is the motor, the human operator should teach all the position that the robot arm has to, to achieve, to clean the motor. But you can – human said, if I have to teach the robot what they have to do on just one single motor, you spend one week to do the programme and one hour to clean the motor. So it does not make any sense. So when I went there, they still thought to do, to use this solution, and they thought, okay, why we cannot use the robot arm just lie a tele-manipulator. The robot arm cost twenty-five thousand Euro. There is a company in Canada that has a very nice component, which costs more than the robot. We can connect that with the robot. In this way the human operator has not to teach the robot the position, but just to look inside the robot cell, move the component and the robot perform exactly the movement that the human operator want."
(Alessio, robotics start-up founder, robot developer, COOP)

"In the sense that you might end up raising people, who can't talk to anyone but robots. You can see this in your daily life, to a certain extent, when you go to a party; I don't go to that many, maybe you go to more, but when you go out, you always see people looking at their phones, rather than talking to their neighbors. I know it's difficult to talk to someone you don't know, but even people, who usually communicate well, prefer to engage with their phone. I think it's interesting to consider what kind of people we are creating."
(Valdemar, engineer and CEO, robot developer, WIPER)

"We don't have social scientists in the company but in several of the European projects we are participating in we do collaborate with psychological – psychology experts, with social scientists and with more people from that part."
(Daniel, software developer, robot developer, BUDDY)

"At first, they were involved in developing the concept, then we had a user liaison, who took part in the early testing and made some comments on that. Since then, we've expanded the circle to include a few people, whom we call from time to time; either they come here or we visit them."
(Valdemar, engineer and CEO, robot developer, WIPER)

"I've involved two therapists from that place that need to help us train this citizen alongside the exo skeleton, according to her, like her development, this citizen's development, you can say, alright, before we start, you have therapeutic knowledge that I don't, so if you think about what you've learned or what you know as therapists, do you see any advantages or gains or anything that I haven't thought of because I don't deal directly with the citizen."
(Nikoline, rehab center staff, affected stakeholder, REGAIN)

"Well, like I just said, you need to be able to evaluate what's the problem for the patient, and then you need to know the technology. What does this technology offer, what's it's functionality?"
(Viktor, physiotherapist, affected stakeholder, REGAIN)

"Well if we cannot reach 100%, maybe we can reach 90%". This was something that we discussed with The Advisory Board of [Costumers] and then they just said: "Well for us it doesn't matter if it is 95, 90 or 85% harvest rate, because maybe 5% we can leave, but if we have 10% or 15%, we cannot. So we have to send people in the crop, and they will have to do the harvesting. So, that made us think: 'Ok, it doesn't make sense if we have like 70% harvest rate to increase it to 85% harvest rate, because for the growers the difference isn't that big, so this won't be our goal to have 5% or 10% more harvest rate.' This is how they [costumers] interfere with the design process. But I think that the majority of the design is done more by the robotics people."
(Sofie, crop expert, robot maker, SANDY)

Interviewer: "And you produce them here on your own—?"
Felix: "Yes, we assemble and produce them. I mean, the components are sourced from all over the world – China, Europe, France, Slovenia."
(Felix, CEO advisor, robot maker, WAREHOUSE)

Interviewer: "You have mentioned autonomous robots. I know that your company also produces, designs autonomous robots. What do you mean by autonomy? You said handling?"
Ali: "Yeah. Autonomy, I am referring to mainly making decisions, ok? How can you develop a robot that can make decisions?"
Interviewer: "And your robots already have these capacities?"
Ali: "Yeah, so when I said making decisions, that could be without supervision or that could be in an open plain, or that could be close-loop. For example, I want to shut down the lights when there is no person around."
(Ali, start-up founder, robot developer, WAREHOUSE)

"I wouldn't discourage the use of robots at all. I already work in an industry that unfortunately does see a reduction in staff from their clients as a result of putting in our system, but I wouldn't discourage robots because, at the end of the day, for us, our customer comes first and our customer is the owner of the business, the director, and for them it's about the profitability. And I think from my experience with how the market's going, the demand, I think robots are going to actually help with that. And I think as an individual, I'm guilty to all the stuff that, you know, online within five seconds and expect it to be there the next day and when it doesn't, I'm on the phone to them, you know, "Why has it not arrived?"
(Patrick, software company, account manager, affected stakeholder, WAREHOUSE)

Interviewer: "Do you collaborate with social scientists? You as your company?"
Ali: "We have, ok, we are basically requirement-driven. So, our autonomous robotics is not autonomous in a sense of it will go and decide something what the robot needs to do. But is it clues %. So, we have a rule-based autonomous. So, we have a layers of safety. Because when the customers comes to us, I will give a very simple example of a fieldbot, ok? We work with a big client, they have vehicles, inside their premises they have over a thousand vehicles, and they have a petrol station inside, and they want automate that. So, we can go there, it has to fill the things up, and a vehicle move away, ok? So, what are

the risks in that robot? So, we assess that risk. First of all we analyse how the manual operation happens, ok? And then we have to identify together we the client what are the other risks are."
Interviewer: "How do you do that in practice that you involve clients in the design process?"
Ali: "We don't involve [them] in design process. We involve users in the requirement process."
Interviewer: "Ok, so before."
Ali: "Yeah, always users has well-defined hazards, well-defined warnings, well-defined the actual rules and safety for the environments, ok? So, the challenge here is that, ok, these rules are for human operator, ok? And how we can expand that to apply a robot, ok? In which case, in here we don't aim to duplicate human. We aim to address the actual challenge there is to solve the problem."
(Ali, start-up founder, robot developer, WAREHOUSE)

Chapter 4 Ethics beyond safety

"The need of higher productivity is a reality for different sectors. So, this increase of productivity and the cost of the human operator is higher, higher in particular in Europe. So, there is not the choice of the robot versus the operator: It's no work in Europe versus having the work in Europe, or working with the robot and the operator, not increasing the number of operators. I think it's not trivial. We have to be able to understand this. So, the option is not to, is also lose all the jobs because, otherwise, in Europe, we will not have just no production."
(Emilia, director of research and innovation, robot maker, COOP)

"I got my PhD in 2012 and so the topic there was Kantian ethics and so quite theoretical history – history of ethics basically about the enlightenment ethics of Kant. Then I worked for three years at a university and I started then transitioning into doing more practical applied ethics, medical ethics and things like that. And then in 2015 I started working here at the technical university and basically since then I have done a lot of work on ethical issues related to robotics."
(Nils, university lecturer, affected stakeholder, WAREHOUSE)

Interviewer: "I also have some questions regarding the topic of ethics. What is important to you there?"
Kai: "I think there are manifold. One question that will probably arise again and again, are of course all these safety things, where I also must ask myself as well about these issues, so at the moment, the safety norms are very high."
(Kai, mechanical engineer and cluster leader, robot developer, COBOT)

Interviewer: "Would you, would you – do you think there would be any specific ethical issues related to the use of robots like your robot?"
Jean: "I think if robots are introduced without the relevant safety and approval process, then that would be unethical. But I think there isn't an issue provided, you know, we've done our due diligence and we're confident that it's a safe system to use."
(Jean, underground engineer, affected stakeholder, OTTO)

"Sometimes we go from a situation where we're not identifying a problem, and then suddenly we identify a safety problem. And we didn't see it coming."
(Pierre, underground engineer, affected stakeholder, OTTO)

Interviewer: "Do you have any specific recommendations for ethical robot design, whatever it is?"
Jean: "So, I guess I'd think one around the safety implications of what – making sure that's very robust."
(Jean, underground engineer, affected stakeholder, OTTO)

"The ethical way of thinking, the ethics is something that, up to now, is not something that the robot seems not to be able to implement. Because it's something so subjective, so cultural, so culturally dependent, and so complex that it's not – let's say – modelable. You cannot model something you don't know. So, whatever is not fully understood and is not fully transferrable to a model, is not implementable in a robot."
(Arturo, engineer, robot developer, REGAIN)

Chapter 5 Inclusive design

"One of my main tasks has been to deliver proposals concerning the design of the remote control. I developed a prototype, which in principle met the requirements, but there were some problems: It easily becomes strenuous to activate the button for a longer time; the remote's placement in regards to the thumb could be optimized, and the prototype fits some hand sizes much better than other. The challenge is, therefore, to improve the ergonomics. It is also a declared goal to make the remote more flexible, so that it can be used by humans with different hand shapes and sizes."
(Liva, production technologist, robot maker, WIPER)

"The remote is supposed to be used by construction workers in the construction industry. Since construction workers do not have the same hand size, it is important that the remote is designed flexible and can be used by humans with different hands. Even if the operators are mostly men with big hands, the remote nevertheless has to be designed so that it can be used also by men with smaller hands and women."
(Liva, production technologist, robot maker, WIPER)

"Right now, a teacher is only a guide [for kids] while a pupil is supposed to acquire knowledge on his/her own. He/she shall show the results of his work to the teacher. It is very good to learn from kids. For example, we switch roles."
(Anna, private school teacher, affected stakeholder, ATOM)

Robert: "So the introduction of equipment always brings some bad ethics side, but the world moves in this direction, as if it is not something we can avoid, there is no chance to avoid it."
Interviewer: "Right, why cannot we avoid it? Technology, be-

cause we talk about technology, yes? That the world is moving in this direction. As it is such a common, popular belief."
Robert: "Because the human has been driven by inventiveness and it always was the case. Since I remember it, I do not know, as it is described in some ancient myths or in prehistory, a human has always been looking for a tool. And technology is a tool to do, only now we are higher, faster, further, and we want to travel, we want to explore the world, so we construct planes, we construct cars, etc. And that it cannot be avoided, that is simply a human nature."
(Robert, robotics start-up co-founder, robot developer, ATOM)

"Probably yes, but they bring too many conveniences, they entertain us so well, so I don't think the society all of the sudden switches to not using it."
(Erwin, university psychologist, robot maker, ATOM)

Chapter 6 Innovation economics

This chapter build on research within the field of innovation economics, and does not directly rely on our ethnographic data.

Chapter 7 Learning in Practice

"Really I'm working in the mechanical and architecture of the vehicle, about the self-driving system and working with the connection between software, the electrical part and mechanical part but really my material is focused in the mechanical development or in development. But I know, in this process I know about the – what we need to connect the vehicle with the world, so to see the things, to avoid objects so we need a radar, we need a camera, we need sensors, but it's the [camera] maybe off the vehicle, not the software, it's not my material, the software."
(Hugo, mechanical engineer, robot developer, HERBIE)

"There is partly a resistance among people because I think you are as a person you are scared to change. It's like a change that you see that you are not sure that it will be good or bad. Also, it's a humanoid robot so maybe you feel threatened, I don't know, and there's all these jobs fear, a topic of job replacement."
(Salome, communications director at a robotics company, robot maker, BUDDY)

"I think some children are afraid. They do not understand, do not want to. Just as with the people, it may be a bad example, but like the older people, they just are not keen on getting to know new things."
(Leon, robotics start-up co-founder, robot developer, ATOM)

"And it is seen many places where you introduce something that runs automatically. People go like, 'ah, the new, no, no, that won't work, we, now we have done it this way for the past 20 years, it works every time. It can't possibly do as good as we do'."
(Vladimir, operation and production technologist, robot developer, WIPER)

Nikoline: "I think generally people are very receptive towards technology if you can tell there's a point in using it…Of course, there are always going to be someone who is against technology, but generally, if you have a good argument and you're presenting it professionally: 'as a part of your treatment, we're recommending you this technology,' then of course it's only a few who are going to say no"
Annika: "And if you can draw attention to the advantages, because then it'll strike home with the individual. We more frequently experience resistance towards it with the staff."
(Nikoline, rehabilitation physiotherapist, affected stakeholder. Annika, project leader, affected stakeholder. Both REGAIN)

Emilia: "If we want a robot more and more in the house, we have to have some, say, open space."
Interviewer: "So we need to redesign environments?"
Emilia: "Yes, a little bit. I think if we want to have robots that are working and not stopping every time you want something. If you think when I activate a Roomba, I remove the chairs, I remove things that- I remove the wirings, so, you know, not to go every two minutes to adjust, to start again."
(Emilia, director of research and innovation, robot maker, COOP)

"I would say, yeah, for sure, the work of the, of the operator would change if it has to collaborate with a, with a robot as it's, I guess, something unknown for him and he should take confidence with the new tool. But in the end, I think in this step of technology which we are now, it's more like a tool. The, the collaborative robot is more a tool which is improving the, the human skills."
(Pino, robot developer at a company, robot developer, COOP)

Kian: "We collaborated, at the beginning it was a very close collaboration, because the robot knew how to measure but did not know our switches, our equipment etc. And so we had to "teach" the robot developers all that, teach to know all our equipment, with the problems you that can have with a robot of that kind. The hardware and hardware equipment, very complicated, very different from one another and climatic conditions - day, night, sun. And also, at the software level because it is a challenging thing, let's say it was a great effort, especially on their side."
Interviewer: "What did you do in practice?"
Kian: "They would come with us, we would leave, we would go to measure in various stations, running tests and modifying where there was a need to modify. They listened to our needs, tried to satisfy us, in short, what our needs were, and to make the robot work for what was needed by the metro."
(Kian, operator at the metro company, affected stakeholder, OTTO)

"There's a lot of people who are driving lorries and that now who, they're youngsters and they're just raising their families and some of them have mortgages. I mean it's, it's not just like telephone boxes are pieces of machinery, but so many of

them are being pulled down and made obsolete because of mobile phones, but there's still a telecommunications, it's just the way that they change their business. But with actually replacing a human with automation, then the human's not there anymore, it's different, it's not just an upgrade of technology, it's a replacement of a human being, which will see a lot of people out of a job."
(Richard, delivery driver, affected stakeholder, HERBIE)

"When you remove the driver probably you can better see the change, but the huge change inside the car, the technology inside the car. Really you don't know exactly what happens with the supply chain of the manufacturing of the car, the maintenance of the car. But probably, 70% of the supply chain for the maintenance of the car will be replaced. 70% is a lot."
(Gabriel, CEO, robot maker, HERBIE)

"More than remove the driver! Because to remove the driver is only one thing in one car. But if you change the system, the oil and electrical car, you remove all of the supply chain, not only the driver."
(Jose, development officer, robot maker, HERBIE)

Interviewer: "When you have to catch up and follow up on new developments, do you do training?"
Benny: "Yeah, we get a certain amount of training. You learn on the job. Google is always good. Lot of it we learn on the job. We go through the press, we go through forums, because somebody out there has always had the same problem. The internet is brilliant for things like that."
Interviewer: "So it's a lot of self-training that you do then?"
Benny: "Oh yeah, most definitely. You can't go on every course and learn every aspect for every model of car. It's different if you're in a dealership."
(Benny, mechanic at family-owned garage, affected stakeholder, HERBIE)

"Those who abandon the machine are not robot-minded."
(Nikolas, affected stakeholder, SANDY)

"Yes, of course, I suppose that would be absolutely necessary to train them towards the nature of tasks that are not easily automatable. It's being called for, everywhere. The point here is that the – I mean if the purpose is to acquire so-called digital skills_ the amount of – I mean not just basic digital skills, but digital skills are also necessary to be an actual – to be an actor in this field. On the one hand, I'm not 100% sure that there will be, in industry at least, as many digital workers as there currently are production workers, for example. So there may be a need for reconversion outside of industrial companies, which raises very significant issues, and I come back to this later. So the big question, despite all the discourses for retraining and upskilling, etc., obviously nobody has taken a complete grasp of the volume we are talking about. It just starts appearing. Basically all our training, our lifelong learning infrastructure is dimensioned around having a few percent of the workforce undergoing a few days of training per year. And here what we're talking about is not days of training in a year, but probably weeks, if not months. And the fraction of the workforce that would need to be retrained is in the 10% to 15% of the workforce per year probably, yeah, let's say something like that. So it's – I mean in terms of fraction of the workforce, you're multiplying things by 2 or 3. In terms of duration per worker, you're multiplying the duration by 10. So all in all you're multiplying the budget by 30, which is a leap completely forward and which is completely beyond the scope and the magnitude of current financing systems for the training of the workforce."
(Yves, policy advisor, affected stakeholder, COOP)

Interviewer: "But how do you train your operators?"
Axel: "The training of the operator, the way we are [organized is] they are dedicated to an area. So, if we put the robot in this area we try to train as many as possible who are involved in this area. And then the way we [train them] in the room where we explain them what is this technology, how it works, and then there will be a practical training here in the lab. Among the operators we have a tutor [who has] worked with the machines for a long time. The guy we are going to meet later he's a tutor, meaning that he knows the technology pretty well and he will be with the operator doing the trials for several weeks. And then when they are autonomous they can work with the team. And then they are certified."
Interviewer: "So how long it will take do you think, training?"
Axel: "This machine is pretty straightforward. So, I guess they have the first meeting in the room for two hours. Then they have two days of training and then the tutor is with them for several trials. And then it really depends if we feel that the guys are really getting to the stuff, it's going to be pretty quick. If we see that the guy is not very comfortable with that, we will spend longer with him. We tried to provide the operator tablet instead of a video. What is interesting is that sometimes in the personal life like now almost everybody has a tablet. It's pretty standard. Today when we give tablets to an operator it's really different for him, it's a new thing and he doesn't know what to do and so on, even if he has one. So we do not actually – we really have to keep in mind that change is really important, even for a tablet, which is a very small change, can be a big impact in production. The shipyard, they have had a decrease of production in the past, so we hired some of their people. For sure we are training them before putting them into production, so we are training them with external an company, but also with a training room. So, you have a training centre right here, just here. You can take a look through the window."
(Axel, engineer and business developer, robot maker, COOP)

