UKRI Interdisciplinary Textiles Circularity Centre [EP/V011766/1]
Materials Circularity Research strand
WP 3.2 Material-Centered Design methods
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Redacted transcript

Study 1

Activity 1

Participant (P) F: [00:00:02] I have used silk a lot in designing textiles and making textiles and wear them until they're threadbear, but find that at that point, it's very difficult to continue the life of them. Now I'm skipping to the next step, but I do a lot of mending of it, but that obviously, you lose the actual identity of the material, I find with silk. That's the best material that I've put if anyone else wants to consider.

Moderator RM: [00:00:32] What kind of garment do you feel sits? What do you identify as a garment that sits in well with silk?

PF: [00:00:39] I think the difficulty that I've had with silk is generally in shirts and blouses, around the shoulders, the seams especially. It comes to a point where it will wear through. I think also sometimes around buttons. Anywhere where it's already reinforced if you'd like, that's where it's harder to then also try to continue fixing it. Those, I suppose, practical kind of garments. I wouldn't say that I would find that with a silk dress because a silk dress perhaps I don't wear it as frequently as I would like to wear a silk shirt for instance, because, to me at least, I think it's an everyday item or can be.

Moderator RM: [00:01:21] A couple of interesting words that you said there was threadbear and seaming. There's a wear that happens, right?

PF: [00:01:28] Yes.

Moderator RM: [00:01:28] Correct me if I'm wrong. The seams and anything that has a punch through, it's breaking the structure of that material. Silk is normally a woven material. It's very unlikely that you'd get a knitted silk shirt. It's interesting that when you're breaking that pattern of the needle going through a woven, that's where that damage is happening. What's your current practice now?

PF: [00:01:56] I try to repair as much as possible.

Moderator RM: [00:02:00] Is there any specific practice that you would use?

PF: [00:02:03] I've tried a few different things. I've tried reinforcing from the back, so using any--

Moderator RM: [00:02:13] Interfacing.

PF: [00:02:14] Thank you. Yes, interfacing from the back, and then either embroidering on top, but that can make it heavier and sometimes more difficult. Also just standard mending techniques like darning or stitches across. I think when it comes to a point where that's not possible, I have tried doing other things like if it is a shirt where it wears around the shoulders, to cut off the sleeves and just wear it as a sleeveless thing. You try until eventually there's not much left.

[laughter]

Moderator: [00:02:45] [unintelligible 00:02:45]

PF: [00:02:47] Yes, just chip off until eventually there's nothing. I have also tried to use things for making more decorative quilting, so cutting it apart into smaller pieces, especially if it's still a nice material that you want to continue using. That's what I would say I currently do.

PB: [00:03:03] Would kind of staining come into this as well, because I find the problem with silk is it just picks up stains so easily, and I love it, but I just find that it doesn't last quite as long because once it gets to a certain stage, I try and get rid of the stains, and whether they're under the arm, if it's a hot summer or whatever, then it just doesn't seem to wear as well as something that you can wash more easily. It's the protein thing as well, isn't it, because you can only use certain means to get rid of stains on silk.

Moderator RM: [00:03:43] I think what I'm hearing from both of you is the delicateness, and the reason why we love silk so much is that it has real qualities to it. It is hard to replicate. If you were to repair it, potentially it would be an invisible repair or something that you wouldn't necessarily want to show. Like you said that if it was heavier, then potentially, it weighs that material down. That's really interesting. Great. Thank you so much. Does anyone want to go?

PC: [00:04:09] I have something add actually to that.

Moderator: [00:04:11] Please, yes.

PC: [00:04:11] It's interesting that, yes, it's true for silk, but I also have observed that it's same actually for denim that has been worn a lot and a lot, a lot, especially the crotch area. I have worked in jeans shop where we repair jeans, so that crotch is the first area to break. I could see how, let's say, denim that is 100% or the denim that has some elastic added will be breaking.

Of course, you can see the harder material will wear for longer. However, I still would say the same applies. If you start adding thick, chunky patches, especially if you add some glue to attach it or something, then sometimes the darning is like machine darning where you just go over really a lot. That is, in my practice, not a good way. I would rather look at similar fabrics on similar fabrics using lighter stitches to help it go from the hole towards the worn out area, not just looking at the hole because then around the area is really vulnerable.

Moderator: [00:05:26] Yes, we were talking to someone the other day about the idea of jeans and the way they're constructed at the moment. It feels that they're less

durable and they're lasting a lot less longer. There's always specific areas that it feels that there's weakness in the material.

PC: [00:05:44] It also takes off some of the comfort if you have a big chunky patches in your crotch. That's not very comfortable. Same thing if it's around your armpits where the skin is really delicate. It's really uncomfortable to wear. It really makes a big difference to add those patches.

Moderator: [00:06:02] Comfort's a big one. Thank you. That's great. Does anyone else have a different material that they were working with?

PC: [00:06:10] I would like to ask because I don't know if you already are using this **[unintelligible 00:06:16]** or recycled different type of material to create that yarn or thread, but maybe you're doing it. Anyway, I have the idea there because I felt that it could be quite interesting. There is already exist different type of thread, when you are going to choose your sewing a garment from polyester or cotton. Then we also find the mix of cotton cover on polyester with this specifically idea to try to extend the longevity of that.

I was wondering if that application was already being used because it would be very interesting to have that type thread which is cotton reinforced with something that has been **[unintelligible 00:07:11]** with that same purpose instead of using polyester. It would be earlier in the process rather than to prepare already a garment or a fabric. I don't know if that thing is already in use, but I think it would be also interesting to implement **[unintelligible 00:07:31]** with that material in early stages.

Moderator: [00:07:33] Yes. That's a really interesting theme. What I'm hearing is that you think about repair at the very beginning as a reinforcement of a yarn more so than when it comes to the garment level.

PC: [00:07:43] Yes, because you might need the thread to sew the garment as well. If that thing is already reuse it in certain way with materials that are creating this view and concept that you have. It would be also huge application and eliminating the creation of polyester threads and at the beginning I use so that I can reinforce or lasting the thread or the garment from the very beginning.

Moderator: [00:08:17] We find that that's a real challenge in the textile industry is that these new materials that we're creating, we want them to have the same properties as these existing polyesters that are strong and have that reinforcement already in them. It's a challenge, isn't it, when it comes to celluloses that, how do we make sure that those materials are being created in a way that's going to last. Great. Thank you. Anyone else want to talk about their materials or garments?

PG: [00:08:50] I could go. I was looking at sportswear. I work with smart textiles, so this gets a little more complicated, where we're actually integrating electronics and conductive materials into the textiles, making it even more complicated. To take sportswear as an example, it would be the stretch. It's really important if you're tracking someone's fitness through smart garments, then it needs to fit really well. Overuse can then start stretching this. It loses that elasticity, and then it becomes too loose for the garment to even perform what it's supposed to do, which is to measure your heart rate or your muscle performance.

The other thing that we find with things like Lycra and spandex and all of that is the thinning of it over time. Also, I don't know if this is the technical term, I just called it bobbling. [laughs] The little kind of like-- yes, that's it. That's what I was looking for. That becomes then something that people don't really like. It just makes it look old. Then because we also have conductive threads in either knit or woven or printed into the garment, that makes it harder to repair because you can't just cut things wherever you want because that'll just cut the circuit as well.

Currently, what we do, I guess currently what happens in the industry is because these garments are so expensive because of all the electronics. People are a lot more careful with it and they don't wash it as rigorously as you would your regular sportswear. That's how we're preventing and trying to make it last longer. Because they pay a lot of money for it, they take better care of it for it to last longer.

Moderator RM: [00:10:42] Yes, that's really interesting, the idea of electronics within textiles because that's something that's coming up, right?

PG: [00:10:48] Exactly, yes.

Moderator: [00:10:49] It's a feature that's definitely happening, so potentially that's an interesting point that we can **[unintelligible 00:10:55]** along the silk shirts. There are two really poignant ideas there that we can see how using this technology could potentially increase the identity of **[unintelligible 00:11:04]**. Great. Does anyone else want to come through just in the last few minutes?

PD: [00:11:09] I don't have a particular material. I do have materials I do prefer. Usually, I do work with natural materials because I feel like they age just much nicer, so up to the point where actually a garment needs the repair, you still have those signs of aging, which are just lovely to look at. I also only work with **[unintelligible 00:11:39]** materials, which I find makes the repairs much easier because you don't have to switch between different material types.

Moderator RM: [00:11:52] That's really interesting, three different points. We have a type of repair with silk that we use that potentially wants to be a little bit more invisible or a little bit more delicate and refined because we love that material. We want it to be prolonged. Then we have an idea that actually consumer experience works with a lot as well, is this idea of actually it's a loved item and you see the value in it because it has some form of damage, so potentially you would work with a more visible type of repair that shows how loved that material has been.

Then we have an electronic element that brings in, okay, how a more practical level of we need to use something that is going to be able to be durable and sustainable in the use of the actual material. That's really interesting, some really great ideas there.

PF: [00:12:43] I just have one more that goes hand in hand with the sportswear a little bit, which I personally maybe someone else has any good ideas, but I just personally never know what to do with is underwear when it reaches the end of its life. Because again, nobody's going to want to have wearing reused underwear. That's just not going to-- so unless it is recycled and turned into something else, I'm not sure--

I feel like even if you buy the best quality, after a few years of washing, especially terrible like UK water, it's all gray, it all looks terrible, and all the different components, especially for brows and stuff, all the little buckles, like, what on earth do you do with it? At the moment, all the underwear especially if it's like knickers, I use them to polish shoes and stuff. What else can you really do with it? I think that's really something that I would be-- if somebody had an answer for, it would be--

Moderator RM: [00:13:41] That's great. Just feels like it leads into the deconstruction idea **[unintelligible 00:13:46]** the materials that were used and some that are taken away and replaced, reducing that **[unintelligible 00:13:53]**

Speaker 8: [00:13:55] It's a brewing system.

Moderator RM: [00:13:56] Yes, and then we put that tiny part that no one wants. That's really great.

[00:14:08] [END OF AUDIO]

Activity 2

[00:00:09] PF: I have used silk a lot in designing textiles and making textiles, and wear them until they're threadbare, but find that, at that point, it's very difficult to continue the life of them. I find that I do a lot of- well, now, I'm skipping to the next step, but I do a lot of mending of it but that, obviously, you lose the actual identity of the material, I find, with silk. That's the material that I've put if anyone else wants to continue.

[00:00:39] Moderator RM: Great, yes. What do you identify as a garment that sits in well with silk?

[00:00:47] F: I think the difficulty that I've had with silk is generally in shirts and blouses, so around the shoulders, around the seams especially. It comes to a point where it will wear through, and I think also sometimes around buttons. Anywhere where it's already reinforced, if you like, that's where it's harder to then also try to continue fixing it, so those, I suppose, practical kind of garments. I wouldn't say that I would find that with a silk dress because a silk dress, perhaps I don't wear it as frequently as I would like to wear a silk shirt, for instance, because, to me, at least, I think it's an everyday item or can be.

[00:01:28] Moderator RM: A couple of interesting words that you said there was "threadbare" and the seaming that comes- there's a wear that happens, right?

[00:01:35] F: Yes.

[00:01:36] Moderator RM: Correct me if I'm wrong, the seams and anything that has a punch through, so it's breaking that, the structure of that material?

[00:01:44] F: Yes.

[00:01:45] Moderator RM: Silk is normally a woven material. It's very unlikely that you'd get a knitted silk shirt. It's interesting that when you're breaking that pattern of the needle going through, woven, that's where that damage is happening. What's your current practice now?

[00:02:03] F: I try to repair as much as possible.

[00:02:07] Moderator: Is there any specific practice that you would use?

[00:02:10] F: I've tried a few different things. I've tried reinforcing from the back, so using any sort of...

[00:02:20] Moderator: Interfacings.

[00:02:21] F: Thank you. Yes, interfacing from the back and then either embroidering on top, but that can make it heavier and, sometimes, it seems, more difficult, but also just standard mending techniques like donning or stitches across. I think when it comes to a point where that's not possible, I have tried doing other things. Like if it is a shirt where it wears around the shoulders, to cut off the sleeves, and just wear it as a sleeveless thing. You try until, eventually, there's not much left.

[laughter]

[00:02:53] B: It's normal.

[00:02:54] F: Yes, just chip off until, eventually, there's nothing. I have also tried to use things for making more decorative quilting, so cutting it apart into smaller pieces, especially if it's still a nice material that you want to continue using. That's what I would say I currently do.

[00:03:10] B: That's great. Would staining come into this as well? Because I find the problem with silk is it just picks up stains so easily, and I love it, but I just find that it doesn't last quite as long because once it gets to a certain stage, I try and get rid of the stains, and whether they're under the arm, if it's a hot summer or whatever. It's just, yes, it just doesn't seem to wear as well as something that you can wash more easily. It's the protein thing as well, isn't it? Because you can only use certain means to get rid of stains on silk, yes.

