CIRCE

Creative Fellow

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01 Main insight

The questions of sustainable production are questions that can only be answered in a relevant way by a perspective that listens and creates answers from the collaboration of different disciplines and skills. In fact, the Techre project is primarily focused on sustainability and responsible resource management of technical textile waste. In the project, I have been looking for answers to a clever way of preserving the material, despite the production that generates scraps that are not used in the process, thus representing the problem of discarded material. Apart from the dimensions, material retains all the characteristics of a new material, which is problematic because in most cases, due to the complexity of the construction and the current regulatory framework in place, it is not recycled.

By working with a number of companies and combining different approaches, it has become clear that it is through design, as part of the cultural creative industries, that we are able to connect and synthesise different perspectives into a tangible response that points to a possible way forward for the industry.

Certainly one insight is that there is a wealth of material and opportunities for collaboration, but because of the complexity of the issues and the historical disengagement of the creative industries, design is not included in these kinds of conversations. Thus, the underlying problem is that the project needed to discuss the importance of design and the opportunities that collaboration can bring before it could really address the issues of material. This is another unique, multifaceted problem of small-scale production companies which, as a result, do not apply the principles that design can bring to collaboration. It was also relatively difficult from a designer's point of view to make contact, especially with larger companies that would be open to collaboration.

As the project shows, it is the link between research, experimentation and demonstration with product models that is a key building block in establishing practices that could utilise unused material as sustainably as possible. It is through the ability to visualise that the creative industries are crucial in contexts where they have not been part of the conversation in the past. It is essential to introduce creative principles into the production of companies that make products and therefore waste. Through projects like Techre we can get guidance for new programmes from existing companies that are not currently organised in a way that optimises their scrap as a material that enables new products and services. As well I see the same value in making new companies that target the material left over from current production and treat it as a raw material for new products with high added value and a high degree of sustainability in the design of the entire life cycle of the product, which would exploit the full potential of the material.

Creative approaches, combined with qualitative research techniques that allow us to obtain relevant information quickly and efficiently, are two key untapped tools that can accelerate the transformation to sustainable production in existing production facilities. By combining research with the ability to visualise and produce tangible models and prototypes, designers can quickly demonstrate possible future scenarios, which can lead to faster decisions that companies can take with greater confidence as the future becomes more tangible.

It has also become clear that it makes a lot of sense to work at a local level. Local in this case means both geographically and mentally, because the area we are most familiar with is often the area where we can make the biggest and fastest contribution as designers, and when we combine this with geographical proximity and the familiarity that proximity brings, the project becomes, at least in a sense, a local community project. This has also shown the positive aspect of working on a small geographical scale, where knowledge is concentrated in one place and we can communicate quickly with production and appropriately react and adapt.

What is surprising is that local problems are very likely to be transferable, and that lessons that work in one environment can be very quickly transferred to another environment. Environment that may be culturally very different, but in terms of production an identical industry. However, if we look at the arguments for local integration from a distance, we see that the main argument is the sustainability that this way of working brings. With local production, everything happens faster, with fewer emissions and with far less energy consumption. The project has deliberately been carried out mostly in a “do it yourself” manner, which I think is an important part of making the results accessible to local production, to make them realise that they are already empowered and do not need significant changes in knowledge, and that by introducing collaboration with cultural and creative industries, new products and services can be created without significant changes in production, but above all in the culture of the company, which is reflected in the collaboration and openness. Of corse in the process the products will get more refined, but that doesn’t mean that we can’t act now with what we already have.

02 Creative endeavour

Most conversations about sustainability start with waste separation and end with conceptual discussions about the materials of the future that are currently too expensive and, for once, out of reach for the general public. However fascinating topic, as fascinating and inspiring that it is, in a way, it seems that this way of thinking is an excuse to keep things as they are today. The problem arises when part of the conversation gets lost when we get to the subject of what is the space in between. So the materials that are already being produced and used also have wonderful properties, but they are almost entirely untapped. That is due to our lack of understanding of resources and the current policies that allow various harmful wastes to be discarded without responsible management and the consequences of not having that kind of management.

The problem is very broad and touches in particular on the fact that the systemic way in which new products are currently manufactured, even before they leave the production halls, results in material residues that are not returned to the production cycle. This problem is particularly acute in the textile sector, which is the sector addressed in this project, and textiles are particularly important in terms of environmental impact. On average, EU consumption of textiles has the fourth highest impact on the environment and climate change, after food, housing and mobility. It is also the third largest consumer of water and land and the fifth largest consumer of primary raw materials and greenhouse gas emissions (Textile Strategy, 2023). Specifically, I am focusing on technical textiles, which, like resource efficiency, is often a topic that, in the context of textiles, tends to be avoided, as it is mostly only about fast fashion, which is of course harmful, but far from being the only problem with textiles. Technical textiles are products made for non-aesthetic purposes where function is the primary criterion (Tortora, 1996). The easiest way to understand the breadth of technical textiles is to look at the section from Techtextil, the largest trade fair for technical textiles, which is used as the standard classification.