Bart: "Yes, so the introduction of these – these technologies is very useful, because the company who bought the robots decided to upgrade the competences of the same operators instead of giving them manual tools. Many operators are really happy because they have only to push a button and the robot works alone and at the end they only have to see the final report to make decision."
Interviewer: "And do they require any special training?"
Bart: "Yes, we make a sort of training for 150 people. Yes, because they bought 38 robots. More or less every robot is associated with five people, a team, to make a sort of turnover during the week. To use the robot you need only two people,

but we make a sort of training of five, six people for each team and at the end we make the training for 150 persons for one week; three days of theoretical issues and two days in the field practicing. And of course later we have a control, so we can give also advice after this step of training. So, by phone we give advice to the operator and the operator follows our indication of how best to use the robot."
Interviewer: "So robots are not autonomous?"
Bart: "It's a sort of hybrid process. For the reason of weight and dimensions, the total weight of the robot is up to 100 kilos. For reason of the safety of the operators, we need to split the robot in many parts because to be used only by two operators, you need to create blocks of maximum of 50 kilos, so 25 kilo per each operators. So, we divide the robot in mobile platforms, these in the lower part here and these composed by three blocks, so the central block and the block of wheels. We have two bumpers, due to safety reason for the operators. So, sensors, so that when you touch it, it blocks immediately and the most important part that is the head of the robot with the computer and so on. So in this step, the operators have to manually mount the robot. Directly on the spot where it is to be used. But for this operation, it takes only two minutes.
(Bart, business developer, robot maker, OTTO)

Interviewer: "Does it take long for the workers to learn how to use your robot?"
Giovanni: "No. No. I would say that with a week of training you can already have a good ability to use it. It is a very simple interface. Because the main part is this: once the measurement process has been launched, the instrument goes into an automatic mode and no longer needs the intervention of the operator until the end. It finishes by itself, it advances by itself, so it's completely automated, except for the initial part of information that needs to be uploaded to the system - in what station it is located, in which switch it is located and in what direction it is heading to. Because the switches could be read in one way or another. For the robot, it makes no difference, the important thing is to steer the direction of movement at the beginning. So, he knows, with respect to the verse in which he is inserted, which components he finds first and automatically starts with the measurements."
(Giovanni, head of unit, robot maker, OTTO)

Chapter 8 Imaginaries

"The second part, they start being afraid. And why are they afraid? Yeah, unfortunately also because we have those neo-wise men like Gates and Hawking and Musk that say like "Robotics and AI is going to destroy the world." And they are acclaimed, they are the richest and smartest on the planet – yeah, sure, they must be right. So the problem is we actually sow fear and we generate a vacuum. On one hand you have a positive perception, on the other hand somebody tells you it's bad. And then what happens is, you don't want to discuss it anymore. And, you know I have a very stupid analogy but it is exactly the same in fact. If I run around in Edinburgh, and I am afraid a lion is going to eat me. And I'm no longer leaving this room because there might be a lion out there, then I have a problem. A psychological problem. If I'm living in Africa and I'm out in the bush at night with no lights and nothing, and I'm running around and I'm afraid a lion might eat me – yeah, okay, then I might have a reason to be afraid. And this is unfortunately the state. We are casting shadows on the wall that make people afraid of things that are not there. But we're also not explaining them that there is not a bogeyman living in that cupboard. And I think this is one important thing that euRobotics has to address. We have to do information policy. We have to help people understand what's going on and that they might not have to be afraid. Or, in which case they have to be afraid of what."
(Dominik Boesl at ERF 2017)

"I guess, something that could be intelligent in some way and gets out of your control, I mean we have very – we have very old stories about this, the Golem or more recently Frankenstein and so on, so it's –it's not just – yeah, I mean this – all this idea has been translated into robotics. And robots, although they are a human product, could, at some moment, be this other I don't know, yeah, intelligent partner."
(Dieter, head of robotics lab, robot developer, BUDDY)

"So if something is, it comes to my mind, this movie, WALL-E from Disney, that movie, like, showed us a future where we were all fat and lazy because all the machines and robots were doing our tasks, that's not respect for life. If the robot or if the machine is, like, affecting us, like, our health, in some way, then it's not respect for life. Even though it is not killing us."
(Roberto, robotics developer, robot developer, SPECTRUS)

Alexander: "As engineer who is excited about technology it is always exciting to see how the film industry is imagining that. Creative people. These are of course interesting visions, when they walk around completely autonomously. When the Terminator has his battery with him, with which he can save human lives for months. Over here we just have a mobile robot who worlds mobile on this self-driving transport vehicle. It works for exactly two minutes, then its battery is empty. There you see, of course, that there is a certain gap between such a thing really functioning at some point."
Interviewer: "Yes, yes. So, batteries are important technological challenges with such autonomous robots?"
Alexander: "Yes. And of course all of the controlling software. They probably are also programmed in the films. They learn everything by themselves. We are very far from this. When I think about that here, that I have to program every single pose."
(Alexander, development engineer, robot developer, COBOT)

"Their expectations are influenced obviously by science fiction and what they read or see on the screen. And so, when they see a robot in real life, even if it's the first time they've ever seen one, they expect it to be – particularly if it's the first time, they expect it to be just like a robot out of Star Wars or something like that. And when the robot doesn't demonstrate that level of intelligence and does something which indicates it has a lack of intelligence, like it's facing a wall and it's talking

to the wall or something like that, then people have a kind of negative reaction to it."
(Paul, head of social robotics lab, robot developer, BUDDY)

Arturo: "Not that smooth. Not that functional. I mean, it moved quite in a smooth way, knowing exactly the direction, knowing exactly where the human was, but in the real life it's not like that [laughter], we all know. And of course, it would require a lot of more inputs."
Interviewer: "So to make this video, it was not just filming one take with the / It was more work to make the video look like this?"
Arturo: "Yeah."
(Arturo, engineer, robot developer, REGAIN)

"Exactly, yes. Well, actually his characteristics/features are always being promoted/presented really good, yes. Well so from many applications, one can recognize, what he can do, exactly. One doesn't see the weaknesses, nope. Well, the weaknesses are actually, that he is very expensive and error-prone. But the features are promoted/presented very nicely, and is also done well, I find, yes. Well, so one finds a lot about the robot, yes. (…) But we have also done many applications, which the marketing then had used. Well especially here, corporate research [P] has, as said, the first years, actually the Robot wing of GI came and they have only been dealing with applications, and there then of course again many films established. That the robot installs a headlight in a car, or that he bakes pizza, or something like that. Well so that are many things with prior-development, such applications established, which then were also used from the marketing for professional films, yes."
(Kevin, robot developer, COBOT)

Interviewer: "So how accurately do you think this type of video – videos describe robots, depict the robot?"
Dieter: "Well, this is a – this is a robot – sorry, this is a video I think made by this -- By their own company, so I think they're quite accurate in presenting – of course, every time you're presenting a product, you dress it a little bit up, yeah? But I think, I mean all what the robots perform is real so I wouldn't say it's – it's a fake."
(Dieter, head of robotics lab, robot developer, BUDDY)

Daniel: "And in my opinion, they are not so different to the same risks you can find in other fields. They are just risks that have to be evaluated and then decisions need to be taken. But they have to be taken from trying to get all this prejudice out, especially assuming that what we've seen on popular culture and on popular media, it's just movie, it's not reality."
Interviewer: "Maybe once people will start using robots they will change their opinions?"
Daniel: "That will change for sure. So yeah, obviously a big part is fear of the unknown and once the unknown becomes known the fear may disappear. And the fear will disappear in a big part, it's just that we are in a field that it's in its infancy and there's a lot of prejudice from – that comes from popular culture and popular media which is – has absolutely nothing to do with what we do here in reality."
(Daniel, software developer, robot developer, BUDDY)

"It has software, it has mechanics and it has hardware. And it can't work without any of those, but to make some people understand robotics as something between mechanics and hardware. Pure robotics people in the university will understand robotics as just software, but in the real world you need all of them, and you cannot work without the other."
(Edgar, system architect, robot developer, SPECTRUS)

"It's also a society difference between Eastern and Western countries. For example, if we speak in Japan, China, Korea about service robots, everybody is crazy because they want it. When we speak about this about – mainly in the US and in Europe, the first thing is 'wow, Terminator is running'"
(Donovan, BUDDY robotics CEO, robot developer, BUDDY)

"For us, it's always the robots, in every Western movie, the robots are the ones that destroy humanity. In, looking at Asian movies, robots are the ones that save humanity. So it starts from the beginning, childhood comic, that robots are the good and not the bad guys. And I think they generally have a different approach to technology, maybe it's also a question of belief, because every object is something divine and a stone can also be something great, even a robot, so even a robot has a soul. So many, those are quite a few factors, I think, that come in there, that probably make it easier in Japan at first, once the technology is there. Yes, we say here that we have neither the technology nor the acceptance."
(Kai, Mechanical engineer and cluster leader, robot developer, COBOT)

"But there are so many robot definitions, especially in the literature as well."
(Samuel, product innovation manager, robot developer, SPECTRUS)

"If you read the real definition, robots, it was done – they fight more than five years in order to define an agreement and if you read the definition, the definition could be whatever you want."
(Donovan, BUDDY robotics CEO, robot developer, BUDDY)

"And embedded, of course, a physical system."
(Edgar, System architect, robot developer, SPECTRUS)

"A robot has to have an embodiment, so it has to have a physical part."
(Donovan, BUDDY robotics CEO, robot developer, BUDDY)

"I think, a robot has intelligence, I'm not sure about social intelligence, but intelligence. It's a technology for me, if I think of robots, they do have an embodiment, but it could probably also be without an embodiment. Yeah."
(Katharina, user studies and project manager, robot maker, SPECTRUS)

"So, from my point of view it [the robot] is rather, what can you say, an intelligent machine, where the machine itself could also be software."
(Elias, university researcher, robot developer, WIPER)

"Actually a robot is just a physical part of the software, because there is a lot of software that runs installed on robots."
(Felix, CEO advisor, robot maker, WAREHOUSE)

Nathan: "So most robots are still handling machines. Due to the ascent of software and intelligence, like machine learning and so on and so forth, the fragment with the software becomes bigger and therefore, also the intelligence grows. The robot, so it becomes a more intelligent helper."
Interviewer: "So, software is an important part of the robot?"
Nathan: "Yes, more and more so. So, our firms used to be and still is famous because the technology is very robust and durable. And we developed the first bend-arm robot. And there, it was important that it moves from A to B very precisely and always does the same. And that persists for a long time. Whereas now a robot has to be able to do a lot more and be a lot more intelligent. Plus, with more complex robots like ours, the software has to be able to do more as well. And we are transforming from being a machine company to being a software company."
(Nathan, mechatronics engineer, robot developer, COBOT)

"Because, for example, the coffee machine in the bar is a robot, actually, because it has some sensors, it elaborates this flow and heat data, and it enacts some actions on the basis of this data. So actually, yeah, there are a lot of robots in my life."
(Arturo, engineer, robot developer, REGAIN)

"And, yeah, when you speak about robots, you of course speak of certain autonomy, of kind of intelligence, input, output behavior. I mean, it's a couple of sensing things in its environment and to respond, to act accordingly."
(Dieter, head of robotics lab, robot developer, BUDDY)

"That will change for sure. So yeah, obviously a big part is fear of the unknown and once the unknown becomes known the fear may disappear. And the fear will disappear in a big part, it's just that we are in a field that it's in its infancy and there's a lot of prejudice from – that comes from popular culture and popular media which is – has absolutely nothing to do with what we do here in reality."
(Daniel, software developer, robot developer, BUDDY)

"This is namely the fascination that we humans may have for other intelligences. I mean since – since the birth of humankind, there have been gods, there have been angels, there have been elves, there have been extra-terrestrial and so on, always this kind of fascination of not being alone and of interacting with another type of intelligence. Yeah? And robots, although they are a human product, could, at some moment, be this other, I don't know, yeah, intelligent partner"
(Dieter, head of robotics lab, robot developer, BUDDY)

"So very complicated question because like I, like I told you, I think we cannot understand how the robots are thinking, while improving the kind of learning, I think. Maybe the robot know it is more intelligent than the human, but we come to know it, I think it's dangerous. I have seen the position of Elon Musk and Mark Zuckerberg about the intelligent artificial and Mark says it's an incredible opportunity to improve the life of the people and Musk says the robots will kill all the humans species because the human species have the supremacy in the planet, but human isn't perfect and the robot will be perfect. It will be one-hundred percent logical. I think it's really, I think, it's dangerous but I don't know, I don't know about the evolution of the robot, we don't know."
(Hugo, mechanical engineer, robot developer, HERBIE)

"The word intelligent is perhaps a bit tricky, but automation and intelligence will probably be attached to it in some way, it can carry out some tasks on its own, right?"
(Elias, university researcher, robot developer, WIPER)

"Yeah, autonomous means that you have a certain level of, this is a making ability, maybe, so you can say more, more intelligent."
(Pino, robot developer at a company, robot developer, COOP)

"Due to the ascent of software and intelligence, like machine learning and so on and so forth, the fragment with the software becomes bigger and therefore, also the intelligence grows."
(Nathan, mechatronics engineer, robot developer, COBOT)

"Well, to me what comes up is a good helper, an advanced machine that can do things for us, something that makes life easier and in some instances even better."
(Villads, CEO of robotics company, robot maker, WIPER)

"The definition will change, obviously. Before, they were handling-helpers that handled something or installed or did whatever. Now, a robot is more there for support. So most robots are still handling machines. Due to the ascent of software and intelligence, like machine learning and so on and so forth, the fragment with the software becomes bigger and therefore, also the intelligence grows. The robot, so it becomes a more intelligent helper."
(Nathan, mechatronics engineer, robot developer, COBOT)

"A commitment to respect people, to respect everything because we can't place a robot in the middle of everything. We just place a human because the idea is not to put robot, to put, just to put robot. It's to put a robot to help people to, to do some added task, a non-added value task, and that's why we have to, to take care about how we can use a robot and to put the robot at the correct place."
(Nicolas, programmer, robot maker, COOP)

"But I don't think that they are robot ethical issues, it's more machines in general or tools; like the same as you have a knife, the knife can kill someone. Do we ethical issues with a knife?"
(Edgar, system architect, robot developer, SPECTRUS)

"You can ask many questions of course. Robots carrying weapons and drones, uh, dropping bombs is certainly, I think, not something, we would like to have. And I think there are a lot of risks actually. Certainly, if you look, at what we are

dealing with here with unstructured environment and variation. So things we develop here, let's say for the biological field, is maybe very easy transferrable to also developing some very bad robots. I think, intelligent robots and so on. So, yes, there is, I think you can raise a lot of questions about that. And where's the border, and how far do you go? What happens if a robot with a sharp knife is getting out of control? Who's responsible for that? Uh, all these kinds of things."
(Espen, senior researcher, robot developer, SANDY)

"This brings two problems, of course in the public exactly these ethical problems, but they take away our jobs and tomorrow they are eeh – they cannot do all that yet. So, but due to these great videos I see everywhere I might get the impression as, let's say, outsider. That is why we have a hard time with customers who don't come from the traditional automation. I will name a typical, hm, who could we take, maybe like retail companies are coming and saying, we need a robot to stock up the shelves in our store, I have seen all that on youtube, he reaches out, takes them, puts it down and it can't be that hard."
(Kai, mechanical engineer and cluster leader, robot developer, COBOT)

"Oh, that's so difficult, because right now, I'm working with robots every day, and I think most people think they are further than I actually see every day, it's like not even internet connection is sometimes working, and, and then they are just really stupid, so."
(Katharina, user studies and project manager, robot maker, SPECTRUS)

"I for example don't think that from one day to the other everyone who do such a job somewhere that can theoretically be replaced, that they will suddenly not have a job anymore. That I don't think, because, that will all proceed much slower because, if you look at how complex just the task is to put something on a shelf, yes, we humans intuitively do that right. We have a sense for the products."
(Valerie, mechanical engineer, robot developer, COBOT)

"Children aged four do not go online and are not looking for new trends and technology. Children walk through a popular chain children's toys store and say 'wow'. Either they see commercials on TV, or on Youtube, or they say 'wow, what is it'. 'I want or do not want to.'"
(Robert, robotics start-up co-founder, robot developer, ATOM)

Interviewer: "I mean, the moment a human later on, or a child or a parent or a user, will see the robot in practice, do you think he/she is going to be surprised? I do not know what people may expect after watching a movie or it is rather something else?"
Robert: "As long as it's on the screen it always seems to me that people who are not aware of it take it as a science fiction. So just something is going on and this is going to happen in reality. It is known that the movie has its own demands. Actually, the robot's action is exactly the same, but the question is how a human is going to feel like? How does it feel? Is it associated with the Transformer or some Ironman and artificial intelligence that will make me to just turn it on and it is going to be my friend to talk to or just take it in a way that it's a robot that will be [operated] by the tablet, half-robot toy. So it's hard [difficult] for me to say what the viewer feels. The film shows the accurately the operation of the robot, so it all depends on the imagination and comes to somebody mind."
(Robert, robotics start-up co-founder, robot developer, ATOM)

"Another issue is also the desire to seek support for certain projects that have potential, but of course it has to be properly presented, presented, persuaded potential investors that, firstly, the project is interesting and secondly that the team behind this project is able to lead to such a stage that may result in further development of the company."
(Matis, engineer and marketing expert at robotic start-up, robot maker, ATOM)

Interviewer: "But do you think these type of videos, do they accurately describe the robots?"
Nils: "Well, I think it depends. I mean it's – obviously whenever you put out a video introducing a concept, you would, you know, you have to make it viewable, like understandable to the viewer and it may not be – reflect the actual conditions and then – that, you know, you would actually have in the work situation."
Interviewer: "So what would be the difference?"
Nils: "Well, for example, well, this of course depends on how well the robots function."
Interviewer: "Yeah."
Nils: "You're probably not gonna show robots, you know, screwing up, falling, like dropping the boxes or, you know, driving straight into a wall 'cause they thought that was where the boxes were standing or something like that. Or, you know, humans that have to change the battery of the robot or whatever it might be and, you know, being frustrated it doesn't quite work."
Interviewer: "The videos, they don't show these things."
Nils: "That's right."
Interviewer: "But why not?"
Nils: "Well, I mean if a company wants to bring robots into the warehouse and present this publically as a good thing, they would of course want to show a kind of rosy picture of everything working very well and they – if – I mean in this particular video there were no humans as far as I could see. I mean we only saw a few seconds, but I would assume that if they were, they would, you know, look very professional, like they know what they're doing and they would maybe smile at the robot, etc."
(Nils, university lecturer, affected stakeholder, WAREHOUSE)