[00:03:50] F: I would agree.

[00:03:50] Moderator: I think what I'm hearing from both of you is that the delicateness- and the reason why we love silk so much is that it has real qualities to it that it's hard to replicate, right? And so, if you were to repair it, potentially it would be an invisible repair or something that you wouldn't necessarily want to show. Like you said, that if it was heavier, then, potentially, it weighs that material down. That's really interesting. Great, thank you so much. Does anyone want to go?

[00:04:16] C I have something to add, actually, to that.

[00:04:17] Moderator: Please, yes.

[00:04:19] C: It's interesting that, yes, it's true for silk, but I also have observed that it's the same actually for denim that has been worn a lot and a lot, a lot, especially the crotch area. I have worked in a jeans shop where we repair jeans, so that crotch is the first area to break. I could see how, let's say, denim that is 100% or the denim that has some elastic added, it will be breaking.

Of course, you can see the harder material will wear for longer. However, I still would say the same applies. If you start adding thick, chunky patches, especially if you add some glue to attach it or something, then so it really. Sometimes the darning is machine-darning where you just go over really a lot. That is, in my practice, not a good way. I would rather look at similar fabrics, on similar fabrics using lighter stitches to help it go from the hole towards the worn-out area, not just looking at the hole because then around the area is really vulnerable.

[00:05:33] Moderator: Yes. We were talking to someone the other day about the idea of jeans and the way they're constructed at the moment, it feels that they're less durable and they're lasting a lot less longer, yes. There's always specific areas that feel that there's weakness in a material.

[00:05:51] F: Then, also, as it takes off some of the comfort. If you have big, chunky patches in your crotch, that's not very comfortable. The same thing if it's around your armpits where the skin is really delicate, it's really uncomfortable to wear, so it really makes a big difference to add those patches.

[00:06:09] Moderator: Comfort's a big one, yes. Thank you. That's great. Does anyone else have a different material that they were working with?

[00:06:18] G: I would like to ask because I don't know if you already are using this **[unintelligible 00:06:23]** or recycled different type of material to create that yarn or thread, but maybe you are doing it. Anyway, I have the idea there- because I felt that it could be quite interesting, there already exist different type of thread when you are going to choose our sowing garment, from polyester or cotton, and then we also find the mix of cotton cover on polyester with this, specifically, idea to try to extend the longevity of the thread.

I was wondering if that application was already being used because it would be very interesting to have that type of thread, which is cotton, but reinforced with something that has been outside it and that same purpose, instead of using polyester, so it would be earlier in the process rather than to prepare, already, a garment or a fabric. Well, I don't know if that thing is already in use, but I think it would be also interesting to implement or to count with that material in the early stages.

[00:07:41] Moderator: Yes, that's a really interesting thing. What I'm hearing is that you'd think about repair at the very beginning as a reinforcement of a yarn more so than when it comes to the garment level?

[00:07:50] G: Yes, because you may need the thread to sew the garment as well, so if that thing is already- we use it in certain way with materials that are creating this view and concept that you have, it would be also huge application and eliminating the creation of polyester threads and, in the beginning, use that and enforce or lasting the thread or the garment from the very beginning.

[00:08:24] Moderator: Yes, we find that that's a real challenge in the textile industry, is that these new materials that we're creating, we want them to have the same properties as these existing polyesters, right? That are strong and have that reinforcement already in them. Yes, it's a challenge, isn't it? When it comes to cellulose, that, how do we make sure that those materials are being created in a way that's going to last. Yes, that was great. Thank you. Anyone else want to talk about their materials or garments?

[00:08:57] D: I could go. I was looking at sportswear- I work with smart textiles, so this gets a little more complicated, where they were actually integrating electronics and conductive materials into the textiles, making it even more complicated. To take sportswear as an example, it would be the stretch of it. It's really important. If you're tracking someone's fitness through smart garments, then it needs to fit really well, and overuse can then start stretching this.

It loses that elasticity and then it becomes too loose for the garment to even perform what it's supposed to do, which is to measure your heart rate or your muscle performance.

The other thing that you find with things like Lycra and spandex and all of that is the thinning of it over time. Also, I don't know if this is the technical term, I just call it "bobbling." [laughter]

You know the little kind of? Yes, that's it. That's what I was looking for, yes. That becomes, then, something that people don't really like. It just makes it look old. Then because we also have conductive threads in either knit or woven or printed into the garment, that makes it harder to repair because you can't just cut things wherever you want because that'll just cut the circuits as well. Currently, what we do- I guess, currently, what happens in the industry is because these garments are so expensive because of all the electronics, people are a lot more careful with it and they don't wash it as rigorously as you would your regular sportswear.

That's how we're preventing and trying to make it last longer, and because they pay a lot of money for it, they take better care of it for it to last longer.

[00:10:50] Moderator: Yes, that's really interesting, the idea of electronics within textiles because that's something that's coming up, right?

[00:10:55] D: Exactly, yes.

[00:10:56] Moderator: It's a feature that's definitely happening, so, potentially, that's an interesting point that we can move forward along the silk shirts. There's two really poignant ideas there that we can see how using this technology could potentially increase the longevity of. Great. Does anyone else want to come through just in the last few minutes?

[00:11:16] Speaker 6: I don't have a particular material I would- well, I do have materials I do prefer. Usually, I only work with natural materials because I feel like they age just much nicer, so up to the point where actually the garment needs the repair. You still have those signs of aging, which are just lovely to look at, and I also only work

with normal materials, which I find makes the repairs much easier because you don't have to switch between different material types, so, yes.

[00:11:59] Moderator: That's really interesting, like three different points of- so we have a type of repair with silk that we use that potentially wants to be a little bit more invisible or a little bit more delicate and refined, and because we love that material, we want it to be prolonged. Then we have an idea that, actually, consumer experience works with a lot as well, is this idea of actually, it's the loved item and you see the value in it because it has some form of damage, so potentially you would work with a more visible type of repair that shows how loved that material has been.

Then we have an electronic element that brings in, "Okay, how" a more practical level of we need to use something that is going to be able to be durable and sustainable in the use of the actual material. That's really interesting, some really great ideas there.

[00:12:50] F: I just had one more that goes hand in hand with the sportswear a little bit, which I personally- maybe someone else has any good ideas, but that I just personally never know what to do with is underwear when it reaches the end of its life because, again, nobody's going to want to have wear reused underwear. It's just not going to-- So unless it is, yes, recycled and turned into something else, I'm not sure- and I feel like it's really even if you buy the best quality, I think after a few years of washing in especially terrible UK water, it's all gray, it all looks terrible, and all the different components, especially for bras and stuff, like all the little buckles, what on earth do you do with it? At the moment, old underwear, especially if it's like knickers, I use them to polish shoes and stuff. What else can you really do with it? I think that's-

[00:13:42] C: Like **[unintelligible 00:13:43]**.

[00:13:43] F: Yes, that's really something that I would be- like if somebody had an answer for it, it would be…

[00:13:48] Moderator: That's great, yes. It feels like it leads into the deconstruction idea, right? That, potentially, there's materials that were used and some that are taken away and replaced, reducing that wastage. Great.

[00:14:02] D: In your **[unintelligible 00:14:03]** system?

[00:14:04] Moderator: Yes, and then we put that tiny part that no one wants in there.

[laughter]

[00:14:06] D: Yes, see if it.

[00:14:09] Moderator: So.

Study 2.1

[00:00:00] Moderator RM: Write a brand logo onto a material and the more wear that happens on that material, the more that logo appears, it almost creates this shift in consumer value, right? The longer you hold on to that material, the more value it has, the value almost grows with the garment. I don't know, it's something I was thinking about, as you were talking about repair, how do we, in the how does that, and that is something, because a bio reacting thing could happen, right? I think you think about the UV and the more it's exposed to UV over time, the stronger that pigment becomes or something like that, that could be applied with the robotic arm or even more shit. Even more the shape.

[00:00:47] Moderator RM: Yes, the shades.

[00:00:49] H: Yes, shades. Shades more. If it is get the color, usually when it's..

[00:00:56] Moderator RM: It loses the color with the sun. Yes, yes.

[00:01:02] Moderator MR: I think it's very interesting that you mentioned, the colors are very bright and iridescent, and I'm thinking **[unintelligible 00:01:08]** now and then iridescent, but.

[00:01:11] H: No, they're..

[00:01:13] Moderator MR: They're not still very bright, and I think that's really nice to think about because you saw the samples over there where we, there's a natural dye is included in the spinning. Because the filaments are quite transparent, it's very bright, and people react to that, and I think it's really nice because even in other types of coatings and colors, and it's maybe not just about the pattern, the design, but also the color itself, being very special. Even if it's applied to a repair, and you have a bag or a shirt, but then you see, oh, that's bad design. Because it's a specific color. **[unintelligible 00:01:54]**

[00:02:09] Moderator RM I think lots of ideas flowing around. Yes, it's like sometimes it can be hard to ideate when we have such a solid process. Think about bags and the way, it's an age-old techniques of creating, right? Adding in a technology can be difficult.

[00:02:26] H: Yes, but could I create the actual bag somehow?

[00:02:31] Moderator RM Yes, like build it.

[00:02:33] H: Build from zero, and then you don't have any waste.

[00:02:37] Moderator RM Yes, built in bag.

[00:02:40] Moderator MR: The pin system, where yarn placement could shape it as well as coat it.

[00:02:49] Moderator RM Yes, so an all-in-one system, right? Yarn placement to create.

[00:02:55] H: Was something that we took I think bags and accessories are completely different than- in circularity they're not that bad because they're made for forever or luxury brands. The definition of luxury, it's not.

[00:03:17] Moderator RM: It's changing, right? Do you feel?

[00:03:19] H: Yes, but actually by definition it's sustainable because they create a product to last for years, that you're going to give to your daughter- we would do the same with, I don't know, T-shirts, it would be functionally different.

[00:03:39] Moderator RM: Yes. Yes, that's very true.

[00:03:43] Moderator MR: Yes, but I also wonder, because I think it's an interesting area, this whole thing, specifically. It's a way, I mean, to make it durable, to reinforce it, to make it last, and I'm almost wondering if that's true. Because we were talking about reuse. If you have something like a shirt that you want to reuse, and keep them after, coated in the jacket. [laughs] I don't know, you can just change the weight of the fabric as well, and make it different ways it could be used in different products as well.

[00:04:17] H: Or add another color.

[00:04:18] Moderator MR: Another color.

[00:04:20] H: To have the feeling that you have a new product.

[00:04:22] Moderator MR: Exactly.

[00:04:21] H: I know it's the same, but you're..

[00:04:24] Moderator MR: Yes, because we have the base, you need a base for the material to coat on.

[00:04:29] Moderator RM: Yes, builds it up.

[00:04:31] Moderator MR: Using something that doesn't really **[unintelligible 00:04:33]** own purpose otherwise.

[00:04:35] Moderator RM: Yes, you start with a T-shirt, and then after five years bring it back in and we'll turn it into a jacket, and then after 10 years coming back in and we'll turn it into a bag, or these almost marking points of what that one material can become in the future.

[00:05:02] Moderator MR: We have a lot of ideas here. I'm wondering, which one is for you is most where you think is- They combined a lot of ideas is why I'm no longer thinking in terms of robotic arm helping system to be the life of the product or to **[unintelligible 00:05:23].** Is there some specific application that you're most interested in in terms of the color?

[00:05:38] H: Yes, I get color. We don't have any for current practice.

[00:05:44] Moderator RM: Yes, if you want to talk about, your current practice, that's more getting people to think about how they would currently use, or currently repair their materials in the process.

[00:06:01] H: With that tool?

[00:06:02] Moderator RM No, this is what we've done in the application stage, and then current practice is, we talked about, your bioprocess and your work, fashion brand. Yes, but if have anything that comes to mind when you think about current practice and repair, potentially?

[00:06:26] H: I think for me, the most common one is to stitch, re-stitch. Re-stitching.

[00:06:30] Moderator RM Re-stitching.

[00:06:32] Moderator RM: Yes, to repair, I don't know if you have the trousers, you can, get it to make a short, I don't know if.

[00:06:45] Moderator RM Yes, reconstruction.

[00:06:46] Moderator MR: Yes. I think.

[00:06:49] H: Get the most common one, I guess. Or re-dye it, I also did that a lot. With chemical or natural, but, you could, yes, re-dye it.

[00:07:05] Moderator MR: Yes, that's interesting because that's really related to the coating.

[00:07:09] H: Yes, and color.

[00:07:10] Moderator MR: [unintelligible 00:07:10] a lot of dyeing, use a lot of water to **[unintelligible 00:07:14]**.

[00:07:11] H: Yes. Yes.

