

# 1 Interview transcripts

## 1.1 Lisa Passing

**S00:** Please introduce yourself briefly at the beginning and talk about your connection to e-clothing in activism, or in related areas, i.e. clothing or digital activism.

**S01:** I'm Lisa Passing, I live and work in Berlin and the surrounding area. I've been a member of the Feminist Hacker Collective and Hackspace Heart of Code since 2017. We do activism on various, mainly gender-focused topics within the tech industry. From 2014 to 2024, I was active in "Cryptoparty Berlin". We gave workshops on digital security and privacy for individuals with different threat models, i.e. different approaches and also different attack vectors. I also deal a lot with hardware in the course of the hackspace and a lot with DIY electronics and intersections from all these subject areas.

**S00:** Okay, thank you very much. Then we come to digital activism. You've just said that you're very active in this area. Can you describe what digital activism means to you?

**S01:** For me, digital activism is primarily about using digital tools. So you don't go from door to door and knock on doors, but you use a website to spread information or to collect information. That can be very different. So that can be from campaigns like, for example, I remember parts of this Schufa campaign where people wanted to expose the Schufa algorithm and relied on people donating data to them. It was a kind of online data collection campaign, because that was the easiest way. And something like this would not be possible in this form without digital means and tools. This tool character is exactly what stands out most for me in digital activism.

**S00:** What special functions do you think digital technologies take on?

**S01:** I think it's the functionality of good accessibility. I don't have to go to a café or anywhere else to sign a petition, I can do it from my computer or cell phone. Activism is very accessible for me, very close. And also that it can be so versatile. It's not just about filling in something with a pen or not having to physically appear somewhere, but the interaction can look completely different. And it can be less barrier-free at first, because there are also people who can't necessarily always go out or perhaps don't have

time because they have other commitments. But you can also get involved and be active somewhere else, i.e. at other times, other places, other opportunities for interaction.

**S00:** You just described the digital space for digital activism. To what extent do you see opportunities to combine the digital space with the real world for digital activism?

**S01:** Good question. I think a pretty simple kind of combination is just to inform and call, so a demo call and then you make a demo ticket. So that you know where you need to be to go out and have a simple digital tool to support and facilitate that. Conversely, you could also say that you are on site and perhaps have digital options on site to keep people involved. This could be, for example, signing up to a mailing list, but doing it locally. Or you can simply ask people you meet locally. The interesting thing is, the more I think about it, many of the advantages I mentioned in the previous question are not necessarily available on site. I have to think for a moment, you could collect things, you could call. I think you could also simply provide other things. I'm thinking of information and exchange, especially in combination. I can't think of any other things off the top of my head.

**S00:** If you can think of anything else, you can say it later. You've already mentioned a few advantages of digital activism, but perhaps to summarize: What do you think are the advantages and disadvantages of digital activism?

**S01:** The advantages of digital activism are that it is accessible. In the sense that I can use it at any time within my own time frame. I can reach more people, so the reach also plays a big role. The disadvantages are perhaps precisely these things, so I often have a kind of fatigue. There's always another online petition that you can fill out. And then you say to yourself, I've already filled out two this week and then I don't feel like doing the new one anymore, even though it's probably just as important, if not more. Sometimes you miss the personal connection when you only see and find something like this online. It's also this click activism, where you just click and you're no longer involved, like when you actually have to organize it yourself and get people to become active. That's another type of work. I can also imagine that a lot of classic activism work is lost if you only focus on digital.

**S00:** Now it's back to the future of digital activism and then we'll slowly move on to e-clothing. How do you see the future and development of digital activism?

**S01:** Digital activism will continue to exist and I think it will become more and more important. Especially because more and more of our lives are taking place digitally and our digital lives are also being monitored and restricted more and more. This includes the classics, such as chat control or building backdoors into encrypted communication. These are topics that come up every two or three years. And this is also really about activism, about preserving the digital space and protecting ourselves from it. It is also still important to protect the infrastructure itself, but also to expand it further. So that we can make this possible across other areas. We have to make sure that I can sign an online petition and still keep my data secure. You don't want to sign something and have the political opposition access the signature list and then know exactly who voted for and who voted against. Something like that can quickly become problematic.

**S00:** Then we come to the e-clothing part. As you already know, the work is about the potential and limits of e-clothing in activism. How would you imagine the use of e-clothing in activism?

**S01:** What I can totally imagine is a kind of wow effect, because it's very new and very unknown and very niche. I think if you have a message or something that you want to spread quickly in the physical space, then you have something that stands out a lot. For example, something that flashes or makes noises where people don't expect noises or a combination or something that looks very freaky. This initially arouses interest and, in the best case, arouses curiosity and opens the door to conversation. To say: "What are you all about?" I believe that an approach that goes down even better, especially with younger generations. They can post it straight away on TikTok or Instagram and reach people even faster. Something physical is then brought back into the digital space in order to use the dissemination mechanisms there.

**S00:** That's also an interesting aspect. I would say you've already answered the question somewhat: To what extent does the combination of clothing and digital technologies offer an enrichment for activism?

**S01:** That's exciting. I believe that clothing is very commonplace. That's why T-shirts with a political print are still popular, because you wear it on your body and while people are looking at you, they are automatically confronted with your message. And with e-clothing, this is reinforced by the technological aspect. The technological aspect is also

becoming increasingly commonplace. We all have phones now. And this connection is even more exciting and catchy. Now I've briefly forgotten what the main part of the question was.

**S00:** What enrichment does the connection bring for activism?

**S01:** Thank you. I think the enrichment is this novelty factor, which says that this is another representation of the problem. If you want to educate to say it's a different way of looking at it that's maybe a bit more interactive and can't be represented by a video or a website with simple graphics. It's clothing that does something different and is a different medium and I think that can be super effective depending on the use case.

**S00:** We've talked about a lot of positive things so far and now we come to the question of whether you think the combination of clothing and digital technologies can also bring challenges in the context of activism and if so, what are they?

**S01:** I think the challenge in activism specifically is that anything electronic requires digital expertise. I've worked with many activist groups over the years and I've noticed, especially with the cryptoparties, that technical expertise is rarely available. I could imagine that a group might be able to design their own e-clothing, but very few have the ability to implement it. There is a gap between what people want and what they can actually implement. Depending on what is supposed to happen, it could also become very expensive very quickly. Not just in the material. You think that one component is very cheap, but if you need 200 of them, it's no longer quite so cheap. And then there's the working time, because these are mainly one-offs. I think producing something like this on a large scale in an activist context is unlikely to impossible.

**S00:** Do you already know of any examples of e-clothing that you have seen as a form of activism and if so, which ones and what exactly made them activist for you?

**S01:** I would give two examples that a friend of mine did in the Heart of Code hackspace context. One project she called the Mörb vest. She doesn't like it when people come into her personal space, especially strangers. She didn't like that at all and then she installed distance sensors in an old vest and a battery pack and a piezo element at the back. She could then wear the vest and if people came too close to her, the vest would make buzzer noises. She didn't want to keep pointing people out and saying, "You're way too close to me right now." So she outsourced it to the clothing and the clothing gives the person the

feedback to keep their distance. The problem was that people thought it was way too cool that the vest made a sound. They then deliberately got very close to her to trigger the vest. She wore it to two events and then it didn't work for her anymore. And the same friend has [...]

**S00:** Do you want to talk briefly about what made it activist for you? What factors did you attribute this to?

**S01:** For me, the activist part was the fact that, especially as a FLINTA person, you have a sense of distress at larger events. Especially in such very technical communities, where the gender proportion is more white, heterosexual and male. You're often unsure whether you're being flirted with or not and that's kind of uncomfortable. You don't necessarily want to address that and I think you can outsource it to a neutral factor that says I want to have 30 centimetres of space around me and you have no business being there. And that can be in the form of clothing. The man then gets a rap on the knuckles, but not from me. With FLINTA people, it's often the case that it's simply accepted because it would be too strange to address it. It also gives me a kind of reinforcement that the boundaries I have set for myself are being enforced.

**S00:** And now the second example. I just interrupted you there.

**S01:** This friend also designed a self-dancing dress. Self-dancing, but rather in quotation marks, because it was LED strips that she sewed onto her dress from top to bottom. I think there were a total of 13 battery packs that she wore around her waist because the dress consumed a lot of electricity. She used several microphones to record the ambient noise. The idea was that the dress would dance for her because she found it strange to dance at larger parties. The dress dances for her by reacting to the ambient sound and doing a very simple beat analysis. Then it looks like the dress is dance along for her. This allows me to still participate, even though it would be too physically weird for me and I would feel uncomfortable. I don't want to be the party pooper, I want to take part in a different way than others do. I liked the idea for that. To say, what is the social expectation in this space? You have to participate now, but you might not be able to or want to do it in the same way that other people do. I thought this trick she used was quite good. You can redirect the dancing to the dress while you're drinking your drink.

**S00:** So clothes take on a role that you have difficulties with.

**S01:** Yes, exactly.

**S00:** Okay, now we come to the area of application of e-clothing. You've already mentioned two examples of applications. What other examples of use could you imagine in the area of e-clothing in activism?

**S01:** That's actually a question I hadn't prepared for. What examples of use? One idea that I personally always find quite nice is to share knowledge. I said earlier that many activist groups don't have any expertise and you could combine something like that with workshops: How do you go about something like this? How can you build something like this? I think the ADFC once had a bicycle distance sensor campaign. It's not e-clothing, but to get the point across. In the campaign, you could attach distance sensors to your bike and see how close cars were passing you and then evaluate this. Because they knew beforehand that very few people know how to put this together, they held workshops. There, people can also give feedback on what can be improved in the instructions. There was also a community and knowledge-sharing aspect to it. I think technology with clothing also has a very strong attraction factor, because people find it cool and get involved. You can do a lot of interdisciplinary, educational work: How does it work? What do you have to pay attention to? You can involve people through the community and strengthen the activist core. You then have people who have already built it and tell others about it because it was cool. Then you might have more people who rebuild it, improve it, make it easier or you actually reach a critical mass that you say you can do bigger things. So you get larger quantities and somehow make it cheaper.

**S00:** Because that fits quite well thematically and you mentioned knowledge transfer. To what extent do you see e-clothing as an interface for more FLINTA people to become more involved with digital technologies? You already mentioned that the community tends to be male dominated.

**S01:** I actually see a lot of potential here, because many crafts, such as embroidery, knitting and weaving, tend to have a female connotation, but also have a lot to do with algorithms and pattern thinking. Which in turn we also have in programming and combining that and saying it's about making clothes that somehow look cool and also do something cool or communicate with something else. Maybe also draw attention to something that is important to you. I think that's great for teenagers from 12/13 upwards and would go

down really well. I only have minimal experience, but we often give soldering workshops where we explain soldering. And I've noticed that if you don't just solder normal kits where something happens at the end, but for example at a festival we soldered glowing earrings, we suddenly had lots of girls at our soldering station. I remember there was a father there with his two daughters and he had never thought about soldering with his daughters, even though he does hobby building himself and has his own soldering station at home. And then they were sitting there soldering and were really engrossed in it and he said: "Okay, I've just learned something." And that was a real moment of success. I think if you realize that the girls are interested and they take it back to their schools or girls' clubs, that could work out really well.