Interviewer: "I would like also to show you, going back to the robot's appearance – I will show you your own video for a moment, which you have on the site – and ask how much / I'll see if it starts / Which you know, this movie. How well this movie shows what your robot is. Is this a real picture of it or somehow changed?"
Matis: "That is, the image of our robot, which we created in

terms of the Kickstarter campaign. However, there is nothing to hide that the Kickstarter campaigns must be prepared in a way that catches your attention."
Interviewer: "Children?"
Matis: "Viewers, but not children. Not children."
Interviewer: "Not children?"
Matis: "Because Kickstarter is the solution through which adults are largely digging up. It is adults who decide on the purchase of a given solution, the adults spend money from their credit cards, PayPal accounts by paying for this kind of solutions and when the adult – even when the child says 'listen dad, see this cool project is on Kickstarter, browsing the Internet, I saw it', so the decision is on the parent's side whether they want to decide on this solution or not."
Interviewer: "So in what sense is this, I do not know, changed or enhanced [beefed up] the image of the robot, right? Could you say that?"
Matis: "Not so much changed and beef up [enhanced]. This is the image of our robot, which shows one part of the whole solution."
Interviewer: "How?"
Matis: "So this section, which is in a sense related to the emotions and the manner of receipt of this robot, because it also results from many analyses that we conducted in terms of Kickstarter campaigns, which are – if we want to stand out from many different projects, we have to find some niche that we want to fill as part of this project. So here we moved from such a strictly technical presentation of the product, we simply went towards something that shows the topic we talked about earlier, so the form of the robot personality, some form of emotion that is expressed by the story presented in this video. But we also did this campaign similarly, taking into account what I mentioned, i.e. the parent is someone who spends money from their card, [is] not a child who can pay. Getting back on the topic of the games you talked about, there are a lot of different games in which there is a lot of brutality and unfortunately playing on tablets, smartphones – many of these games can be downloaded for free when the child sits and plays, when is presented an advertisement of any game there, which is often done so that it is difficult to close it and the child can unconsciously install the game and then start playing it. If the parent is not sitting with the child, does not check regularly what they are doing, then it may be that later the child has trouble sleeping – why? Because they installed a game that was free, and which was so cleverly prepared by the creators that just the child of this game would involuntarily download and install. So I think that there are quite a big threat and a very big problem – that is, based on content, based on applications available free of charge, in which the child is trying to squeeze in through the ignorance of the child's elements that should not be."
Interviewer: "So as I understand this is not in the robot?"
Matis: "No no. There are absolutely no such things in our robot. We want to make a product that is a fair product in terms of the transparency of what we buy and we also want to inform about such things."
(Matis, engineer and marketing expert at robotic start-up, robot maker, ATOM)

Interviewer: "How good is the film, how credibly and accurately shows your robot, and how could someone be surprised if already saw it?"
Erwin: "I mean personally I have a little problem with this because I have got the impression that around the robot was built very, very big hype and I am curious whether what the end user will get meets their expectations. Because if a robot is to develop with a child, if it is to teach them about emotions, then if it turns out that at the moment there will be only emotions shown to a small degree or without talking it through, or let put it that way, using the voice. These are not our decisions. Because we straight off said that it would be best if there was a speaker [voice-over]. But for reasons independent of us it has not been done. So I am very curious how it will be accepted. Surely when it comes to this programming matters, learning programming, the robot has a very solid foundation. The four programming languages are, in fact, demonstrated here. Here, I do not think there is [will be] any disappointment. As for the application itself and the game itself, I am still very curious about what the final visualisation and presentation of our story will be through a cartoon. It seems to me that there should not be a disappointment, but it is always some unknown [uncertainty]."
Interviewer: "You say that hype was built, that the excitement around the robot. How is it undergoing? Just by the way, using movies?"
Erwin: "By the way, using movies, on the Facebook fan page. The places [events] where [visited by] colleagues are, i.e. the opening of the technical fairs, or one of the start-ups visited by the president. The president, who was expected to open the production line or flight by flying in one of the aircrafts to the Middle East in search of new investors, or simply the photos with prominent politicians and celebrities. So it has just been built up. That means, at the moment also that [the fact] they cooperate with us, because recently also one of our colleagues said that they were in a few places where was said 'Oh, I see that you cooperate with the university, it's great.'"
Interviewer: "Brand."
Erwin: "That is the whole thing that I am very proud of, because it was done on a barter basis. They found it to be beneficial to them, we found that it is beneficial to us and cost-less. Simply by putting [logo], letting us place the university logo on the robot's box. They state that it simply raises/increases the quality of their product."
(Erwin, university psychologist, robot maker, ATOM)

Interviewer: "So what do you think this robot was doing? And why do you think it was created?
Arturo: "Ha! Yes. I don't know."
Interviewer: "From what you saw."
Arturo: "It was a kind of, well, from this video, it looked like a companion, I think. [Laughter] Something that provides, maybe services, because the lady in the video was young and perfectly able to do everything, but maybe it was a companion helping people that can't actually do whatever, maybe with impairments, I don't know. Could be."
Interviewer: "Could you imagine that this robot would be here, now? I mean, would it be like this one you just saw, in the

movie, if it was here? From your knowledge as a roboticist, is this—"
Arturo: "Implementable?"
Interviewer: "--Is this how it works? You know, in real life, if you saw it?"
Arturo: "Not that smooth. Not that functional. I mean, it moved quite in a smooth way, knowing exactly the direction, knowing exactly where the human was, but in the real life it's not like that, we all know. And of course, it would require a lot of more inputs."
Interviewer: "So to make this video, it was not just filming one take with the / It was more work to make the video look like this?"
Arturo: "Yeah."
(Arturo, engineer, robot developer, REGAIN)

Interviewer: "Yes. Yes. We have actually, well nope, what we haven't discussed, not yet, is like the presentation of robots, well for example in films, like promotion videos. Do you think that the technology is presented in the right way?"
Kevin: "Yes, well this particular robot, I find, is presented/promoted super well, yes. Since years that is our showcase, it is being sold everywhere and much marketing is done, also in films, yes. Nope, he is always presented and promoted very good, I find, yes."
Interviewer: "Yes, is that also the one, that then opens the beer bottle?"
Kevin: "Exactly, yes. Well, actually his characteristics/features are always being promoted/presented really good, yes. Well so from many applications, one can recognize, what he can do, exactly. One doesn't see the weaknesses, nope. Well, the weaknesses are actually, that he is very expensive and error-prone. But the features are promoted/presented very nicely, and is also done well, I find, yes. Well, so one finds a lot about the robot, yes."
Interviewer: "Yes, and but then do you also participate in that, well so if they produce such films or is only marketing doing that?"
Kevin: "I believe, such films only marketing does, yes. But we have also done many applications, which the marketing then had used. Well especially here, corporate research has, as said, the first years, actually the Robot wing of GI came and they have only been dealing with applications, and there then of course again many films established. That the robot installs a headlight in a car, or that he bakes pizza, or something like that. Well so that are many things with prior-development, such applications established, which then were also used from the marketing for professional films, yes."
(Kevin, robot developer, COBOT)

Interviewer: "So how accurately do you think this type of video – videos describe robots, depict the robot?"
Dieter: "Well, this is a – this is a robot – sorry, this is a video I think made by this own company, so I think they're quite accurate in presenting – of course, every time you're presenting a product, you dress it a little bit up, yeah? But I think, I mean all what the robots perform is real so I wouldn't say it's – it's a fake."
Interviewer: "And do you sometimes make videos in your own lab for the public?"
Dieter: "We do. We have people who are doing this and, yeah. We try to be accurate, but at the same time understandable because these videos are normally for the general audience, so we have to keep – to be technical in a minimum of – as long as we are understandable."
Interviewer: "And that's not that easy sometimes, is it?"
Dieter: "Sometimes it's complicated, yeah."
(Dieter, head of robotics lab, robot developer, BUDDY)

Interviewer: "To what extent this sort of films convey the essence of your robot? Or its actual character."
Igor: "In this case, I think, they do a lot."
Interviewer: "And to what extent there is a mismatch? But no, you are saying that they do a lot, right?"
Igor: "In this case, there is no mismatch. In this case, the project was already in such an advanced form that, in fact, everything that was shown here is available in our robot in production, it has already been sent to the backers. Of course, some of the technical elements have changed, so there are probably no longer ultraviolet sensors that were supposed to be there, so it was designed this way, its forward element here, sort of a breast [torso]. Later on it changed, probably they rejected it, there is only infrared left. But we do not know exactly (laughs), because we no longer participated later in this."
(Igor, designer at a company, robot maker, ATOM)

Interviewer: "Because we have a movie here, the first one – I do not know if it is first, but the one that appear on the website as a first, that from Kickstarter, right? How much do you think this film or the other two, as if it fully illustrates [shows] what a robot is? And how much, one that has already seen the robot, in practice, may be surprised?"
Monika: "It's not like watching these videos I see the same things that I see in the classroom. So if we give kids in the workshops, even bricks or something, we have even downstairs in the transfer room. We could have had 10 children, and there were blocks, jigsaw puzzles, they could do whatever they wanted, it is how it looked like. Children were riding, building some kind of construction, putting up obstacles and so on. So that's it, maybe when it comes to applications, here is not shown, because we do not see this application, how did it happen that the robot moves or follows the hand. So the parent may be positively or negatively surprised, I do not know what they imagined how sees the film. However, that is exactly what I see every day having classes with children."
(Monika, scenario developer at robotics start-up, robot maker, ATOM)

Interviewer: "Because I'm going to ask you how much do you think, how well this film captures the way the robot looks, how the robot behaves, and to what extent it maybe shows something else. After seeing this movie and later, after meeting a robot, would you be surprised by anything or it is relatively well-reflected?"
Natalia: "I think so. But we have already got, let me say, a bit pre-programmed robots, right? Because here children

start, let's say, from turning on, from executing these basic commands, while during the workshops, well, our robot was already able to do something."
(Natalia, school teacher, affected stakeholder, ATOM)

Interviewer: "So, why do we have all these concerns and talks about threats coming from robotics? Why do you think there is this perception of robotics as a sort of a threat?"
Pedro: "So, it's like if you ask me, and I'm just answering like first thing that comes into my mind it's because of the ignorance of people. People have no idea about what they are talking about."
Interviewer: "Including the mass media?"
Pedro: "Especially the mass media. Yeah, it's incredible how much media is continuously failing regarding to these different approaches. Science-fiction, it helps a lot to inspire people. I fully agree and I think that it's very necessary. But at the same time, a lot of people, they are just looking to the science media and trying to like thinking that that is going to happen for real and it's like, yeah, mainly misinformation and ignorance. And, yeah, I truly – it's – I cannot see a big difference between artificial intelligence and robotics and genetics or chemistry or physics, that it's like in genetics we can create a virus and kill everyone"
(Pedro, HRI researcher at a data company, robot maker, BUDDY)

Daniel: "There are for me like two big challenges. One of them is there is sort of a pre-conception that robotics, artificial intelligence and all of this has to be bad or dangerous or threatening, but there is no reason for that."
Interviewer: "So where does it come from, this misconception?"
Daniel: "Mostly from movies, popular culture and a little bit of the fear we have of becoming irrelevant, if a robot can do what I can do, then what's the point of having me? Well, you can do other stuff as well. They are not mutually exclusive. So, this would be a big challenge. There's a lot of pre-conceptions on that. Some of them come from this we could say slight fear of being replaced, a lot of them come from popular media, movies, books, we can all name movies and books in which robots are evil. But this has no direct translation to reality, there's no reason why this has to be this way."
Interviewer: "And there is no risk of replacement of humans?"
Daniel: "Yes and no. There is a risk of replacement of humans, in certain specific tasks. That's the whole point of what we're doing, trying to be able to delegate humans to do a task that only humans can do and then remove the necessity of having humans doing tasks that are either dangerous or a health risk or simply _ I'm trying to find the word that it's not 'stupid' basically."
(Daniel, software developer, robot developer, BUDDY)

Daniel: "And in my opinion, they are not so different to the same risks you can find in other fields. They are just risks that have to be evaluated and then decisions need to be taken. But they have to be taken from trying to get all this prejudice out, especially assuming that what we've seen on popular culture and on popular media, it's just movie, it's not reality."
Interviewer: "Maybe once people will start using robots they will change their opinions?"
Daniel: "That will change for sure. So yeah, obviously a big part is fear of the unknown and once the unknown becomes known the fear may disappear. And the fear will disappear in a big part, it's just that we are in a field that it's in its infancy and there's a lot of prejudice from – that comes from popular culture and popular media which is – has absolutely nothing to do with what we do here in reality."
Interviewer: "So why do they fuel these fears then, the mass media and others?"
Daniel: "Because it's easy and because it sells."
Interviewer: "It sells."
Daniel: "If you're going to do a movie obviously you want something to happen. A movie of what we do here every week it would be an extremely boring movie, believe me."
(Daniel, software developer, robot developer, BUDDY)

Interviewer: "So, a part of this interview is about the presentation of robots in films and in demonstration videos. And now the question is, how does that relate to reality? And how do you see that, do films you can find on the internet depict robots in the right way?"
Nathan: "Well. So on the one hand, that films are always only showing humanoid robots. Here in Europe, the trend is not like that. In Asia, in Japan, they put faces everywhere. That I think is totally critical, also ethically. Because people should be able to recognize that it is a robot and not a human. There is no reason to build robots as humanoids, in my opinions. But that is a European picture. The Japanese see that differently. In the films that is not really like that. What, I agree with Musk, that the intelligence in machine learning is actually a danger because it can become really dangerous. When we look at how just in this small group, who big their success is in the shortest time. And we are definitely not number one in this field. Then you can imagine what governments or some big institutions like NASA or I don't know what. What kind of things they build, which is really problematic. That is depicted quite well and is, in my opinion, totally realistic."
Nathan: "And what you can see with the media, what sticks out a lot, is that when the news, that was crazy with that Chinese company last year, when they brought something about Cobotics in the news on the national TV-stations and when they presented something, that was total bullshit. Then you think you know a lot about it and you see that it is bullshit and all the other stuff they tell me I don't know about but probably it is also bullshit!"
Interviewer: "What bullshit did they bring in the news? As I am living in Denmark now, I do not watch the news here anymore."
Nathan: "The robot is there to do this and that. Or the robot will do this and that easily in the future. But we are around 20 years from these results. So, the picture is just simply too far ahead. Obviously also appears to be forced. And internationally, we want to be among the leaders in technology."
Interviewer: "And how come that some of the media push that image so much?"
Nathan: "I have done some interviews and I am curious what will come from this. They interviewed us, especially at our old cells. And most of the time – thank God – they sent it before-

hand, but sometimes not. And then they write such bullshit. Which I first of all didn't say that way and second of all, which is simply not true. Well, that is because the press is not very mindful when it comes to technical things. No one checks it and then they just publish it. And there is no evil plan behind it but…"
Interviewer: "Yeah, well, I am also very literate when it comes to technical things. But it won't be shown on television. Just in some obscure anthropological journals."
Nathan: "No, it was also newspapers though."
Interviewer: "And the role of the media in bringing this fear into society, does that play into that? Why do they write that?"
Nathan: "Well, with the national news I don't feel like they want to spread fear. I would say that they just misunderstand it. And Hollywood just wants good ratings. They don't care if they spread fear or not."
(Nathan, mechatronics engineer, robot developer, COBOT)

Arturo: "I think that the robotics that, let's say, public know is not the real one. It's the one presented by the media. So the imaginary is totally different from the reality. And maybe some effort could be done in spreading the actual status of the art – the actual state of the art. And how the things are in the real reality, let's say. Because there are so poor knowledge about science in general, I think, but robotics in particular, because --"
Interviewer: "So that would help your work? If people were more knowledgeable about what technology really is?"
Arturo: "It could help, I think, in understanding what a robot could be used for. I mean, if people knew what the actual potentialities and the actual tasks a robot could implement, they could require something to the developers. So they could help in this way."
(Arturo, engineer, robot developer, REGAIN)

Roberto: "That's a good thing, because, actually, I mean, it's not ethics related, but I think there is, like, a big misunderstanding of what a robot does. I can see, for instance, this example that some months ago, Artificial Intelligence from Facebook was able to keep a conversation by itself, or something like that, I don't remember it that well, and the first reaction in social media was like, wow, now they are having their own intelligence, they will conquer us, it was actually no, I mean, it was a specific purposed design, that algorithm was designed for that specific purpose, it's not that that algorithm will chat and then will cook something and then will go into the supermarket and then will buy groceries or that's no. And I am of the idea a machine, even though it's software or hardware, a robot or whatever, it's always doing whatever it was programmed to do. So, if the designer or the developer is being responsible, then there shouldn't be any problem, and if these guidelines are helping for that, then I think it's a great work to pursue."
Interviewer: "And is there anything else you would like to comment on the guidelines? Which, when you have for example ten guidelines or for example ten points to follow, which needs to be followed all over the EU, would there be one which you think, this is the most important one?"
Roberto: "Respect to life, I would say. And that's not only, like, talking about killing. But respect to life is, like, everything that can affect us in a way, it doesn't matter that it's not killing us but if it's, like, reducing our life quality, then it's not a good thing. So if something is, it comes to my mind, this movie, WALL-E from Disney, that movie, like, showed us a future where we were all fat and lazy because all the machines and robots were doing our tasks, that's not respect for life. If the robot or if the machine is, like, affecting us, like, our health, in some way, then it's not respect for life. Even though it is not killing us. Yeah."
(Roberto, robotics developer, robot developer, SPECTRUS)

Interviewer: "Yes. – What other kinds of questions do we normally ask? Yes, we also have questions about the representation of robots in movies for example. How does that correlate with the work of actual real robots?"
Alexander: "Yes, that's right, WALL-E who cleans up. Or I Robot or however they are called."
Interviewer: "Do such films have positive or negative consequences for robot developers?"
Alexander: "As engineer who is excited about technology it is always exciting to see how the film industry is imagining that. Creative people. These are of course interesting visions, when they walk around completely autonomously. When the Terminator has his battery with him, with which he can save human lives for months. Over here we just have a mobile robot who worlds mobile on this self-driving transport vehicle. It works for exactly two minutes, then its battery is empty. There you see, of course, that there is a certain gap between such a thing really functioning at some point."
Interviewer: "Yes, yes. So, batteries are important technological challenges with such autonomous robots?"
Alexander: "Yes. And of course all of the controlling software. They probably are also programmed in the films. They learn everything by themselves. We are very far from this. When I think about that here, that I have to program every single pose."
(Alexander, development engineer, robot developer, COBOT)