[00:07:16] Moderator MR: Then same as dyeing, something that we're dyeing, something **[unintelligible 00:07:21]** the whole washing machine though [crosstalk]--

[00:07:24] H: Yes, you have to put it in the washing machine and yes, when I do it with natural dye, because then you always have a leftover bath, which is super, super colorful, but then you can reuse it to create something else. Again, create a bath. I'm just going to create a bath. Then you have a leftover bath, and then you can create a painting. You can. It's a waste for them. It's not, it doesn't have to be a waste. It's what I mean. Again, we use it for another application.

[00:08:03] Moderator RM: That's leading into a second part of what we're looking at. How could we link these things, if you come out with a waste dye, could that be used in another place or a product or something? Yes.

[00:08:17] Moderator MR: Not everyone would do it.

[00:08:19] H: No, it's because, because yes, because then I was thinking, yes, when I did that, for example, yes, then I have the leftover bowels and for example if I use avocado skins. I could also reuse them to make a bio-material, but I guess, maybe people have not blended a powder and then try to make a material.

[00:08:47] Moderator MR: Yes, current practices, I think, like we're saying, there's a lot of gaps with people, not everyone knows where to **[unintelligible 00:08:56]** for that. It all depends on the material as well. Yes, so there's a lot of gaps at the moment in the current practice.

[00:09:07] H: I think it's that what you say, is not everyone knows. Because, for example, my friends, they're happy to, but they just don't know how, and sometimes, I can just give them an example, which is, for us, common. We do that every day, but they don't, they don't think about it. They would be happy to better know when we would have to create more workshops like this to engage people. There's I think a lot of educational **[unintelligible 00:09:40].**

[00:09:45] Moderator RM: Yes. Great, I mean, maybe we're coming up to time for the break?

[00:09:51] Moderator MR: Yes.

[00:09:51] Moderator RM: Yes, we can take a break.

[00:09:56] Moderator MR: [unintelligible 00:09:56]

[00:10:04] Moderator RM: Yes, let's get served. Yes.

[00:10:08] Moderator MR: Oh, thank you

[00:10:09] [END OF AUDIO]

Study 3.1

[00:00:00] Moderator RM: -materials. Sorry, we're going a bit- I know that you two totally know, but.

[00:00:03] K: I got a really good example.

[00:00:06] Moderator RM: Yes, [laughter] the diamond still. Brilliant.

[00:00:08] K: I want to say, though, I darned a pair, and it took me the entire car journey to Glasgow and back, so I know how scalable that is. I had it on my foot.

[00:00:19] I: Yes, it doesn't stretch, though, like they were saying.

[00:00:20] K: I didn't do it as in a knit stitch, I just avoided the stitch because I'm not a designer, but I know how to read who you've--

[00:00:30] Moderator RM: So darning.

[00:00:31] I: It's these places that are worn, have the most wear, so you don't need to stretch this early on these- maybe it's better to have a normal thing.

[00:00:40] Moderator RM: Okay. Well, that's really interesting because going back to your thought process about having those mixed medias is that potentially a needle puncher, like you say, could really reinforce a small part of a garment that really needs that strength and rigidity, so in potentially like elbows or knees or anything that needed a rubbing. That's a great example what you've just shown of the back of a sock that has the rub on the back of the shoe. It doesn't need that stretch, as you say, but it does need a form of rigidity to it so that it doesn't wear through, so what you've done is an amazing iteration of reinforcing as well as repair. Were those parts, were they already holes, or were they thinning?

[00:01:33] K: Yes, on the heel there was a hole, but on the pad of the foot, it was just quite threading. It wasn't quite finished because it's so slow and so legless too. [laughs]

[00:01:43] Moderator RM: Yes, that's a great way..

[00:01:47] K: Use case.

[00:01:47] moderator RM: -a use case of that, so you have-

[00:01:50] I: I would love that actually for my Doc Martens, which I've never been able to break in properly. I always wear band-aids or plasters whenever I wear them. If I had socks with some kind of padding.

[00:01:59] K: Reinforced to wear them.

[00:02:00] I: Yes, reinforced. That'd save me so many plasters.

[00:02:04] K: Also, on the inside leg of trousers, particularly jeans, they can wear through, and when you repair them by over stitching, it ends up being quite rigid and it can actually then rub your skin or if it's really thick and rigid and has a lot of stitching, so even just adding a lighter layer that's not quite so rigid using this technology could be quite useful. I don't know how you get the garment if it would be possible to maneuver it into the machine, for example.

[00:02:42] Moderator RM: That's the great part about how you lay the needle bed is that it's customisable. For repair or for darning or things like that, the idea that the needles can be taken out and arranged in different ways means that it becomes personable and, what's the word, customisable depending on what repair you need to do. Because I think something that happens with repaired items is that they need such different needs. You could have one day a t-shirt that needs one area looked at, and then next it's completely different, so there's no blow in terms of what you need to do on a daily basis.

Potentially, that's another use of the needle bed layout is that it is customisable, so that aids to repair potentially. I'm trying to think about the patterning and maybe there's something in the setup of the needles that we can explore that would potentially be fortuitous, but that was a great flow of what you do as a current practice feeding into

this, so maybe we could talk a bit more about both of your current practices, about what do you do now to prepare your materials.

[00:04:02] I: Sometimes I take a more creative approach where if there's a stain on a shirt, I'll just cut it out for the follow-ups of the design element. As far as technology, I don't think I really use much.

[00:04:17] moderator RM: Yes, that's a great example. It doesn't need to be technology driven, just whatever you do now that aids the current practice or repair.

[00:04:29] Moderator MR: It's like it's a very visible repair because you're cutting it out and almost cutting it out creates a very aesthetic feature. This is customised in some way by removing it because there's some kind of repairs where it's like trying to hide or make it invisible if there was a stain or that there was a connection in exalting it by doing it which is really interesting as well as a practice.

[00:04:59] I: That and then just covering it up with another patch. Also making a design element or something like that because it's almost impossible to have a truly invisible mending.

[00:05:11] Moderator RM: Yes, as I say, it's really difficult. I wonder as well if there's something that we do with this technology that doesn't use any other fibers, but mainly the mechanical process of punching. You were saying earlier about the idea of the felting and maybe that doesn't need any other form of the textile.

[00:05:35] I: Maybe you can buy it by itself like that.

[00:05:39] Moderator RM: Yes, it's one of those. If you had I'm thinking of your jersey, if you needle punched in a certain pattern into the jersey without the need of any other fibers being introduced, it would condense and bind certain parts in a pattern. It wouldn't be that you're adding in any materials into the needle punching, but you're creating a pattern for something. I'm wondering if anyone has an idea of what that pattern could create or turn into. I know it's a little bit of a tricky one, isn't it?

[00:06:19] Moderator MR: I'm wondering if there's a link almost to the patterns we see for different threads. Yes, almost different patterns and then the needle thread potentially being able to also have a range of different patterns based on the design, but moving and honoring a part of the equipment, which, I don't know, getting different patterns the same, what will happen in a new practice if it was having different patterns in terms of building.

[00:06:54] I: You said it already, but use a branding for the--

[00:06:57] Moderator MR: Yes, that's nice.

[00:07:00] moderator RM: Yes, I think the branding part is really interesting. Sorry, I'm just trying to create some drawings. It just gets ideas flowing. I know it's difficult to ideate how the properties of a material might change, depending on applying it to a mechanical functioning. Because as we've already said, it becomes denser when you felt it, so I'm wondering if potentially there's a gradient of density that you can add into a material already existing.

Potentially, a collar, for instance. If you needle punched a collar that's potentially a little bit more flimsy, would it add stiffness? Is this a way that we could replace, it's an out there idea, but replace starching of jeans, for instance? Could it be that you go into your local launderette, and you say, "Okay, I need my jeans to feel stiffer." There's a needle punched felting that happens to that jean quality that makes part of it stiffer, part of it less stiff. I always remember my neighbor used to really over starch his jeans. They were like cardboard, and he loved them like that, but is that potentially ruining the project?

[00:08:21] K: Does that starch for you, is that the weight of the denim?

[00:08:24] moderator RM: Yes, it would take away the starching. The weight of the denim, it would become more denser if you needle punched it, potentially. Those weird applications that potentially this could--

[00:08:38] Moderator MR: I think I went the directions, like you said earlier, about softening the seams in a denim, or anything that can be a bit stretchy and also reinforcement of socks and darning and padding of material or product that it helps comfort as well as durability in some context, and I'm also curious as well, you said earlier about using patches when you cut a hole where there's material from the patch.

Would that be useful for you to think about needle punching this patch in some ways so it's a custom pattern or color or weight, because weight came up as well, or do you usually take the patches from another garment, the upsising, for example? I'm just wondering if that's something that could be useful.

[00:09:28] I: It's always interesting to have a short length, different textures to it that's made of patterns.

[00:09:35] Moderator RM: Weights. I'm wondering as well if this technology- sorry, we are completely forgetting the flow, but it seems to be working. We'll remember. This idea of felting seams instead of sewing seams, could that be fortuitous in terms of disassembly? Also, we're not using a polyester filament to sew a garment together, but you're using more of a mechanical process that's not actually meant to be- it's feeding into ideas of fast, not fast fashion, but disassembly and construction. I'm thinking about the modular shirt, for instance. It could be an easier way to pull apart so it's designed to last for six months at a time.

[00:10:32] Moderator MR: Like a Velcro?

[00:10:34] moderator RM: Yes. Like a bit of a more reinforced Velcro instead of, sorry, just an idea that if anyone wants to jump on that or think about how that could work.

[00:10:46] K: I think it would need to be durable enough to see out the lifecycle of the garment.

[00:10:54] RM: Exactly.

[00:10:54] K: Rather than determine the lifecycle of the garment so that it actually facilitates recycling rather than expedites recycling.

[00:11:02] Moderator RM: What kind of garment do you think would have that life span?

[00:11:07] K: Well, if we're talking about woven garments, I guess something tailored, maybe. Like a tailored jacket perhaps.

[00:11:16] I: Children's clothing as well.

[00:11:18] Moderator RM: Great example. I'm taking a leaf out of Amber's book here and doing some random drawings. [laughs]

[00:11:29] K: Everyone's doing it.

[00:11:29] Moderator RM: It feels like it looks. No. I love that because you know they're going to grow out of it, so maybe it's that the seams are felted, or the seams are needle punched so that they can be taken apart and added in an extra section for when they grow. I think children's clothing is a big sector for that. It's like the given that they're going to get bigger. [chuckles]

[00:11:56] Moderator MR: It might be a really nice thing about reconstruction, what we're talking about. You can disassemble it and make it in a different size all the time. This is very nice.

[00:12:09] moderator RM: I wonder, do you use it in, so going back to what you were saying about how you'd cut out, normally you would cut out a material if it had a stain on it. Is there something that you would do with a needle puncher potentially to edit that stain or make it a feature or something maybe?

[00:12:26] K: Yes. Adding a different weight, I don't know, different textures as a design element, but I can't really think of what we talked about reinforcements and the added impact as a design element. I don't know what else.

[00:12:48] Moderator RM: Thinking back to the fibers and materials and their specific properties, if by adding in like we were saying like wool, for instance, the shorter fibers. If we bound those into a garment, for instance, is there a different property that would bring? I know that wool is used to almost as a cooling fiber, especially merino, they're almost used as exercise fibers now, aren't they? I'm wondering if you added that in through needle punching into a garment, kind of that same idea of building different elements into a garment again.

[00:13:29] K: I don't know if you'd retain the properties of merino or if it was just an additional fiber. I guess you also have to think about the laundering of mixed fiber garments or if you're trying to retain the properties of one, how that responds when you wash it. In fact, is it even washable? Or if you then have to engage with a specialist laundry process to protect the needle functioning process from degrading.

[00:14:02] Moderator MR: Would you then use the same fibre ideally? For example, it is a cotton t-shirt or something that you're mending up, then in trousers you wouldn't put wool for softness. Would you want to needle punch using the same design?

[00:14:19] K: I suppose it depends what your objective is. Whether it's to improve the longevity of the garment for recycling or reuse or if it's to make one of repair with the

assumption that that garment will be worn to the point where it's not able to be fed back into that loop. I don't know. It's quite an open question and there's so many combinations and factors that could influence it.

Also, if it's using this process to be more sustainable ultimately or whether it's using it, and how we define the sustainability. If it's looking at upcycling with design and printing textures or if we're looking to work with mono materials or we're looking at the water use of laundering and reducing that. I think those factors will determine how you would use the fibers and where you would use this process. Quite a lot of factors.

[00:15:28] Moderator MR: That would be really nice to map these. It's different circular design approaches, but maybe one thing we should mention about the wool is that actually it works with mixed fibers, which is quite rare because usually you would aim for more materiality in a circular economy. Most mechanical recycling processes, there's no way to know what was what. What happens when it's usually down cycled and then it's insulation material and it doesn't have the same quality anymore. Then in chemical recycling, you first need to do a great treatment step to separate materials, and it doesn't always work with all different blends and it's adding a lot of energy and water to it.