**S00:** Really good example. You spoke earlier about the challenges of combining clothing and digital technologies. What solutions do you think could help overcome these in practice? I think you particularly described the hurdle of dealing with digital technologies and communicating them.

**S01:** Exactly, I think I would differentiate between two points. Firstly, assembling and building the finished product, the finished clothing. But I think it starts a bit earlier, because even understanding the parts about the hardware, if it's not written down exactly what the parts are that you need and what they are or what the alternatives are that you can also use, that it's already very overwhelming for many when buying. Initially, this doesn't have much to do with actual technical expertise, but rather I'm buying something that I've never bought before. And that's also important in terms of sustainability. Many people in the maker scene don't really care, they just buy something from some store in China. Then it is sent from three different factories in China across the globe in small bags. The question then arises, does it all have to come individually or is there perhaps a large importer in my city so that you don't have to go five times. You should also think about where you buy things that are as sustainable as possible. But that's also a huge knowledge base and you have to gather this knowledge first. I often struggle with this myself. For example, if I can't get something, I have to import it from China. And then when it comes to building and implementing, it's about following instructions, which is a bit more low-threshold, or it's about building up knowledge so that people have to implement completely new approaches on their own and that's the highest level of difficulty. And if it's mainly about making something for a fixed date, you also have to think

about what you're going to do with it when the whole thing is over. Are the electronics integrated into the clothing in such a way that you can get them out again? Can it be recycled in any way? Where do you take it? These are completely different problems. Or it ends up in a box at home and you don't look at it for five years and it ends up in the residual waste.

**S00:** Yes, that's definitely an important issue. Probably also in general in the maker scene. Then we come to your perspective as an expert in digital activism and the question of how e-clothing should be designed from a technical perspective in order to be used in the field of activism?

**S01:** I think the biggest and most important idea that comes directly from digital activism is the open source idea. In activism, it only makes sense if you can reproduce everything or it's so open that you can copy it and the interfaces are open. For example, if the clothing interacts with an online database or an online service. Where does the data come from? So making the entire stack behind it as open as possible. On the one hand from a security perspective, because I believe that open source is the most secure software in principle, because several eyes are looking at it. But also to say that we're not doing this for our small group and we're not like the big players, because we can make it open and comprehensible. For example, for the next group that might want to do it in France. A bit of international solidarity and also to build a community through something simple like a DIY guide.

**S00:** You just mentioned the issue of data protection. To what extent does this play a role in e-clothing? How do you envision the use of e-clothing in terms of data protection?

**S01:** Yes, that's a good question. If the garment is specifically about tracking things on your own body, then it's important to say where the data is sent. Is it more stationary, i.e. just one person with a laptop and router, and all communication takes place via a local network and then the digital data is deleted, or is it about collecting the data and then making something out of it? Then it would definitely have to be [...] Although it also depends: I was just about to say that it has to be anonymized in any case. On the other hand, it could be the point of not anonymizing it. I think you have to look specifically: what does the e-clothing piece do, what is the use case and what data is really needed for



what we want to do? The more I think about it, it can have very different dimensions. But also very classic things: how is it transmitted, is the transmission encrypted, where is it stored, is it a server, who has access to the server, where is the server hosted, is there a backup running, who has access to the backup. In other words, classic security topics in which the activist groups also need to be trained. Or you ask a friendly tech collective if they can help you out.

**S00:** So similar parallels to the digital sector.

**S01:** Yes, definitely.

**S00:** Now we come to the future prospects. You can now imagine the future in 10 to 20 years' time. If you imagine the future of e-clothing in activism in 10 to 20 years, what would it look like from your perspective?

**S01:** I suspect that it will remain relatively niche. I think closing this knowledge gap on a broader level will be tough. I still think more than it is now, but still niche. The people who are interested in it and make new well-documented projects, then other projects always follow and people can learn from that. It's a kind of multiplying effect. I think the components are cheaper and I also think it's becoming more and more interesting to get data. I am involved in several projects that are trying to collect data where there is none yet. For example, femicide in Germany, which is still something of a black box. We know it's a problem, it's pretty bad, but there's no proper data set. And then to say that there are groups that have collected this data and then you can use this data. Especially with the topic of gender-based violence, which is very close to the body, you can think about how to present the data now on e-clothing. That could be very impressive, so of course it's a terrible topic, but it could be a very effective and vivid way of presenting topics through clothing. I think something like this has a lot of potential in the future. If it's done well, I can also imagine it being taken up more by the mainstream. Compared to projects that are very artistic. These are projects that people know about who are otherwise not in this bubble.

**S00:** How many years do you think it will take for e-clothing to establish itself in the mainstream of activism?

**S01:** I don't think I actually see it becoming mainstream. That's a gut feeling, but I don't see it. I think that there will be several groups that use it, but in a very selective

way and then very effectively, but I don't see it in the mainstream at all.

**S00:** From your perspective, what current issues or developments in digital technologies could influence the future of e-clothing in activism?

**S01:** Good question. I think a big issue that's happening right now in a global context is the current political developments in the US. A lot of people who are in the technology sector are wondering what will happen if we can no longer rely on the digital infrastructure of and in the USA. Simply because they are no longer there, so any databases with measurement data are deleted and what if AWS says there are taxes on data queries within the US. I think there's more and more of a trend now to host infrastructure in Europe and focus more on decentralization and looking at where things are coming from. I think for people who have nothing to do with technology, it's so abstract that they don't even see the problem that you're afraid of. With e-clothing, I see the advantage of addressing this issue: What does the digital infrastructure have to do with me and my body? On the other hand, I believe that many techie people are thinking about how things can be broken down further or made simpler: Hosting databases, creating interfaces to what that is. In a kind of trickle-down effect, so that it becomes easier for activists to access something like this. A kind of "counterculture" is emerging again: we have to pay attention to the basics because we don't know what we can rely on. So nothing very new, but a rediscovery of the classic that can be taken up again in an activist and artistic way.

**S00:** Then we're almost at the end. Finally, if you had to summarize the importance of e-clothing in activism, what do you think is the potential and what are the limits of its use?

**S01:** I think the potential is very great, especially in the area of getting girls and other FLINTAs excited about technology or creating the bridge to communicate in the first place. The potential to draw attention to things. As a medium, to draw attention to things that other media may not be able to capture and are not as impressive. Creating new spaces and new communication channels. I see limits mainly in the implementation due to a lack of knowledge and perhaps also to a certain extent in the idea of sustainability: is it worth buying so much stuff for what I ultimately want to do, or is another medium or another type of communication, such as completely digital, more helpful.

**S00:** Is there anything else we haven't touched on that you think is important for e-clothing in activism?

**S01:** I have already included all the things that were important to me, especially for knowledge transfer.

## 1.2 Antonella Giannone

**S00:** To begin with, I would like you to introduce yourself and talk about your relationship to the topic of e-clothing in activism and the related areas of clothing and digital technologies.

**S01:** My name is Antonella Giannone and I have been a professor of fashion theory, fashion sociology and costume history at the Weißensee Kunsthochschule Berlin since 2013. Before that, I taught in Italy as a lecturer at a university that also focused on fashion and fashion studies. I had a subject there called Socioanthropology of the Fashion Product. I also wrote my diploma thesis and my doctoral dissertation in these areas, which is why I have been familiar with the subject of clothing and fashion for several decades. And above all, I have been moving and researching in these areas and continue to do so. I don't have a direct connection to e-clothing. I was interviewed about it again and again. In the beginning there was the term smart textiles or smart wearables. This term is actually not so appealing, but wearables definitely is. In the beginning, when I arrived in Germany, the question kept coming up because wearables kept popping up at trade fairs there, including in Berlin. And I tried to contribute my expertise in the field of clothing, how clothing works, and which functions can be expanded or replaced. But I don't really have an in-depth, personal involvement with e-clothing. What I can say is that the subject of e-textiles is represented at our university. We have a so-called e-lab and within this e-lab there is also a position for e-textiles. Of course, I've always seen or even supervised projects that actually had something to do with this. There was always the idea of extending certain functions of clothing with sensors, for example. Certain projects were used to try out the idea of deformability, i.e. garments could take on different patterns and deformations with certain sensors that reacted to heat or cold. There were also interesting projects in the bachelor's area with the connection between textiles, i.e. items of clothing, mostly wool sweaters, and sound. There was an attempt

to create certain sounds through certain movements. But I really have to say that for me this area is such that I can understand or grasp what the functions are, how it works and where it comes from, that we want to give garments a different function than the supposedly usual ones, but I can't say how things work technically. I have absolutely no expertise in electronics.

**S00:** That was also important to me in the interview, that I bring in expertise from different areas. I also interviewed a person who doesn't deal with clothing, for example, but only with digital technologies.

**S01:** This topic is really strongly represented here, especially in the field of textile and material design. And I can also think of other examples, for example there was a student who designed flowers so that they reacted to heat or less heat. So the possibility of an accessory that moves and unfolds. A similar project involved the idea of hair. Hair in the sense of a sweater or fur. And the idea was to somehow imitate this, in other words to control the movement electronically. But it's also interesting to see where the inspiration for these things comes from, because it's often in the field of biomimetics and you can learn a lot from nature. Which natural elements or the function: for example, imitating the external oils of animals. That's why there are always a few attempts at transposition from one area to another. E-textiles, wearables or e-clothing can often take over this function.

**S00:** What is your experience of using clothing for protests or activism?

**S01:** I was asked to give a presentation at a conference together with a colleague and then she was ill and I gave a presentation on my own. I was always interested in this topic. The topic of body representation, i.e. the construction of social bodies, is very present in all the research I have been doing for years. That's why I've already collected a lot on this area and the idea was how the body, the protesting body, can be characterized: What does a body have to have in order to be recognized as a protesting body? And that's what the whole thing was constructed around, and because my colleague was no longer able to come to the conference, we thought we'd write a book. For me, the focus on the construction of bodies in social spaces has always been very important. Shortly before that, we identified the bodies of artists with another colleague. Before that, I wrote about the bodies of politicians and before that about the bodies of academics. To what extent

is this homo academicus also recognizable in clothing? And before that, the functionality of the model. To what extent is a model, what we call a model in fashion, also a social figure of the present and what aspects are involved? As I said, in the course of all this research, I came up with the idea of also analyzing the bodies of protesters. That was specifically in the context of a seminar I gave in 2019. The seminar was called "The Dressed Body in Performance" and we really identified different spaces of performance. And it wasn't just about constructed performance like in theater or film, but also in social spaces. In this seminar, we read Judith Butler's book. And we really asked ourselves the question: How can an individual body become a collective body? Judith Butler never talks about clothing. She talks about the alliance of bodies. The question that I ask myself and that we continue to ask ourselves in this book is: How can an alliance of bodies be emphasized, underlined, but also constructed in the moment? And we thought that clothing plays a major role in this. In the design of a unity that is colorful on the level of clothing, on the level of the way clothing is worn. In other words, this unified moment that clothing offers. Judith Butler, following Anna Arendt, talks about this very strong spatial dimension of protest. Protest is bodies in spaces, bodies in space, bodies that are given a space of appearance. And that raised the question for me: How do you change a street, a real or virtual space into a protest space with several bodies at the same time? Clothing and textiles can somehow also represent this dimension, i.e. the appropriation and transformation of spaces.