Donovan: "I think that people are more than ready and they would love to have. When I say the all the people it's also a society difference between Eastern and Western countries. For example, if we speak in Japan, China, Korea about service robots, everybody is crazy because they want it. When we speak about this about – mainly in the US and in Europe, the first thing is 'wow, Terminator is running'."
Interviewer: "I know, but why is this fear so common?"
Donovan: "Because we have a very good tradition of these movies like Terminator and a lot of them that the machine will be against the humans. And so, this in unconsciousness put a lot of fear and scare on the people, that when they see the robots are scared. And from the other side because in some way we are more aggressive and we used to be very, very aggressive and humans imagine that we need – I can give you a lot of example but in most interesting problems are about nature what we did with the animals. When we see an animal that probably could be a problem for us, it could be dangerous for us, we used to kill them."
(Donovan, BUDDY robotics CEO, robot developer, BUDDY)

Felix: "Just like robots are something that is a little bit from the science fiction and the scientific world that is sort of alien to people, so people are not very comfortable with robots yet. And when you see people who are new to what we do here when you are on the edge of the picking station and you see the robot approaching, typically many people maybe not necessarily step back, but they will kind of, you know, lean back. You definitely see it with people. But people who have been working with robots for a few days, that's normal."
(Felix, CEO advisor, robot maker, WAREHOUSE)

Interviewer: "And humanoids are not there yet, not in the society. So, how do you communicate to people about something that they have not seen yet, or they know only from films? Is there any specific approach you follow?"
Salome: "Demystifying all this stuff that came from movies, like all the myths of, okay, robot, you have the police and robot is"
Interviewer: "But you have a police robot in Dubai."
Salome: "Yeah, but I mean, the concept that is promoted by some films, so the science fiction and it's very attractive and it's very, oh, oh, but this is not reality, this is not what robots can or aim to do. So, on side is this, so make, being realistic on what the robots can do. And then defending that robots have a great potential in helping us and in improving our life, even though it's a change and people usually are afraid of change, it has a very big potential and I believe it will be accepted as the time goes. More accepted."
(Salome, communications director at a robotics company, robot maker, BUDDY)

Felix: "Yes, I think it started with people in their own spare time. Again, it was in the apartment and then it moved down to the garage because the robot got bigger. So, by any means, it's not industrial. Really, it's more like a kit made of the components available on the market. But even to understand how you control it, how it moves, what it takes to carry a rack, because you'll see the system is actually about bringing racks to people and racks carrying goods, so this is where it started and this was in Eastern Europe. The idea was to try and see how difficult it is because, when you look at it, it looks simple. Okay, a robot, you see many great things when we watch science fictions videos, but in reality they were trying to understand what does it take to create something like this. So the point was you can call it research but it was more like a hobby at this stage."
(Felix, CEO advisor, robot maker, WAREHOUSE)

Paul: "Yeah, I mean, I think that the main challenge that we kind of faced most of the time and it sort of held true in the airport as well was that peoples' expectations around what they can do as they're interacting with the robot are significantly higher than where the technology is actually at. Their expectations are influenced obviously by science fiction and what they read or see on the screen. And so, when they see a robot in real life, even if it's the first time they've ever seen one, they expect it to be – particularly if it's the first time, they expect it to be just like a robot out of Star Wars or something like that. And when the robot doesn't demonstrate that level of intelligence and does something which indicates it has a lack of intelligence, like it's facing a wall and it's talking to the wall or something like that, then people have a kind of negative reaction to it. And kind of dismiss it as something useful because it doesn't meet that certain expectation of where they think robots should be."
(Paul, head of social robotics lab, robot developer, BUDDY)

"Well, you can start from the top and say that there are quite a lot of opinions about how the robotic technology can develop, and there is Stephen Hawking and other robot gurus around who say something like they are taking over the world and all that. And that is not something that worries me personally because, after all, we are still in control and I bet we will continue to be so. But obviously, if robots made it that far almost like some sort of science fiction-like, and put our influence on our own lives under pressure and things like that, that would of course be a bad thing. I don't believe that that is going to happen. But it is good to be worried, it is good to think about such things also and it is something that we stay updated on because we are part of the robotic world, you might say. So that is like, way up under the ceiling, right?"
(Villads, CEO of robotics company, robot maker, WIPER)

Interviewer: "And you know that people they are often afraid of robots, right? They say, oh no, robots, artificial intelligence. Why do you think people are afraid?"
Oriana: "The films perhaps"
Interviewer: "Because of films maybe, yeah."
Oriana: "I don't know, but it's really but when for example the technology is very intelligent and the persons sometimes I don't think anything, it's possible you say, ah, the robot programmed for the people and it's possible for the bad."
Interviewer: "Bad purposes?"
Oriana: "Purposes. But normal for – it's possible for the films, I don't know."
(Oriana, nurse Ph.D., affected stakeholder, BUDDY)

"I think they'll become more domesticated. I think eventually you'll see them around the home. I mean, you see enough of it in the movies anyway. iRobot I think is a classic example. I don't think it'll ever happen in my lifetime, but yeah, you can get them to hoover the floor and cut the grass at the moment, can't you, to a certain level of intelligent thinking. But whether they'll actually replace a human in the home for doing the things that a human does, I think we're a long way from that."
(Benny, mechanic at family-owned garage, affected stakeholder, HERBIE)

Interviewer: "So this was the difference. And how will these robots be used, perhaps, on a larger scale in the future in each school – this robot or some other. How do you think, how will this affect our society? Will it change anything or not necessarily?"
Natalia: "I don't think so. I think we are not threated by the Terminator reality from the movies."
Interviewer: "No? Right, why not? As sometimes - I also asked here about this video, as sometimes it is so that the film

shows something different than it is in reality, especially when it comes to robots."
Natalia: "I mean this robot is designed [constructed] in a way that it would not have a chance to take control over people, because after all, we have to help it learn to exist in our world, so it can move, make sounds."
Interviewer: "Is this story, in general, related to this robot, that it came from outer space and now we have to teach it, is it well developed?"
Natalia: "It is."
(Natalia, school teacher, affected stakeholder, ATOM)

Interviewer: "You said that the Terminator is not a threat to us. Is there any other kind of robot – this robot will not overtake the world but any other robots? What do you think?"
Natalia: "Still, human management [supervision] will always be needed. Maybe not as much as at the time when these various robots are being created, but despite everything, the human's supervision over what they do, how they perform, I think that it will be needed all the time."
(Natalia, school teacher, affected stakeholder, ATOM)

Interviewer: "Why do you think people wouldn't like to have a – only a robot as a pilot?"
Edith: "I think because in our minds machines can fail, I guess. Maybe also it has to do with something they see on TV basically, all the films that are made about the subject of robots going wild and I think that's completely different; that's science fiction. I think they just have problems trusting it because they think, 'Oh, it could crash' and then who's going to fly us, sort of?"
(Edith, pilot, affected stakeholder, COOP)

Bruno: "It is from our perspective that the robotics itself is a very wide field and because it focuses a lot, a lot of important aspects. There is automation, information technology, cybernetics, sensors, so there are so many elements in robotics. The world today is really heading a stage in which robots will become more and more important, because even the issue of autonomous cars that have, have to replace a human in certain aspects. Here we really got involved with a Robotics start-up as this is a very interesting project for us, because it is supposed to show children how to use a robot but above all how to learn. That is, it is an educational element for children for three years old. You can show how to have fun with programming, how to understand these whole mechanics and how to use it. Because it is, this is a very basic element for us, because above all, in these matters, awareness is a key."
Interviewer: "Awareness of what?"
Bruno: "Awareness of the person who uses the robot, what is the scope, scope of this work and what can be done about it. Of course, you can imagine/ You do not even have to imagine, science fiction movies show this robotics in another dimension, that with its artificial intelligence, it develops, they are independent. At some point, they are a threat to people and it can be said that in this case it may also be a threat but quite different. The point is that every child who gets this robot does not get this robot in relation to parents, in the sense that 'this is a robot, it will teach you, yes, and that's it, and I have my important matters.'"
(Bruno, city sport facilities manager, affected stakeholder, ATOM)

Interviewer: "And when I say 'robot'? Five words that come to your mind?"
Luca: "Being used to science fiction films, what automatically comes to my mind are plots of the films about robots, that is all these things like artificial intelligence, now because I work here, the things that come to my mind are also exoskeletons, which honestly, they would not automatically come to my mind before. For me the robot is a famous little robot that you would take, activate it through electricity, it would move, carry out tasks, or those that are androids in films, things like that."
(Luca, physiotherapist, affected stakeholder, REGAIN)

Interviewer: "What is the difference between human beings and anthropomorphic robots?"
Marco: "So, basically, in my opinion, the human being is something that has self-consciousness, has a series of, let's say, has his own experience, in any case emotions, things like that. Anthropomorphic robots, I mean in general in science fiction, must resemble humans, I still cannot see them at the moment. From my point of view with all these characteristics they are out of place. I mean make them feel emotions. To also discern them in certain situations in an unforeseeable manner. I mean the fact that, I do not know, when he has reacted instinctively, paradoxically, instinct has to be the most codified thing of all. The moment we act instinctively it means we are not thinking, it's something we've probably imagined projectively. But often instinctively, if has a possibility a posteriori to analyse what he has done instinctively, he says, 'but I never, I would never react in that way based on what I know about myself.' In my opinion all these components, robots are still, I find it a bit difficult."
(Marco, technician, robot developer, REGAIN)

Interviewer: "You were talking about the youtube videos that exist and that are totally unrealistic, or how do you assess that?"
Kai: "No. Well, not unrealistically. But now we come --"
Interviewer: "-Yes, that was now the part about the representation of the robots --"
Kai: "Yes, so there I have more the problem that everyone is obligated to, especially in the publicly funded projects, now I will criticize them. They show how great everything is and that you managed to do everything, what you did. No matter how much you are faking in the end, in the end everything was fine and we could do anything. Because of that, now the situation arises of course that, if I wasn't a robot expert, but only informed via the media or such, and see where there, I think there the impression arises that we are much further than we actually are in reality. That means, I think, well the robots can already do all of that."
Interviewer: "Yes."
Kai: "This brings two problems, of course in the public exactly these ethical problems, but they take away our jobs and tomorrow they are eeh – they cannot do all that yet. So, but

due to these great videos I see everywhere I might get the impression as, let's say, outsider. That is why we have a hard time with costumers who don't come from the traditional automation. I will name a typical, hm, who could we take, maybe like retail companies are coming and saying, we need a robot to stock up the shelves in our store, I have seen all that on youtube, he reaches out, takes them, puts it down and it can't be that hard. So that means with costumers who are not in contact with robotics, their expectations to robotics are extremely high. Probably due to a certain public representation. Yes, everyone shows how great they are, especially the publicly funded projects show off what they have done and that we are that and that far by now, that means, well, from my point of view you should be able to say in these, especially in these projects, that's what we didn't manage, there still is a problem and that we haven't solved. At the moment this is not rewarded though, to say this is not possible, or we didn't manage this, totally didn't work out, we don't want to hear that. Although that would be much more honest in science, from my perspective. You could say, where do we stand, what are the problems, instead of saying, look at this project, we have promised we can do anything and anything goes. Even when of course some problems exists. So, and with videos it is like this, don't believe any video if you haven't faked it yourself."
Interviewer: "Yes. Yes, but that is often PR material."
Kai: "Exactly."
Interviewer: "So, these films are PR stunts?"
Kai: "Right, and now I still sometimes have the feeling, especially with the EU, and that I address to the EU, as criticism, everything super important, some projects just deteriorate to being just a PR promotion. So, there everything is just about how many videos do you have, how many clicks, how much twitter, how much there, it is not about how much have you reached content-wise. Yes, that is such a way"
Interviewer: "And that is with the projects done on national grants a little different right?"
Kai: "No, is similar."
Interviewer: "Yes."
Kai: "You have to show success. I think the research might not be in the focus so much but then it is about how many costumers do you have again, did they buy it already? Where I say, no this is a research project, cannot sell it yet, but -- So this balance between, do you actually want research or do you want products now?
Interviewer: "Yes."
Kai: "There is some kind of a tension obviously. And then we have a hard time again, when we present results internally on some level and say, see we have something really great here and tomorrow everyone will buy that and we say, yeah but to the product there is a long way to go."
(Kai, mechanical engineer and cluster leader, robot developer, COBOT)

Dieter: "Then why not, yeah, but that's I think is – I mean of course, from the popular culture point of view, there are lots of stories about robots becoming bad and revolting against humans and so there's more on – on Occident, in the – in the West -- Western countries than in Japan. They have quite the opposite views, yeah, and – but anyway, I think they will be accepted if they really respond to the expectative and if they aren't viewed as a threat to a – to a human."
Interviewer: "And why do you think people are afraid of robots? I know it's because of the films and mass media, but where does it come from, all this image in the mass media? Do you have any ideas?"
Dieter: "Probably the – something that is even in the rules of our civilisation, I guess, something that could be intelligent in some way and gets out of your control, I mean we have very – we have very old stories about this, the Golem or more recently Frankenstein and so on, so it's –it's not just – yeah, I mean this – all this idea has been translated into robotics."
Interviewer: "So, it's very old. So – but we know that robots are not intelligent enough to overtake the world for now, so what – what are the real threats, do you think, if there are any, in robotics?"
Dieter: "Well, the first that comes to mind is – is unemployment, as always when – but, well, there's always this view that new technology – technology may – may cause unemployment on the one side but may create new kinds of employment on the other side. Well, I don't know because we have also to change our minds of how this society works, so we have always the ideas and centuries ago that you have to work to get paid and to have kind of right of living."
Interviewer: "Yes"
Dieter: "But maybe this has to change also."
Interviewer: "That's very interesting. How could we change that?"
Dieter: "Yeah, this is already outside Robotics."
Interviewer: "But it's related. Maybe robotics could change this system."
Dieter: "Yeah, yeah, surely this is – I mean this – this is the point because if they performed all or many works more efficiently than humans then – but of course this means that then enterprises have to share their benefits with all the society and things like that"
(Dieter, head of robotics lab, robot developer, BUDDY)

"Yeah. Then there's another point, coming back to the – how are robots viewed, the threat they – they mean to us or probably they maybe mean to us, and there's an another view which may come to weight a little bit this. This is namely the fascination that we humans may have for other intelligences. I mean since – since the birth of humankind, there have been gods, there have been angels, there have been elves, there have been extra-terrestrial and so on, always this kind of fascination of not being alone and of interacting with another type of intelligence – And robots, although they are a human product, could, at some moment, be this other, I don't know, yeah, intelligent partner"
(Dieter, head of robotics lab, robot developer, BUDDY)

"Nowhere near being able to do something like that yet. There's no ethical concerns with what we're currently doing. But if you fast forward many years to a point where you have a artificially intelligent robot that is able to interact with customers and sell products to them or encourage them to engage in particular financial activities or anything like that, and that's not just a financial situation, that applies to – that could apply

to any kind of context, healthcare, anything. Once you get to that point where you have sort of an autonomous, purely autonomous interaction, then there are kind of ethical issues around ensuring that those interactions are sort of abiding by what we would consider sort of social norms, abiding by kind of legal and regulatory frameworks that are in place, like, you know, sort of now showing the wrong financial product to the wrong customer, something that's – there's that."
(Paul, head of social robotics lab, robot developer, BUDDY)

Interviewer: "Could you define a robot? What are the five words that come to your mind when I say a robot?"
Edith: "Yeah, computer basically, I think. Yeah, strangely now something that resembles a human, sort of in the way it sort of moves and looks, I guess. Yeah, something very intelligent. Very versatile as well. I guess you can teach it anything you would like to. Yeah, I guess these days maybe artificial intelligence as well."
(Edith, pilot, affected stakeholder, COOP)

Interviewer: "I wanted to ask you also about your definition of robot, because we talk – everyone talks about robots, we are talking about robots, but what is a robot? Can you give me like five associations with the term robot?"
Nima: "So it's an autonomous intelligent system that communicates. And that's, that would be the most basic for me."
Interviewer: "There are many different visions, And if you actually say autonomous, autonomous is very limited in most robots, right?"
Nima: "Yeah, well, but autonomy not in mobile, so people think autonomy in that it's mobile, but I don't think in autonomy that it can think or it can do things autonomously."
Interviewer: "So, what do you mean?"
Nima: "So, for me a robot it cannot have to move, it doesn't have to move, so if it's intelligent it makes autonomous decisions. For me that's a robot in essence. Then it can move, it can do other things. It can perceive depending on the sensor and depending on the actuators then it can move, it can do lots of other things."
(Nima, robot designer, robot developer, BUDDY)

Interviewer: "So how accurately do you think this type of videos describe robots, depict the robot?"
Diego: "Well, this is a video I think made by their own company, so I think they're quite accurate in presenting – of course, every time you're presenting a product, you dress it up a little bit, yeah? But I think, I mean all what the robots perform is real so I wouldn't say it's – it's a fake."
(Dieter, head of robotics lab, robot developer, BUDDY)

Hugo: "The problem, it's not the physical robot, the problem is the mind of the robot, because I think the intelligence of the machines is growing and it's growing very fast. I think when the robot, now it's more intelligent than the humans. The robot will not let, know it, at the humans so what about this moment, I really don't know. I remember in the university in a subject about logical decisions exercise. We have a train with two --"
Interviewer: "Yeah, the trolley problem."
Hugo: "Yes, the trolley problem; in one – who is the name of, the trial over there?"
Interviewer: "Yes it's going, it has a choice between killing five people or killing twenty people."
Hugo: "Or one person, that's your son, and twenty people that you don't know, what is the logical decision? In my logical decision I think I have a choice, but for the robot."
Interviewer: "What's your choice?"
Hugo: "My son. But from the ethical point we have to talk for hours about this, but I think it's my son. But what about the robot, the logical decision is twenty versus one, I think. So very complicated question because like I, like I told you, I think we cannot understand how the robots are thinking, while improving the kind of learning, I think. Maybe the robot know it is more intelligent than the human, but we come to know it, I think it's dangerous. I have seen the position of Elon Musk and Mark Zuckerberg about the intelligent artificial and Mark says it's an incredible opportunity to improve the life of the people and Mark says the robots will kill all the humans species because the human species have the supremacy in the planet, but human isn't perfect and the robot will be perfect. It will be one-hundred percent logical. I think it's really, I think, it's dangerous but I don't know, I don't know about the evolution of the robot, we don't know."
Interviewer: "Because it'll be dangerous because it will be calculating decisions?"
Hugo: "Yes."
Interviewer: "And chooses who lives and who dies."
Hugo: "About the – I don't remember the word, ambre – hungry in the world, what is the more logical decision, okay if you have ten-billion people we can kill two-million people and the problem is solved. It's a logical decision. And the robot, what's the logical decision for a robot, the robot that is not that creative, hasn't the empathy, the logical decision is, okay, we need to kill half of the population in the planet and the hungry problem is solved."
(Hugo, mechanical engineer, robot developer, HERBIE)