-Agrotech (horticulture, landscape, gardening, agriculture, forestry, animal keeping)
-Meditech (hygienic, medicine)
-Okotech (environmental protection, recycling, waste disposal)
-Clothtech (garments, shoes)
-Buildtech (massive construction, engineering & industrial building)
-Mobiltech (cars, ships, aircrafts, trains, space travel)
-Geotech (road, railway, irrigation, hydraulic structures, waste landfills, dams)
-Hometech (furniture, upholstery, interior furnishing, rugs, floor covering)
-Packtech (packaging, protective-cover, sacks, big bags, container systems)
-Indutech (filtration, cleaning, mechanical engineering, chemical industry)
-Protech (person and property protection)
-Sporttech (sport & leisure, active wear, outdoor, sport articles) (About TechTextil, n.d.)

Given that this type of textile is designed for a specific technical purpose, is almost exclusively made of synthetic materials, and in many cases combines materials and contains various coatings to increase UV resistance, prevent mould growth, etc. It is clear that these materials are very difficult to recycle, and in practice this means that they are discarded as mixed waste and not recycled because the process is currently too complex and too expensive. The key link is that this kind of awareness is linked to is the fact that the textile production process almost always involves some kind of cutting or transformation of the material. Textile material is almost always wound on a fixed width roll, which inherently means offcuts, which in many cases translate into a residue that is not consumed, and therefore the new material becomes waste that is not recycled.

Part of the solution, at least as I see it, is to set up a system within these types of production facilities, to ensure that these offcuts are logically used and incorporated into products. According to the waste hierarchy, which is probably the most established way of thinking about resource use, the first and most important thing is to prevent and reduce the amount of waste generated by households, industry and all levels of government (EPA, 2022). This means that the first priority should be to ensure that new virgin materials are used as little as possible and that the materials that have already been made and used are used as much as possible - that they are used in their entirety.

One of the starting points for thinking about the use of materials is certainly the Circular Strategies Wheel developed by DDC, where basically in the first stage, when we design products we try to identify and define each step in the life cycle of the product. This view is crucial because it helps us make decisions about what new products to make and how to design and manufacture them. We also try to imagine the part of the product cycle when it is broken or not working and needs to be repaired, so we design it so that it can be repaired and parts can be replaced. At the same time, when it can no longer be repaired, it is not worth it, or the product is unusable for other reasons, we think about how it can be used in another product. Even at this stage of product design, we think about possible next products using the material from the previous product and how to make the transition from one product to another as sustainable and easy as possible. It is only at the next stage that the material is likely to be obsolete and can only be used as a filler or other type of material that adds relatively little value. Only after that there is an attempt made to recycle the material or, if this is not possible, to recover energy from it by incineration (Tool 01: Circular Strategies Wheel, 2023).

I had already explored these issues to some extent in my Bachelor degree project as a product designer, where I looked at ways in which a small tent manufacturing and repair company could turn its waste into products. The task, which focused on one company only, required me to capture and map the waste produced by the company. At the same time I had to consider the technology, capabilities and capacity of the company to produce the product. The result was a multi-purpose children's cushion for nursery schools, which can be produced entirely within the company's capacity and combines the company's material remnants with new materials.

The key difference in this project is that it is broader in terms of industry and material, but at the same time it focuses on the cuttings of material, its properties and how it can be used in a meaningful way, regardless of the company. The potential for this process is greater than a small company, because it can be scaled up to a service. Connecting different companies that could become a source of new material for the service. That would be benefiting both the companies that know that they have put the material into production other than the bin, and of course the service that gains value from material that would otherwise end up in landfill.

The final point, which links with the previous ones and is key to the timing of the project, is that currently in the European Union, textile waste does not have to be collected separately in most cases and can be disposed of without sorting in smaller companies. However, the European Commission's initiative to put an end to this and encourage companies to use materials more wisely is key. "The European Commission is proposing to introduce mandatory and harmonised Extended Producer Responsibility (EPR) schemes for textiles in all EU Member States. Producers will cover the costs of management of textile waste, which will also give them incentives to reduce waste and increase the circularity of textile products - designing better products from the start. How much producers will pay to the EPR scheme will be adjusted based on the environmental performance of textiles, a principle known as 'eco-modulation'." (Press Corner, n.d.) It is this initiative that allows and encourages a project like this to be turned into an organisation that can take scraps from different companies and combine them into a new format and products that extract value from the material, while making sure that new scraps are not thrown away.

With my project and experiments, I want to contribute to the issue of unused material in the form of scraps that are generated in different parts of production and use technical textiles. This issue is part of the wider problem of reuse, reuse, recycling in the textile sector, but at the same time I am questioning the unscrupulous treatment of technical textile waste. It seems that this type of textile is not included in discussions about sustainability, despite its problematic nature, since it is largely not recycled, and at the same time the material is very widespread.

It is also interesting to note that in the European Commission documents that are supposed to try to regulate this area, they practically only mention fashion and the problematic issues of fast fashion. They do not mention the material, which is even more problematic because of the way it is produced. The project is very hands-on and also focuses on experimenting with material, because from my point of view the important question is one that touches on production and therefore also on the way in which material is preserved. The question is whether processes that are already used in the sector, such as thermoforming in the manufacture of felt products, can be translated and used to reduce waste in the manufacture of new products. Whether the leftovers can be reduced and the so-called by-product converted into a format that allows and encourages companies to use products made from this type of material. But it is also important to emphasise that I am approaching the process in such a way that I am focusing on the 'new waste', the clean and in all ways functioning by-product that is made during production. Taking it back and making it available in a new usable format that can be used as part of new products as a new material should be.