**S00:** My next question would also have been for you to describe what clothing activism means to you. Is that what you just described what constitutes clothing activism for you? Or is there something else?

**S01:** No, that's definitely it. Definitely the formation of a collective dimension of the body and therefore also through clothing. The formation of a collective dimension of the clothed body. That is definitely a big part of activism. I mean, you can also protest on your own. It's not that you can't protest on your own. When we are really involved in an action in space or between spaces, there are always several people involved. The effectiveness of a protest is also like this, of this multiplication, of this diffusion, of these movements that attract attention in a somewhat circular way. A protesting person attracts less attention than a mass that really changes the space. Or depending on the space in which we move. This multiplication is actually already an important component. What

Judith Butler describes with this alliance. That is definitely a part of it. When we examined the various examples in the book, we realized that many other elements flow together in these protest bodies or protest clothes. So that you also have to see them anthropologically in broader contexts. If you think of carnivals, parades, many moments of collective appearance. These are moves that both protests and other forms of something like carnival parades have in common. We have come to the conclusion that protest clothing and clothing in activism also form utopian spaces. And in these utopias, of course, other functions of clothing can be expressed that are not necessarily foregrounded in everyday clothing. For example, the ability of clothing to connect people, to unite people, also materially, which is more likely to be expressed at large collective events. I think that in this utopian moment of clothing, clothing is able to not only define people as we know it, to define, individualize, make special, etc., but to bring people together physically, to create a physical closeness.

**S00:** I assume you've already mentioned one advantage of clothing activism, i.e. the function of physically connecting people. What disadvantages do you see in clothing activism or what other advantages do you see?

**S01:** In terms of the effectiveness of the protest or in terms of what sense?

**S00:** Feel free to elaborate on the effectiveness of protest, I meant clothing activism in general.

**S01:** I was recently in Bari at my original university talking about the book and about protest dress. And not to fashion or creative students, but to political scientists. This was at the Faculty of Political Science. An interesting question that kept coming up, of course, was to what extent the increase in the use of clothing led to a liquefaction of political content in activism or could lead to greater effectiveness. I mean, it's becoming more and more, there's hardly a protest that doesn't express something textile. I was a bit surprised by the question, which I should have expected. For me, I found an answer, and that is that the idea that you can be politically active with clothing is not just an expression. I always assume that clothing is not just an expression of something that is somewhere else, but that this construction of clothed bodies in a political sense has a commonality of effects. I mean, this awareness that bodies can be used to be politically active and that clothing is naturally part of this. This awareness is always broader. I have

the impression that from all these movements, examples and images of clothing protests that reach us every day, the awareness certainly remains that we have a body, and this body is political, politically usable and politically effective. In the majority, it is even more effective. This awareness that you can express something and make a difference with just a few instruments. I think this awareness is now present. Twenty years ago, political statements, for example on red carpets, were still an exception. And when they did, they were a sensation. Nowadays, almost every carpet, whether red or any other color, is used to express something. Every stage is used to convey something through clothing. This awareness has grown and I think that's an advantage. The question is whether this liquefies or aestheticizes content or whether it just remains an image and the content is then somehow no longer as present. We remember certain images of a demonstration because of the aesthetic dimension of the clothing, the textiles, but not the content. I don't know, that could, also due to the proliferation on the internet, due to the piling up of the most diverse protest movements from all over the world, that could lead to people being overwhelmed and losing focus on the different protest actions. This "image overload", which we are also seeing at all other levels, could be a risk. The risk that clothing is what remains of the protest at the end.

**S00:** Thank you for the insight into the protest with clothes. You've just mentioned the mix with the digital component on the internet. That's why we're now moving on to the topic of e-clothing. How could you imagine the use of e-clothing in activism?

**S01:** I just have to ask a quick question, e-clothing in the physical sense?

**S00:** Exactly.

**S01:** If you fantasize a little bit, but also fantasize a little bit stereotypically, you could imagine the function that you've identified in general in a potentiated way with e-clothing. For example, the possibility of people connecting through clothing, hugging or creating something. Or even visibility. One topic that comes up again and again is the visibility of protesting people. This is usually achieved through color. Think of the pink caps and yellow vests, for example. Signal colors are very often used to increase visibility. There is the transition to bright items of clothing. Above all, protest is something that takes place during the day to ensure this visibility. You can probably imagine protest clothes that also work at night. At the moment, at many demonstrations in the evening, we see

cell phones being used as lighting, for example. Mobile phones are in some way a kind of e-clothing. They are not clothes, but they have definitely become prostheses of our own hands and eyes. It's not that they are really separate objects from us. There is an incredible interaction between us and these objects (mobile phones). That's why you could imagine a couple of features shining, making light and so on, could be projected directly onto clothing. It's a gesture that people always make at protests, turning around and looking at how many people are behind me and how big the crowd is. That's always an empowering moment in a protest, when you see that there are a lot of people here now. I think that e-clothing can offer this view to the rear in some way. A common feature of e-textiles is to extend bodily functions. What else is there? Warmth. It can be cold in protest. You don't stay as long as you might like because you're too cold. Maybe the function of a blanket, but in a more agile way, to provide warmth.

**S00:** That's definitely some interesting input. My next question would actually have been to what extent the combination of clothing and digital technology is an enrichment for activism. From my point of view, you've already partially answered that, but if you'd like to add anything else, please feel free to do so.

**S01:** I would say it definitely has potential. Potential in the sense of expanding the functions that the body and clothing already have. So based on the goals of visibility and cohesion, clothing can provide some support in this sense. As I said, through the production of warmth, through possibilities of connection, through possibilities of lighting and through the production of colors. In any case, I would answer the question positively. E-clothing can definitely offer more. You can really go in many directions. There was once a project at university where a skirt was designed that widens when there are large crowds of people on the subway to protect women from potential harassment. In the context of protest, one aspect is also the function of protection, i.e. how clothing can protect me, how people and bodies can be protected by clothing. This idea of inflatables, i.e. things, items of clothing that can inflate on certain occasions to create more distance between people, to regulate the spaces in between. This can also be between people and the police. This idea that clothing functions as protection, as armor. An idea that is strongly represented at protests. This can also be supported technologically, technically, electronically, but of course you need the experts to realize this. The whole e-textile or e-clothing stories always come from functions that clothing has anthropologically and are basically an extension, a



further projection, a crossing of boundaries, which is actually also a challenge, but which also comes from functions that clothing has.

**S00:** Then do you also see challenges that this connection with clothing and digital technologies could bring with it? And if so, what are they?

**S01:** Yes, definitely. Creative challenges, technical challenges with the aim of spreading and amplifying the effectiveness or certain things that should be there in a demonstration, in protest and in activism. In any case, certain reinforcement of approaches that are actually already there: Cohesion etc.

**S00:** Have you already seen examples in the field of e-clothing that you perceived as a form of activism? If so, which ones and what exactly made them activist for you?

**S01:** No, I haven't seen any e-clothing in principle. I mean, what can yellow vests do, for example, or golden rescue blankets that are used in protest marches, which are actually there to produce warmth. That's not really e-clothing, it's more in the analog realm. If you could transfer this function to e-clothing, these would be examples. Do you have any so that I can perhaps [...]?

**S00:** I just had an interview that was more about "individual activism", where someone designed a vest that communicated to people when they got too close to the person because they often had problems with it. The vest took over the communication for them, so to speak, and said: "Stop, this is my personal space. Don't come any closer." As a third level, so to speak, which helps with communication. Apart from that, I've seen a lot in the artistic field. Certain designers who deal a lot with e-fashion, where the garment has conveyed a political message. I think that was the spider dress, for example, which also symbolized distance. And then another thing that can also point in this direction: It's an e-textile kit where you put different components together and make garments out of them. Thinking further, this could of course lead to the production of sustainable clothing or make clothing last longer by constantly redesigning it and adapting it to trends, thereby wasting fewer resources. But I think that's a topic that still has a lot of scope.

**S01:** Yes, of course, in terms of art and design. I have a few examples that come to mind. But really in the area of design and how it could be transported or used in street protests would be a further step. For example, there was a designer who created and produced bomber jackets. Bomber jackets that filter the air. The air filtration was of course

intended as a position against climate change and for ecology. To turn the idea around a bit. I had this in a lecture in Venice. It was about the extent to which clothing protects us from the environment or from climate catastrophes, because that's the common way of thinking that we have to save ourselves. And then there are lots of different examples of saving ourselves through clothing: inflatable things etc. What was presented there is the possibility that we can also actively contribute to saving the planet through clothing, even if only symbolically. For me, it was the bomber jacket that can filter the air and is able to provide oxygen in a situation where there is less oxygen, for example. For me, that was an example of the opposite position, that people currently have a duty to help protect the planet themselves and should not only protect themselves from the earth, from natural disasters, but also help to protect the environment themselves. These are the examples I have in the design sector. E-textiles, like the Hug T-shirts, which simulated a hug or made a hug tangible to the senses. Of course, you could also link this to a political message, for example against individualism. There is certain e-clothing that can be repurposed. I would really differentiate between the two, but you've probably done that. On the one hand the functional and then the symbolic.

**S00:** Yes exactly, that's what I did.

**S01:** For example, there are a lot of e-textiles or e-clothing that have been created in the medical field. I had a student who connected textiles with some sensors, with some computer-controlled things, for patients with Alzheimer's, for example, who often can't find their way back. That could also be an idea of how to find your way back. During demonstrations, for example, you often don't know exactly which way to go or you arrive later. That's how you find your way back, i.e. through clothing with a retrieval function.

**S00:** Yes, that's true. This function of finding your way back can be very helpful, especially during demonstrations. Another thing that occurred to me, by the way, that can also be used at street protests, because you asked for examples earlier, someone designed a hoodie with infrared lights built in and they made it impossible to see your face with night vision cameras, which happens with clothing through masks, and there it happened by tricking the electronics.

**S01:** Yes, totally. For example, in terms of identifiability, masking, there are certainly differences that can be made. You could think of it as transparent masks that can darken

on certain occasions.

**S00:** Maybe we'll come back to this in a moment when we talk about future perspectives. First of all, from your point of view as a fashion expert, how do you think e-clothing should be designed in terms of aesthetics and functionality in order to be used in the field of activism?