Hypothetically, in the system, obviously, we don't want to add more energy and more water use, more stages. Hypothetically, what it can do with this process, we can separate plants and then, for example, just leave one blend and use just one element because the cotton wool, for example, it would be possible from my perspective. I think your point is really important about what's the strategy we're aiming for as well because as one way of thinking, okay, it's about reducing water use, then how would you design to do that? Obviously would you- I don't know. It's a design question. We could spend an hour discussing it. Then the other aspect is what are we aiming for?

Are we aiming for better recycling, which is easier to recycle and turn it into new materials which is one thing we need to keep in mind. We need to design with that in mind. We need to know what happens. We need to know that the materials can be retained in the value at the end of life, which we can. In this context, really, we aim for extending the life of materials and products and that really depend. That will be lots of different materials and products depending on your practice. I think it's interesting maybe what we can do and we will do after as well as map against these ideas. What's the circularity or circular design imperative within this?

We were talking about comfort and we were talking about weight and about different materials and different creative approaches also to use with technologies. I think also it's maybe most important to what you do in your practice. Like you were saying with the patches, so it's like a custom-made patch, you can make really quickly on the weight and color and shape what you want and you don't have any waste.

I'm almost imagining you could have a little spreader next to it as well. You have a little fabric that you might want to spread and then really construct for the patch and you're reusing the full fabric as well. You have a nice little circular look in your studio practice around the material level of what you can reuse. Then you can add the garment as customised and have different weights. It's just like a few ideas based on different practices.

[00:18:50] Moderator RM: Just going off the back of what you've just said about having a closed loop practice within your own studio. I often feel that when- so if you're sewing, correct me if I'm wrong because I know you guys are repairing and using, but when the thread that you- do you know how when you're in a sewing and you pull the thread through the bobbin and you cut it and you've got this weird amount of waste that comes, maybe that becomes our, in a closed loop practice, in a closed loop studio, that becomes our material that we use for the patching. Just going off of what you said. That could be a nice way to think about how we're using circular raw materials but for a darning process.

You create the patches and then you darn with it using your current practice. Sorry, just to bounce off of your idea there.

[00:19:40] K: I guess one problem is supply and demand. If you need more than you generate, you then generate more waste to feed a system. It's looking at whether- like the level of sustainability, for want of a better word, in that system, because my feeling is you wouldn't be able to do very much with the bit you cut off when you stitch, because actually a lot of machines will take up the thread so you end up with this much.

[00:20:10] Moderator RM: That would be great, if you were doing that in your current practice and you built up lots of those bits, that would be the perfect size for this kind of process- [crosstalk]

[00:20:20] I: We're still overlocking the machines as well.

[00:20:22] K: Yes, that's true.

[00:20:22] I: You have to create a long tail first and then feed the thing through, feed the garment through.

[00:20:26] Moderator RM: Exactly, yes.

[00:20:28] K: When you're changing threads, that becomes even longer because you have to pull them out and start a new chain.

[00:20:33] Speaker 1: I always remember in my- I did my degree in textiles, there was a total bin worth of scraps that were used at the end. There was always a student that would do their study on those materials. [laughs] It's the best thing for a student to do as well because then you're not paying anything for your raw materials as well, it was brilliant. You had this textile bin that was always there.

I'm assuming that's what happens in a studio space as well. We always have this scrap pile that would go into that recycling system. Something we like to talk about when we talk about this system is that the recycling system is the last stage that we want it to go through. It's like the very end of life. What happens if those end-of-life pieces, like those scraps coming from the overlocker actually have value and could be used to repair?

[00:21:30] Moderator MR: I think it's a really good point in terms of a bit like recycling polyester when there was a huge production of plastic bottles, or even sometimes

produced just to be recycled, not even used, to cope with the demand of recycled polyester. It created a whole issue with where it's coming from, the supply-- exactly.

[00:21:56] I: I didn't mean to be pessimistic about it, but just realistic about the availability of those materials.

[00:22:04] Moderator MR: No, but that's very important because in that context you need to think, like what you were saying about the textile studio, it makes me think there might be production waste. We've been talking a lot about post-consumer waste, but there are still textile companies producing and they- in weaving or even manufacturing of trousers, there'll be some offcuts, there'll be some production waste, which currently is a huge gap as well they don't know what to do with it.

There's always a cooperative, you would work with a lot of designers' studios that have this waste put together to create this very high-end customised patches as well which can be branded or have different kind of properties linked to it which is also very nice. Another thing that has sprung to mind is a lot of times you get companies contacting you, "Oh, we have this waste of this material we don't know what to do with it."

It's just a huge issue with either being very complex materials, like synthetics. I'm just thinking I was speaking to a company, and they produce padding for clothing sometimes and that's very synthetic and thermoformed. It's not a really nice material what they do with it and there's no recycling system. I think that happens a lot probably with waste collection as well.

There's materials that can't be recycled. Either they can be reused in some way or even thinking about these types of materials that can be reused as well. That being a potential option, if not it can be disassembled and reused rather than it being dispersed or, at the moment, landfilled and separated. We don't want to create another problem in terms of where our waste is coming from as well.

[00:24:12] Moderator RM: Yes, hopefully, people wouldn't be like, "Oh, it's fine," just cut off the extra so that I have more to darn with.

[00:24:18] Moderator MR: Yes, exactly.

[00:24:20] Moderator RM: I'm thinking on an actual garment level as well now, how do we change the properties of an actual garment? In terms of needle punching, we know that it would dense in a material, and could that be used as a form of iterative boning, for example, of a material? It stiffened the right part of the material so that it changed the shape of a garment without adding in an extra material type, potentially?

I'm trying to think of those like, "Okay, we know that it changes the mechanical properties of the textile, so what kind of applications could we move through?" I know in our book we have step one, step two, step three, so is there anything that comes to mind?

[00:25:09] J: Could be used for not just fashion feel, maybe interior design kind of feel as well, because they need felt material for, I don't know, rock systems, stuff like that. It could be used in another approach as well, not just fashion, I think.

[00:25:27] Moderator RM: I think of interiors as like the trim of a pillow or something but it is thicker. Potentially, it's adding that thickness to a material to change the weight.

[00:25:38] J: You know like a room partition.

[00:25:42] Moderator RM: Oh, yes. Yes, yes, yes. The room partitioning. It's like you could use it almost like a non-woven material.

[00:25:50] J: It's also like how in a recording studio, they have a soundproof wall, that kind of stuff. It could be used for that kind of form as well for fielding because you make the material thicker, it could absolutely absorb the sound or stuff like that.

[00:26:07] Speaker 6: Also, you could also use it for painting because imagine we have different weight, you have different stages, so you have different weight. If you have part determine ends, then you can create anything.

[00:26:30] Moderator RM: Yes, the boning change you were saying.

[00:26:36] Moderator MR: I think that's awesome because usually it's a heat-treated process as well, there's a lot of synthetics being used for heating that are complex. We have a lot of products we've discussed. We've talked about socks reinforcement, trousers, t-shirts, there's quite a lot of product potential applications as well. I feel like it's, I don't know what you think, but I think it's a process. It could be applied to lots of different ones, it's not necessarily one specific product, or is it specific in your practice or with your group of scientists, most probably, for I see a gap for reinforcement.

[00:27:23] K: This goes with reinforcement, but in some of my designs I have belts. Basically, anywhere you'd use a fusible, you'd use a- "Let me try this thing."

[00:27:37] I: I suppose you were **[unintelligible 00:27:39]** like an interface or something.

[00:27:44] Moderator RM: Interfacing was something that we talked about last time as well, wasn't it, like using almost a premade material that could be used to interface say something. Maybe interfacing actually it's almost like a down cycle, though, isn't it, if you made interfacing out of scrap material and non-woven. Interfacing is non-woven, but it's made from electrospinning, which is a different type of non-woven production. Maybe there's a mechanical form of creating interface materials.

[00:28:21] Moderator MR: I think we had it in a study last week as well, because a lot of times in repair, then there's all these invisible things you don't think about like the interfacing, having material or even just taking a thread for repairing. A lot of times it's cotton thread or cotton polyesters, so it's also not from waste. We're thinking about all these systems that we currently are using already for repairing patches. If they were made from virgin materials, or a lot of times they're not stretchy, for example, as well. You have a jersey or something like that that you need to reinforce. Thinking about all these different practices we already have.

Sometimes the consideration, yes, it's better, it's sustainable, because it's repairing, but I'm used to this use of solvents and different aspects in these processes. They're sometimes a little bit less visible in the system because they haven't been thought

about. I think in one thing that came up, which was about how interfacing is very direct because everyone knows how to just iron it down.

A 3D printer in this context was a bit more complex in terms of thinking of how you might need to know how to program it and things like this. I think with a needle puncher if it's about that felting potential of a circular loop that you have, it's almost like a little printer that can needle punch your materials together. I don't know what are your thoughts in terms of the accessibility of the technology as well in the context of, like you have questions in terms of understanding the process, in terms of where we are now in establishing it.

[00:30:13] I: Maybe you could be offered a service where you get registered to a tailor and get a repair. A service that reduces the time but brings about a similar repair outcome. It reduces the cost of the repair and therefore improves the lifecycle of the garment or the use cycle of the garment.

[00:30:37] K: At the same time, I'm curious how hard it is or easy it is to set up the machine because each garment, each repair will have a different requirement. How difficult is it to change the fibers, change the design, reprogram it?

[00:30:53] K: The machine itself, so we're actually building a machine at the moment at Manchester. We haven't personally seen it in person. Essentially, changing the fibre wouldn't be a problem because you put it in at the bottom between two panels. You could literally take atop and it's almost the same action as putting it out underneath the sewing machine. It's like one thing.

I think changing the needle is a little bit more time consuming, but potentially not. A half a day job. I think about setting up a loom for warps and wefts and it's probably that same kind of time commitment.

[00:31:32] Moderator MR: I think it's really important input as well because, thinking from you as a designer, you would want to be able to change this. It's almost thinking because there's this opportunity of a machine is being built and then almost the design input being, "Okay. Well, it needs to be having an interface or some aspect that would enable you to change this as well."

This is something we really want to integrate, not everything can be even prototyped because this is already a challenge of building a machine that does the needle punching. Thinking about also recommendations for how the technology should be working in order to enable the repair, and the practice students will take this. I think it's important.

[00:32:15] Speaker 1: Thank you.

[00:32:16] Moderator MR: Okay?

[00:32:17] moderator RM: Yes.

[00:32:17] Moderator MR: Wondering if we should go into a little break.

[00:32:19] moderator RM: Yes.

[00:32:20] Moderator MR: And then we continue.

[00:32:23] [END OF AUDIO]

Study 2.2

[00:00:00] Moderator MR: Enable them to make it connect with a general consumer person that might not know where it goes.

[00:00:09] Moderator RM: It might be a nice place to start by choosing one of the things that have been illustrated and seeing where that would fit in the location-wise.

[00:00:16] Moderator MR: Yes. Exactly.

[00:00:17] Moderator MR: Maybe an easy one to start with, just to get the ball rolling, is the three sections of brown bags. Sorry, I can't read. I've got my glasses on. The drawing.

[00:00:26] Moderator MR: We will probably finish up recording. Prepare **[unintelligible 00:00:29]** why would you want to drop in or something to **[unintelligible 00:00:35]** might need to be **[unintelligible 00:00:36]**.

[00:00:41] H: [unintelligible 00:00:41] if you grow anything it must be in a lab, in a specific environment.

[00:00:51] moderator RM: Maybe that's a part of the system that is added, this repair lab or something that is..

[00:01:01] H: It's like a repair lab, but as you mentioned, that we could also work with a tailor, maybe AI to help people visualise how it would look like because you could grow and we can work with nature, and try to control it, but we never know. Maybe AI could help to maybe propose a different visualisation of how it could look and then the customer also has to be open. It could look like a position A, B, C, or D. Then at the end, you have the surprise effect not on your, it's like you're buying completely new products but you don't know exactly what.

[00:01:51] Moderator RM: What it's going to take. Where would you see that in the system being in terms of a location? They sit in a hub, don't they? It's [crosstalk].

[00:02:03] H: Yes. I was thinking that but then if we are still thinking about luxury products, do you think luxury clients will go there?

[00:02:16] Moderator RM: Interesting.

[00:02:17] H: Should maybe luxury brands have partnerships with apps? Then you leave it at the (redacted) boutique, and then become clients, I can't picture them going to that kind of places.

[00:02:39] Moderator MR: Because I feel like it's such an experience as well that if you go to luxury brands stores **[unintelligible 00:02:44]** I'm just wondering. I don't

know if you could do the repair lab as a separate. Sometimes you have robotic arms in a glass box so you can see what's happening, but you're not there because of safety. Do you think it might work as a section of a store or do think it would be separate? There's a shopping culture exists almost [crosstalk] As a **[unintelligible 00:03:25]** so that probably then let **[unintelligible 00:03:29]** the consumers **[unintelligible 00:03:31]** over there **[unintelligible 00:03:33]** store.