Gathering the cuttings from the manufacturers

Mosquito nets cuttings

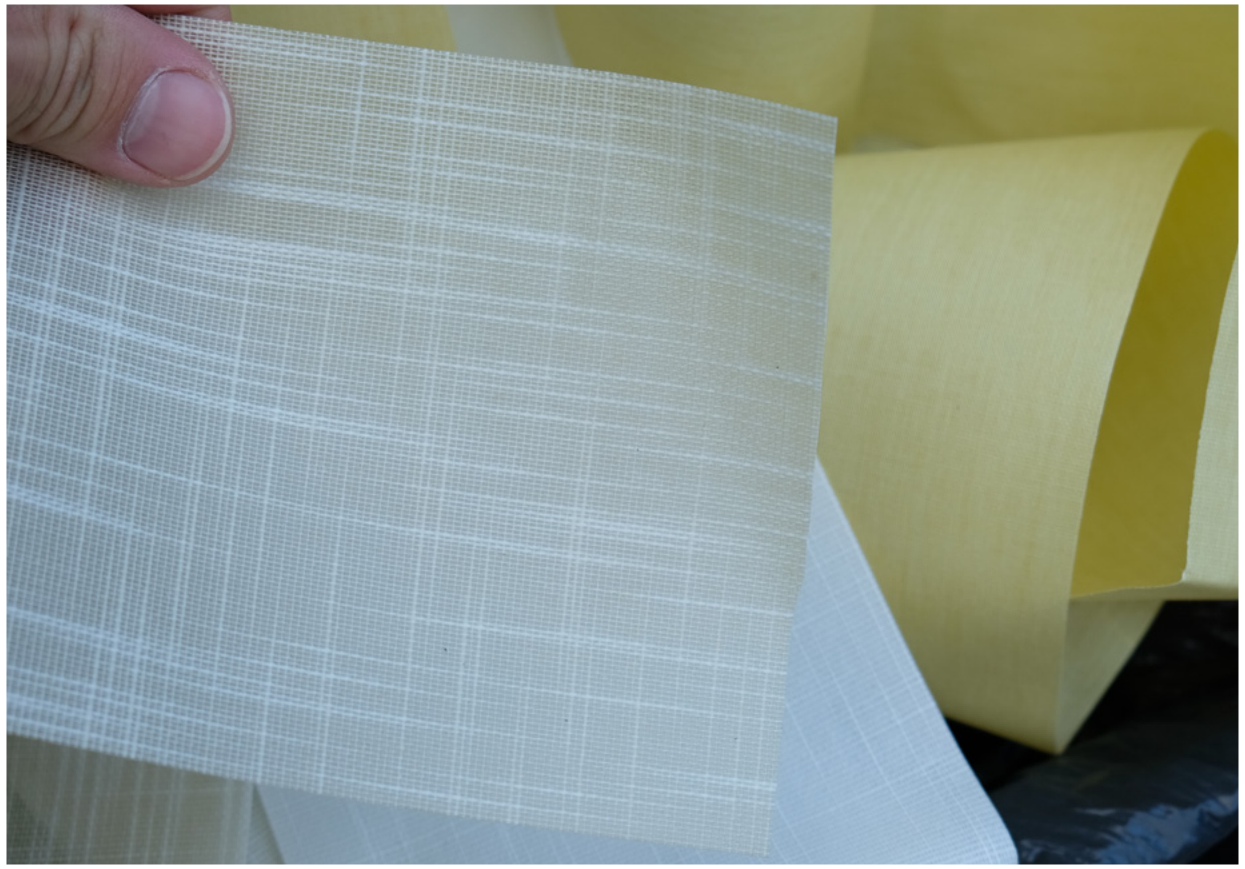
03 Creative process

At the beginning of the project, further research was needed. I was already largely familiar with the area, but it was necessary to obtain additional information in order to carry out a more in-depth and meaningful project. I chose the companies that I wanted to work with, mainly on the basis of what materials they used, as I wanted to have a fairly wide range of materials and offcuts to make an initial assessment of what was useful and what wasn't. In the initial phase, I also got useful information and guidance for the companies from a sustainability expert at the Industrial Design programe at the University of Ljubljana. I also wanted to get a clearer overview of the topic itself, so I arranged an interview with a professor, an expert in textile ecology at the Faculty of Natural Sciences and Engineering at the University of Ljubljana. She also gave me further guidance on where cooperation, considering the waste, could be useful. Based on the information I received, I then contacted a company involved in the production of halls made of large tarpaulins - polyester coated with PVC. Company, which repairs and manufactures tents and other camping equipment. In the third sector, that was mainly shading companies, two companies have decided to take part and have prepared their own offcuts of materials. From the first shading company I received quite a lot of samples, both for external blinds and for internal blinds and curtains, which they produce for various public and commercial buildings. I was told by the second company that they have a lot of off-cuts from the production of mosquito nets, so I received a week's worth of off-cuts from the nets that are cut to fit mosquito nets.
I also contacted eight other companies, but those, otherwise companies in the same industry, did not respond to the initiative. This phase was a little more time-consuming than originally planned, as the whole thing took place around the Labour Day holiday in May, so communication was rather slow and ineffective. I also attribute some of the reluctance of companies to talk about scrap or waste to the fact that they do not want to get involved and reveal how much and what kind of scrap they have because they do not have to deal with it at the moment, and of course it does not go well with the current green trends, that consumers are getting more and more excited about.
I also suspect that the cold mailing method has not been the most effective with companies, because as an intruder in their work you mostly just stop the work process. At this stage I have actually contacted two different experts in the field of ecology, one in textiles and one in design. I have also been in contact with four companies that make products using technical textiles, so given the timetable and the slight delay in the work, I decided that I had enough information and materials to start the experimenting process. I tackled the next stage, preferring to go back to the theoretical part for information if it was really necessary to continue.