**S01:** We also kind of described this at the end of the book, that this protest clothing, i.e. the use of clothing in protests, is so interesting and so effective for us because it is always difficult to predict. Anything can, any item of clothing can in principle become a protest garment and it's hard to predict what it will become. And that's also the potential in it, the potential for surprise. A lot of things have to do with it, with this unpredictability, with the idea that clothing for protest is really so vibrant and anything can be possible. That's why it's kind of hard to say. One characteristic really has to be: this combinability, this transformability of things in the context of protest, of garments. This idea that you mentioned earlier about the kit, that a kit with different things also lends itself to different creative people, but also always new modular combinability. I find that interesting, because concentrating on just one piece of clothing and saying that's great, we can keep thinking that way, that's not the point, the point of clothed bodies in protest actions is their changeability. This idea that they can transform.

**S00:** Now you can go into the future perspective. Think visionary and imagine the future of e-clothing in activism in ten to twenty years and what it would look like?

**S01:** My first hope and vision for the future is that protesting, dissent and everything associated with it will continue to ensure the safety of bodies in spaces. At the moment, based on the political constellations, I would like to emphasize that this is not guaranteed. You have to be constantly alert to this. My vision of the future is that we continue to build on this potentiality, on this awareness, and that the bodies remain in motion, that the clothed bodies continue to protest and defend themselves. In my vision of the future, there is the possibility that e-clothing will expand and continue to emphasize certain characteristics that clothing already has in connection with protest. A nice vision of the future is, just like we had with cell phones and the internet, etc., that this expertise in e-clothing, which is still a really specialized expertise, continues to spread, that everyone is able to access their visibility at night, their own colors, certain characteristics in the

room through e-clothing. Not just a kit with already prepared objects, but a widespread expertise in the field of e-textiles in the way you can come up with the idea yourself. A special feature of protest dresses, it must be added, is that they very often have a very strong do-it-yourself component. We don't wear carnival costumes or go to a carnival store and buy a protest garment. They are created in the interaction with clothing and if e-clothing is to have a future in this area, a prerequisite is interaction with every person. For me, it's hard to imagine that experts will make more and more e-clothing that will then be adapted, but there's also a bit of do-it-yourself involved.

**S00:** That's interesting, I also have the feeling that with e-textiles, the DIY maker community is very large and mediates there. That's definitely a very exciting point. And then I wanted to ask what current issues or developments in the clothing sector could influence the future of e-clothing in activism from your perspective?

**S01:** Safety, definitely. The ability that clothing has to protect people. But not in a negative sense, but in the sense of offering more comfortable conditions if you want to convey political content with your own body.

**S00:** Finally, if you had to summarize the importance of e-clothing in activism, what is the potential from a subtle point of view and what are the limits of its use?

**S01:** The potential is that there are many characteristics of clothing that e-clothing can strengthen and reinforce, but the condition for this is that this use of e-clothing is more widespread. Of course there are do-it-yourself communities, but they are communities that specialize in one area. As I said, the main characteristic of protest clothing, of clothing in activism, is that it is selforganized with the means you have and where you can also improvise something. This ability to improvise must also be guaranteed with e-clothing, because that is a very important component of clothing in activism.

**S00:** Thank you very much. Is there anything else we haven't talked about yet that you think is important for the topic of e-clothing in activism?

**S01:** No. I just have one more question: <question about the scope of the master thesis>

**S00:** <answer to the question>

**S01:** One component that could be mentioned from the examples of protest clothing

collected is that you can in principle protest with all kinds of things. You can really protest with anything, every object, every sign, every textile can somehow be repurposed and that's why I think that certain things from one area of e-clothing, which is actually not in the area of activism, are integrated into another form of actionism, into protests. A great feature is the repurposing, workwear becomes protest clothing or elements, accessories from a certain category, like yellow vests. You don't need clothing that is specially made for activism, e-clothing that is specially made for activism, but from the functions that clothing can have. In principle, all kinds of e-clothing can be used for activism.

**S00:** What about fashion in general? From what I've heard, there's already a lot of research into e-textiles, but it's rarely used so far, right?

**S01:** It still remains a niche, I would say. The applications are more in the field of medicine, where there are very different projects. In our product design department, for example, there are always things that could be described as e-clothing. For example, a part can measure blood pressure and all kinds of things in this area. So it's really not that much anymore. There was a big wave at the beginning, but then I had the impression that it became a little less. You have to say that this topic is sometimes accepted among creative people, but sometimes not at all. In our field of fashion, they at least have a certain interest in it.

**S00:** Interesting. When I was researching, I also had the feeling that there was more in the early 2000s. There was quite a lot around 2010 and then it became a bit quieter. When there was something about wearables, it tended to be fitness trackers and Google Glasses, but otherwise not that much. Although I recently read an article about a T-shirt that was also more in the area of fitness and tracked bodily functions.

**S01:** Yes, exactly, all these measurements are part of it, but you would see them more in a medical field or function in general, but less in fashion. In fashion, there is a fashion designer, Iris van Herpen, who does a lot, but she also mixes a lot. The special thing about her is that she mixes very analog, handmade pieces with garments that move, that are electronically controlled. Apart from Iris van Herpen as the main protagonist, I wouldn't say imitators, but designers who react to this aesthetic in this context, but not so many anymore. I was at Iris van Herpen's exhibition two years ago. You could see a lot of things there. I broached the subject with students because we were talking

about memory storage in a seminar, which is also interesting for e-clothing. Memory storage and clothing, how clothing stores memory, and we discussed this in relation to Iris van Herpen. To what extent very avant-garde garments [...] <connection failed due to internet problems>

### 1.3 Mika Satomi

**S00:** At the beginning, I would ask you to introduce yourself and talk about your connection to E-clothing, maybe also e-clothing in the field of activism or related areas, such as clothing or digital technologies.

**S01:** How should I introduce myself? I don't know what context you need.

**S00:** What are you doing? What is your connection to e-clothing or e-textiles? And maybe your connection with activism.

**S01:** My name is Mika Satomi. I would say I am an artist, designer, educator, but mostly I would say I'm an artist at the moment. Connection to e-clothing or I would say e-textiles. I started to work in 2006, 2007 with the medium e-textiles in collaboration with my colleague, Hannah Perner-Wilson. We started a collective called Kobakant. With this collective, we experimented with e-textiles to create interactive installations. Within our work, we were always interested in how technology could be made to serve our wishes and desires and how we as an everyone in the society could have a say in what we want to have and what we want the technology to be. We were kind of engaged very strongly with the DIY method. So we made an open source database for e-textiles in terms of technique and material resources. We also did a lot of workshops to explain it to people who are interested. From people who are working at a university to public workshops where everyone who had genuine interest in technology or even like: "Oh, can you stitch a line for LED?" Maybe if you talk about activism, and this is something I wanted to ask you: Why are you interested in activism, and what is activism for you? I wouldn't call what we do activism, but we were active in the DIY scene. And the DIY scene is, to some extent, activism. So that's my connection to electronic textiles or e-clothing.

**S00:** To your question, I was thinking about activism, because I noticed that clothing is often related to activism. You have statement t-shirts, these self-knitted hats, that were a countermovement against the MAGA caps of Trump, they were called pussy hats and

were self-knitted. And also inside the fashion industry is a lot of activism: e.g produce sustainable clothing. I would also say this is a form of activism, to produce sustainable clothing. And the same applies to digital technologies. There you have a lot of examples as well. I divided my work into symbolic activism and functional activism. Symbolic activism for digital technologies is happening a lot on social media e.g clicktivism, where you like posts that are related to a political topic, share some information about political happenings or something similar. Functional activism in the context of digital technologies could be data activism: to develop applications that are more reliable when it comes to data security. When you develop them by yourself you don't have to not rely on big companies. And I would say open source is also a big thing in digital activism. I would say that's also a kind of activism to share information, to include more people. It really depends on what you define as activism, I also stumbled a lot in my work about it. For me, it has different forms, one is symbolic activism, where you create awareness about a topic and pull more attention to the topic. Functional activism you detect topics where injustice is happening and directly try to do something against the injustice. And one question, should I use the term e-textiles? I always use the term e-clothing. Is it better for you when I use the term e-textiles?

**S01:** Yes, I'm more used to that word. I don't know, for me, it feels like what I do is not really clothing. I do costumes, which is clothing, but is not directly clothing.

**S00:** Then I will try to refer to e-textiles, but for the record: My definition of the term would also include costumes. I think there is some overlapping between the terms. I just want to clarify this.

**S01:** I think, in general e-textiles community people, have a lot of problems with how to exactly name things because it's not really clearly defined. I think wearable technology was actually never really defined until. I mean, it's just so cold and no one really used it, but wearable computing was clearly defined. I think e-textiles are also not clearly defined, but people just started to use them. And e-clothing, I don't know if anyone defined that. It's just making more and more terms in that sense.

**S00:** Yes that's right. When I was researching, I found a lot of terms, but nothing exact. Sometimes they use wearables and sometimes they use e-textiles. It was not that clear.

**S01:** I think wearables especially became this marketing term and then it became every-

thing. And also when you say wearables, is it wearable technology or wearable computing, which are actually two different things.

**S00:** Yes, that's right. E-textiles are also partially overlapping with wearables, but also not completely.

**S01:** Not really.

**S00:** Okay, then we go on with the questions. My first questions are general questions about e-textiles. It doesn't have to be in the context of activism. What aspects do you personally find particularly exciting about e-textiles?

**S01:** In the beginning I was fascinated by the materiality of it. It's an electrical device or an electrical circuit you can make out of textile materials, which means that you can use textile techniques. That was fascinating in the beginning. But as we started to work with it, what was interesting is that because it is in the textile materials, it opens up interest to a lot of people who are normally not interested in technology. It was a really interesting medium to talk with someone or make the storytelling to someone to engage with technology. And also, for us, we could invent things, we could just make up, understand how sensors work and make our own sensors. Of course, you can do that with conventional PCB technique. But with textiles, it felt very open or it is a much wider field that is in front of us. That was the interest for me. Now, I'm not sure how much I'm even interested in e-textile, to be honest. Because as you work, you also see the downside of these technological devices, which is the same for electronic textiles. At the moment, I'm in-between a phase of not necessarily promoting it so much.

**S00:** Would you also say that e-textiles was back then a more famous topic and stopped nowadays? Is it not that present anymore?

**S01:** No I wouldn't say that. I think it is actually more and more present in that sense. It's coming into the commercial field. Before it was more a niche thing, it was research, it was artistic work. Now I think more people picked it up or the industry picked it up. And to some extent, it's coming into the commercial products realm. I personally feel I was always a little bit afraid of it actually creating a huge amount of e-waste and easy access to create a lot of trash that we don't want to have or unnecessary devices that we don't want to have. I'm more and more noticing that, even though we try to talk about it and hope that when more people have access to technological knowledge, these things



would be much more discussed and maybe not solved, but dealt with in a different way. But now I'm losing faith in the idea that when more people are participating, that the course of development will be different. That's why I'm slowing it down a bit, doing a lot of workshops and promoting people. Hey, let's use this, let's learn about it.