Nathan: "Define. Yes. Well, define comes from Czech, means work and was by Čapek, or what was his name? Well, there was this theater play, that means somehow worker. Yes, well this term, the definition will change, obviously. Before, they were handling-helpers that handled something or installed or did whatever. Now, a robot is more there for support. So most robots are still handling machines. Due to the ascent of software and intelligence, like machine learning and so on and so forth, the fragment with the software becomes bigger and therefore, also the intelligence grows. The robot, so it becomes a more intelligent helper."
Interviewer: "So, software is an important part of the robot?"
Nathan: "Yes, more and more so. So, our firms used to be and still is famous because the technology is very robust and durable. And we developed the first bend-arm robot. And there, it was important that it moves from A to B very precisely and always does the same. And that persists for a long time. Whereas now a robot has to be able to do a lot more and be a lot more intelligent. Plus, with more complex robots like ours, the software has to be able to do more as well. And we

are transforming from being a machine company to being a software company."
(Nathan, mechatronics engineer, robot developer, COBOT)

Interviewer: "So if you should describe robots, what is a robot? Like five words?"
Katharina: "That's difficult. I think, a robot has intelligence, I'm not sure about social intelligence, but intelligence. It's a technology for me, if I think of robots, they do have an embodiment, but it could probably also be without an embodiment. Yeah. Is two enough? "
Interviewer: "So in ten years, what do you imagine the impact of robots would be on you personally? Like, your work life, your personal life?"
Katharina: "Oh, that's so difficult, because right now, I'm working with robots every day, and I think most people think they are further than I actually see every day, it's like not even internet connection is sometimes working, and, and then they are just really stupid, so. But I think there is a point, when, when the technology will just evolve really quickly, and the intelligence and social intelligence will, will increase a lot of robots, and, I think, when that point is reached, then I think it will go faster, and that could be within the next 10 years, it could be in 10 years, I don't know. But, I do see that we get lots of more smart technology, and that that influences our lives already. I wouldn't call that really robotic technology, so still the robots that clean the house, they are more smart than actual robots, I think. But I think those will probably effect out every day lives much more, than intelligent systems that, that don't have an embodiment online, that you don't interact much more with people."
(Katharina, user studies and project manager, robot maker, SPECTRUS)

Interviewer: "I have a question here where it says, and it's just any robot, but give me five words you associate with robot."
Annie: "Five words. Modern, efficient. Future. It's the future, they're the future. Expensive. It's what I think. Uh, how many words was that?"
Interviewer: "That was four."
Annie: "Five words. I don't know, intelligent, clever. That kind of thing, like, I think they're incredible machines that can do this, yeah."
(Annie, lobbyist, stakeholder, SANDY)

Liva: "Mm, I think there's already, if you look at the industrial sector, so much has already happened in the last ten years, and I think that development is going to continue, but I also think it will affect our private lives, you will also see, a lot is also happening in that area, and it's happening fast. My daughter has a lot of electronic devices and an iPhone and all sorts of things, that I didn't have. I know it's not robots. But I think, if we're thinking extremes, then I think the next step is going to be that the robots will become more intelligent, or that we somehow, eh, I don't know, get some sort of implant so that we can act with the robots somehow, so it's more thought-driven, or more incorporated you know? It becomes part of us somehow, right?"
Interviewer: "Yes. And what are your thoughts about that? You know, the whole, what do you think?"
Liva: "It's crazy! If you can just go on Google in your head or have some RAM implanted or something like that."
(Liva, production technologist, robot maker, WIPER)

Interviewer: "Interesting. Then what if, the word robot, what is a robot?"
Elias: "For me? Well it's a lot of things, I consider, well a robot is, most people think of an arm that moves and that sort of thing, in my point of view. It can be both be an automation, an automatic system that is, but it can also be what goes on, on a PC, Commonly known as a program."
Interviewer: "Yes".
Elias: "So, from my point of view it's rather, what can you say, an intelligent machine, where the machine itself could also be software. A drone is also a robot."
Interviewer: "Yes, yes, so even if something is remote controlled"
Elias: "Yes, it could be, if there's automation and"
Interviewer: "Automation, yes exactly."
Elias: "Yes."
Interviewer: "So the automation is actually the Decisive factor?"
Elias: "The word intelligent is perhaps a bit tricky, but automation and intelligence will probably be attached to it in some way, it can carry out some tasks on its own, right?"
(Elias, university researcher, robot developer, WIPER)

Jorge: "Well, what, what I'm sure is gonna be a big revolution is when, when we have robots at home that are capable of communicating with natural language. That's gonna be huge. And I'm thinking robots that are not going to be intelligent. It's just robots that are able to, to learn and communicate in a reasonable way. If you think in the pets that we have at home, you know, I have a cat and other people have dogs."
Interviewer: "So that will be the level of communication?"
Jorge: "No. No, no, there will be a big jump because you, even, even if you try to, you know, anthropomorphize the pets and try to, to assign kind of a communication that is, is not there really – I mean, my cat, I'm sure she, she only understands the name, and the rest is probably noise."
Interviewer: "Yes."
Jorge: "But imagine a robot, it has a natural language, it can learn, and I, and I think that's a very important point that many people ignore because it's a lot, a lot of debate and artificial intelligence and intelligence machines that, it's not going to happen in a long, long time."
Interviewer: "But natural language is also a big challenge."
Jorge: "It is a big challenge, yeah, but, you know, from deep learning and all these things that, you start to have machines that deal quite well with, with language."
Interviewer: "And these machines, they don't have to be intelligent to learn a language?"
Jorge: "No, not at all. It's like, you know, it's like this, these neural networks that learn how to paint like van Gogh but, you know, van Gogh is there. But surprisingly, the machines are capable of, you know, in a way, making an internal map of what's his style and then you, you, you show a picture and they, they paint the, the, it's really impressive. So how, how

does it work? We don't know. And does it require any understanding of who van Gogh was or anything? No. But since we put so much into, from our side into the relationship we have with, with pets, for example, we don't need the, the reverse to happen. That all depends what's gonna happen, but from, from my side, again if, if this robot that's capable of learning becomes a reality, which I don't see how is it going to happen, I mean, as much as I'm close to someone who's using that or, I'll be, I'll be, you know, monitoring myself with, with what's happening. I don't know if you have seen this movie, Robot and Frank?"
Interviewer: "Yes, I did."
Jorge: "Because that, that in a way illustrates – it is, of course, a movie, but it illustrates to the, the whole point. I mean, like when the scene when the robot is saying, 'I can, I can erase my memory,' and this is not an intelligent robot; it's just a robot that adapts and is flexible, and the guy said, 'How, how can you do that?' I mean, I don't want it to happen."
(Jorge, head of research lab, robot maker, BUDDY)

Conor: "Well for me proper AI is something where a robot can, or a machine can actually think and make a decision in an intelligent way, and I don't think that has happened yet really. Well there's a lot of talk about maybe it will happen eventually. I don't think maybe that's, it'll never be emotionally intelligent, so some people say maybe it can, because a robot can, or automation can become emotionally intelligent, but I don't think that will ever really happen."
Interviewer: "Would it be necessary?"
Conor: "I think it would if you look at just, say the recruitment process, so you'd have, I suppose it's the basic, do you need an emotional intelligent piece to the recruitment process? At the moment that is done by people, so some would say that's a good thing, other people would say that's a bad thing. So if you come in here and I think, oh yeah, you're very good on paper, you have the skills but I don't really like you. So that's the emotional decision making in the recruitment process. So if a machine does that, that takes that out, which is good for bias in some ways, but someone obviously has to programme the machine to ask the right questions and will there be implicit bias in those certain questions. So I think that is probably the biggest question really for me."
(Conor, recruitment agency general manager, affected stakeholder, WAREHOUSE)

Interviewer: "So why is it intelligence though, because it can do that?"
Gabriel: "The intelligence, it's only calculus."
Interviewer: "If it's calculating something."
Gabriel: "But it's intelligent."
Interviewer: "You could say a calculator is intelligent then because it calculates"
Gabriel: "This is my point, it's intelligent or it's not intelligent. Because, for example, you can say, a robot is one metre from me, one metre or one metre twenty, or eighty centimetres, or two metres. Why you say one metre? Because your eyes look the distance and approximately identify probabilistic, using the probabilistic, because are using the previous knowledge about the distance say, it's one metre from me. The computer use the one image and say, I don't know, really don't say nothing, only take a picture and send the picture in one file, don't recognise nothing. The first step is identify the object. But after it's necessary to identify if one object is two metres or one metre of the distance, it's another very big challenge. You have in your brain the possibility to identify using your eyes the distance of the object. This is very, very complicated, probably have a lot of calculus, but really the brain made the calculus automatically, don't use calculus or yes, I don't know. Or really the science don't know about this. Similarly, one person with good memory you probably know one person with big memory and other person with no big memory but is more intelligent, because can solve one problem without previous knowledge about this problem. This is real intelligence. Computers don't have intelligence, only calculus. And the calculus today, the sciences say it's intelligence. Because need to simulate the brain when identify the distance, when identify one object. Yes, it's to simulate the intelligence."
(Gabriel, CEO, robot maker, HERBIE)

"Besides that there's a big part that is – it's just a big new craze, 'robotics is dangerous, robotics has to be controlled', yeah, robotics has to be controlled like everything else in the world, it's not more dangerous than other stuff, it's not more dangerous than the press the first time it was invented, back in the – yes, it can bring a huge change in the world and reshape our society, and we have to make sure that we are reshaping it in the right way. But we are not gonna do that by being scared of it or by trying to prevent this from happening, we're only going to be able to reshape the future to what we want it to be by embracing the fact that this can be helpful, and we have to find out how to make it helpful. That's a little bit on all of us."
(Daniel, software developer, robot developer, BUDDY)

"I mean, robotics is just because it's a new tech – well, it's a technology that at some point it's going to end up in our houses and we're going to use it like every day."
(Nima, robot designer, robot developer, BUDDY)

Marco: "That is for me. I guess for me, robot is something that in some way, at least even if a small part has its own independence, let's say, from a human, it has to do something on itself."
Interviewer: "Okay. And what's the difference between automated and autonomous?"
Marco: "They are, yeah, different concepts, I guess, because autonomous just means that it is doing a task by itself. Automated, for me, it means that you are using some kind of technology to do a particular task."
Pino: "Yeah, autonomous means that you have a certain level of, this is a making ability, maybe, so you can say more, more intelligent."
Interviewer: "And if an autonomous robot make, makes a mistake, who is responsible then?"
Marco: "Depends on the mistake. Depends where the failure happened. So it can be, let's say, a software bug. It can be something related to the hardware, something related to the sensors. It could be a lot of stuff. So then it depends – I don't know – on, I guess, who installed the particular system and

from who, let's say, certified that it was, let's say, respecting some kind of safety related, let's say – what can I say? – conditions, let's say."
(Pino and Marco, robot developers at a company, robot developer, COOP)

"when I see it I know that it is an industrial robot. [laughs] So _ in the past, the industrial robots should be just a machine. A machine that has to – like a mechanical slave that has to do what man cannot do. The mankind cannot do. I strongly believe that the next step is to have industrial robots and not many more, but just robot. And then I can tell you the difference between different kind of robots. That is – should become really a co-worker. So robot has to become a co-worker, has to collaborate. Because the robot was the core of the production. Now it's not any more possible because of the quantity of the product that you have to create every time, there's a lot of set of product. There's not any more million of pieces, but the quantity are smaller now. And you need to use the flexibility of human operator. So the human operator has to become again the core of the production, and he has just to delegate some repetitive task to the robot."
(Alessio, robotics start-up founder, robot developer, COOP)

Ali: "I think the people already have misunderstanding of robotics, ok? And robotics are everywhere. I said the car is a robot, but how we define a robot for us? And again it is coming back to technology. When you say technology, people have misperception of technology has to computer, has to camera. Technology is something that can enhance our life. The car enhances our life. This is a technology, ok? It is how we define. So, it will be, as long as we stay with the definition of robotics, it will always remain the same. Because, what I am saying it will remain true, because you are focusing on solving a problem. You are not focusing on actual things, but something that solves the problem, right? Ok, so when I look at a problem, I don't focus on, let me facilitate how human does the work, ok? I don't do that. I look at that, ok, what human does. And that it is the process I might aim to, to automate it."
Interviewer: "So, it is something new. It's not a replication of the human?"
Ali: "It has to be always an inevitable approach to address it. It is a right now reason for something else, this is how we have been living it. Some people have perception, they give the robot wrong direction, saying as soon as it is a robot, it has to be like a human."
(Ali, start-up founder, robot developer, WAREHOUSE)

Interviewer: "Yes. What is a robot for you, if you had to define it?"
Valerie: "Actually. So, you don't only say robot, you also call it manipulator. And in my opinion, that sometimes nails it better, actually, everything that can manage a movement task. And more than, - let me think, something with just a motor that is not a robot for [me] either. That is more gearing or something like that. But for example for me a robot is not only, the big orange robot behind the safety fence, but there is also micro robotics, that are really small or there is also like, like animals, spider-like something, or such. That can move. Yes. That I would also count."
(Valerie, mechanical engineer, robot developer, COBOT)

"Yeah I don't know if there is a definition for a robot. There is this, there is a kind of robotics they make a lot of guidelines I don't know if they have come up with definitions, I don't know."
(Carmela, robot maker, REGAIN)

"No, it's not something new and also working in the field I work in, the electronic field, seems maybe 30 years or something like that, I don't see robotics as a new thing. It is just another way of what they call also mechatronics, where we put together some electronics, some mechanical component. So, it's a device, it's a different way of interaction, if you compare to a screen, but it's always a device. I have no imaginary of robots as something different from a machine. In my opinion, a robot has some kind of clear functionality."
(Alba, robot developer, REGAIN)

Arturo: "Yeah, this is another complex question, because it depends on your definition of robot. Of course. So if you consider a robot something that is capable of somehow thinking or operating some data and using activator on the base of the data he acquired, I think there are a lot of robots in my life and in the life of everyone. Because, for example, the coffee machine in the bar is a robot, actually, because it has some sensors, it elaborates this flow and heat data, and it puts / enacts some actions to / on the base of this data. So actually, yeah, there are a lot of robots in my life."
Interviewer: "But you said it was a matter of definition?"
Arturo: "Yeah, it's a matter of definition. Because this is what I think is a robot. Something that is able to act on the base of data he acquired. But, I don't think it's the universal definition for robots. So it's up to the definition. I think that most of the people think that robots are something anthropomorphic, that has some kind of really complex intelligence – they can think just like a human being. So it's, I think, this is the most common idea of robots. So, even the industrial robots are not, are not in the common imaginary of the people, when they speak about robots."
(Arturo, engineer, robot developer, REGAIN)

Interviewer: "Now, the definition of a robot, is it something that's manmade to make life easier for humans?"
Hunter: "So as in the sense of a moving robotic instrument I suppose, but we've got scanners and things which are programmed. I know that's more electronically but it's still something that we use daily. As it goes for anything that moves, no, we've got nothing like that."
(Hunter, garage owner, affected stakeholder, HERBIE)

"I think you've got the stereotype of a robot looking like this human figure in a hard shell kind of thing, but then obviously that's not exactly what a robot is, is it? Robots perform whole different activities and look like different things to suit different needs, whatever they require them to do. In terms of defining, pretty blank on that."
(Rohit, car salesman, affected stakeholder, HERBIE)

Interviewer: "Yes, to regulate that use. And how would you define a robot? Because we are speaking about robots, like you mentioned AI, a washing machine and a few other things, [laughs] I don't have a definition, so what are the five words you would associate, when I say robot, then what do you think?"
Alex: "Well, for me, all mechanical machines worked by a computer is a robot. It could be this robot, it could be a big computer, it could be a robotic arm, it could be a car."
Interviewer: "A machine and a computer combined?"
Alex: "Yeah."
(Alex, head of science exhibition, affected stakeholder, BUDDY)

Interviewer: "What to include, how to develop ethical guidelines?"
Dieter: "Yeah, first, keep always in mind that robots are machines and that we design them not to replace us but to help us. And I would say this is then the main point."
Interviewer: "I think I can see it that many people, researchers, users, they keep saying that robots are not meant to replace us, but yet it's a very common fear, so there is this mismatch between what we say we want and between what we are actually hearing from other sources."
Dieter: "Yeah."
Interviewer: "Why is it so?"
Dieter: "Well, because – well, it's this thing that, like all technologies, it's not only the issue of the developer, but also of the people who are using it. And of course they look for the benefit. So, it is – it has kind of founded a fear, but because if you can replace human work, the – I mean the entrepreneur will do it. But, well, as I said before, it depends also on what value they want to give to their product. I mean sometimes the human intervention is necessary, or give them the added value which, well, robots alone can give, so it – it depends so on the particular case."
(Dieter, head of robotics lab, robot developer, BUDDY)

Donovan: "Yes. So, it was not a robot, so what is it? But you are specialised in robot? Yes. But robot has to have an embodiment, so it has to have a physical part."
Interviewer: "So why different people think that virtual robots are also robots, why is it, this confusion, you think? Or disagreement at least?"
Donovan: "Why? Because probably there's no institution at the moment that just said, and fix the name of the robots. If you read the real definition, robots, it was done – they fight more than five years in order to define an agreement and if you read the definition, the definition could be whatever you want."
(Donovan, BUDDY robotics CEO, robot developer, BUDDY)

Interviewer: "Okay. Yeah, it's also difficult for us who have spent a lot of time trying to define ethics and robot, which is my next question is, can you give me five words that you associate with robot?"
Samuel: "Well, I think, to me a robot is a device that sort of senses something and then it processes that data, sensor data, and then it takes some kind of decision based on that. And it's sort of an autonomous decision in a way that it's, some of it is of course, I mean, based on algorithms and so on, some of it could be based on AI or more intelligent ways of doing it, but it's something that senses, processes the data and then it does something that reacts, I mean, let's say it's an environment that it senses, then it reacts based on that and then makes a route for example. And that's sort of, but there is so many robot definitions, especially in the literature as well. So I think it's, and it is also changing maybe a bit because some definitions it's almost like every electronic device is a robot then, because it does something, but, yeah, to me it's something that senses, and then it does something based on that."
(Samuel, product innovation manager, robot devleoper, SPECTRUS)