Field research

After the research oriented introduction to the project, I actually collected various materials from companies and collected them in my workshop. I was in contact with the companies myself, so it took some negotiation to get the scraps especially to get enough of them to experiment with the material. A meaningful insight is that one company told me that for some time now they have a plan to use their cuttings, but for now they just didn't get a good way of doing so, and that's why they were a bit reserved to give me more of the cuttings. Where I could, I got the material information from catalogues, and where I couldn't, I went back online and checked the information that way to actually have a proper classification of the material and not only the manufacturers marketing or branding name. I think in some ways those names are sometimes misleading as they sound a lot more natural as the materials actually are.

Basically I had to divide the shade cuttings by size and type of residue, as they were very different. So I also divided the smaller shade remnants into sizes, and I did the same with the mesh used to make the mosquito nets. Since tarp company told me that they did not have a lot of scrap at the moment, and since I got a glimpse into their working methods, I decided to leave their scrap out of the further research.Tent company's scrap is basically so different from piece to piece, both in material and in size and quantity, because they are in the business of boutique production on request where every scrap is different, so for the purposes of the current project I decided to focus on shade scrap from two companies.



Cuttings from slated curtains

The selection offered an extremely wide range of materials and quantities to experiment with, as well as the fact that the types of waste are relatively consistent, as most companies produce similar products that are also relatively consistent in size. The material has therefore been narrowed down to external and internal blinds, offcuts from awning and offcuts from nets used to make mosquito screens. However, the size of the offcuts varied considerably, with certain offcuts from the manufacture of awnings and similar large external blinds all being several metres long and between 25 cm and 40 cm wide. On the other hand, most of the pleats were smaller in length and width, as were the remnants of the vertical blinds. The good thing about the slatted curtains is that they are very consistent in width, due to the size of the slats, which are apparently only shortened during production. This meant that there were large quantities of cuttings of the same size available, which is excellent information when folding smaller pieces into a larger format.

Once all the materials had been selected and dimensioned, I carried out some basic heat tests on all of them to see if they could be joined by welding or if they would need to be joined with adhesives or resins. That was done with some clamps for compression and a hot air gun. For the interior blinds, almost all of the sections could be heat pressed, in that case meaning that the cuttings could be reassembled into composition without adding any new materials that would act as a glue. This was not possible with the mesh and awning material. Whether the material can be heat-sealed can be seen and felt to some extent, as acrylic fabrics are very different from polyester and PVC fabrics. The mosquito nets did bond to some extent, but not well enough, I suspect because they are impregnated on both sides to make them more resistant to UV rays and that layer of coating than prevents the material to bond similar to what grease or dirt on a surface would prevent when gluing with adhesive.

As the mesh is geometrically permeable, it was later used as a 'reinforcement' to permeate the material from both sides and thus allow bonding. So where heat was applied, the logic was that the melted polyester would pass through the holes in the mesh and fuse with the polyester on the other side of the mesh, but this was not ideal because instead of adding strength, which was expected as more material was added, the mesh weakened the structure because it weakened the joint. Where several layers of polyester were added and only one mesh, this weakness was less noticeable because the pressure caused more polyester to bond over the meshes, creating a stronger joint, but it was still not ideal. I suppose I could have achieved different results with a higher grammage material.