**S00:** You already answered the second question that I have. But if you want to add something about the disadvantages in combining digital technologies and clothing or e-textiles, or is that all disadvantages you could think of?

**S01:** Well, I think there are many disadvantages, but I think the biggest problem is that it creates e-waste that is at the same time textile waste. I don't think there is really a clear waste method developed to deal with the waste and how you can recycle it or discard it without creating toxic waste. I think this is the biggest disadvantage of e-textiles. But also, we had this approach, maybe in 2010 or a bit earlier: "Let's make this new gadget that sells." You can become rich or successful by creating these new things, the new need, what can we solve? I was hoping that this approach would change. But I think this kind of new materials and new techniques promote this idea or promote this action of let's make the next new cool thing. That's maybe another disadvantage.

**S00:** That's an interesting point. Now we are coming to the future perspective. I think you answered it already. What future and developments do you see in the e-textile sector in general?

**S01:** You mean new development.

**S00:** Yes.

**S01:** I don't know. That sounds very much like progress, the new, the next. What I wish to have is more the other way around. Because you know it, you don't have to have it. You can have it, but you can decide to have it. And not that, because I have to have it, or it's a new thing, so we have to develop it. I hope that it's not like that for the future, but at the same time, I feel like this will be the future. It's the new thing, the next thing. We have to make the new, the next.

**S00:** I see what you mean. Now we are coming to the context of activism with e-textiles. How would you imagine the use of e-textiles in the field of activism?

**S01:** I think it's the big question of: How do you define activism? I don't see the im-

mediate use of e-textiles in activism. I don't know, blinking LED in the demonstration. I don't see that. But my activism in Kobakant was democratizing technology. For this e-textiles did play a certain role, I think it is a very good medium to engage people who are not interested in technology or feel distanced to technological knowledge. In a broader sense, I think this is activism. For example, I have a friend in Austria who is teaching people to become teachers in primary school and middle schools. In Austria instead of separating boys to technology and girls to textile work, they combine it together. Within this, they are also developing a colloquium with e-textiles, because it deals with spores. You can do technological things, but you also learn how to do textile techniques. For me, in a way, this is also activism to change the status quo and how society deals with it. For example, gender issues or the roles of gender. That's what I see e-textiles can do in terms of activism or in terms of changing people's mind.

**S00:** How does the combination of clothing and digital technologies enrich activism?

**S01:** It doesn't enrich on its own.

**S00:** But maybe the combination of it?

**S01:** I don't know if I get exactly what you mean. What do you mean by combining digital technology and clothing?

**S00:** What I mean is: You could use clothing itself in the context of activism and you can use digital technologies itself for activism. But how can the combination of both enrich activism?

**S01:** I think it's really context-based. For example, clothing or the body, is very political. On its own, you can do very radical activism, or you can be very loud-spoken in the activism, when you want to express your own idea or ideology. I don't know if you need additional technology for that. It's already a very strong medium. But on the other hand, it also depends on if you dare to use that strong political language or not. There is this one layer with only clothing and because its clothing, it's also the human body. Digital technology, on the other hand, can be used in activism itself as a tool, but also digital technology itself is a topic of activism. So you can combine it, but you can also do a very strong thing on its own. By just combining, of course, anything becomes stronger, but on the other hand, you're just mixing two things.

**S00:** The next question would be what are the challenges when you combine clothing and digital technologies and use it for activism?

**S01:** Maybe then the contrary, because you mix the two things, the focus of what you want to express could become blurry, or it may not be very clear to the other side. Because at the end of the day, what you want to do is you want to express your opinion or your ideology, and then maybe you want to get people on your side. Especially the ones who do not agree with you, you want to convince them that they would come to you or come to your side. By combining different things, sometimes it becomes louder, or it gets a lot of attention. But at the end of the day, it really depends on your ideology, or what you want to say, and how you can get the other people to your side. I was just thinking, maybe one advantage of mixing digital technology with clothing for activism in general is that you can create a vision, things you couldn't do without digital technologies, to show to the other people, or to create this another scenario, that you want to express. Or you want to show that you don't want to go there and then this could be also the way to demonstrate this. You can use this as a very strong tool.

**S00:** Do you already have examples of e-textiles that you have seen as a form of activism? You already told me about the school example, but do you have some examples? You can also refer to some of your own works that you maybe see as activism, and what makes them activistic for you?

**S01:** It's kind of the same line. I think there are a lot of works, artistic works, that you can call activism. A lot of artistic work comes from critical expression to the status quo of the society. In that sense, you can't take it as a single activism, but of course a lot of artists themselves are not calling themselves activists and it is not situated in the demonstration, or within the activism itself. I mean, sometimes yes, but sometimes not, so you may not read it in that way, but I think there is a broader sense of activism. You may not call it e-clothing, but there have been works, for example, hacking knitting patterns to create, brand logos that are not made from the brand, or knitting fashion collections of a famous brand, but it's not theirs. It's just a copy, and these things are made with the hacked knitting machine. It's only using digital technology to enable it, but on its own doesn't have technology inside. If you open it to these kinds of works, there are quite many works that are commenting on fashion, fashion industry, and things

like that.

**S00:** Do you also know some artistic works that are related to e-textile, that, in a broader sense, would be activism for you?

**S01:** For example, there was a work from Melissa Coleman. She was making a necklace that every time a child's death happens at the births in Africa it lights up as a form of awareness. I would say to let people know how often these things happen. There are these kinds of works that display a certain topic that [...] But again, I wouldn't call it activism, but it has a critical narrative behind.

**S00:** You already mentioned some application fields of e-textiles in the field of activism. What other application fields can you think of e-textiles in activism?

**S01:** What do you have in mind with application?

**S00:** You already mentioned the open source aspect and teaching aspect of e-textiles, maybe something like that. Or maybe - I am missing the word for it - maybe "delete" the status quo.

**S01:** Maybe, challenge the status quo.

**S00:** Yes, challenge, that's good.

**S01:** I think I have a problem without the context of activism, what is action, what is the ideology of this activism that you are thinking about? Because if you want to demonstrate about women's rights, and then as an action, you wore a pussy hat, that is not a separate thing. You are talking about certain things, and you have certain things and within the context of a demonstration, where a lot of people are and then you want to show your solidarity or you want to show groupness. Then there is a certain action that happens, but the action is not a separate thing to the rest. So if it is a different ideology, then the same action wouldn't work.

**S00:** So you mean it has to be seen in the context. So the action is combined with the context it is used for, but the action can be something different than an e-textile?

**S01:** I think, do you use an e-textile, because it is the context and the medium? It is about electronics, textile or technology. So that's the context itself. And you use the context or the medium itself of the context to talk about it. That's one thing. Or is it really a tool for something else? So there is another ideology that you want to talk about, and

for that to make it visible, you take a t-shirt that blinks, that everyone can see and there are thousands of people wearing it, you can see, but that is different from the context.

**S00:** And do you see that e-textiles are more used in the context itself or outside this context, as a statement piece to get more attention?

**S01:** I think you could probably do both. Coming back to the example of the pink hat. It could be about textile and textile workers and then you use the textile itself as a motif to activate a talk about it. Or you can use this thing to talk about something else like feminism or women's rights and then it happens that people pick this particular type of knitted hat and both probably just happened to be or you planning the action and decide this strategically. In my work I like to use the medium directly and don't like to connect two things. But if another person sees the strength in connecting another thing that is not about this ideology that I want to talk about but using it together makes a strong context or makes a strong voice then maybe why not.

**S00:** Do you also see the attention seeking aspect in e-textiles? So that you get more attention when you use e-textiles in the context of activism or in street protests?

**S01:** Not necessarily on its own. I think if you had a silver thread in your hat it would not make anything. I mean probably immediately what people think or what I imagine what you have in mind is: Of course if you put a blinking led and if you stand at night it stands out of course but on its own doesn't do anything.

**S00:** Okay great, I just had one interview where this came up, that is why I wanted to hear your opinion on that. We already talked about the challenges that come up when you're combining clothing and digital technologies. You said that it can blur the ideology behind it, if I understood you right. How do you think we solve this issue that you have when you're combining textiles with digital technologies or use e-textiles for activism?

**S01:** If your aim is to do activism so I want to address this opinion strongly to the public then this is the main thing for me. And if the best way to talk about this is to bang the metal then I will bang the metal. I don't need a textile. But if you talk about this thing and it works very well to use this medium or textile and use digital technology then I would do that. But I can't just put two things together just because I want to use e-textile. I think the context of activism or the context of what you want to say is the most and should be the most central thing.

**S00:** From your perspective as an e-textile expert, how should e-textile be designed in terms of aesthetic and also functionality to be used in activism? I know you already said that you should not use it because it's e-textile but when you want to use it and you think it's the perfect medium to convey your message how would you design it in terms of aesthetic and functionality.

**S01:** In a way the context should lead you to the material or lead you to the aesthetic. For the Kobakant work we often talk about how the material should lead the process so instead of forcing the material to do something or to look like something you know the material itself likes to be in a certain shape or it looks beautiful or aesthetic because of its materiality itself. So we try to let the material lead you more than forcing the aesthetic into the material. But for activism. I don't know.

**S00:** That's a fair point to say that you have to see the context and if it fits to the context and activism then you can use it and can design it for that.

**S01:** Yes, and maybe your context should lead you to a certain aesthetic and also the material you use is leading you to a certain aesthetic and I think you don't have to fight with it but kind of let it speak on its own.

**S00:** You can now think visionary about the future. How would you imagine the future of e-textiles in activism in 10 to 20 years?

**S01:** Maybe it is not used at all.

**S00:** Could be.

**S01:** I mean our little wish was that it promotes much more the creation of works or hand craft works because of the textiles and I don't see that's really happening in a mass but it would be very nice if it goes more in that direction and people start to create electrical devices for someone that is made just by me or my grandma made this e-sweater and then you want to keep it for 20 years. That would be my wish for the future that goes against mass production.

**S00:** So also the sustainable aspect if you design it yourself you give more value to it and keep it longer.

**S01:** Because it's made by a human hand by someone you know or maybe you don't even know. It gives value to it.

**S00:** So from your perspective what current issues and developments in e-textiles could influence the future of e-textiles in the field of activism?

**S01:** The influence is what?

**S00:** What development that you see now in e-textiles how could they influence the future of how e-textiles are being used in the field of activism?

**S01:** I don't know if a better pen makes a better activist.

**S00:** What do you mean by that?

**S01:** So if there is a pen plotter. Or how do you call these big pens? Would it make activism better because you can make better banners? I don't know if that directly connects.

**S00:** So you think that the development in e-textiles is not addressing activism in itself?

**S01:** No I don't think so. I don't think that e-textile itself could or does address something about activism. Maybe the people who are making activism have more access to the technology or e-textile then maybe it is used more often. It could be but I don't know. I was wondering if I want to say, maybe in the future we see less activism because people are more content or we see more activism because people are more participating in the political or social levels. I mean probably it's nice to see more activism because I mean there will always be something that we want. We as participants of the society want to say something. Maybe it's healthy when people could say these things rather than just be busy every day and don't think about the bigger picture. Maybe more activism for the future.