Interviewer: "And what about when you say the word "robot", like, what, uh, what do you think of then?"
Alexander: "Ehm, robot for me, there has to be something physical as well. I know that some people define a robot as a search engine, but for me it's a mechanical construction. It has to be controlled in an intelligent way, and preferably non-simple. Non-simple, that means, there could be something that only has one degree of freedom. Or like that, I just mean, it's not all mechanical constructions."
Interviewer: "No, okay. So, when someone says that, that, uh, that a washing machine, a modern dish washer actually is a robot, you're not agreeing with that, right? "
Alexander: "Eh, not in my view, no."
(Alexander, university robotics researcher, robot maker, WIPER)

Interviewer: "And how, in general, would you define a robot? Five words that you associate with the word robot?"
Robert: "I have such a technical idea."
Interviewer: Obviously from your own perspective.
M: From my perspective, robot is a device with a certain degree of automation that has a specific objective and it pursuses it."
(Robert, robotics start-up co-founder, robot developer, ATOM)

Interviewer: "Give me five words you associate with robots."
Luke: "Well at the moment 'car' is quite a good one, but 'helper', I guess. Chat. Terminator."
Suzy: "Oh, this is interesting to me, to see how your brain works."
Luke: "Don't read into that that I'm suggesting that I think the Terminator is a good thing. It's just that's kind of the classic"
Interviewer: "That's what you associate with the term robot?"
Luke: "That is the kind of science fiction of a robot really, is this kind of robot"
Suzy: "You see, I don't agree it's classic. Well, maybe. I don't really watch many films, so maybe that's why. Maybe I'm less influenced; I don't have a TV and I'm less influenced by popular culture."
Luke: "Oh, okay. Well I do feel that they are two separate categories really. In my mind, a robot is traditionally talking more about, well, first of all it's talking about an application, so it's slightly narrower. Normally, I think I'd think of it as a mechanical thing which physically interacts with the physical world, really. But then people call these AIs, like Chatbots, robots, which to me is a bit of a, strays away from what I'd tradition-

ally call a robot, being a more physical thing really. Yeah, an AI, most people talk about an AI. So in our fields, when people talk about AI, they're typically talking about techniques that are mostly machine learning techniques, but also multi-agent system techniques that are used to generally do classification or optimisation type tasks. But then when I talk with non-industry participants and talk about AI, they start thinking of Skynet."
Interviewer: "It's in iRobots, I think, Skynet? No. Terminator."
Luke: "Skynet is the Terminator thing, yeah. So they start thinking of, essentially, a kind of singularity type of AI that is trying to take over the world, or is in some way kind of malicious, really. That's what the general— When I talk with people who don't work in this industry— It's partly also why I think characterising what we do, which is kind of an applied form of some machine learning multi-agent techniques, characterising it as AI hasn't been that helpful, generally."
(Suzy, AI scientist, robot maker. Luke, robot maker. Both HERBIE)

Interviewer: "That's great to hear. And if you think about robots and you should put five words on a robot, what is a robot for you?"
Oswaldo: "A robot is efficient, when he's reliable. Okay, I have difficulty with these five words because I usually think on a more like efficient machine. A robot is a machine, and for me a robot is a product like any other but I think it is a transformative product in a way that maybe other new technologies are not."
(Oswaldo, industrial designer, robot developer, SPECTRUS)

Interviewer: "My last question, what would be your recommendations for a project like us, like someone who wants to help robot designers to build robots that are ethically – useful from the ethical point of view? How to, for us, how to develop these ethical guidelines for robot designers in a way that these guidelines actually can be used?"
Alph: "You know, between robot designers there is already three basic laws."
Interviewer: "Asimov's laws? "
Alph: "Yeah."
Interviewer: "Do they really apply these laws?"
Alph: "Really. I didn't expect it really."
Interviewer: "Even in their own company they think about it as well."
Alph: "I am talking with different people from the various businesses; all of them mention these laws. So all of them know these laws, and all of them really using it. I don't."
Interviewer: "You don't?"
Alph: "No, I never fix on it because I have much more laws than just three. But this three is a part of my own."
Interviewer: "And you think they are sufficient?"
Alph: "I think so. It's not my opinion, it's just our community opinion."
(Alph, robotics start-up founder & CEO, robot developer, WAREHOUSE)

Dieter: "You could put some rules on – on the top, so to say, but I think it's very difficult to capture ethical behaviour in just a couple of rules. I mean the – the typical idea of the three laws of Asimov. I think this works only for literature, and I mean it works because it causes the situations from misunderstandings and so of these laws or misinterpretations of the laws that the conflicts between the laws and so on that have – that Asimov has used to write all his stories, but I mean in the practical world, I think it – you would have to – to make lots of rules. If you at least want to – well, if you see the civil law book, it's a very thick book and a lot of laws."
Interviewer: "So, it's not possible to develop all the potential rules for – for the robot, ethical rules. So, is there any other approach we should take? Any other options to make sure that the robot behaves ethically?"
Dieter: "The humans who are going to use the robots have to be ethical."
(Dieter, head of robotics lab, robot developer, BUDDY)

Interviewer: "So, should it be possible in general to create some ethical principles for robots? The guidelines you mentioned?"
Igor: "These are the three principles of robotics by Isaac Asimov, so far we have not come up with anything better and unfortunately these rules imply paradoxes. And especially here with autonomous cars, especially – less evil, choice, minimizing costs, etc."
(Igor, designer at a company, robot maker, ATOM)

"Well, and that was for one of the main reason why I was so happy when my colleague asked me to have this interview with you. I thought a lot of time about ethics in robotics. I read a lot, but I'm still confused in this, this discussion. So if we don't just do – we don't just want to think about the three robotics laws of Asimov. But also how we have to interface with, with the robot. Because okay, we can have in the future, high skill, high artificial intelligence. Of course they have to, to protect us as first. I strongly believe that still the human has to be more important than the robot. But in some way we have also to learn how to interface kindly with the robot. If then more – if the robot will learn from our action [laughs] because it's not made to behave ethically."
(Alessio, robotics start-up founder, robot developer, COOP)

Kai: "At the moment I suppose, that he then says, okay, he first has to, well, so I think in the end those three famous robot laws of Asimov will apply there as well, it should rather try to destroy himself than me."
Interviewer: "Yes. Yes, yes but that is, and this, such questions are also posed regarding self-driving cars, yes."
Kai: "Yes, so for example, we had the funny case, well not really funny, well it was funny. The last one that got hurt here with the mobile robot system got hurt because it had safety protection zones. So, most of the time, protections zones are there if the robot is moving and I walk in front of it, it stops. Now the problem was, he was walking behind the robot. The robot was moving and he walks behind and is talking, walks to fast and into the protection zone, the robot stops and he walks into the robot."
(Kai, mechanical engineer and cluster leader, robot developer, COBOT)

Interviewer: "But there's also, in this video, the notion of the robot having a will of its own. Because it's going, it's seeing the woman, and then taking the rose."
Alba: "But again, this is imaginary. We are going back to the three robot law by Asimov. It was fiction, it was not science. Asimov was a science, so his fiction is wonderful, but that is fiction and another thing is science."
Interviewer: "I love it, too. Yeah. But anyway, his three laws are still widely, you know, cited, in a way."
Alba: "But it's another thing. A robot is developed for other things. This is my perspective."
Interviewer: "Yeah. Okay. Good. I think it was actually not bad to show this. I think that could be."
Alba: "Yeah, yeah, it was very nice."
(Alba, robot developer, REGAIN)

Petrucelli: "We are introducing the logic of cybersecurity."
Interviewer: "Yes, and this would be the biggest ethical challenge?"
Petrucelli: "For example, creating security systems already at the stage of a design process. It is interesting how in the convention on robotics Asimov's manifesto on robots was exposed: A robot should not hurt anyone. And a convention was: if a man managed to do what we are expecting from a robot, it would be all good. Because a man should hurt anyone, should not, should not. So, in such a case we are in front of something that, if viewed through the lens of biological enhancement of a person that has lost some of the abilities that, from a biological perspective, he or she should have – talk, grasp, walk, get up, relate – it has a series of positive aspects. If you, however, look at the negative aspects, a person could be biologically enhanced to hurt others, he or she could give a vocal command to start another robot to hurt, this too. So, you see that a borderline is very thin, it is very thin."
(Dr. Petrucelli, head of hospital, affected stakeholder, REGAIN)

Michael: "And I think, the main issue is maybe to have humans always having the last word on any decision of the robot."
Interviewer: "Why?"
Michael: "Because, I would have some fears if a robot will be able to overturn a human's decision."
Interviewer: "Why, would be so scary?"
Michael: "Because I think no one can know where it ends up then finally if a robot will have the power to overcome a human's decision."
Interviewer: "So what are the risks? Where, where do you think it can end up?"
Michael: "The worst scenario, maybe we end up in a, in a scenario like in the Terminator movie. I don't know."
(Michael, traffic controller, affected stakeholder, COOP)

Interviewer: "So last question in this first part: Do you foresee any general ethical issues in the use of robots in general?"
Espen: "You can ask many questions of course. Robots carrying weapons and drones, uh, dropping bombs is certainly, I think, not something, we would like to have. And I think there are a lot of risks actually. Certainly, if you look, at what we are dealing with here with unstructured environment and variation. So things we develop here, let's say for the biological field, is maybe very easy transferrable to also developing some very bad robots. I think, intelligent robots and so on. So, yes, there is, I think you can raise a lot of questions about that. And where's the border, and how far do you go? What happens if a robot with a sharp knife is getting out of control? Who's responsible for that? Uh, all these kinds of things."
(Espen, senior researcher, robot developer, SANDY)

Interviewer: Could you imagine them taking over any of your work tasks?
Mathias: "So that's a tricky question, because I'm both a robot user, but I'm also a developer. So, that's a bit of a tricky question. Some of the things that I do, when I implement, you see, one of our aims, main goals, is to automate that, so that we don't need to send me to every customer. So that's, something I work with every day. How can we automate or make some of the software more intelligent, so we don't need to use so many man hours at making the robots work at customers?"
Interviewer: "And if robots, and this is very hypothetical, if they could replace your work entirely in the future, would you accept a basic income and stop working?"
Mathias: "So that's very hypothetical, and that's very hard for me to imagine that it's possible, because I'm working with automation on making them more clever, and there will always be, that task cannot ever end, because some of the thing that we humans do is so difficult to automate. There is no limit to that task. But, yeah, I could see myself as being a user of the robots, if they were that intelligent, and they could come up with more intelligent proposals than I have, then I could see myself as a user of a robot, and if that is also automated."
(Mathias, system integrator, robot maker, SPECTRUS)

Felix: "They [the robots] behave by the rules. Sometimes there may be a failure, but again it's by design what we try to do everything we mentioned. So we want to make sure it's affordable but it's trustworthy as well, because if you don't trust robots you're not going to use it."
Interviewer: "And if it's fully autonomous, it can learn, it can decide on its own?"
Felix: "It will definitely spot the patterns. And again, this is what – but it's not the robot, it's more the software, actually a robot is just a physical part of the software, because there is a lot of software that runs installed on robots. Do you trust your computer? To what extent do you trust it? I think to the same extent you can trust robots. Your computer is not moving, that's probably the only difference, but it has a lot of software."
(Felix, CEO advisor, robot maker, WAREHOUSE)

Interviewer: "The one hand there is this expectation of many robots to be introduced to work environments, but on the other hand you haven't seen many of them because there are not that many yet. Is that correct?"
Yves: "It is indeed correct. The point here is that when – in terms of, I would say robots, the way we see them in science fiction films, this may take some time to be present because it costs quite a lot of money to have all this hardware to be produced. On the other hand, if you consider a robot being a sort of an expert system which, as I mentioned, drives the machine or gives advice to the maintenance worker as to what

he or she should be doing, then I see it as potentially present much, much faster because it's just a computer. It's just software, computer software running, and this costs much, much less. So I would be – and if I'm not mistaken I think at least these systems that support humans in decisions that they take at work are currently being implemented in some advanced companies."
(Yves, policy advisor, affected stakeholder, COOP)

Arne: "In the companies, it still is very much at the beginning. I was at a conference where a professor, who held an important talk, used the image: 'Don't worry about the development of the automobile. There will be enough occupational activities in the future, and intelligent people are not required to do them'. They used the example that one will use data glasses and used an SAP-video, which one should watch again on Google. Said by the professor like that, so, and he then is being told everything narrowly via the data glasses. For now, this still is a science fiction vision or horror, but if this would be the image of digitalization, it sure would be one, which we won´t support since it reduces the person to an appendage, and rather is deskilling. And it isn´t the guiding principle which we pursuit in the case of digitalization. Data glasses can support humans very well, in the visualization of models, in solving problems, and can do some interesting things there. If I though only wear the data glasses, ignoring what kind of physical load they might come with, but this so to say is, I wouldn´t say that the decision already has been made."
(Arne, disctrict union secretary, affected stakeholder, COBOT)

Olo: "Well I know, the controls."
Interviewer: "So would you have an autonomous car that looked exactly like a Ford, BMW, a regular car? Given that you don't have to be the driver anymore."
Olo: "Well you could go the other way, it doesn't need to look fancy."
Interviewer: "What would it look like for you?"
Olo: "Well it wouldn't bother me if it looked like a Ford or a BMW or a Fiat but I think if you're going down the lines of autonomous cars I think People buy a BMW because they like to be seen to have accomplished things, or an Audi or a Mercedes or a Range Rover. I think if you're going to go down the autonomous route you're actually in a way if you looked at all the science fiction movies sort of like your George Orwellian kind of thing where everybody has the similar kind of transportation. Because they're going to be limited, I would imagine, to start off with what they can do, you know, they won't be able to do a hundred and seventy mile an hour like a Porsche or something like that. So they'll start off, I should imagine they'll be very much a clone, it'll be something that won't be a branded kind of image, they'll all have a similar kind of look to them rather than being outlandish or whatever. Because I think for somebody to say I've got an autonomous car it would be enough to have an autonomous car without saying I've got a whatever."
(Olo, mechanic + garage owner, affected stakeholder, HERBIE)

Nima: "Oh, I don't know, so the main ones would be to not harm people in any sense, not physical or psychological. So, in our lab we take – so we are going to deal with these people with disabilities, mentally and physical, and you have to take care of all what it can suppose for that person, you know, to deal with that situation that is new, so you don't want to harm. So, to create excessive empathy with a new technology that it can confuse that person or it can harm by physical action, those are the most two basic ones. And then from there, science fiction, from what it can make all the other ones."
Interviewer: "Could you give me an example of a situation where a person gets confused? We said we should avoid it. But what would be the situation?"
Nima: "So, for instance, I don't know, create a level of synergy between the robot that it's communicating like a human, by voice and making the other person think that that robot is his friend, and it will help him in anything, it's just a robot, it's a tool that you can use or you cannot, you can't confuse that person in order to think that it's gonna be a friend or it's gonna be – you know, so another kind of entity that it's not think of."
(Nima, robot designer, robot developer, BUDDY)

"If I wear a robot that makes my arm move and I control it through sensors: let's hypothesise that in a moment that sensors get activated the robot that I am wearing does what my hand wants. Let's assume that these sensors send an impulse to what we define as the mind of the robot that, after receiving instructions from the body of a person, executes a task. If someone intervened in the control mode from outside and instead of making a robot execute a positive task he or she would make a robot execute a negative task with regards to the person with whom I have an interaction regardless my will, you understand that this too seems to be science fiction."
(Dr. PETRUCELLI, head of hospital, affected stakeholder, REGAIN)

"So ethics, for me, is that what we are building is anyway, we are really building, trying to help the operator or trying to help to, the production, trying to help to increase the, the productivity and increase the, to improve the quality of the life of the people that are working in that. So for me, ethics means that what we are doing is following an improvement of the quality of life. So, it's not to cancel the operator. It's not to, or to put, to do dangerous things for the, for the operator or for ourselves."
(Emilia, director of research and innovation, robot maker, COOP)

Interviewer: "Yes. In your work, what is ethics? How would you describe ethics? Like quickly, five words that come to your mind when I say ethics."
Nicolas: "A commitment to respect people, to respect everything because we can't place a robot in the middle of everything. We just place a human because the idea is not to put robot, to put, just to put robot. It's to put a robot to help people to, to do some added task, a non-added value task, and that's why we have to, to take care about how we can use a robot and to put the robot at the correct place. It's just a tool. It's not a/ When I say the robot is just a position, okay? It's just a tool."
(Nicolas, programmer, robot maker, COOP)

Andrea: "It's having already now in Sweden, but it doesn't mean that we are against because we can't be against something that – it's – it's already here, you know. As – as I told you, you can't make donkey shot and make your file against the wind but– will you win? No, you will lose."
Interviewer: "But why not? Technology is made by someone, by people?"
Andrea: "People, who want to make money. I'm not making money with my job as unionist. They are making money."
Interviewer: "They? Who are they?"
Andrea: "The industry. The goal of the industry, but it's – it's not unclear, it's fair to me, okay? I'm doing my job, they're doing their job. The job of the industry is to make money, so they are trying to gain more profits everywhere. Is this ethics? This is not to me because especially when you're talking about transportation, your paramount should be safety, not revenue. So this is not ethic. If you're forcing your technology only to make profit, this is not ethical."
(Andrea, traffic controller, affected stakeholder, COOP)

Interviewer: "That adds some value. Okay. So, do you foresee any ethical issues in future in related to the use of robots?"
Ilaria: "Yeah, of course, yeah. As long as I think about it, they appear more to me. For example, this taking care of other human beings or many things, I think in general, we should use robots as a tool, helping us, but not substituting us."
(Ilaria, academic teacher, affected stakeholder, BUDDY)

Tad: "There is a human behind the robot. The robot cannot do it itself. But I do not know, artificial intelligence, if we start - so it does not turn into the opposite direction. There were movies about the robot that assembles itself."
Interviewer: "Right, and what if your robot suddenly builds itself?"
Tad: "This one is very nice and polite. He performs only the actions we teach him. But it can be also a threat with artificial intelligence, we don't know."
Interviewer: "What kind?"
Tad: "For example, they will take over control over us. They will start to act and create their civilisation, and human being will be repulsed. The worst scenario would be if they started to learn on their own."
Interviewer: "There already exist learning robots."
Tad: "Learning robots. To what extent - how, what will happen?"
(Tad, science festival organizer, affected stakeholder, ATOM)

Nima: "In our work, so the good part of doing research in our research institute is the regulations are outside, so you can treat them outside. So, you can do your research not follow – so following the basic regulations and then you can go far away in order to test some things. But I don't feel like regulations really put any kind of bound in our research."
Interviewer: "A few more questions and we will finish. You've mentioned that we should include ethics in education. But how to incorporate ethics into the design process in practice? It's not, it's not easy sometimes."
Nima: "There are multiple examples of how we have implemented something, hardware, software, and it has gone wrong. So, it's a good way for starting, so this is a bad design, we should be thinking about this kind of design that amplifies, like society agreement."
Interviewer: "Do you ever discuss ethics?"
Nima: "Yeah, actually I've been collaborating like during the last months in robotics and ethics talks for students, for undergraduate. And we did a forum also here with all the students of the different Bachelor students of the institute. And we actually participated, we are trying to do more ethics in our institute."
(Nima, robot designer, robot developer, BUDDY)

Oscar: "It is 2017, robots are able to use machine learning mechanisms with artificial intelligence and are able to perform many tasks and learn some patterns themselves in the way that the human brain does. And now it seems to me that the next step, which is somewhere ahead of us, and that I fear of the most, is when the robots, in addition to being able to use artificial intelligence and what they have learned to solve problems, they will be able to replicate themselves. And robots will be able to design better robots, stronger robots, more durable robots."
Igor: "This is a so-called 'Uncanny valley'."
Oscar: "And then it may get out of our, people's control. Then we do not know what is going to happen."
(Igor and Oscar, designer and co-founder at a company, robot makers, ATOM)

Chapter 9 Economics of robotization

This chapter reviews macroeconomic impacts of robotization and does not build directly on our ethnographic data.