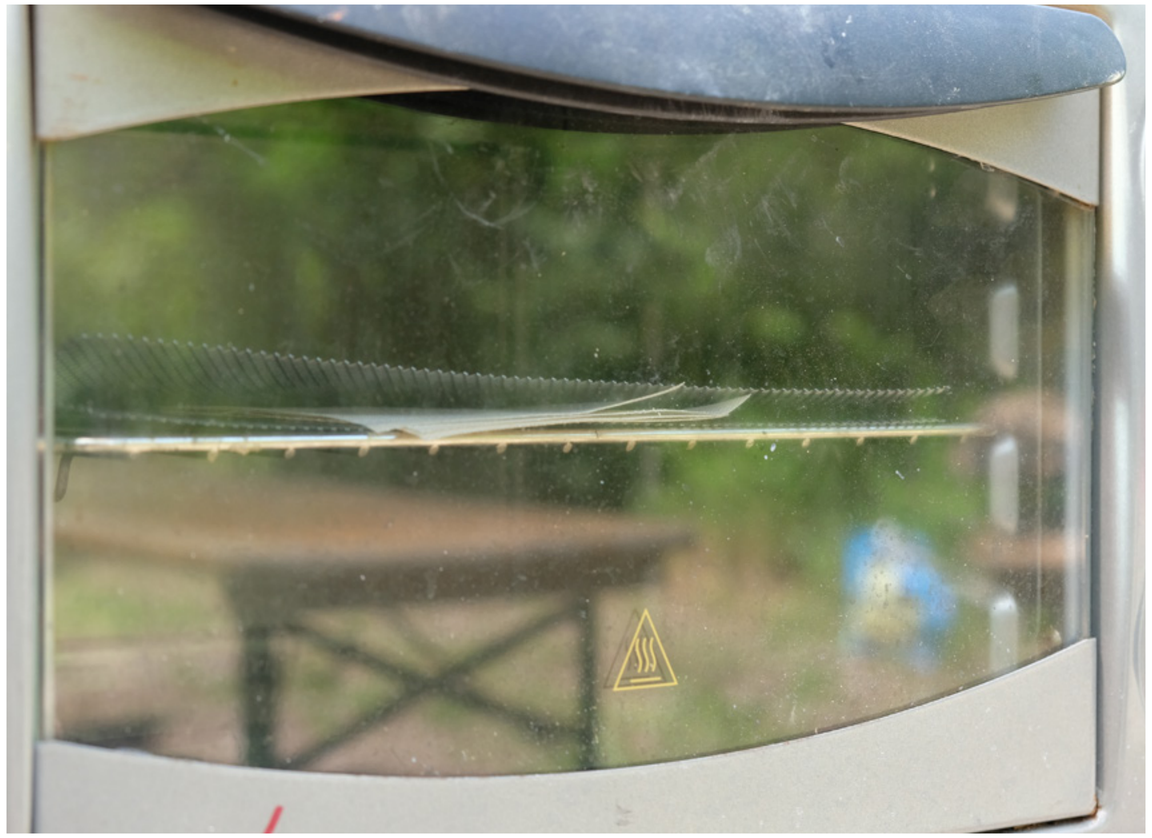
On the other hand, the mesh worked perfectly in the case where I bonded the acrylic to the mesh with resin and in the case where I used glue. In that case, the mesh allowed the glue to flow freely, greatly reducing the amount of binder needed. In simple terms, the opposite is true when using a non-porous material, where each layer would have to be specially coated with resin, here only the first layer had to be coated a little more, then I was able to use four layers of mesh without coating and still achieve perfect bonding of all the layers of material and I am sure that with some more experimentation and adjustments there could be even less resin used.