**S00:** Do you think e-textiles could amplify that activism?

**S01:** Maybe to promote the idea that when you have something you could say it and you could act rather than thinking that's not for me or it's too big and keep quiet. You could promote this kind of attitude so that you can be active.

**S00:** If you had to summarize the importance of e-textiles in the context of activism, what do you think is the potential and what are the limitations of it?

**S01:** I think the potential is maybe as I said to promote this idea that you can be an agent you can be active by just learning new things especially learning technological tools

and learning that it's not only one way to do it. What was the second question?

**S00:** What are the limitations?

**S01:** I mean of course it's very easy for people to say: "That was fun but it's not for me" or "It's my hobby" and then they are not actually becoming active in society. Of course there is always this limitation. I think we probably can not change this.

**S00:** Is there anything that we haven't touched in the interview that you think is important in the context of e-textile and activism?

**S01:** No, but I hope it's not blinking led in the demonstration.

## 1.4 Barbro Scholz

Note: The recording started a little earlier because we discussed the different terms used in relation to e-clothing, which could be relevant to the work.

**S00:** <Question about the definition and distinction between e-textiles and wearables>

**S01:** Exactly, you asked about the wording or the terminology in the areas of wearables, e-clothing, e-textiles and smart textiles. I think these definitions, which are not the same, come from the interdisciplinary fields that are integrated into it, because of course some come from the textile and material side, others from the wearable side. This also has to do with a hierarchy in the different research or design worlds. For me, a wearable could also be a smartwatch, but then it has nothing to do with textiles at all. I come from the textile, fashion and clothing side, so for me a wearable that I make always has something to do with textiles or body wearability. And it always has a different focus.

**S00:** So theoretically I could also use the term "textile wearables" or something similar in my thesis.

**S01:** Exactly, if the materiality is important to you or how the things look from the clothing, costume, fashion side, then I might even do that, especially when it comes to tracking or something like that, you quickly get into the area of "sports watch pedometer", but everything that doesn't have so much to do with materiality at all, but is only functional, how do I bring the sensors and the computer to the body. And then maybe it's a plastic wristband. If you look at wearables and how people wear them, what they do with them and what they express through clothing, then I would also say e-textile



wearable, because then you always have the textiles involved. But I also think e-clothing is quite good because it includes the clothing.

**S00:** <General process and definition of terms>

**S00:** To start with, I'd like you to introduce yourself and talk about your relationship to the topic of e-clothing in activism.

**S01:** I can just tell you something about my background, where I come from and what I do. My background is actually in industrial design, but that wasn't enough for me. When I was studying, I was just starting out with user experience and interface design and that's where I started and then moved on to e-textiles through my own interest in clothing, fashion and textiles. In my Master's degree, I also focused on smart textiles and went to the Swedish School of Textiles. The university was one of the first in Europe to do design research with smart textiles or e-textiles and it was a good place to work in depth. And for me, it was always about more than just the function of having a button. For example, there used to be a ski jacket where you could connect an MP3 player and press play, shuffle and so on via a strip on the zipper. Of course, I find that partly interesting to know what works functionally, but from a design perspective I find it interesting to see what else it can do or what it means for us when technology looks completely different to what we expect or is not a glass screen, which we are used to from cell phones, smartphones or tablets, but when the material plays a different role again. Textiles in particular are a material that is close to the body and that everyone knows from an early age. We always have it around us, we wear it on our bodies and this brings the technology to us in a different way. We can perceive it differently and, if we don't consciously hide things, we have the opportunity to perhaps create a different relationship to technology, which is omnipresent. Perhaps to create a poetic, playful relationship. "Playfulness" is also a term like that. That's a bit the direction I come from. In 2012, I founded Stuhmer | Scholz with my colleague and friend, where we focused primarily on innovative textile products and design research into new materials, because at that time there was a technical gap in the market for products. On the one hand, there were textile manufacturers and tailors with whom we worked in production, who had very traditional knowledge. And if you then said: "But technology should go into it." Then they said: "What? No, I'm not touching that." And conversely, the electronics world said: "Textiles aren't our thing at all." So we

played the bridge a bit and helped develop new products, such as the textile film lamps. Maybe you know them from the film industry, the Carpet Lights. That was before LED panels were really cheap and when only large spotlights were available, these textile lights were developed. We helped develop them. They are completely textile, foldable and are much more durable than plastic panels and can be repaired. It's a really clever product for electronic textiles. They are available in standard sizes. There are all these 4x4, 8x8 film lighting sizes. Everything has been used, even in major productions such as Game of Thrones and in many German cinemas. So just to show the film sector again. And Klima-ACT! is a design research project I worked on, which was about using a multimodal virtual reality experience to motivate people to take action on climate change. So that people go through this experience and, through the interdisciplinary team, we can convey a certain amount of fun in this experience so that people enjoy being there and have a positive learning environment. On the other hand, of course, you also have to convey the urgency so that it's not just a game with some topic. It has to be shown that you're experiencing something that's pretty bad because it's on your doorstep and people are behaving badly. It was primarily about empathy and storytelling and that the different areas are explored, e.g. how do the senses interact? VR is very visual at first, then you can also use the auditory in a targeted way, how strong something should feel. The initial plan was to incorporate haptic elements. That's where the actuators and vibration motors that we built into the wearables came from. My part was to consciously incorporate the textile material into the experience, the close-to-the-body feel that everyone actually has with textiles because we know them, including this sorting out, it feels like something familiar, it feels like something soft, like something pleasant or scratchy. We deliberately didn't include a technical feel in the design of the wearables. If you look at gamer vests, they all look like military vests or protective vests and have a combative and masculine look, and are also intended for a specific target group. That's the first layer of activism for me. Activism also lies in the fact that I have said that it cannot be that these vests do not actually fit women at all, simply because of their body shapes. That alone excludes a very large target group because it doesn't work properly. And it's also a technology battle: "We have more motors", "We can resolve it more precisely" like the pixels in the photos used to be. That's why we've worked on saying it's about telling the story and the multisensory interplay of stimuli. It's enough that they are impulses. We don't have

to simulate perfectly resolved rain, but we have to do something to go with what you see and hear that supports the whole thing. We went more for the experience level than for the perfect technical implementation. We always said: "Go Gadgetto", like Inspector Gadget, I don't know if you know him.

**S01:** Ah yes, of course.

**S00:** That was always a joke. I think we can put in a thousand things, but then you're wearing a robot and not at all what we want. That was part of the story. It was also a lot of work to explore the interdisciplinary, how we set the focus. And to convey the strength of design, that design can do much more than just look cool. We then focused our work on how we could touch people emotionally with the story and how to get there. We placed a lot of emphasis on the design of the installation before you dive into VR. We basically have three objects: the wearable, which is textile, a Hollywood swing and a blanket, which is the interaction object and is also tracked. The objects fit together in terms of design. We have designed them uniformly, with certain elements, such as triangles, that appear again and again. And, of course, they are also symbolic of inaction and staying seated comfortably. You know that the world is coming to an end, but you don't move. We have incorporated this into the design. As I said, body awareness is what slips away when you're in VR. You forget that you have a body. Sometimes you can't even see your feet because they don't exist virtually. We have embedded weights in both the wearable and the ceiling. Due to the nature of the double fabric, we were able to incorporate small weights. So that you reinforce this physicality even more while you are in VR. And that you have a stronger body awareness because you can feel your body more through these weights. Similar to a weighted ceiling. We incorporated things like that. The one level of activism I mentioned earlier, with the technology, is that it doesn't look technical. This has enabled us to involve a larger target group. We showed it in museums in particular. As a result, more people who had perhaps never tried VR before stopped to look. Even older people who are not tech-savvy. I would say, also in terms of diversity, that it wasn't just male gamers who thought it was cool and were attracted to it anyway, but all kinds of people who didn't have any barriers.

**S00:** Do you think it was partly due to the wearable that so many different people were interested in it who wouldn't otherwise be interested in technology?

**S01:** Yes, exactly. I would say that we wove a color gradient and used materials that you would also find in normal clothing. The yarn blend gave it a slight sheen. This gave it something classy that appealed to other people. And the wearable was cut like a sporty, futuristic rain jacket. So that you understood the futuristic aspect, but the material made it relatively down-to-earth and it could be seen as a piece of clothing. It had lots of openings. The parts were all connected and only had an elastic part on the inside and there were weights. This meant it fitted all kinds of people. For example, I made the sleeves very long and they only had one cuff. This meant that different arm lengths worked straight away and the weights brought the actuators to the body. That was a technical function, but it meant we didn't have to do all the constricting. We used the weights to tighten what you normally have to do with the vests. This also worked well with different sizes. And what's also important is that it's a multi-user application. The two players or two users have the same wearable. They both have the same thing on and are immediately a team when they put it on, so they can establish a relationship and then sit together on the Hollywood swing, where they also fit well because of the material. And then they put on their glasses. They have the blanket in their hands, then they put the glasses on. And then the blanket is still there. So the look of the wearables is the same. The Hollywood swing also has these triangles, the same pattern that you've just seen and the blanket too. So it connects the before and after pretty well. We also did a study that showed that the people who were in it didn't just take off their glasses afterwards and it was over, but they were totally immersed in the moment. And besides, this only has limited to do with e-clothing, but rather with joint interaction: We made the blanket in such a way that you have to hold it in pairs to solve a task, otherwise it doesn't work. Right from the start, the two people had to coordinate: "Shall we get up now and do something?", "Shall we hold this together in front of it?", "Maybe we can do something here?" As a result, they grew together as a team in a very short space of time - the experience lasts around 15 minutes - because there was a level of communication that they had to use immediately. This is only partly due to the clothing, but is part of the overall concept and has the positive effect that the weather gets worse and worse over time. At first it's quite nice and you sit there and think: "It's nice here." And then the extreme weather comes, starts slowly and gets worse and worse. Of course, it's also a disaster that you experience and you can't turn it back, there's only one negative outcome, but you experience it together.

This idea that you can achieve even more together is also part of it.

**S00:** Oh, I didn't know that it was a multiplayer experience.

**S01:** That was a really cool learning from the development steps, that doing it together and demanding communication through our design, what you have to do and what you see. That worked really well and was a component in this: It remains positive, even though everything is just getting worse and worse, you still have each other and talk and have gotten to know each other briefly and have become a team. And technically: the glasses and the wearables are in one place and are tracked as a result. The people were tracked, as was the ceiling and the swing was also placed exactly where it is in the virtual world. You can always go back and sit down. That's the electronic level, I would say. Do you have another question about the project?

**S00:** Yes, you just said something very interesting, which I also came across in my research on digital activism, that when you transfer something physical into the digital world, the emotionality can get lost. You just said something about emotionality in relation to clothing. To what extent do e-textiles or e-clothing offer the opportunity to bring emotionality back into digital technologies?