[00:03:36] Interviewee 3: To the store. Yes.

[00:03:37] Moderator RM: I wonder if the linking thing, going back to what you're saying about the AI, whether that's something that happens at home. It's like a personalised thing and then they get to see the options and what's possible and then they're more likely to be drawn into coming into the store to get that option done. Right? It's almost like linking that from what you're saying, luxury people that consume luxury items aren't willing to come in and do it. Maybe that's the incentive, the AI pulls people in to do that with them. Something that we know through our other research done within the centre is that if people have an experience of repairing their garments, then they're more likely to hold onto it. We want to try and encourage them to do that as much as possible. Maybe that's the way you can do it.

[00:04:29] H: You could create an app and **[unintelligible 00:04:33]** with the robotic pick-the-spray technique. Then you have resolution if you want to grow mycelium. Then because sometimes also clients, they don't have the idea or they don't know how it could look like, so maybe through the color. Really had them to visualise and make them feel like they're part of it, they chose it.

[00:05:10] Moderator RM: You get that with makeup brands, don't you? Where you give a scan of your face and they say what shade of foundation you are or something. I think there's a lot at the moment going around about people's color analysis and what clothing you're meant to wear in terms of that. I wonder if there's an AI.

[00:05:29] Moderator MR: [unintelligible 00:05:29]

[00:05:30] moderator RM: Yes. Exactly. What kind of cut. I know that there's AI that says color analysis, but then you could say, well we can spray dye this the exact color depending on your season that you are. It's just a silly thing, but it's quite poppy thing at the moment that people are doing. That's one. What's nice about the location-wise for the bottom left one is that it happens over time. The location, it's null and void, right? It's happening in time.

[00:06:09] Moderator MR: I'm wondering as well, so one perspective is the brand, so it's in store, we come back to AI-enabled to do that. I'm wondering for example, if it's from your startup perspective as well, so if you wanted to, what would help you make that possible? Would you want to collaborate with someone that might have that tool so you don't need to do it yourself?

[00:06:39] H: Yes, because I think as a startup, that kind of tool might be too expensive.

[00:06:49] Moderator MR: Would it be a centralised tool that you can access?

[00:06:53] H: Yes, like collaborations. We could collaborate with many different start-ups because I don't know, if I'm a startup selling accessories, I could collaborate with the start-up making clothes, another one making sneakers. Then you fund together one, two, and then you offer all together. It's becoming the new normal to have as a start-up, you also have a service to repair what you're selling.

[00:07:28] Moderator RM: It's like using the whole idea of how manufacturing- they'll be selling the same type of material to five different types of brands. Right? Maybe that's the pull for the repair is that you have a place that has the robotic arm, the needle puncture, they have these technologies for the repairing, and that brands could come in and say, okay, we need this type of repair.

[00:07:56] Moderator MR: That'd be really nice. It's the robotic arm and then just be like, I need this repair. I will give you the cloth. **[inaudible 00:08:05]** It's done, it's a service that you can do with a startup, and then another startup you can use the different material using the same, like a printing service, but not printing. robotics. It could be very nice. Would you go there or would you send the product there or would the consumer go there and just **[unintelligible 00:08:33]**?

[00:08:36] H: I think I will send it there.

[00:08:38] Moderator MR: You send.

[00:08:38] Moderator RM: Send it. There needs to be almost iterations, right? It's like showing the consumer what's happening is almost the most exciting part, right? They see a robotic arm repairing their material, they're more likely to be invested in that process and like, "Wow, great. I can't believe that happens." I don't know if it's almost like an exhibition piece thing to begin with where people come in and they say, "Oh." This is the robotic arm. This is what it does, this is the type of thing that we can do, we can do that with your material." They go, "Yes, wow. We'll send it off and get it done." Then it comes back to the same place. I don't know, someone seems to be-

[00:09:23] Speaker 3: It was **[unintelligible 00:09:24]** at some point, a sustainability corner where they had **[unintelligible 00:09:29]** 3D printer, you could go and see what was made.

[00:09:36] Moderator MR: Maybe. Before it was gone for repair?

[00:09:41] Speaker 3: No. It was not for repair but it's the idea, you go there and you see something that is done there and still in a luxury environment **[unintelligible 00:09:51]**.

[silence]

[00:10:00] H: I would maybe share with the client the idea behind it, but I will not show too much. Because when it's a bit mysterious, then they want it. I would be transparent about it, we could spray it, we could create a 3D printing on it. Maybe I would exhibit it in a shop for a while but then it's the mysterious robot that is hidden from everyone. You don't know what is cooking but then create something new. I think I'm more into the business. Yes, thinking of it, but each time you don't have access to something,

the customer wants it more or when you don't know what's going on, you really want it or you want to try.

[00:11:18] Moderator MR: It makes me think, I love the words mystery and mysterious. [chuckles] It's really great. It also makes me think a little bit about how you assign luxury. A lot of times, it's made in Italy and made in France. You really associate with elements in French and supply chains are usually more Europe-based as well, which is almost like this craftsmanship and tradition of techniques. It makes me think, you have this mystery, but it's in a specific location [crosstalk] connected to being super high-tech. Maybe inside Google or something specific. I was just trying to think-

[00:12:04] H: Yes, it's true.

[00:12:04] Moderator MR: -from some aspect.

[00:12:07] Moderator RM: I see how radical innovation, where you have someone completely not connected to the textile industry creating this repair situation. Like you say, going into Google or going into a tech company to be like, "Oh, well, we can combine these technologies," and where that would be. Also we want to make sure that all types of people have access to this kind of technology. When it comes to marketing and branding, it's difficult, isn't it? Obviously, we talk about it all trickling down from the top and coming through and we want it to be an accessible thing. That's why we've created the SPN.

[00:13:00] H: How could we sell it? Is it a subscription? Is it like you buy your products? Is it part of the price you pay for the product or do you pay a subscription and then every month you can bring three items to repair it? How could it work?

[00:13:27] Speaker 3: Something like a **[unintelligible 00:13:29]** but for bags.

[00:13:35] Moderator RM: I'm wondering if, going back to the collaboration, to make these concepts happen, what people need to be in the room talking to each other? I think often we lead with consumers making the decisions, but then we need brands to cooperate with technical stuff, science, technologies. They need to be talking and where that would be. Who else needs to be involved in thinking like your bio-coating? Do you need a scientist that does that? A designer that knows where to put it on the material? Do brands need to exchange knowledge of how they want their materials to be cared for?

[00:14:31] Moderator MR: It really sounds like a really nice connection with brands, startups, and tech companies in some way. There's a lot of tech potential in terms of the app and the history and in terms of the design.

[00:14:50] Moderator RM: Design as well.

[00:14:58] Moderator MR: We have most of these parts. A little bit of what's here, but again, in terms of also the steps of the use case, even thinking, an example of it's someone you know that doesn't know where to repair it and they send it in and it gets packed and printed. It's just one example, but it could be the different steps of the use case of a specific bag or a shirt or something like this. Specifically connected to a material or a garment or a tool and different roles as well. **[inaudible 00:15:38]** I feel

like there's also a change in the role of what you would do as well because there's a lot of hats that you are. You are a start-up [crosstalk] material development, business development.

[00:15:58] H: Everything.

[00:15:58] Moderator MR: Everything. The marketing. [chuckles] Everything. It's thinking about changes, the roles. Does it change the role of the brand especially now, actually, the brand as well? Change the role from the brand of selling to maybe, enabling this heritage and long life of products as well. There's lots of different things. I don't know if you want this. If you want a specific scenario to draw it out, but we have quite a lot here as well. I feel like there's a lot of changes in the use of the product and the role and the places. I'm just going to hand over **[inaudible 00:16:44]**.

[00:16:46] Moderator RM: I really like your idea of the use changing the heritage of a brand. It's like, "Oh, we're going to keep hold of this," and that is what changes the heritage, is the material lasting longer. That for me really resonates with that bottom left one of this idea of how do we build that heritage again, of materials.

[00:17:12] Moderator MR: Yes.

[00:17:13] Moderator RM: The idea, again, going all the way back to what we were talking about, leather wearing. I'm wondering if there's a part of your bio-coating that when it wears, it displays a different texture or it has a different property to it over time that becomes desirable. I think that's a really nice way to build that heritage for brands, especially luxury brands if they want that.

[00:17:46] Moderator MR: It's also connected to a product sometimes. Thinking about the [redacted luxury brand] bag, it's an example of a heritage item that really increases value if it's a very long time. It's a really good **[unintelligible 00:18:02]** design. I was thinking about replicating the idea of the heritage in online **[unintelligible 00:18:10]** with the service of– can I say the service? I don't know.

[00:18:18] Moderator RM: Yes.

[00:18:19] H: Yes, it's a service.

[00:18:24] Moderator MR: [unintelligible 00:18:24] if you want to fill it in as an example.

[00:18:42] Moderator RM: I like the idea of showing this interest. It needs to be used.

[00:19:01] Moderator MR: I'm wondering if there was a final step of this run-through **[unintelligible 00:19:06]**. I was just thinking about this mystery and the heritage in Hermès Birkin bag right now.

[00:19:11] Moderator RM: That's great.

[00:19:13] Moderator MR: Thinking about if that's a use case of recreating that with a robotic arm.

[00:19:23] Moderator RM: Heritage and technology. That combined process.

[00:19:26] Moderator MR: Yes, because we have so many ideas right now in this room. Lots of what's happening. I was just wondering if we wanted to simplify it to step 1, 2, 3, what would be your starting point? This is the bag, shirt, or any product. You go through these three steps to add that value. This heritage online mystery. It's high-tech because there are so many things that I was thinking. It's a challenge.

[00:20:04] Moderator RM: It is.

[00:20:05] Moderator MR: To think of what to think through.

[00:20:07] Moderator RM: I suppose it's adding something back in there as innately responsive to that brand is probably something that would build that. I'm wondering if it's something that is added into even just an actual heritage piece that is worn and torn or whatever, but maybe by adding in the technology you are preparing it but also adding in an element of that technology. Whether it's the biomaterial and then it's like heritage and new. This hybrid of material and newness that also- I don't know. Hybrid bags, I don't know. It doesn't have to be a bag.

[00:21:04] H: Yes. **[unintelligible 00:21:05]** when you mentioned robotic and heritage, for me-

[00:21:12] Moderator RM: This reaction.

[00:21:14] H: Everyday, just **[unintelligible 00:21:15]** or is it our heritage from our generation?

[00:21:25] Moderator RM: Yes, what is the new generation's heritage?

[00:21:27] H: Yes, right. The definition of heritage.

[00:21:34] Moderator RM: What's that going to build into with all of this new technology?

[00:21:39] Moderator MR: I was already going into a whole different direction on this thing about heritage, family. **[inaudible 00:21:49]** and then thinking in our robotic we already had this. Some family **[unintelligible 00:21:53]** or something like this. I was just going to power of **[unintelligible 00:22:00]**. It's an interesting narrative, it's strong.

[00:22:08] Moderator RM: Like a biomaterial put onto a heritage item. No, maybe not.

[00:22:13] Moderator MR: I don't know **[unintelligible 00:22:14]** there's just something like an heirloom with a robotic.

[00:22:22] Moderator RM: First ever. Like family crests added in.

[00:22:32] Moderator MR: Yes.

[00:22:33] moderator RM: Does it have family crests anymore?

[00:22:36] Moderator MR: Does it have any what?

[00:22:37] Moderator RM: Crest. It's a Scottish thing. We've got a family crest. That makes your family fancy but it's not, it's just very Scottish.

[00:22:45] Moderator MR: Okay.

[00:22:49] Moderator RM: Cool.

[00:22:51] Moderator MR: [unintelligible 00:22:51]

[00:22:52] Moderator RM: Yes, just do this. ID8.

[00:22:55] Moderator MR: Yes.

[pause 00:22:57]

[00:23:08] Moderator RM: I feel like that's a great brand name, Modern Heritage.

[00:23:11] Moderator MR: True.

[00:23:14] Moderator RM: Repairing your loved items. [silence]

[00:23:30] [END OF AUDIO]

Study 3.2

[00:00:00] K: Done essentially or have a patch added while you wait kind of thing. Like if you come back in an hour, rather than spending 14 hours darning your socks because that's just not available to everyone, that time -that amount of time. Also, it requires a skill set, a fairly crude skill set, but it's still a skill set.

[00:00:27] Moderator RM: Do you feel the needle puncher would allow for more time in the system? It gives the value that's added from the needle puncher is a time thing potentially?