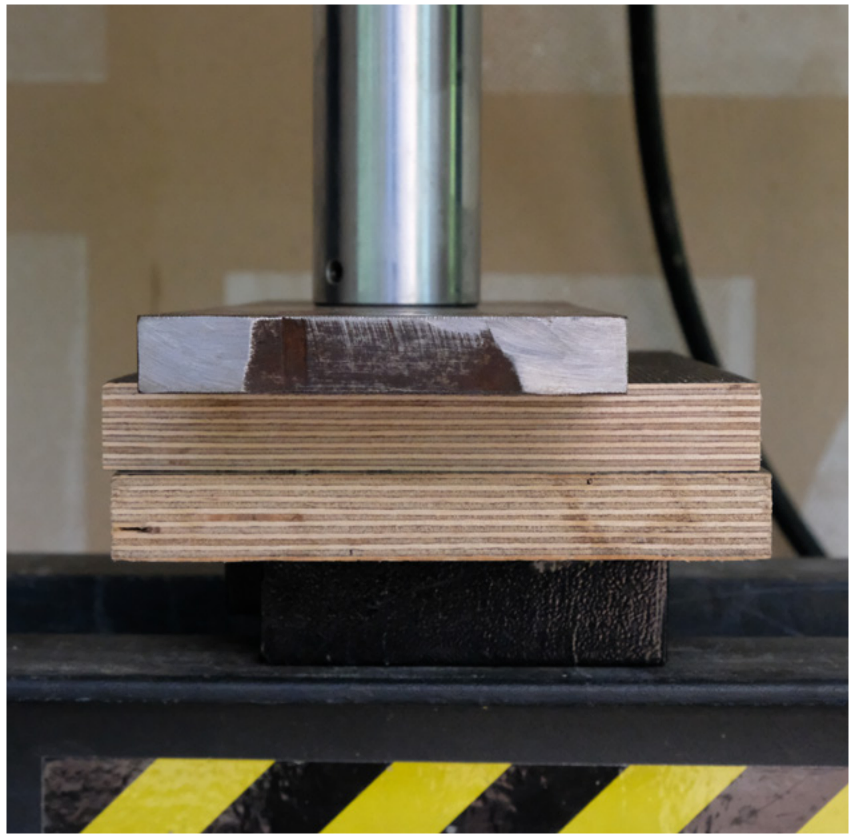
Cutting to size

Preparation for pressing

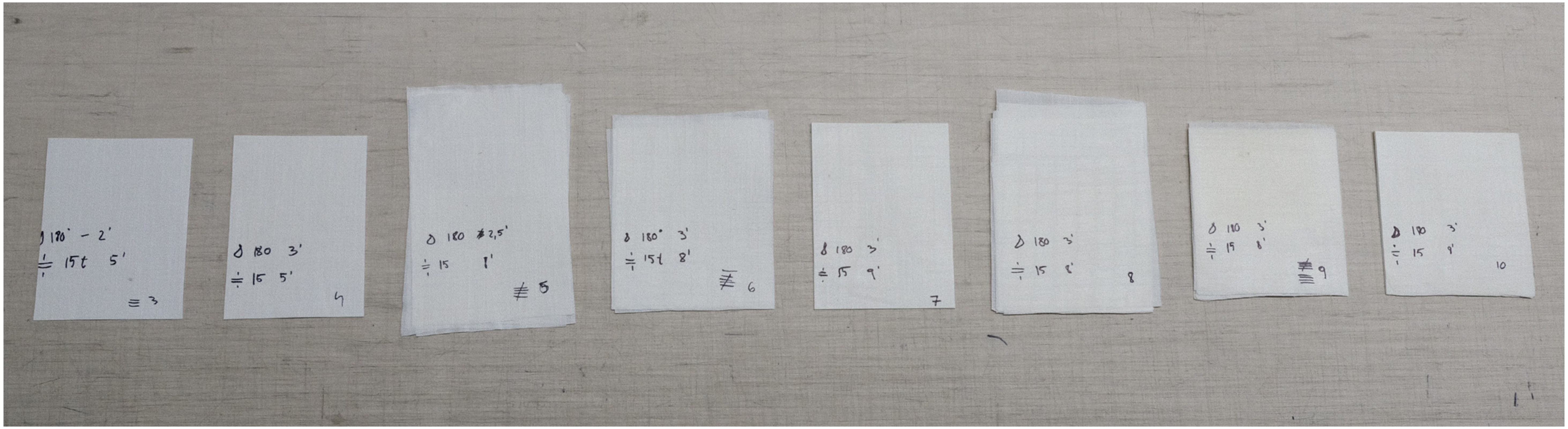
Heat and press bonding

I prepared the materials by cutting them to a manageable size for transfer to the oven and press. After arranging the layers to the desired look, they were placed between grids to prevent deformation during heating. Timed heating was followed by rapid transfer to the press to achieve the desired pressure. Temperature and time were adjusted by trial and error due to material variations. A labelling system was introduced to track key parameters on the samples for efficient differentiation.