**S01:** That's a bit what many people say about e-textiles, that's also the idea behind it. When it started, I don't know how much you are into the field of human-computer interaction, because there is a lot of design research going on, there were tangible user interfaces, it was about having something haptic and that gave you a different relationship to technology. When it shifted, technology became smaller and could be integrated and was no longer necessarily a device that sits on a table, but could be an environment or a material, since then there has been a lot of research or thinking about what that actually means. The fact that e-textiles give us a completely different view of technology and can convey emotions. We all have a favorite sweater, a favorite blanket, because everyone immediately thinks of textiles because we know them, so you can connect people emotionally to technology in a different way or convey or connect them to digital applications.

**S00:** Okay, thanks, that was my question too. If you haven't finished yet, you can continue from where you left off earlier.

**S01:** Right, interrupt me whenever you think of something. That's actually a super applied example of what else I do, because I'm still doing a PhD, but it's in an artistic

program, so I can work even more freely with the materialities and I work with light and textiles on the body. That came from the idea that when you start with e-textiles, the first thing you do is sew an LED onto a piece of fabric. However, that's also strange because the ability to glow doesn't necessarily make the fabric better. So I'm questioning this standard a bit and I'm concerned because textiles often only become the carrier of materials because they are flexible, but are not designed at all and are simply there so that you have a wearable so that the technology somehow holds on to the body at all. I am therefore also looking at textile design in this area. This has also been incorporated into the other project. I deal with a new materialism, i.e. new materialism with post-humanist theories, where for me it also quickly takes on this activist level, which is why I mention it here, because of course, if you question the body concept and material concept and also question gender concepts, you are immediately in something that quickly becomes activist, which I also think is totally good. Just by referring to feminist literature or not thinking in categories and saying, this is the material and this is the female body, it's dressed this way, the male body is dressed this way, but instead looking at it more openly and perhaps thinking in a more interdisciplinary way and considering and allowing what is possible in this area and reflecting that back into textile technology. That is also a different approach, that you don't say that this is engineering and this is beautiful design. Instead, it goes hand in hand and that's why I thought it was somehow quite good, because it perhaps also fits in with your question.

**S00:** Yes, I also have a question about that. I've often heard that e-textiles are well suited to questioning the status quo because they offer a transition. Especially when it comes to textile work, such as knitting and crocheting, these are often associated with women and technology with men. That could also be a form of activism, what's your take on that?

**S01:** Absolutely, there are many examples at the maker level, which is also a form of activism. E-textiles are very strongly represented there. The connotations you just mentioned are actually there all the time. I have to keep presenting the work in different contexts, I have to keep explaining that textiles are not just "feminine and emotional", but if I want to make a fabric, I have to know exactly how many threads on how many centimetres and you also work with machines. This is a centuries long engineering feat, but it's also a feat for female engineers. It's often pushed onto the female track and e-textiles definitely offer a platform for that, I would say. What's interesting, for example, is that

I'm working on another project, which is a small study on textile interfaces and textures, which is more of a finger interaction. We came across the fact that in the literature of human computer interaction, the application-oriented part is often dominated by the engineering attitude. dominated by the engineering approach. And they are very much stuck in these dualisms and simply say, for example, that e-textiles don't work properly, but no further research is done into them. You don't look at the potential, you just try to find the goal somehow. Of course, it's the same when you develop products, but the performance is different and it's not easy. The literature often says things like that it is not controllable. And you just think: "Of course you can, but you have to value the engineering that goes into the textile and have someone explain it to you."

**S00:** Another question that fits quite well right now: What are current issues, perhaps from developments in the field of e-textiles or e-clothing, that could influence the future of e-clothing activism from your perspective?

**S01:** That's a tricky question. Areas where e-textiles or e-clothing are being applied are health and accessibility. If you think about it, what can textiles do better than a button or an input surface and how can they support people with disabilities. I would say that this could be seen as activist, because these are areas where often no money is invested, because it is not a wellness topic, but unfortunately a niche. I believe that a lot has already happened in this area, I don't know how much further development there will be. But everything that has to do with technology close to the body that is used in health, for example, if you have a shirt that collects certain biodata, such as heart monitoring, if you embed that in textiles and also in garments that fit all body shapes, that of course also has a level where you can be more inclusive. In the area where I was with Klima-ACT!, there are a few things where I think that horizons are developing that not only pay attention to making technology wearable, but we make it wearable on the body. Like the distinction between "wear" and "carry". There are a lot of projects where it's really just about the fact that it's a piece of clothing and you stick something on it. This thinking that the garment does something is, I think, something that could come if the right people are allowed to continue working on it and if they are given the space to do so. I think that's a misunderstanding of what design can still do, which is more than just giving a nice finish, but also the various ways of thinking, I would call it. I'm just thinking about what else I can think of in terms of activism. I was very much into virtual

reality, that's local for now. It was also intended as an application that there would be a digital network to other places where people are also doing this and you have a kind of exchange of how people go through this application and then perhaps get involved in new activism or form groups. A bit like a climate protection platform or a learning platform. We also had a concept, which has so far only been implemented as a concept, that there is a virtual learning space where you include this level of experience in order to confront people with more facts than with an experience, and I think this bridge is also possible. An example that goes further than just feeding an app: We've been working with a company that has virtual meeting rooms as their main area of activity, but at a level where people can interact with each other in real time in VR around the world. So there is a lot of software solution behind it, there would be the workshop potential of being in different places. Of course, the scenario of the wearable being available in many places is probably not a given, but if you take what we have developed, i.e. how you can touch people emotionally and then it is still just the VR glasses, but you are in the space that plays on the aesthetics or also incorporates the experience into the learning process, that is of course a digital application that perhaps fits in quite well with your topic. That you might meet up again after you've had this experience with the textiles. So that you have a VR workshop where you experience things.

**S00:** I just remembered, there is a kind of solution that makes it possible to simulate proximity via e-textiles.

**S01:** Exactly.

**S00:** People who are further away or to reassure people. I recently saw something that is supposed to help people with panic attacks because they get feedback via their clothing. That's also a really interesting aspect that I hadn't thought about before. So in a way for the connection.

**S01:** Yes, that's from around the 2010s. When the whole thing got a bit of a boost and more research was done. I don't know, maybe you came across the Hug shirt as well?

**S00:** Yes

**S01:** That's a good example of what's technically possible and how you can still use it. For a while, there was a lot of work on how emotions could be transported and made visible. For example, there was a cushion from the same period where, if you miss someone, in a



long-distance relationship for example, you can touch the cushion and it lights up in the other person's face. It was a lot about levels of communication. There are also wearables that can change on the outside so that you can show your mood. After that, it flattened out a bit with emotions. I actually find the projects we just talked about interesting because they really do simulate touch. But then there were also projects where only color coding was used and you thought that an emotion is more than green or red. There's also a lot of this in human-computer interaction, where post-humanist theories and feminist literature are included so that you can break down the idea that it's not a simple translation, but that you can also think about it conceptually in a different way. I think that also has something to do with e-clothing, this understanding of the body. There is the body and the mind, but actually that's not true, if we have a shirt that simulates a hug, then our emotions and thoughts are addressed via our body. You actually have to understand it as a whole concept because we are human beings. It's that old image again, the woman with the emotions, the man with the thoughts. And if you understand it as a whole or leave out the dualisms, there is something different in the user experience, because of course it is a surface that I touch and feel, whether it is unpleasant or pleasant. That also influences how I think about it. This philosophical part is an attempt to broaden the horizon a little more than the green and red LEDs.

**S00:** A question that would fit in very well with this, from your perspective, how would it be best to design e-clothing or e-textiles aesthetically, but also functionally, in order to use them in the field of activism? You've already mentioned a few things about inclusion. But perhaps you could refer directly to how you approach the topic in your work.

**S01:** Exactly, so in my own research work, I'm so deep into it that I look at the materials very closely that it might go a bit too far. One project I worked on in 2018 was a wearable that is worn on the wrist called Beta Light. It was a grant called Wear Sustain and the aim was to develop sustainable e-textiles products or product concepts. That was also the starting signal for my doctoral thesis, because we considered what kind of material light is and whether it could be used, for example, if you live in a one-room apartment and use it for home office and leisure, whether you can change something about the lighting conditions there and what changes when people wear the light and the lamp is not standing somewhere. That was the starting point. In addition to the lighting concept, we naturally also looked at the sustainability aspect. I don't know if that's enough activism for what

you're investigating, but basically we said, if you're developing a product, it makes sense to make it modular so that I can respond to innovations in technology. Maybe in two years there will be better batteries or a more efficient microchip. It makes no sense at all to design everything in a self-contained way. We have included the production chain, what makes sense at all if we do something like this, how far do we actually want to drive for it, what kind of logistics radius can a product actually cover and have tried to plan as Europe-wide as possible. The part about the light could also be described as activism, i.e. the discussion between personal space and public space, perhaps that also has a kind of relevance. That didn't really answer your question. I thought I could make more connections through sustainability.

**S00:** I mean, that's also an aspect of the design decision for e-clothing and it's been mentioned a lot. And it also plays a role in the clothing sector as well as in digital activism [...]

**S01:** Totally.

**S00:** [...] because it's an omnipresent topic. You've already said a few things about it in between, for example about inclusion and that you don't necessarily just think about the aesthetic aspect, but also not just the functional aspect.

**S01:** Exactly. I have an image in my head all the time where I think, is that what you see in there? When you think of activism, you naturally think of a demonstration scenario and then I always think of jackets where you press the button and then the groups connect. That's somehow not what you're asking about either.

**S00:** But I mean, that could also be a possibility.

**S01:** Exactly. Of course, the fact that it can be digitally networked means there are lots of possibilities. Then there's always the question of what makes sense, when and where. I believe that the maker movement in the area of wearables or e-clothing, there are more things that can be activist. Simply because it comes from a community mindset and is therefore accessible to all kinds of people and it's not luxury innovative product things. I think that's a point, anyone who makes e-textiles or e-clothing is already in a group that is activist anyway. There are the engineers and they make perfectly laminated sensors that can be integrated, that last a long time and that is also important, especially when it comes to health issues. The other one has the potential to be a bit freer. It's a bit more

of a hacker mentality. The makers and we tackle it ourselves and put it together ourselves and that's why we can network.

**S00:** Yes, I also feel that accessibility and open source are major topics within the maker scene. How do you see this in general with e-textiles? I always feel that e-textiles have not yet reached the mainstream. When I talked about it with friends who have nothing to do with the topic, they immediately thought of e-clothing as purely digital clothing. What is your impression of how e-clothing has been received in everyday life so far, i.e., outside this "filter bubble"?