[00:00:37] K: No, I think it solves a problem for people who don't have time to repair things, so they just get rid of them. I think it also bypasses- I don't know if this is an advantage, but you need to learn the skills yourself to do these things. That could go in either direction. It's reinforcing a problem by undermining the need to learn those skills. It also sits within a system where people expect things to happen quickly. Otherwise, they're not interested generally, especially if it's something with a hole. I think it could have value in that regard.

[00:01:17] Moderator RM: You've touched on it a little bit as well, but within that idea, is there an interaction that happens between people? Is there a co-operation that needs to happen between that?

[00:01:29] K: I guess the user of the garment needs to identify the problem that this could be the solution, then take it to a retailer who offers this as a service. My feeling

is that it would work best as a free service. Almost an experimental service that cascades a value system throughout society rather than something you pay for because I don't imagine that the cost would be relative to the real cost of buying the machinery, installing it, customising it, training someone to use it, all of these things. I think that cost might act as a barrier for the person bringing the item in.

[00:02:22] Moderator MR: It would need to be the cost if the end cost **[unintelligible 00:02:25]** subsidised you must do the repair?

[00:02:29] K: Yes.

[00:02:30] Moderator MR: [unintelligible 00:02:31] time for dining on the train and I was thinking, "Can we have a machine on the train?"

[laughter]

[00:02:38] K: Once everyone takes their old socks off.

[laughter]

[00:02:44] Moderator RM: You know what I was thinking as well is that just in terms of these different systems that we see or different acting systems, I wonder if there's a needle puncher that sits in the Gather SPN station. What I was thinking is that because we have this third section of materials that are going to go to the landfill recycling, maybe that the Gather station has a needle puncher to actually divert those materials from going there and actually add a second loop of life into them to create these concepts. Maybe it's that it sits in Gather. Maybe that's another idea.

[00:03:21] I: Following on from the train idea, I don't know if you're aware of Kate Fletcher's haberdash emergency-

[00:03:27] Moderator RM: Oh yes.

[00:03:27] I: -project? It's a repair station. It's a conceptual project, but it sits in a dry cleaners. Do you know it?

[00:03:37] J: The laundromat, yes.

[00:03:38] I: Yes. While people are waiting for that service, they're actually using their time to solve a problem and I guess maybe upskill, but engage with their garments in a different way so that time then becomes active time rather than passive time.

[00:03:54] Moderator RM: Oh, I love that active time. Upskill and active time.

[00:04:00] Moderator MR: They would learn too in a haberdashery **[unintelligible 00:04:02]**?

[00:04:03] I: I don't know too much about it. I don't even know if there's that- I didn't find a huge amount of information on it, but it's like a repair station that sits in a dry cleaners in Huddersfield or somewhere similar.

[00:04:16] Moderator RM: I think she does an on-the-road one as well. It's like an iteration. It's like a haberdashery on wheels [crosstalk] visiting different places.

[00:04:29] K: It could be looking at experiences.

[00:04:32] Moderator RM: Yes, street food but for repair.

[00:04:35] Moderator MR: Street repair.

[00:04:36] Moderator RM: Street repair, yes.

[00:04:38] K: Looking at scenarios and services that are available where there's a time component that's not necessarily- engaging with that process that could be used in a different way like a train journey, I suppose.

[00:05:01] Moderator RM: Feel free to add anything on this map. I've been capturing but quite largely capturing.

[00:05:11] I: I think this will definitely fit in the design group as well because we're talking about reinforcing seams, using it as a design element, and using it as part of the construction. I find it difficult right now to see small designers having this. It seems like a big piece of machinery to fit into small studios.

[00:05:40] Moderator RM: Actually, the machines, it could be this big. Am I right?

[00:05:46] Moderator MR: It's the desktop size-

[00:05:48] Moderator RM: A desktop size?

[00:05:48] Moderator MR: -I guess. Yes, but I think-

[00:05:51] Moderator RM: The scale is a thing. It's a piece of machinery that is-

[00:05:57] Moderator MR: Yes. I think the question- I'm wondering the design, is it something you might want to have like something that more designers can share, or would it be something you would want in your own studio if it was not the size- if it was a box size or printer size, would you want it there or would you think it would be something maybe centralized where more designers can have access to it? Like a print studio sometimes.

[00:06:24] K: I guess that would depend on the cost as well, if it's feasible for one designer to have it. If it is, I imagine at the early stages, more expensive, then it would make sense to have a shared machine, shared space.

[00:06:38] Moderator RM: A shared space that would work like a hub where people could come and repair and it has all of these technologies depending on use. I had an idea of maybe just a potential different use case and adding to this board of- You know how small brands might potentially have- going back to our idea about it not being something that small brands could use. They have these stamps that have their trademark on, and I wonder if there's a textile version, thinking of the scale of the machine. If it's scaled down and it's specifically made into- adding onto the logo and

then you stamp the needle punch felting into the garment. Just the scale of it is taken down-

[00:07:25] I: The branding.

[00:07:26] Moderator RM: Branded, yes. I feel very bad drawing a stamp with needle punching onto a material, but it could be that it needle-felts brand onto, like we're saying, but the scale is taken down. **[unintelligible 00:07:37]** stamp on it.

[00:07:39] Moderator MR: Yes, like a smaller tool that you could have depending on what the purpose is. Cost was a question. If cost was not an issue, you would keep it in your studio and then you need to experiment with that.

[00:07:59] I: I work from home so space is an issue. If it was the size of a sewing machine, it would be a lot more viable.

[00:08:17] Moderator MR: It could be like a stem or something like a small box size for the home, and if it's bigger, then it would be somewhere where you could have access to other services. I think a laundromat is a really good example because that's a place where people would automatically sometimes go. For example, like a dry cleaners where it has a repair service or alteration service. That's something that is also quite distributed. You can find it locally in your neighborhood. You don't need to commute somewhere to get that done. That's another thing that came up a lot before **[unintelligible 00:08:53]**.

[00:08:54] Moderator RM: I just added it on here as well as the idea of the hub being on wheels, the haberdashery. Because we mentioned in one of the last studies was someone- Sorry, I sat behind you and talking over your shoulder. That someone was saying about how if she's busy with her children, she doesn't have time to pop into town, is there a service that comes to her and does?

With the hub on wheels, potentially it's something that moves around from place to place allowing people that don't have access to a high street to be involved in that process as well, of a process of repair. Because I'm thinking of people that wouldn't engage more so with repair or reinforcement or these ideas are probably people that aren't time- What's the phrase?

[00:09:41] K: Time-poor?

[00:09:41] Moderator MR: Time-poor.

[00:09:42] Moderator RM: Time-poor, yes. Time luxury. That was the exact opposite. We all look to have time luxury.

[00:09:52] Moderator MR: I think it goes back to what you were saying initially about this. It's in the store and people drop it off and they don't need to think where it is as well in the time. They come back after an hour, and we can get it. It's just this immediate knowing where to go as well if they purchase an item potentially, so that's another option.

[00:10:13] K: I think it'd be quite a novel way to raise the profile of repairing garments because it's an innovation in repair that's not rooted in history that appeals to people

who want new things and want to keep up with the changing of trends and technology. I don't know, I think it might appeal to that demographic of people who feel like they're adding value to their garment.

[00:10:47] Moderator MR: With new **[inaudible 00:10:47]** technology.

[00:10:50] K: Yes. Then they might think about repairing the items they already own beyond that. Perhaps it might cascade to other processes or techniques.

[00:11:03] Moderator MR: It makes me think of an Apple store for repair, and just thinking about people that- It's clear because it's always busy and I'm always wondering why it's always full of people that almost go to interact with the technology or understand the new technology. I'm thinking would that be some kind of raising a profile **[unintelligible 00:11:26]** repair?

[00:11:29] I: Having a store you mean?

[00:11:31] Moderator MR: Yes.

[00:11:34] I: We talked a lot about repair hubs this morning, but I think they speak to people who are already part of that conversation. I don't know that they necessarily bring in a huge number of people beyond that group that already engage with those kinds of things. I feel this might engage with a different type of person perhaps.

[00:11:58] Moderator RM: Yes, definitely. To add to that point, we have another participant who discussed about how their partner went into the store, and they were offering a repair service, and they got really excited, but that wasn't necessarily something that they ever engaged with before. I think you're right, having a shop front with these technologies, doing these things, is a bit like the Apple store where you go in and you take selfies with a new iPhone or whatever, it's **[unintelligible 00:12:22]** people love to do. You come in and you get to interact somehow with that technology, even if it's in a small way, and you still feel like there's an autonomy there **[unintelligible 00:12:34].**

I mentioned briefly on our old ground, but that we find from other studies within the **[unintelligible 00:12:41]** is that if consumers have a relationship with the mending process or the actual process of repair, they're more likely to hold onto the material because the value that they've added in is their time and their process. We try to encourage people to be a part of the process as much as possible because then they're more likely to hold onto that material. If it's like a drop-off service that someone comes in and just does it for you, that has less value to them because they haven't spent that time on it.

It's almost like this idea of being time **[unintelligible 00:13:14]**, and you value that time a bit more. Those socks that you've created, I doubt that you'd be throwing those away any time soon because you invested that amount of time and there's a point at the time, but it's a process **[unintelligible 00:13:30]** practice. I wonder if that facilitates that, even if it's a small interaction with it, they go, "Wow, I've had that interaction with that technology material."

I suppose to move the conversation towards the idea of cooperation and linking different factors in the system, is there anything that is a barrier to you seeing this being produced? If we created this pop-up **[unintelligible 00:14:02]** on the train or wherever it is, are there any barriers that you see turning up for that in terms of communication or collaboration between different actors in the system?

[00:14:16] K: My first thought is just how to properly and accurately explain the process to customers because this is my first time hearing about it and I think I have a grasp, but I'd like to see it in action to see examples and samples. I guess communicating that to the customer so that they can start to come up with ideas of how they want to repair their clothes and customise it so that, like you said, have a connection to the process of repairing.

[00:14:41] Moderator RM: Yes. Knowledge exchange and- yes.

[00:14:44] I: I think it feels quite speculative. I hear you say one's being built, but I can't see how it becomes commercial. I think partly because for it to have any value, it would have to be scalable. I think the barriers are maybe people embracing it within their existing business models, communicating it in a way that people understand so that they feel they want to engage with it. Then also it relies on a person with a garment that has a hole in or a stain on identifying that and the willingness to then do something about it rather- behavior change. Thinking actually, "Here's a solution to a problem."

I think it is also funding. I think people might pay for it, but I don't think people are going to pay much to have a hole stitched up in a garment or a hole repaired through this process. I don't know how that feeds in.

[00:15:48] Moderator RM: [inaudible 00:15:48] from what you're saying, we had an idea the other day about the communication between what these technologies could be doing, and I've seen **[unintelligible 00:15:56]** action a way that we could mitigate that is by creating a line of material processes that it can create. If you [crosstalk] wanted to trust someone with your garment, you say, "Okay, this is what it can't do. Actually, this is what it can do." You know, it has different levels of **[unintelligible 00:16:13]** creating this. Invisible repair, **[inaudible 00:16:16]** you know, all those kinds of things, do you think that would benefit the consumer? Would that give them that communication and that knowledge **[unintelligible 00:16:25]** being like a physical library?

[00:16:27] Moderator MR: Yes, I think so.

[00:16:28] K: I think collaboration with a known brand as well could be a way to get to their customers and apply it to products that they're already familiar with.

[00:16:39] Moderator RM: You feel like brands have this almost- Oh, sorry, **[inaudible 00:16:44]**. They have this almost- People look up to them, so if they see a brand that they know doing these things, they're more likely to engage with it potentially. Is that what you're saying?

[00:16:55] K: Yes, just for example, like [large sportswear brand], they have cutting-edge technology, and I think- or any sports brand, but customers will look up to them. They have the newest technology in their shoes or their clothing. If this is aligned with

that, it's a way to get to customers, I think. Again, aligning it with a high-tech solution as opposed to something that's more traditional.

[00:17:30] I: I guess then the brands become change agents that disseminate any knowledge about future technologies to people who don't necessarily engage with these technologies in their day to day lives.

[00:17:43] Moderator RM: Yes. They become the knowledge platform, right?

[00:17:46] I: Yes.

[00:17:47] Moderator RM: I wonder if there's something that happens within the brand that gives them- Because they already have the power to be a knowledge platform. It's just the empowerment to do that. **[inaudible 00:17:58]** I really love that idea of giving the brand an elevated- Because I think brands have so much influence over [crosstalk] consumers and they don't necessarily- or maybe they do understand that they- [laughs] they do understand that. It's getting them to know that they have a responsibility to share that and engage with consumers.

[00:18:27] Moderator MR: I'm wondering, just going back to what we were discussing earlier about the simple design strategies that would be at play here. We talked a little bit there a lot and reinforcement. I'm wondering if now, if we think about that system in terms of this as a brand being a change agent, introducing repair for all different approaches for this technology, what approaches would you want consumers that usually don't understand repair, for example, to understand or to adopt? Is it repair? Is it more than that? Is it about washing care or is it because that came out today?