Process of heating and compressing



Different specimens of the compressed material

Workshop with hydraulic press at Krater

temperature

duration of exposure to heat

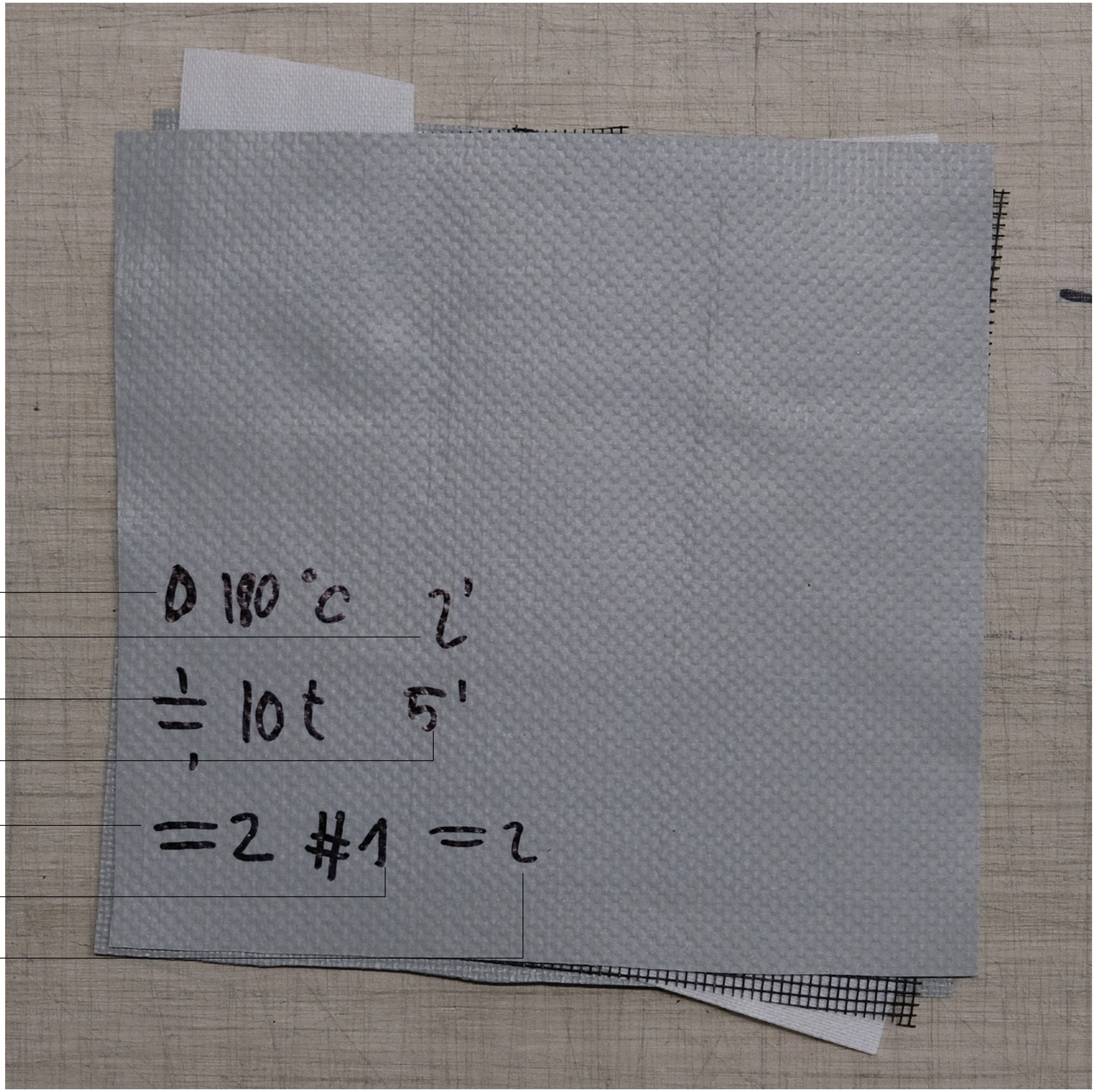
force of pressure

duration of pressing

number of layers

number of layers of nets

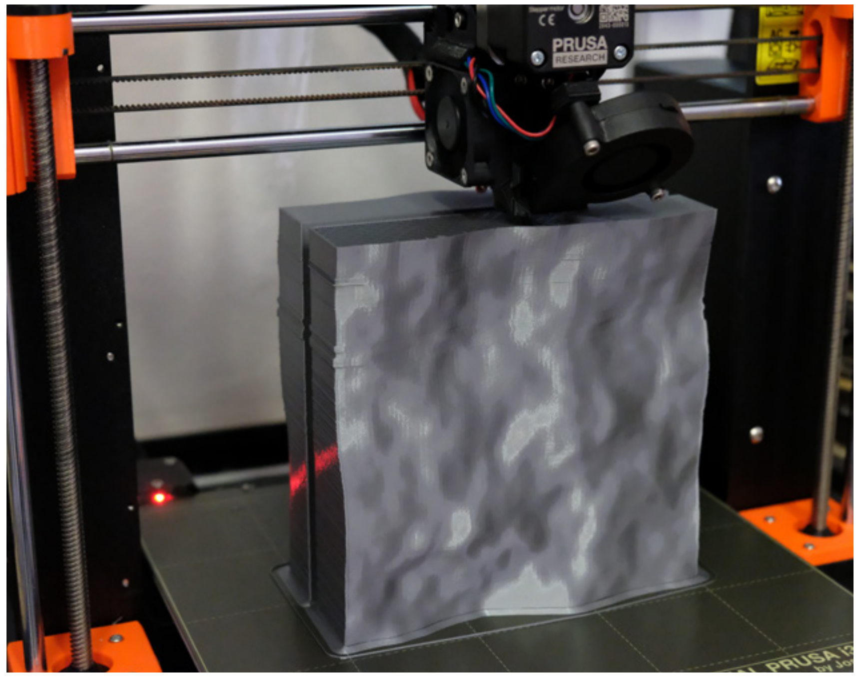
number of layers of second material

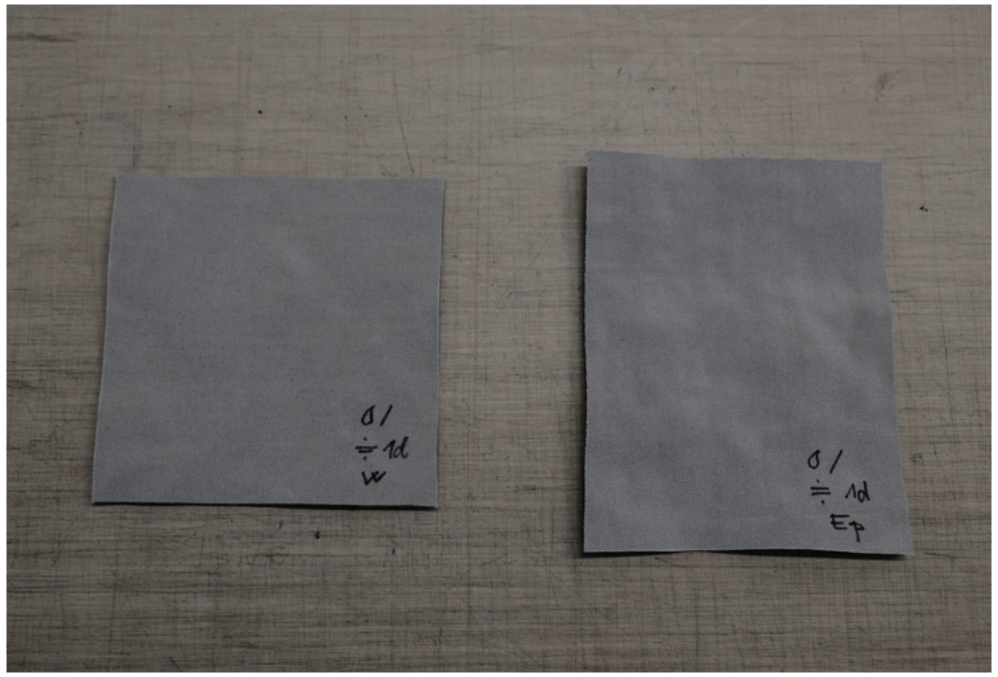


Custom tagging system for sorting and reviewing experiments

Resin bonding

Various experiments involved materials unsuitable for laminating, such as those chemically incompatible with heat bonding. Tests included epoxy resin and water-based coating on different panel shapes, comparing resin and coating based strengths. Mesh allowed a thin layer of binder to adhere through perforations in intermediate layers. Material was cut, resin added and gridded to ensure even distribution. Layers were placed between panels and pressed using plywood moulds or 3D printed moulds for some specific tests that were done for testing strength of tiles if those have some alternative geometry.