Chapter 10 Meaningful work

"Yeah, I think just the stuff that people don't enjoy doing, like housework, which is now delegated to the robot. It's probably far cleverer than I'll ever be, but it would certainly take the pain out of the weekly chores of hoovering, cleaning, washing, ironing, kicking the cat out at two in the morning, all those kinds of things so you can actually get on and enjoy your weekend for what weekends are meant to be."
(Benny, mechanic at family-owned garage, affected stakeholder, HERBIE)

"I tell you what, a robotic ironing machine would be very – of very much interest to me. If it ironed shirts."
(Jean, underground engineer, affected stakeholder, OTTO)

"In my daily life, it could be to iron my clothes. More to tasks that you don't like."
(Alex, head of science exhibition, affected stakeholder, BUDDY)

"Someone to do my dishes, or do my laundry, or you know."
(Oswaldo, industrial designer, robot developer, SPECTRUS)

"So, I guess they will be in those works that are kind of monotone or painful for us to do. For example, in in the hospitals

and so on, carrying the pillows around or helping to lift people and things like that. And then in the homes, I guess first mainly in things that are really necessary, like taking care of other people and things like that. And then more and more in keeping us from the boring tasks related to laundry and things like that."
(Dieter, head of robotics lab, robot developer, BUDDY)

"I have been through it all, but I have always returned to [my work] because you have this idea about cleaning-- if you are happy about cleaning, if you are happy coming to work, then you have something to look forward to. If you are unhappy coming to work, then you cannot be cleaning. Cleaning should mean something to you."
(Bette, hospital cleaning staff, affected stakeholder, SPECTRUS)

"So, for sure there are some kind of jobs that can be replaced easily, let's say, from some others. But then I guess it's always depending on a lot of factors that are maybe the specifications of the particular jobs. So, if it is a job which requires a lot of expertise from the worker, or if it is just something that you can, let's say, simple automation task, you know, for something very repetitive where you do not have added value, so for sure these kind of tasks are the ones that can be replaced easily by a robot. The one where you have a lot of expertise on the specific tasks are more difficult."
(Marco, robot developer at a company, robot developer, COOP)

"I have been here for 13 years – as my other home. I have gotten very used to it, and I am very fond of my work. Because we are many people here, and we have the perfect manager who understands us, and I am very fond of the ward, and the nurses and everything."
(Elif, hospital cleaning staff, affected stakeholder, SPECTRUS)

"It would help! It could help me carry the bags."
(Veronica, hotel cleaning staff, affected stakeholder, SPECTRUS)

"If they had a robot that could make the beds, because one gets really hurting backs due to bending it, due to the low level of the beds."
(Virginia, hotel cleaner, affected stakeholder, SPECTRUS)

"I find it a nice idea, if the robot could take over some functions for the personnel. I think it's a good idea as long as people are not left without jobs."
(Rosi, hotel cleaner, affected stakeholder, SPECTRUS)

Interviewer: "Okay. And why Lithuania?
Villads: "The pay rate is lower and engineers go longer to the litre, for such an engineer over there and so on, right? So that is like, well, that was perhaps something, we could save costs and get more out of it and things like that, right?"
(Villads, CEO of robotics company, robot maker, WIPER)

"I think that for me, responsibility goes along with standards. So when I deploy a robot to a market, if I followed some standards, I know that I am responsible for something. If the robot fails, and I know why it fails - from electrical shortcut, maybe - it's my bad because I didn't follow the standard, something went wrong. I would say, as an engineer, also human-robot interactions should be standardized in some way. So I would say, 'Okay, they tell me to make in this way. I followed the standard, I'm okay.' Now, as it is, since human-robot interaction is not standardized, I try to follow my human being. Okay. I try to say, 'Is it good? Is it not good? Is it ethical? Is it not ethical?'."
(Allan, robot developer REGAIN)

"I think we have to think, you need to bring the efficiency in as well, it's not enough to automate because we aren't allowed to ruin people – and we shouldn't – but if two men could do the same work as a robot and are more flexible and just as fast then you will probably choose the manpower because they've got this flexibility, right? But the minute that the machines are more efficient and more productive, and, we have to utilize the fact that it can work 24 hours a day, 365 days a year. And it should be able to do that without people monitoring it all the time because that's a needless expense."
(Jens, CEO at technical equipment rental business, affected stakeholder, WIPER)

"it's really hard, you know, to adapt our processes, automated processes on this environment"
(Alessio, robotics start-up founder, robot developer, COOP)

"And he has obviously told me a few things that you, well, that you actually just shouldn't go around and tell a lot of people. But one of the things that we found is that, I spoke to him yesterday and we talked about, uh, he wants [the robot] to be an optimization in the work life. As a starting point, that you're going from being two people about this task, to just being one person."
(Jens, CEO at technical equipment rental business, affected stakeholder, WIPER)

"For me, automated is: move from A, position A, position B, very fast, very accurately, but move in an automatic way from position A to position B. And position A is always the same, or is known. Now we want to have adaptability, but faster than human, and I think, still, we are, we are much faster."
(Emilia, director of research and innovation, robot maker, COOP)

"But if humans get an automated robotcar and only drive once in a while, they also lose their ability to drive safely. Because it demands that you drive to become a skilled driver. Our human automatics have to be trained as well."
(Pim, engineer, robot maker, SANDY)

"People in the field, they don't have to be more efficient, they just have to be more productive. That means we have to give them things that make it easier for them. And I think robots can help us there. But they also talked a lot about if we can give the worker some nice tools, stuff that doesn't make his back hurt, stuff that doesn't give him blue fingers, stuff that

doesn't give him vibrations and destroy his physique, but something that is nice and nice to touch, then he will get some job satisfaction and if it makes people happy then we also have productive people."
(Jens, CEO at technical equipment rental business, affected stakeholder, WIPER)

"If the robot, I´d say, for all I know, costs 50,000 Euro, I would pay the same for the person."
(Karl, SME owner, affected stakeholder, COBOT)

"You'd have to adapt to it, wouldn't you? You'd have to learn how to use them, how to work with them."
(Sean, worker, affected stakeholder, WAREHOUSE)

Tolo: "The robots appear increasingly in the human life. Robotisation – I think it is inevitable."
Interviewer: "Why is it inevitable?"
Tolo: "I think the robots will be in every house in the future. They will help the human, get him/her in some jobs, help. In some things, a human is simply weaker than a machine."
(Tolo, toy shop owner, affected stakeholder, ATOM)

"If you could get the old Merc Sprinter to be autonomous and do the Amazon deliveries, as well as shopping deliveries and everything else, then— But then you'd have the people who drive the vans complaining that you're doing them out of a job. But they're probably more efficient because they're not standing there having a cup of tea and a fag, are they, while they're doing their deliveries?"
(Benny, vehicle mechanic, affected stakeholder, HERBIE)

"With the hand it's more efficient, because for example what my boss can earn with us by hand, he cannot earn with the machine…He thinks that, that could be very good for the worker because the work is going to be easier, but from an economical point of view, the growers will not go with that because it's very slow and the workers are much faster than that. So he doesn't think that they will lose their jobs, the growers will always look for handwork."
(Omar, farm worker, affected stakeholder, SANDY)

Interviewer: "A whole. You have also said that technology, the development of this robotic technology is inevitable. Why is it inevitable? And if we decide that we want to change the direction of development, wouldn't it be possible?"
Tolo: "There is no other direction. I think this is the most about security. The cost of a labour is also to be decreased. Replace the human in certain situations. And that is the most crucial point in this topic."
Interviewer: "So that is why we cannot imagine that the robots, or it means that we cannot stop computerisation or robotisation. But I wonder why it is so strong or ubiquitous?"
Tolo: "People are surrounded by technology more and more, and I think they want it. You can see it just after the market. More and more smartphones, more and more mobility. Maybe there will be a virtual reality soon. I think it's going in that direction all the time."
(Tolo, toy shop owner, affected stakeholder, ATOM)

"If we look at elevators, as an example, an elevator is actually a train that we've said needs to go up and down and in the old times, we had an elevator operator who made sure that the elevator stopped at the right floor. And today you'd probably get quite nervous if there was an elevator operator. And I'd probably say, why the hell is he here, there must be something wrong, we can push the buttons ourselves and go up and down, right. I know that a machine like a dishwasher, we used to be scared of those because, what would the women do then? That worked out pretty well, didn't it?"
(Jens, CEO at technical equipment rental business, affected stakeholder, WIPER)

"Surely there are hazards, but I am going to make use of the slogan that we have employed many times: we live in the twenty-first century, technology surrounds us either side, we cannot avoid it. The way we use it depends only on us --and in the case of our robot, children – knowing how to use it wisely. So robots will be there, they will evolve even faster, they will come along more and more in our homes, they will be cheaper, they will be better and cheaper labour force, so surely also when it comes to the labour market, they will come out and oust people, and we just have to adapt to it. We will not avoid it.
(Erwin, university psychologist, robot maker, ATOM)

"You cannot have a robot that can cope with any type of situation, and also the sensor, they have flaws, flaw, yeah, flaws."
(Mathias, system integrator, robot maker, SPECTRUS)

"Well, I guess investing in a robot is initially quite expensive but maybe in the end it's – it's going to be a bit cheaper, which could be a benefit."
(Edith, pilot, affected stakeholder, COOP)

"First of all, they are expensive. Second of all, there is an interest and a curiosity in getting such things, and I do not think it will be more than that, because there are only the hands that can do better."
(Bette, hospital cleaning staff, affected stakeholder, SPECTRUS)

Interviewer: "But they do the kind of work, which even a robot couldn´t do?"
Karl: "It actually could, the robot, but why should I delegate work to a robot, if it is done after three hours, and after those three hours, I have to reprogram all-new? That's what I meant earlier."
(Karl, SME owner, affected stakeholder, COBOT)

"And then there of course are other things, like, where a human works with something, and feels, 'Ow!, this is a harder material, now, I have to adjust the machine'. A robot just does the same every time. It would need to be so sensitive, that it immediately feels 'Ah, this'. So, it would need to think or feel like a human, so that it says, 'Ow!, stop, this sheet is harder. Now, I turn it on this side or texture'."
(Karl, SME owner, affected stakeholder, COBOT)

"Because when you work with manual calliper, or manual instruments, you are free, ultimately free, to go around the problem, or to solve the problem, not in a standard way, otherwise the robot is automatic, so the robot has a scheme, has a routine, a robot always follow that scheme, that route, there is no way to go around the problem, and solve it in another way, this is the best."
(Charles, software engineer and manager, robot developer, OTTO)

"Somebody who enjoys it. Because if you don't enjoy it, it's – but somebody just pushy, putting in the hours is no good, you need a bit of get up and go."
(Brian, wholesale store owner, affected stakeholder, WAREHOUSE)

Natalia: "I believe that in every area it may, maybe not replace but help us."
Interviewer: "Do you think that such robots could, probably not immediately, but even replace the teacher at some stage? Run lessons themselves? If they could talk, for example?"
Natalia: "Probably not, because the youth is sometimes very impulsive, so the question is how such a robot would react for example if three people spoke at once."
Interviewer: "Children would not listen if the robot told them to be quiet?"
Natalia: "Well, I think they wouldn't. I don't think so."
(Natalia, school teacher, affected stakeholder, ATOM)

"In the same way that you can still sell shovels to dig holes and wheel barrows to move the dirt, they still live alongside mechanical diggers and dumpers. You need to use the things where it makes sense. And I will say that no matter how many robots Aperture Science makes, there'll still be glaziers who have to go and install a single window somewhere, complicated places, but then maybe the machines will begin by doing the big, heavy, boring jobs."
(Jens, CEO at technical equipment rental business, affected stakeholder, WIPER)

"The trouble is you've got to have some humanity in technology. Otherwise you have problems, it's always been known, you get problems with machines. So the more power you put with the machine then the problem can be bigger."
(Richard, delivery driver, affected stakeholder, HERBIE)

"The driver of the rehabilitation program is still, in the end, the therapist, because it is the therapist or the clinician deciding which kind of rehabilitation you have to do. If I ask you to move an object, or if I ask you to move an object with some kind of stimulation, it's still the same. I mean, it will improve the rehabilitation process because it will give you additional things that you don't have now, but it will not replace a human."
(Alba, robot developer, REGAIN)

Liva: "And I think this robot is different in that respect, because these construction workers, you know, these glass walls weigh about 90-110 kilos, that's standard. And these construction workers are worn out after two-three years, so of course the robot can go in and replace two or three workers, eh, but it also prevents them from breaking their backs, so that's a bit different."
Interviewer: "Because it also has that aiding function?"
Liva: "Yes exactly. The thing about it being a co-bot, I mean. Well, it doesn't necessarily have to mean that it's something positive in that way but just that it functions in collaboration with a human. You know, it assists people in some way. Becomes an extension, or a tool you can use."
(Liva, production technologist, robot maker, WIPER)

Interviewer: "How do you think it will be in the future? Well, because the skill-shortage, it's a fact, that there'll be one."
Karl: "It won't be in the future, it's already happening now."
Interviewer: "Yes, yes, it's happening now, but it will be even worse in the coming years.
Karl: "Which is a problem, actually, of which only very few talk about, really: Here, yes, the promised land, I'd say, the full employment, everyone's dream, is, in my view, to my mind, the greatest economic loss, that could happen. Because, what happens? You can't get any skilled worker anymore. Already today, I can´t find any unskilled workers anymore. And that's just the tip of the iceberg. If I, today, we, do have an advantage, actually, we have, and the number of skilled workers that we need isn't that high. We have a lot, where we can deploy many workers, that, I'd say, do subtask and menial tasks. In the lot, it's not like, that the robot could take over. But now, we have five-six asylum seekers, they speak, more or less good German. We have three-four Spaniards, who do a good job, since one skilled worker adjusts three machines. And there are three, I´d say, unskilled workers, and after three hours, they're done. Then, he readjusts the machines. Then he does his job. But even those unskilled workers are more and more difficult to find."
(Karl, SME owner, affected stakeholder, COBOT)

"Yes, well, they do have aids in the industry, they just aren't used as much in practice because they're difficult to work with. So it's about making the existing aids practicable. And for the people who are there, you can tell it's revolutionary, they no longer have to quit their jobs because they're worn out. It's clear. But it's not a technological revolution."
(Alexander, university robotics researcher, robot maker, WIPER)

"Because at the end the, the, the standard industrial robots will take the position of the human operator. At the same time you have think that in the last ten years a lot of jobs were, were born. Because until ten years ago there were no smart phones, nobody programme apps. So I think the human, the, the, the, the, the technicians, the mankind, has in some way to, to be flexible, and find the opportunities around something. So we have not just to, to remove our wires from our ? I cannot do that, for the rest. Because we, we are not going to reinvent ourselves. The robot do better than us handling of stuff, fine. I will be the manager of that, I will check that, I will create something about that."
(Alessio, robotics start-up founder, robot developer, COOP)

"And not because I'm a robotics person. I'm not telling you this one for business perspective because this way I will become richer, it's not for that. Is, it's because I strongly believe that the robot can help the mankind."
(Alessio, robotics start-up founder, robot developer, COOP)

"Now, a robot is more there for support. So most robots are still handling machines. Due to the ascent of software and intelligence, like machine learning and so on and so forth, the fragment with the software becomes bigger and therefore, also the intelligence grows. The robot, so it becomes a more intelligent helper."
(Nathan, mechatronics engineer, robot developer, COBOT)

"No because, again, it does not replace human but replaces the evaluation of the human. Which is a different thing. It does not do human's job. It helps the human to do his job."
(Giovanni, head of unit, robot maker, OTTO)

"I think they will help me to be - robots that use parts of artificial intelligence, support driving, therefore it's safer on the streets, in medicine. I think it can be, can help to many people's lives"
(Damiano, metro company, diagnostics expert, affected stakeholder, OTTO)

"Then the robot should do these, like, less important tasks, so that's one thing that we are actually, or, yeah/ the robot shouldn't replace the humans but as I say before, to complement the things that the human is doing."
(Roberto, robotics developer, robot developer, SPECTRUS)

"I wouldn't mind, I tell you what, a robotic ironing machine would be of very much interest to me. If it ironed shirts."
(Jean, underground engineer, affected stakeholders, OTTO)

"Well, I don't know. In my daily life, it could be – to iron my clothes. More to tasks that you don't like."
(Alex, head of science exhibition, affected stakeholder, BUDDY)