Is it about reinforcing? Is it about new properties of materials as a specific customisation? Because I think sometimes the repair can be customisation. It doesn't necessarily- it can be both. Are there specific key strategies that you think are most important in this? You were talking about water use. We use different fibers. I'm just wondering if there's something immediate that comes to mind that you think is more important here.

[00:19:42] K: I think customisation is one of the factors that builds emotional durability. It's a known indicator of building relational value with a garment or an item, having some involvement in its design or customisation. I don't know whether that's an academic concept that actually carries through into reality. I'm not sure. I know that if someone gives you a pair of socks made of cashmere, someone in your family, you're probably more likely to darn them than if they're a pair of nylon sports socks. I don't know if I had a little patch sewn on them, if that would mean I held onto them for longer.

[00:20:28] Moderator RM: You've done it yourself.

[00:20:29] I: But that was an investment of my time. The added value , as you were saying, was my time, on top of the existing sentimental value and the value of the materials. I don't know if it's one of those constructs that carries through in the way that it's expected.

[00:20:52] Participant 5: I think it has the potential to be its own brand. Have you seen the childrenswear? They have a **[unintelligible 00:20:58]** that when the kid grows up, they can **[unintelligible 00:21:01]** it?

[00:21:02] I: Oh, Petite something.

[00:21:02] Participant 5: Yes, that one. This one can be something like that, that you buy a **[unintelligible 00:21:08]** of garment for your kid when they're born. You can keep coming back to the store to tailor. You customise it for your kid. You have a **[unintelligible 00:21:16]** of your kid growing up with the family as well.

[00:21:21] Moderator RM: We often talk about the idea of shifting the value of the material. The value almost builds as it gets older. You bring it back, then we'll create something new or upcycle it or we'll add more value into it. It's a whole system change and a thinking process that has to shift for that to be able to be viable, but what we know is that people get excited by those concepts.

Like you were saying, having a system where you can bring back a material and say it's almost a lifetime guarantee, and we'll fix it for you. It's like a dishwasher or something. You almost get a lifetime guarantee with the material, and you get the options to upcycle it and customize it as it gets older.

[00:22:08] Participant 5: It's like you buy a cloth, maybe a bit more expensive than the market price, and then you come back and you pay cheaper just to tailor it to fit your kid. I think it's quite a nice idea because you still use the same material. You don't need to buy new clothes.

[00:22:25] Moderator MR: I think you change **[unintelligible 00:22:26]**.

[00:22:26] Moderator RM: I really like the idea of these almost marketing sustainability things. We're talking about whether- You know a Rolex. You have to sign, you have to be on a waiting list to get the next thing, and you can only get the next iteration of Rolex when you have the first. I wonder if there's a way that you almost get a square needle punched in, that every time that you've had it repaired- Then it builds up into this piece of artwork, and that value again grows with time and you only get that value the longer you hold on to that material. I wonder if there's a concept around that, but **[unintelligible 00:23:09]**.

[00:23:12] Moderator MR: Like a subscription service where you get points.

[00:23:17] Moderator RM: Yes. A coffee stamp. You wear that badge with pride.

[00:23:26] K: I think the narrative is shifting around repair because of the visible repair trend. For example, I have a jumper and I've made eyelets. It had a lot of moth holes in. I actually bought it like that from a charity shop because I wanted to practice that kind of stitch and engage with that process. I've never worn it out of the house. It feels like a jumper I only wear at home and I embrace this fully. If I was to wear it to an interview, for example, even with an organisation who promotes these values, there are social norms that still exist about what being smart looks like, I think.

[00:24:15] Moderator RM: Yes, you are right. Coming back to the brands, they have the power to change those social norms potentially. Maybe it's other actors in the system that have the power to change those social norms. Maybe there's a link in thinking about cooperation to change a social norm. Who do you think needs to be involved in that conversation?

[00:24:39] K: Is that question for me?

[laughter]

[00:24:45] Moderator RM: You don't have to answer.

[00:24:45] K: No, it's changing a system often, isn't it, that the norm sits within. I think people attribute their monetary status to their clothes. There's an alignment. I think I'd be more impressed if I interviewed someone who is wearing a really beautifully darned jumper than I would if someone turned up in a really crisp white shirt that they could have bought from anywhere without any level of skill or engagement that went into bringing that product to the state it was currently in.

That's also because I exist within these circles. I don't really know the answer. I guess it's risky attributing too much power to big brands because they can change the narrative in directions that don't necessarily benefit the greater good of society or the environment. I think they have a platform to communicate from and the power to influence behaviors, but that's also giving them the power to do something else with that.

[00:25:59] RM Once the trend is over, they're onto the next thing.

[00:26:03] K: Yes. I think one potential way around it is normalizing re-commerce at a young age so people grow up with garments that weren't new to them. That destigmatizes wearing second hand garments from an early age. It's not a value you then perpetrate throughout your life or pass on to anyone or expect of anyone. The reality of that is things will be worn out potentially in some ways, and they may have been repaired or altered to fit you. I think we just have to acknowledge that as part of a future reality.

[00:26:53] Moderator MR: That's such a beautiful ending to this conversation. I'm just thinking about preparing. I feel like we gathered a lot of different ideas, but we're also now in terms of thinking where it's taking place. I feel like that was a really nice system we designed about thinking about the brand. How do you make it accessible to people that don't care about repair, do not know repair, don't have the **[inaudible 00:27:26]** of making this more acceptable as well? Like you were saying about the interview, it trickles through and **[unintelligible 00:27:38]** through.

Then there's also opportunities for these very local hubs to repair, and then people just buy more into these existing systems. To conclude, they have these cards. I don't know what they are. Blank cards, the use cases.

[00:27:57] Moderator MR: We have these cards, which are like you see in the catalogue, different use cases and three different steps and also the back of a material. A lot of these were already illustrated by Amber beautifully. Then thinking in terms of

[inaudible 00:28:15] that you wanted to focus on, like you were saying **[unintelligible 00:28:19]** all the time. For example, you're starting from where you were at the beginning. You have a specific product, or material, or garment, or element that needs repair. Then, based on this, can be a brand or can be a different aspect that you want to highlight from today is creating your own personal use case as well based on your practice, your brand, or as a consumer as you wish the perspective can be in both.

Thinking about, so this goes **[unintelligible 00:28:56]** is the garment that you have or the product or specific material. Doesn't matter if **[unintelligible 00:29:02]** that you want to make or the room dividers. Lots of different creative ideas. Then from that, if you had this needle puncher, how would you use it? What's a use case scenario within that? I think lots of ideas **[unintelligible 00:29:18].** It's a little summary, your personal use case.

Then on the back, if you wanted to know very quickly about this material or the location. Is it the brand? Is it the studio? Is it home? Is it the collaboration? **[unintelligible 00:29:35]** It can be just one. It can be really short. It can be a word. It can be a keyword. Doesn't need to be a full sentence or a story. It's just what's in terms of the-

[00:29:49] [END OF AUDIO]

Study 4

M: First polyester. So I think for me the most challenging is how do I extend the life of those materials and add a value to it. Isn't that sort of like a blockchain? And then possibilities, knowing where the material is coming from, and thenAnd then to reuse it efficiently. So then it becomes obvious for longer use. And I think that's where my struggle is within my practice. So I've been looking at different options to do that. But. Either. Obviously looking at bio materials and like. Extending that with weight processing and including different polymers That would be integrated to the polymers so then it can actually be a blended material. So I've been looking and researching different kinds of weight processing, and then bio materials that can be included into it so agar based blended material. So a lot of times it blended with cotton. And then you just don't know how to obviously extend that because there are two different components within that. So I think that for me is a bit of a struggle already. So I try. I mean, there are two parts of my practice which are obviously focused on researching, and then bio innovation and textile. And then there is the other part which is upcycling, and it's always sort of like, look at those two components. And then two parts of my businesses, and then trying to find the middle ground to extend the life of those materials.

RM: So would you say that blended materials are harder to repair?

M: Yes absolutely within my practice, for sure. Cause you kind of want to.
But use them. But also you want to add value to the material. And then, so it's, it's not just looking at it and be like, okay, well, I can't use this polyester anymore, because it's already there. So within my practice and upcycling. It's just finding the balance within that, and then

finding a way to make it. To make it usable, really because it's the material. This is already there.

N: Yeah. And a lot of people. I mean, there's just such an abundance of awful fabric, isn't there? Because of like (fast fashion company), you know there's just so much, even going to kind of source things. To upcycle by using either charity shops, flea markets, it's actually, really, really scary how much rubbish. And I just think, sometimes I look at stuff. And why did someone even design that? You know what like?

O: But then design thousands and thousands, exactly.

N: But at the same time, it's something that they can go to. Well, that stuff is here. We need to do something with it, because that stuff can't go into landfill. So what I'm trying to work on with this kind of next 6 months, where I've said I've got all these projects. I've got things that are maybe like really cool looking material. But I wouldn't want it next to my skin cause there's also a lot coming up about actually the chemicals that are used in it.
That it's not good actually, seeping into our bodies as we heat up this thing. You know, we don't really know. It's still quite small research, but. And there is that fear so? I'm trying to think of ways that I can. Use the cr*** clothing and not turning in clothing, but turning it into practical things that can be used every day. That then. Still the crap iron, but reinforcing it or making it useful, so that you can actually, you know whether it's a bag or an apron, or whatever it is, but something that's practical, so that it gets used and that. It still looks quite nice, because of some of the textures, the colors, the actual look of the fabric. It's quite good. You just don't want to wear it.

RM: Or, as you say, it needs to be double layered so inside that you'd have close to your skin. So whether you're an option, that kind of creates an internal scale again.
That would be amazing if you are reinforcing a lot of those materials with other materials like you say nightmare to stitch?

Yes, absolutely. And I thought I think no. And then finding a way to make this regenerative as well, and obviously the petrochemical material cannot be regenerative. It stays in the landfill, and I think for me what struck me the most, obviously we're very fortunate here in the West, you know, in a Western country, because we do have those infrastructure in place. Going back to the homeland in Africa, where my parents are from looking at the landfill and actually the impact that it has on those communities. I think it's absolutely so. There is also a sense of, I think, colonisation that we have to look into which we're not talking about a lot. And they don't have this infrastructure. And it's really impacting those communities.
And it's most of the time the poorer most impacted. So it's really finding a way to, maybe I don't know, putting in place some sort of infrastructure. So then it's, you know, the wet processing or garment. I think that is important, too.

RM: I mean. So in the last RFH we had a key speaker from Uganda and he came over to educate us on what is happening with the waste and focused on upcycling. But it's a couple of things that you guys have mentioned. Is that going back to your point about adding value? And you're so right. These, like petrochemical fabrics and people that we have confined with our consumer. Experience is the people's touch. They feel want to put it next to their skin, it’s an embodiment of how people use materials so i'm wondering if a way that they're, you

know, thinking about our technology. Now, is there a way that we can start to implement 3D. To kind of think about some practical ways to address those problems. I mean, I've got down here the double layers, and maybe there's a situation where we're working with a 3D woven loom where you combine two panels to combine that It's not that you're. It's not that you're leaving separate materials, but you're leaving 2 materials together to create that.

N: And it could create texture and and maybe this link, seeing those ones where it's got the printing, or like the one where it almost looks quilted is really cool, but I think with some of those like you could almost do that as like pleating you could end up with a garment with loads of materials and be able to like, pleat it. Or, you know, a bit like he does creating heat technology to kind of bring it together or create the pattern pieces.

RM: I think that's something that could really be done with the way as well, because that way you can have different meetings together. That's what you know, you kind of create the tube. So maybe there is a certain kind of. How I say texture that's being created on one side, and then a texture with the synthetic material that that kind of counts balances it so that we have that double, you know.

N: And if that was done, then, thinking about it like a sort of closed loop of it. If, say, the polyester is synthetic, because you want it to last as long as possible. But if it does kind of, then wear? You can then probably just reprint over the piece, or it sounds like they could quite easily be separated and then be brought back into like the bio side of it. Yeah.

RM: And I think that something like a woven loom that can change a structural change in a fabric potentially could be easier to separate rather than a chemical. So we talked about petrochemicals, wondering if anyone else wants to kind of talk about materials that they've put down that they want to discuss.

N: One of the things I put on mine which I do think about all the time, and it's probably the one thing that we generally don't. I don't know anybody, really that would buy second hand underwear like knickers bars, things like that. But generally they are made of really really bad textiles like that's from a hygiene point that the last stain in them the elastic goes in them. They're being washed. There's all those, you know, all like the little microbeads and all the fibers that must go into the water and into the environment. I'm just thinking now, like we are not 3D printers that like dissolvable, you know, that maybe put something back into the water that maybe takes toxins out, or something, or just even that they biodegrade once they've been through a certain use. I mean, I think if you look at the, we use cotton but so maybe we could use the 3D thing rather than using elastic, you can have like a gathering.