**S01:** What's really interesting is that when I started out, there wasn't as much virtual clothing as there is now because VR wasn't as developed yet. Now it's totally normal to constantly buy things or change clothes within games or applications. There is also fashion, i.e. virtual fashion. That's something that didn't exist before, which is why people didn't think of it, and I've often explained it in terms of health products. A current project that is very well known is trying to produce clothing for the deaf. The acoustics are transmitted via vibration on the body. The clothing has vibration motors in the places where the bone comes out a little, e.g. on the collarbone. This makes it possible to experience an orchestra or music through the physical. Because you just said "people who have nothing to do with it", people from my parents' environment suddenly said to me: "Here, don't you do something like this?" and sent it to me. I think there are always products or projects that are becoming better known and, of course, in the sports sector there are also fitness trackers that many people have. As a result, there is a general understanding of what tracking biodata means. When I started out, smartphones were still very new and there were sensors that were wearable, so everything we carry around in our smartphones nowadays was still a thing of the future and so it was normal. The Hug shirt had a different meaning because people weren't used to constantly sending each other messages. There were text messages and nowadays people send messages of appreciation in other ways. GPS data, you can track everything with your cell phone and in the past that just wasn't possible or was just starting to happen, so maybe it had a different meaning. Perhaps I should come back to the question of the fact that it is an interdisciplinary field, as we have already mentioned, there are the makers, there are the engineers, then there is humancomputer interaction, there are so many areas and I often notice that I am suddenly in a total niche with my textile background, because there are

textile engineers who can make perfect, conductive fibers, but are also very focused on the function. Then there are others to whom you first have to explain what textiles actually are, what they can do and why they are an important material in this context. In the Klima-ACT! project, we first held a Playful Textile Interaction workshop with the whole team so that everyone realized: "That's right, you can pull, wrap and lace it." In other words, to convey what else is involved. The Klima-ACT! project is a very clear example, because you understand even more what it's about, because we've been asking ourselves the question the whole time. Why do we need all this technology to get people to do something about climate change? There's actually a certain absurdity in the fact that we have to invent such extra tools, even though everyone knows about them.

**S00:** Is it perhaps sometimes simply because climate change is so far away, at least if you can't see it directly, that you need these digital tools? So that you can get into the action, so you need this immersion effect.

**S01:** Exactly, that was also our approach, that we said, even though we already have extreme weather events in Germany. The project proposal was written before the Ahr Valley, which means that it wasn't so present then and then the Ahr Valley came along and we thought: "Can we still do this at all, nobody is interested anymore." But people still keep forgetting. If you haven't suffered massive damage yourself, you always think: "Oh, that's somewhere else in Germany." I think you're absolutely right, it keeps slipping away because it's also a problem that you think you can't tackle on your own. That's why I think the approach of linking up with digital technologies, including web applications, has potential to bring people together. Potential for people to join forces or not feel like they have to do things alone.

**S00:** Yes, that's right. Because we've discussed a lot of positive things so far, I wanted to go back to the negative aspects. What challenges arise when you combine clothing and digital technologies and then want to use that for activism?

**S01:** It is of course the case that the electronics industry and the textile industry are the two worst industries in terms of sustainability and good concepts are needed so that no more waste is produced. In other words, questioning the usefulness of things and how they can be taken apart again. Which is also a big part and that's why I mentioned the multidisciplinary areas, data collection is of course a huge problem. Everything that can

be collected and goes online can of course go to a trusting or non-trusting addressee. In general, you can ask yourself how much data should actually be collected. Incidentally, I can also think of activism: My master's thesis was in 2012, when I made a speculative concept with pretty, bobbin-lace sensors that track movement. The concept was that you share your work-life balance with your employer and then improve it together. That was the beginning of these optimization concepts and products and it was still a special scenario back then. Shortly afterwards, the first health insurance companies distributed pedometers and now we voluntarily send our data to our fitness app or health insurance fitness app and that is a problem with all kinds of data that we collect. We are easily trackable, we are networkable.

**S00:** Exactly. It's even more sensitive, especially because the data is probably very close to our bodies.

**S01:** Exactly. Of course, it depends on what functions are included, but if you buy a product that can do everything, then you have to spend a lot of time switching things off. We also have to spend a lot of time with the apps that we use, because you have the feeling that you want to have it in your hand and otherwise you're at the mercy of the whole thing, because you can never read through everything.

**S00:** Would that perhaps also be something to consider when designing e-clothing, that it is possible to display everything? That data can be forwarded or something similar.

**S01:** I think so. At Beta-Light, for example, we deliberately worked without data transmission because we said that, in theory, all functions, such as saving light settings, should work locally. Things like networking can be offered and you can go to forums if you want an update for your product, but I would say that's already a design task. Since 2020, there have been very clear product rules for textile products, but also for other products, about how circularly you have to plan your things, that you have to plan and think in cycles. And the same thing that applies to environmental friendliness also applies to data in my view. Especially when you think about AI. The whole area will expand and it's already the case that you use something and you have no idea whether the data will be used immediately to improve the AI. If you then think about body data, that is of course even more sensitive.

**S00:** Yes, there probably needs to be some elaboration on the subject of data protection

or the law.

**S01:** Yes, absolutely. I also think people need to be more aware. It's also really difficult that everything there is these days, whether it's search engines or Instagram, a certain part of it feels like a service, but of course you pay for it with the data you enter. It's relatively opaque and it's almost impossible to refuse things completely. Then you're immediately out of a certain part of everyday life if you stop using it all. You can do that to some extent, but I think there's more leeway than simply surrendering to it. Do you have another question that you haven't asked yet, because I've told you so much and I'm not sure if that's what you need?

**S00:** Definitely. I wrote down a few questions and realized in between that they had already been answered. Ultimately, it's still a very open topic and I'm doing the expert interviews because there isn't that much literature yet. So there is something on wearables, but it was more about potential uses. For example, that wearables could be used to track environmental data, because marginalized groups in particular live in regions that are affected by severe air pollution, for example. The collection of data should then provide factual evidence for demonstrating or taking action for change. I have found something like this so far, but nothing on e-textiles or e-clothing.

**S01:** That's right, I actually don't know that much about the bridge either. I think there are just a lot of critical players who are simply thinking about what actually makes sense. Or you know that a lot is technically possible, but what do you want to use it for? And what are the disadvantages?

**S00:** Above all, I think clothing has always been an everyday object. You just wear it and it has also become part of activism because you have it around you all the time. And we're also in the digital world all the time now, which is perhaps why it's also used for that. It's also very good for mobilizing and spreading information and that's why it's used, of course. So perhaps the question is whether e-clothing needs to be actively integrated into our everyday lives in order to become a bigger part of activism.

**S01:** I was also just thinking that you probably need to look at activism and fashion as a field, in parallel with activism and digital technologies, because it's so multi-layered. I can use a T-shirt to show that I belong to a group and I can network digitally with this T-shirt. Yes, very interesting.

**S00:** I have somehow the feeling that you always open up one topic and then a thousand new topics come up.

**S01:** It's also totally networked. So I think what I was talking about, how interdisciplinary e-text is on its own, you have a whole block of things that are in there and then activism opens up another window. <Recommendation for sources>

**S00:** If there's still time, I have two final questions.

**S01:** Absolutely.

**S00:** One question relates to your "visionary view of the future". How do you envision the future in 10- 20 years with regard to e-clothing in activism?

**S01:** Well, when I think of the different forms of activism, I can imagine that it could be more subtle activism. The things I mentioned, that's my vision of course, but that you can bring together more materiality and what else this clothing expresses besides having a technological function, that you can bring that together even more and be activist through that. I think makerspaces will continue to exist and the phenomenon is perhaps becoming more important the more diffuse it becomes. X is a good example of this. It used to be brand new and was called Twitter and now many people are distancing themselves from it because they don't want anything to do with it politically. I believe that this maker culture is taking on a different relevance because people don't want to expose themselves to certain things or want to separate themselves. I can't really imagine this kind of networking, because I always immediately think of weird, blinking jackets that say: "We are a group." But I could imagine networking in some way, but more on a subtle level. I think of communities that can simply use the internet to overcome spatial separation as great activism. I think that could be something, but then the question always arises: what makes sense, when, and where? And also the question of how secure the data is, because you might not want to be found because you belong to a marginalized group, for example. I think inclusive projects have potential, like the project with hearing, because there might be more focus on that. I don't know if people want to pay money for it, but it's definitely an area where it lends itself because it's even clearer what textiles do differently than other technologies. Or also when it comes to older people who no longer have this connection to technology. One small idea is always: the more intangible things we have around us, the more tangible materials and tactile experiences we want.

I don't know if that will happen. You don't know whether everything will become less tangible and more tattered and whether it's already activism to want something tangible. Of course, it's also difficult to construct a super positive, innovative view of current world events because there is also a flip side to the coin. As you can see from the example of X, it's not just cool because we can find each other digitally, but somehow the surveillance is also totally present or the disadvantages that it can have.

**S00:** Totally, I've also found a lot about that in digital activism, these contradictions: On the one hand, you have more anonymity, but at the same time you're also much more transparent. You can disseminate information very well, but you can also get lost in all the information.

**S01:** Yes, exactly. Perhaps this textile can also make the closeness that is sometimes lost between people tangible again. For example, with all the hate on the internet, that also happens to people because people dehumanize other people. Maybe materiality can be something else, but I don't know if it helps if someone who is ranting on the internet is wearing a jacket that feels nice.

**S00:** A jacket that makes you feel the other person's situation.

**S01:** Yes, exactly. Or maybe a hug. Maybe the hater just needs a hug.

**S00:** Then there's a hug for every hate comment.

**S01:** Exactly.

**S00:** My final question is: If you had to summarize the importance of e-clothing in activism, what do you think is the potential and what are the limits of its use?

**S01:** If I open up the whole political-theoretical box, of course I think it can be more inclusive in all directions, so gender diverse, diverse for people with disabilities. Technology can be a bridge for all kinds of things and I also believe that the sensitivity that lies in the material, but also in a multidisciplinary and diverse group of people who act with it or develop it, can promote positive coexistence, at which level this is activist, is different. It's a bit like the story I told earlier, because before men developed the gamer vests, women weren't considered. But they want to play games or to everyone else who wants to get involved. I believe that there is already potential for this. The limits always lie in the fact that if it is to become a product and it has to come out of the activist maker scene, you



need backers and have to think about product reliability and similar issues. That limits it somewhat. And also what people consider to be a useful product. What I can imagine activism that doesn't just happen quietly is a closer connection to makers. When I think of the way When I think of the way I work and research in the context of the university, there is room to develop something and do something for society in the broadest sense, because it doesn't have to be a profitable product in the end. It's still not easy to get everything that is e-clothing ready for production.

**S00:** So that's the limit you see in terms of use?

**S01:** Yes, well, it depends a bit, maybe there is a wearable that can collect certain data and offers a certain possibility for digital networking and that can of course also be used for different things. That might make it suitable for activism, because it's simply a tool, like a phone is for calling someone, and you can also use it to make activist calls. There are better ways of bringing these two worlds together because the problems were recognized early on, but it is still relatively elaborate. It's also very expensive, so it doesn't have the potential for what you would consider a large group of activism. Yes, exactly, so that's a bit of a hurdle.