Oswaldo: "I don't think it would fit in my life at the moment, but I'm pretty sure someone could make something that would end up in my home; someone to do my dishes, or do my laundry, or you know."
(Oswaldo, industrial designer, robot developer, SPECTRUS)

Emanuel: "I remember the industrial revolution and there was a lot of resistance to the machines but it's impossible to stop that. What's important and I think it's the experience we should remember, is that we should create the social opinion and the political myriad to avoid the negative consequence of that change."
Interviewer: "What would be negative consequence?"
Emanuel: "The negative if we translate this metaphor from the beginning of the industrial revolution workers should work harder, should organise in labour associations, etcetera, to limit the number of hours, to create the social conditions of the welfare state."
(Emanuel, exhibition coordinator, affected stakeholder, BUDDY)

"In my opinion, it should not replace the teacher altogether. It should be, as a supplement to teaching. And that's all it may be."
(Tolo, toy shop owner, affected stakeholder, ATOM)

"The robot will certainly change work. For example, in education, someone will manage this whole school top-down, and in schools, education may be run remotely. Or schools just will not exist. And then everything will be done by internet, by robot."
(Tolo, toy shop owner, affected stakeholder, ATOM)

"They do have a lot of interaction with our patients, and that is so very hard to imagine that, that kind of interaction being solved with a robot. I've seen programs about this; I've seen how they use robots in houses with elderly people for company [laughter], but that's where some of those tasks, or where you have this intimate, intermediate contact, that is very hard to imagine with a robot actually."
(Inge, hospital cleaning department manager, affected stakeholder, SPECTRUS)

"I also think that actually a part of the fact our staff are very happy about being here is because they get a lot of compliments. When they talk to the patients, they can feel they also make a difference for them. And I would hate that that part of the work wouldn't be available, you know? That would be sad. So I guess that would be situations where it is very difficult to see robots. But who knows?"
(Inge, hospital cleaning department manager, affected stakeholder, SPECTRUS)

Interviewer: "What do you think is the major motivation for the people who really enjoy this work?"
Brian: "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)

"There's a craft to this, to some extent, even though we work evidence-based, even if you use the latest techniques and so on, there's still a degree of craftsmanship, and of knowing the human body, when you work with rehabilitation. That's my opinion, at least. There's a touch to it, like, when you move a patient. When you're inexperienced, you often end up lifting and pushing a lot more. When you have more experience, you can often get the patients to use their own strength. It can be explained and put in writing, but you have to try it a few times before you can get the patients to apply their own strength. There's a lot of theory, but also a whole lot of touch."
(Klaus, physiotherapist, affected stakeholder, REGAIN)

"And I know this has happened before, with other revolutions in industry, but it's, how can I say, what would happen to all the drivers? What're you going to do with all them drivers that haven't got jobs. They're going to create more crime."
(Richard, delivery driver, affected stakeholder, HERBIE)

Chapter 11 Gender matters

Bart: "Statistically the number of women who work as manual operators is really low."
Interviewer: "Is there any difference between males and females?"
Bart: "No, because the way – there is the same of course in manual operation, men are faster than women but after the first two minutes you have only to control the robot with a tablet, so it's sort of control by remote and is the same [for men and women]."
(Bart, business developer, robot maker, OTTO)

Interviewer: "Is there a gender aspect already? Because one says, that informatics attracts rather men?"
Marc: "We have that definitely. Pretty much with all those technical jobs, that is very much a male thing. Well, if you know also take, for example, the research lab: We have here now, looking at all projects, I believe, that I can count them, five women. And we are 70-80 staff members, who are always here. In total we are, I believe, 160, but I wouldn't even reach ten percent. But actually, also if you look at the study numbers, then it did increase a little, that more women came.
(Marc, university researcher, affected stakeholder, COBOT)

Interviewer: "Were there any women in your team or only men?"
Matis: "At the beginning, only men."
(Matis, engineer and marketing expert at robotic start-up, robot maker, ATOM)

"There are only a very few women who one trusts to be qualified to work in engineering firms."
(Frederikke, work council representative, affected stakeholder, COBOT)

"normally, all the robotic projects include only men."
(Espen, senior researcher, robot developer, SANDY)

Interviewer: "I noticed that in the action hall it is only men there. I was the only woman."
Aramis: "There are also women who are growers."
Interviewer: "But it is mostly men? Or how is the gender in this industry? Can you tell me a little bit about that?"
Aramis: "There are also women"
Interviewer: "Okay, is there as many women growers as men growers?"
Aramis: "No. Not the same quantity."
Interviewer: "So, more men?"
Aramis: "We can say that, 20% of growers are women, 80% men."
Interviewer: "And then they just, the women growers they not stay so often in the green house because they don't want to watch the auction or?"
Aramis: "The women also go to the auction but they don't stay long there. They just go, check the products and check something, and when they don't want to stay more time there, they go."
Interviewer: "Because there was also, you know, at the betting tables where they were sitting at the screen?"
Aramis: "Yes, only men."
Interviewer: "It was only men. Is that something / I was just surprised to see that"
(Aramis, agriculture engineer, affected stakeholder, SANDY)

Interviewer: "Do you have any – among your customers any female workers? Would it – would this robot be adapted to females?"
Bart: "Yes, but statistically the women that work as manual operator are a really low number with respect to the men. My mind in 150 people, we made a – a training maximum 10 girls.
(Bart, business developer, robot maker, OTTO)

"The gender-gap is crazy in here. In our works councils, the proportions are quite good by now, at least here at the top. However, it is a real tragedy within the individual areas. I can absolutely understand why some female colleagues aren´t in a works council. I wouldn´t want it to be myself."
(Frederikke, work council representative, affected stakeholder, COBOT)

Interviewer: "Do you have any thoughts about gender issues in your, from your trade union perspective?"
Ariel: "Yeah, so obviously, you know there is an underrepresentation of females in air traffic control. I mean we do use probably 25/75, something like that, 75% male, 25% female, so, you know, that's one of the areas that needs to be addressed, absolutely, and my company are trying to understand why that is the case."
Interviewer: "Why do you think women are underrepresented?"
Ariel: "It's probably a whole end-to-end process from recruitment through to career choice and then, you know, ladies that do come in, you know, if they have a family, it tends to be the lady that takes an extended period of maternity leave or goes part time or more some form of flexible shifts or – and some people leave, you know. They start a family and they don't want to work anymore because of the traditional sort of social sector, I would say."
(Ariel, traffic controller and union representative, affected stakeholder, COOP)

Frida: "I wanted to be a mechanic, my parents are the ones that didn't allow it. I don't know why, but due to this dream of mine of being a mechanic, I was charmed by people that worked with cars. It was this curiosity and at least one day I could pay a visit and see. Already since I was little, I busted my brother's small cars to see if it had an engine, but it never had."
Interviewer: "Your parents didn't let you be a mechanic because you were a girl?"
Frida: "Yes, my parents said that this wasn't a job for women. My dad is one of those men that think that work for women has to be a decent job, cleaning or restaurant or else work in the house."
(Frida, hotel cleaning staff, female, affected stakeholder, SPECTRUS)

Interviewer: "Why do you think there are so few women in this sector?"
Edith: "I think because they think it's men's job simply. Yeah, I

don't know, I just always wanted to be a pilot for some reason, I don't know. I just was born like that. But I think they don't even think about it most of the time. They just think, 'Oh, that's a guy's job,' like a fireman or something very stereotypical, I think. But I do see a change a lot as a lot of young women studying their pilot training right now and it's – I think they're recruiting women as well especially just to sort of even the numbers basically."
(Edith, pilot, affected stakeholder, COOP)

Aramis: "The thing is that agriculture can be a bit, I don't know how to call it, sexist. I don't know, if I said the right word. There are not many women working in the lands."
Interviewer: "Okay. Male-dominant?"
Aramis: "Yes, but the thing is that is your chose. You choose."
(Aramis, agriculture engineer, affected stakeholder, SANDY)

"My daughter, she is fifteen, she doesn't want to know anything about programming. She just – I have robots – what only is good for her is just riding the robot, sitting on the robot when it's running around, that's it. She really enjoyed this. And that is it exactly, she can't understand what does it mean programming, even she doesn't enjoy it in school, she doesn't want to know anything about programming."
(Alph, robotics start-up founder & CEO, robot developer, WAREHOUSE)

Felix: "We actually put an accent on hiring ladies as well."
Interviewer: "I was going to ask you about that."
Felix: "Yes, we do have ladies that work in design, in assembly, and there is nothing that will restrict females or women to work in what we do. So, there is no heavy lifting, there is nothing dangerous in our manufacturing, so we try to hire females. It's not easy. There are not as many female engineers, but yeah, there are a few."
(Felix, CEO advisor, robot maker, WAREHOUSE)

Interviewer: "Are there many females employed?"
Pierre: "Very few. Track maintenance is very few. We've got an equal opportunities employment approach we try to encourage that as much as possible. For various reasons the workforce is predominantly male."
(Pierre, underground engineer, affected stakeholder, OTTO)

Interviewer: "It's a hard job [in the assembly station], isn't it?"
Axel: "It's a very hard job, specifically for this area."
Interviewer: "So, is it mostly men who do this job?"
Axel: "It's mostly men, there are women, but it's mostly men. But on (?) that's the opposite, because we have to be more careful about the wiring and stuff, so we have more women."
Interviewer: "Where we just passed there?"
Axel: "No, no, another one we haven't seen [it] yet, for the equipment installation."
(Axel, engineer and business developer, robot maker, COOP)

"Women are not very present in our sector. It is not an attractive job for women because the work as such is heavy, maintenance work. So, there are very few, they prefer other sectors."
(Giovanni, metro company, head of unit, robot maker, OTTO)

Interviewer: "Could you tell me a bit about the make-up of your staff? Are they mostly female, are there male members?"
Inge: "Well, I think we have 98% women, we have very few men."
(Inge, hospital cleaning department manager, affected stakeholder, SPECTRUS)

"Maybe you can imagine how it was for me back then, when I still was assembling cable bundles, being a 16-year-old, still not grown-up woman, for eight hours straight. Maybe that´s where my passions for old-school industrial work comes from, in part. There, in the beginning, there wasn´t any supervision. Sometimes, I´ve stood there, crying, simply because I thought it was shit. However, it very much was, like it´s being summarized about China: 'Everything is better than this bloody farm work'. For those women, it simply was a chance to live their own lives thanks to relatively high wages. To be independent etc. I don´t need to talk more about it, I believe. However, now, with the gender perspective, something very brutal happened. This type of work simply and without any public discussion about it, has been abolished. And other women in the global value chain took over. At some kind of contract manufacturer or/So, it still is gendered, or still remains highly segregated within those areas."
(Frederikke, work council representative, affected stakeholder, COBOT)

"What I think will happen, in the long term, is that we will see a different type of worker; for example, drifting slightly into gender politics, there are many female painters, I don't know how long that's been going on, to me, it's somewhat new, and when you visit a site, it's quite clear that the women there are painters. I think that will change. That's why it's entirely intentional when we show little girls alongside the machine. We will actually also do it in some of our future user videos. The reason there's a man there now is that he is the one who could operate the machine at the time we were making it. It was a practical concern."
(Valdemar, engineer and CEO, robot developer, WIPER)

Interviewer: "And do you think women are as good as men, when working with the systems and robots potentially?"
Ariel: "Yeah, I don't see why they would be – why would there be any difference, you know?"
Interviewer: "You don't see that."
Ariel: "No. I mean we're all – everybody goes through the same training program. Everybody's paid the same. Everybody has the same working conditions so there's no real reason why anybody would be – you know, you get variances of standards, inevitably, like you were just talking about pilots, you know, you have good pilots, bad pilots, you have – not bad but, you know, you have – everybody's competent at their task. Like in any – any job, some people are better, if I can use that word."
Interviewer: "Of course."
Ariel: "But that's not – it's nothing to do with gender."
(Ariel, traffic controller and union representative, affected stakeholder, COOP)

Interviewer: "Do you think it has to do with it is hard labour or is it, like the physical work or?"
Ariel: "No, no women do also physical work in the greenhouses and work as machines."
(Aramis, agriculture engineer, affected stakeholder, SANDY)

Interviewer: "Are there any differences between men and women in terms of their approach towards robots?"
Luca: "A first response that comes to my mind is no. Because personally I have never seen it. We should look at the data, see more."
(Luca, therapist, affected stakeholder, REGAIN)

Interviewer: "Is your robot suitable also for women? Also, for the operators. I don't know if, I don't think there are many [female operators]?
Damiano: "No, I have seen them work."
Interviewer: "Operators."
Damiano: "Operators on the tracks, even better than men."
Interviewer: "Even better men? [laughs]"
Damiano: "Even better than men. Not: better men."
Interviewer: "Right, better than men."
Damiano: "It always depends on what kind of woman you are and what kind, let's say, how being a woman relates to the man [laughs]."
Interviewer: "Yes, but let's talk about your robot. Women and robots. Is it similar?"
Damiano: "It's similar to men. It's not a gender problem: man-woman, it's not a problem."
(Damiano, metro company, diagnostics expert, affected stakeholder, OTTO)

"Women are not very present in our sector. But even the few present absolutely can be in a position to use the robot with maximum ease."
(Giovanni, metro company, head of unit, robot maker, OTTO)

"Teachers when they complete their course, just a handful of them probably is such an enthusiast and they want to introduce technical innovations, but unfortunately this environment is still such that it's hard. Unfortunately - just like that. The state of affairs - there are so many ladies of mature age and for those women innovations - of course there are exceptions, I also know such exceptions, enthusiasts, but the most comfortable [choice] is not to engage in such things, because they can break down, they are more difficult. We see it."
(Helena, brand manager at educational distribution company, robot maker, ATOM)

Interviewer: "Do you think there's any difference between how women and men approach technologies and robots?"
Patrick: "No. I don't think there is any difference in men and women; I think the big difference is age."
(Patrick, software company, account manager, R/affected stakeholder, WAREHOUSE)

Interviewer: "Do you think people are afraid of robots or they are ready for them?"
Alph: "I would say most of the people, old people they are afraid of, but we have several countries like Korea, China, Japan, there's nobody afraid of robots, no one, zero."
Interviewer: "And based on your own practice, what type of reactions do you see?"
Alph: "People really enjoy. Because most of – you know, again, all the men's part of humans they enjoy movies about robots. It's just let's say normal man's behaviour. So, when men are coming they really enjoy what they see. They really enjoy it."
Interviewer: "And when women, do you have women coming?"
Alph: "Yes."
Interviewer: "And? Are they different?"
Alph: "Unfortunately, there is not any women without – there is not many women who don't enjoy this who ever came"
Interviewer: "So, they both, men and women, enjoy the robot?"
Alph: "No, men even if they don't know anything about robots, they come and they enjoy it. But there wasn't any women who wasn't ready to see this robots, wasn't just occasionally there. I would say, most of the people – all the women who would interact, they have a technical background or they – so they are ready to talk about robots, they want to see them and so on and so forth. I've never seen anyone who never heard about robots then came here and said, wow."
(Alph, robotics start-up founder & CEO, robot developer, WAREHOUSE)

"We find the motor trade gets an awful reputation for single young ladies or ladies of any age going into a work place, it's not a very nice place to go into. Hopefully you have seen us just doing your research we try and just be quite friendly. A lot of places do tend to pick on ladies and it's awful."
(Garry, mechanic, affected stakeholder, HERBIE)

Interviewer: "Is there any difference between genders, in the way people approach robots? Based on your experience even, in the recruitment sector?"
Conor: "No, I don't think so. I think the whole software area obviously is much more male dominated, you know, so those, I think there's a difference between those who produce the robots and those who actually utilise them. I don't think those who utilise them, there's any gender imbalance really with how they're used."
(Conor, recruitment agency general manager, affected stakeholder, WAREHOUSE)

Interviewer: "And are there any gender issues related not to sex robots but to robotics in your field maybe? Or not really?"
Nils: "To warehouse robotics, I think I like the question, so this is actually gonna be something that we're going to try to think about in our research, is this a kind of gender-neutral thing, warehouse robots, or are there gendered aspects? I mean I think that human life tends to have all these gender issues in the most unexpected places and, for example, like if you start naming the robots, are people gonna give them female or male names?"
Interviewer: "That's a good question."
Nils: "That's a question and I think that, you know, I'm having trouble coming up with reasons why we would call a robot, let's say, like, you know, John rather than Jane, but I mean, okay, I think if the designer were to make it pink or blue, for

example, you could imagine that this would, you know, be one of the factors. And so, yeah, I think even with the warehouse robots, as soon as you start anthropomorphizing, you start giving it names, you start, you know, calling it, you know, this or that and, you know, if this is a gendered kind of idea, like this is typically male, this is typically female or whatever, very quickly you're just gonna start having these kinds of issues with the warehouse robots."
(Nils, university lecturer, affected stakeholder, WAREHOUSE)

Interviewer: "Why do you think roboticists feed into this picture of autonomous robots that have a mind of their own and they give a rose to a lady?"
Alba: "Because it's what people like. Why when you have the advertising of a car, there's always a nice girl driving it? Same thing."
(Alba, robot developer, REGAIN)

Interviewer: "What would be ethical issues for humanoids like? Safety of course, but any other things?"
Alex: "Gender issues as well."
Interviewer: "What do you mean? The gender of the robot?"
Alex: "The gender of the robot and how the robot can select you as – imagine if it could be, it could talk to you as a man and you are a woman."
(Alex, head of science exhibition, affected stakeholder, BUDDY)

Pix: "the actual real problems in autonomous vehicles that we kind of have to figure out good solutions to are biases, so how do you make sure that you're as good at recognising women as you are at men and, you know, and—"
Interviewer: "Or people of colour."
Pix: "Or people of colour or, you know—"
Interviewer: "Children."
Pix: "Children, yeah, you know, maybe you can't."
Interviewer: "People with disabilities."
Pix:"Yeah, exactly, yeah. Maybe you can't, you know. I mean first of all, you were talking about training those things with like hundreds of thousands of images, how do you curate that data set to make sure that it's got a good bias, and how do you make sure that once you've created that data set that actually that translates into what it's actually learnt is without bias. Or how do you actually just analyse the bias and say, "This is what our bias is," and before you can even correct it. So I think those are major problems, like there's genuine technical challenges in making sure that you don't introduce biases in the system that you weren't aware of."
(Pix, FIVE AI CEO, robot developer, HERBIE)

Chapter 12 Human proximity

We have opted to keep quotations in the main text.