O: But also as well, when you're talking about a kind of underwear, I mean, especially if it's kind of. Different body, scan and friends a bra that is out moulded. Yes, absolutely. Everybody has different breasts. So the potential to actually create something to take out the bones.

O: You know you've got a standard kind of size. You pay whatever 100 plus. So that is something to yeah, to kind of like, scan and create.

N: You can get a lot of browsing where it is almost like seeing all the seamless ones.

Where it's woven. And you have, like the elasticated areas to pull it in Again. It's still not great textiles. They're not. They can't be circular, they still end up not being able to biodegrade.

MR: I think it is a really good opportunity for the 3D woven loom maybe because if you scan you can be woven.

N: And AI, I'd like a box and body.

O: Add your own personal enhancements that you would like.

N: Hot orange there pink there.

O: I was more thinking about a size up (laughter).

RM: Something interesting about structural gathering to replace filaments and fibres. How would that look for replacing elastane. Something we get a lot is replacing cotton but where is the replacement for elastane. So is there a structural way that we could do that with your idea about structural gathering when using this idea of the 3d woven look of putting that in place in certain placesI mean, it's probably a question of a technician or something that maybe.

O: I don't know. Cause there's that kids brand. Yeah, that kind of. So it extends through the construction of a 3D Kind of fabric, so they kind of grow with the child, but I think that's still limited. If you look at how addicted we are to elastic in our sportswear and you know, activewear. I think, I don't know how you would kind of get that, you know. Real kind of performance.

N: With like where you can separate the 5 and then use it in the 3D printer thing or the loom that there must be something in the natural world that is biodegradable starch.
It's stretchy. It's not a gluten, too, bacteria to do all sorts of things. (crosstalk)… make a bacteria do it

N: But yeah it is what is stretchy in. In the natural world. You obviously don't want to. Then, like hurting things in the natural world.

O: You mimic the same.

RM: I think a lot of the time you can look to the natural world for inspiration or natural needs but I think that there is a lot of power in taking something structural. Especially in terms of textiles like, although fibre i do agree elastane is off the charts amazing fibre for stretching and recovery like if you think of a knitted fabric.

CH: Worms are very starchy.

M: So I think, with any kind of gelatin like agar agar.

N: Yeah so with agar agar, or any kind of gelatin, it has to be heated, doesn't it? And then, when it calls down it goes rigid. So could that be something that when it's with the heat of the body it stretches to your natural form, and you take them up, they go back.

M: I think that's possibly something that we could look into.

N: I'd like you to. Tell me about the thing.

M: But it's a substitute for gelatin so I've used it before.

……
M: The more you add the gelatine the more stretchy it becomes but then the more brittle it becomes so that you sort of have to balance that out.

RM: Yeah, I think as well. When we talk about new materials, entry into the market. What are they for? Are they longevity, or are they for fast fashion, are they? For you know, cause I think there is a balance that can, you know, happen. And I just wanna ask [participant L] about this idea that you put glued seams. And just just do you wanna talk about that a little bit more.

L: So. Well, they don't. They don't work that way. Well, so I got given a bunch of just like Victoria, secret, seamless, underwear years ago. And as I wash them eventually there, the seams are like glued, so I've taken to having to sew them back together myself. It's like visibly mended on those. But I don't want to tell anyone else outside of this room that I and people are like. You're mending your underwear.

N: I actually think you should be really proud.

L: But yeah, it was something that, like at 1st was like, Oh, this is so cool, and I bet it's like. I mean, it's glue when it's dissolving and stuff. And I'm like. Actually, if I didn't already have a sewing machine, it would have just thrown out this underwear. And it's all synthetic and horrible. So maybe. Good intention went bad with that one.

RM: No but it links so well with the 3D weaving system. Because I mean, when we talk about, you know, you guys have seen a lot about knitting 3D work, and all of these brands that can kind of knit really well in a 3D. Way, but actually having a woven material being can be a 3D. Structure is something that isn't on the market yet. And I think you know within this session something that we.You know, maybe we could start thinking about the material level. So we're thinking about woven materials. What then? What their qualities are and potentially what we feel. So, for instance, underwear, a lot of that is knitted.

N: I think it's definitely woven. Just say, like an all in one, or like a shapewear thing. That is woven isn't woven with the last stain, and it's like it's like a knit. It's just a very stretchy knit, definitely woven.

O: I don't know, but I don't know the actual construction.

(crosstalk)

RM: Stereotypically a woven structure is a lot stuffer, because it doesn't have a lot of give.

M: I don't think underwear is woven to be really honest.

N: But some stretches like some of it. It depends on what it's for and what it's.

RM: Yeah. So I wonder if from what I know about woven structures, we have a warp and a weft and you know it's very, it kind of creates a stiffer material, because there's not as much structure. And so jeans, for instance, are real common that are made for woven and so I'm wondering if there's something around that. And I think the work in particular could have the potential of having a lot more longevity in them because they have the stiffness.

N: I think it is because the structure is so concrete. It's long, isn't it? And it's looped so it can stretch away.

RM: So are there any garments that come to mind.

N: But when you cut it you cut a woven on the bias, it becomes stretchy, because then it's the opposite. So.

RM: So are there any garments that come to mind when we think about woven materials.

M: Well wool, wool would be a lot of time you use wool, and they have a very high performance, and longevity.

M: Silk is quite stiff as well.

RM: So I wonder if we go back to [moderator MR], just talking about the ideas of reconstruction, repair, upcycle. And I wonder if we start to bring those words into the conversation.

MR: Yeah, I'm just wondering, because I think they talk about material opportunities. But, for example, when you get a lot of polyester based materials, or you have every single month to the skin. What kind of products are they mostly? What kind of shirt? What is it using the dress, the polyester?

O: But look how many kinds of you know, [large fast fashion brand] kind of, what are they called like? The puffer kind of in child's clothing, that's all kinds of polyester, and that's every kind of everybody has some kind.

N: Instead of using down and polyester to fill down like that you could actually use like. The fibers just broken down and actually have that.

O: So there's a company called Fiber lab that are doing that, that a new kind of like lining for brilliant. But even the trimmings- even kind of footwear is polyester,

N: Yeah its the high street fashion you know the kind of throw away piece
……

O: You know those kinds of puffer. I mean to kind of repair them. You can. You can put kind of, you know, patches onto them like 10 kinds of fabric to kind of repair them. But it doesn't kind of stay very long, but it's really difficult to sew, because either the lining comes out. But once you're kind of punching that fabric, you're more likely to tear it. So it's a very difficult kind of fabric to repair.

N: Add some really cool surface detail to it but whereas, if you're kind of you know, if you're kind of spraying, something would be quite all on top of stuff like that, because it would.

RM: So I actually, yeah, I completely agree. And they were talking a lot about fibres and the challenges that happened with that. And I feel that this technology in particular has a real purpose on a product level and has real, you know, there could be real power in to kind of create some concepts of kind of either disassembly ideas of transformation material. So if I think about the fact that we're okay at the moment with iterating it with the idea of trousers we could say that as we're weaving it, could they be woven in a way that after a certain amount of time they transform into another? It doesn't become a jacket, or my mom reminded me of the time I turned jeans into a jacket backwards. So I'm wondering if there's a way that we can use the idea of 3D weaving as a kind of transformative step. To create something more than just one product thing you were talking about. Maybe when you you turn it into a bad but once, if there's something you do at the beginning of its life, where that makes your process easier, you know.

O: I think, especially for our changing bodies. If you want to keep them for a long time. Then I think you know, our body shapes change, kids wear. You know, they grow. But actually they might grow that way. But their waste kind of stays. Yeah, the same for a long time. So actually rather than maybe transforming a different item as much as giving that item the flexibility to become another form of that, or shape, or different size, or from a skinny jeans to a flare.

RM: I think that's such a better idea than just doing a size up because as you body changes your change your style and fashion.

RM: Instead I really love that idea instead of creating something that is, you know, a bit like pretty, instead of just making it bigger. It needs to kind of evolve so the value changes as it worn.

N: That would also really help with overproduction, because you wouldn't have to make so many different size runs of things which often end up going on sale. Oh, you know you end up with a certain size, one which is either really small or really large. They have to then go to fat food to make a certain amount, to get the contract and doing something like that. Just think, you know you could make less of them that they're quicker to make, and whoever buys them has the best ability of being able. It's a bit like the modular stuff, you know, it creates a bit more playfulness, has more value.

Is there possible value in reinforcing some elements as well, you can practice. So one thing is that it just forms. I think there's always, I mean how we are still making jeans that are not reinforced at the crotch is beyond me. Why, men's shirts don't have an extra layer under the armpits to stop them from staining, and the same lovely little things you always had in the forties. That you could just pop in the micro fibre.

O: So obviously, I mean, you know, designers manufacturers know about these. Reports, and you know, I think the back of the call up on a, you know, your [unintelligible] is all of those areas are things that should be the design point rather than kind of wait, you know, waiting to kind of reinforce them when they're broken. That's kind of, I think that's, you know, an earlier decision. Or when you're kind of creating the product.

RM: Leading off of that I have maybe a different question. Thinking directly about the 3D woven looms there is a way that you could use that process to repair. Is there something that could be used in that. Thinking of qualities of it is a difficult question, and the answer might be 'no', it might be that this is something, like you say, so that it gives you the material, more chance. But is there something that we can do with materials that are already in the system that need reinforcement.

O: I think it's thinking about the inner layer, something, you know, if you used your technology like the repair projector, or where it's like the heat and pad that you can kind of say, these are the areas that are kind of actually, wearing thin. You know. Then you can just 3D print to, you know, to cover that area, I'm sure. And whether that's something that happens again, kind of internally or externally, is a decision, whether it's visible or invisible.

N: I mean the design process if you're using the machine to create a product.
If you already know, which we generally do, the stress areas of movement, or whatever or around the collar, and like cut, maybe you could, just as you sell a product, you actually just print off. Like a spare, and then have something that when it's worn, when it's warm you can easily get it replaced. But then the bit that you take off you give back, because then that fibre goes back in for them to add it to the new product.

RM: That's a brilliant idea. I love that it's like when you get a spare button sewed into it that you get a spare sleeve or a spare collar.

N: It's like heel tips are. These are good quality, because they've thought about looking after them. If they've given me these, I better look after them.

RM: And I think something we can do with this technology is allow for that disassembly to be potentially easier. So if we know that those areas are weaker, we know that in the grand scheme of things they shorten the rest of the body.

RM: Then we create a seem because it's all seamless. We create a shift in the way it's woven, so that the disassembly is easier so that you can reattach your spare collar. I think that's a really nice.

O: I do this with my kids' school shirts and I won't buy them polyester ones. I'll buy them cotton. And so, they don't clean up as well. But one of my sons will not wear a long sleeve,

so I can't always get short. So I buy the long sleeves, and I cut the cups off so that I can sew them onto the other one, because they just get black and are covered by a blazer. Just these horrible cars.

N: They wouldn't wear the jumper actually used to work for pringle they actually did a lot of 3D knitting, and because I worked there my kid grew up with they wouldn't wear polyester And I thought you were so precious. But I make you right, cause I wouldn't and I used to buy them secondhand jumpers that were either lamb's wool, or, you know, like a merino, or something, so they never had their badge on it.

RM: I wonder if there is an extension to this technology that means that you can repair wool jumpers so you have a precise woollen jumper that you want to keep hold of and reinforce. Maybe there's an addition, I mean, have you then woven as repairs. They're like little hooks that you hook into a jumper.

N: The speed weaves. It's a tiny thing that you can then weave straight into your garment.

O: You don't weave into the garment you weave on top, and you kind of so.
You kind of weave over the hole. And so the speed weave one side then you kind of go directly into the weave on one side.

RM: You're creating the hook at the other end, and then you kind of, then you sow the end in. So it's not. It's not kind of going directly into the way it creates a kind of a square patch over the top of the hole, like how big that machine is, if it was to repair garments. Would you then have to kind of direct the machine code almost for that particular size hole, and then you'd have to get the garment in like if it's in the middle of a sleeve. How would you get that in.

I think there is definitely knitwear. It's just a pattern, however complex your design is.It's a series of loops so the yarm would either kind of go in front or behind. A loop, and it will go into one or 2 or 3, and then another loop will go over the top. So that you know your construction of how your kind of pattern emerges. So I would say it's very easy to program that pattern. And you know, when you actually see a knitting pattern, it is almost like a kind of computer coding. Really. So it's very kind of similar. So there's definitely a way that you can kind of the machine would be able to kind of go. Okay, if you don't have the plan already, it would be able to kind of read the loop structure, they recreate it.
I've got my specialism in digital knitting. So yeah, it's very codey. Yeah, you look at it, and you go, because it's like a single stitch.