Proccess of laminating wihh resin

After the experiments described earlier and the tests with the different moulds, an evaluation of the produced materials was carried out. Previously, all the samples had been made in a smaller size to save material, as in this case the waste material is also treated as an equivalent raw material. In the experiments, all the tests were carried out with the same size cuttings, taking into account only the quality of the layer joints and the final appearance, as well as feel and actual mechanical properties of the material. Despite the fact that the strongest material produced was made using epoxy resin, I am aware of the environmental problems of the resin, so I decided to continue and perfect another technique. The thermoforming technique was chosen for a material used for interior blinds.

The offcuts, in the form of strips of acrylic fabric that are used for awnings, are of such a size that they can legitimately be used in the manufacture of finished products in the form in which the offcuts are basically found. So the problem is not that these offcuts are useless, the problem is that they need to be used in another industry where smaller format products are made. In this sense, the material is immediately suitable for the production of handbags, shopping bags, backpacks, cushions, outside furniture covers and so on. In this respect, the material is not even in line with the main objective of the project, i.e. the use of offcuts that currently have no functional value.

The second reason for the decision is that the bonding of the acrylic requires the use of a resin which, although it strengthens the material and gives it excellent mechanical properties, means that we have produced a composite material which, even if it is made from a slightly more sustainable resin, is more difficult to recycle at the end of its life cycle. The third reason is that the blinds and curtain sections are very uniform in width, making it easy to remanufacture them into a new format even when we imagine it on a larger scale. In this sense, the main reason is that I do not combine materials and I achieve a new usable material format by not changing the material, but only by transforming it. The material remains the same and in terms of the philosophy of the waste strategy, the material is not changed and we act on the first most desirable level, which is to reduce the residue.

Focused experiments

The experiments with heat continued, so I regularly adjusted the temperature, the time of exposure to heat, the time of exposure to pressure, the different amounts of pressure, as well as the number of layers of material. In this respect, the experiments were also already an improvement of the material, since among all the samples made, those were selected that showed good adhesion and, consequently, good mechanical properties, which can also be assumed to be sufficiently durable for application in various new scenarios and products. At this point, almost all the parameters for the production of the format have been selected, with the exception of the format itself. Due to the size of the oven in which the material was to be heated, a size of 250mm x 250mm was chosen as the largest square format that could still be heated evenly.

At this stage, the plywood plate used for pressing was replaced by an iron plate, which can withstand higher pressures and allows a more even pressure to be applied over the entire surface. However, this method of pressing did not actually work as effectively as expected because the iron plates are 10mm thick, which results in rapid heat dissipation from the material, which by the time it can be pressed with a hydraulic press, has already lost the temperature at which it can be properly bonded. This meant redesign the process, which I did not decide to do, because it also turned out that joining several small chips, overlapping only in certain places, only produced good adhesion where the material was thickest, while everywhere else the material deviated.

Therefore I decided to try to achieve a similar result using an industrial hot air welding machine and compression roller, which does not produce nearly as much force but is sufficient for the proof of work because the material is bonded mainly by temperature and the pressure mainly ensures a uniform surface, which would be easy to achieve if we were actually to produce this type of panel on a larger scale, because switching for a bigger roller would then make sense. After a few tweaks, it proved possible to produce panels using this method, and I have continued with this technology. It is true that it is more time-consuming to produce, but in terms of panels, it is actually a better representation of the technology I envision for producing such a panel.

In the course of making this type of panel, I came up with the idea of making a profile that could make good use of the very narrow but tens of metres long offcuts, which are offcuts along the length of almost the entire bale of material. With this idea in mind, I quickly made an approximation of a tool that would allow me to wind a strip of any length onto the profile, which I would then simply separate. I later tried sanding the surface of the profile, but this initiative didn’t work, as the material didn’t adhere completely and the fabric started to crumple. I also made several versions of the profile format and again, after a few failed attempts and some tweaking, better versions emerged, with a more uniform surface and better mechanical properties that were suitable for use.

I then wanted to implement and test both the panel material and the round profile material in a product to demonstrate the different properties of the material. The panel in its original form was implemented in a table, where the reinforcements also acted as a joint between the legs and the panel. In a slightly modified form it was used again as a shader, where I also used the already made loops of the cuttings.

Most of material experiments, with different material combinations and techniques

Joining with the fan and roller on the table

The method that required a slightly longer manual process was welding with an hot air welding machine and a silicone roller. This method circumvented the problem of cooling the material before pressing, as the air heats the material just before rolling, meaning that the material is pressed when it is at its hottest temperature. This method allowed a greater degree of flexibility as I was able to melt any piece of material, regardless of shape. The problem with this method is that each piece is welded individually and it could take up to two hours to make a panel. However, it is relatively easy to transfer the technology to a larger production scale, where a larger roller and a larger heat curtain could weld a panel in a very short time, thus also ensuring a cost-effective and efficient production in the shape of an infinity belt.

Sorting and joining with the fan

Adding the reinforcements

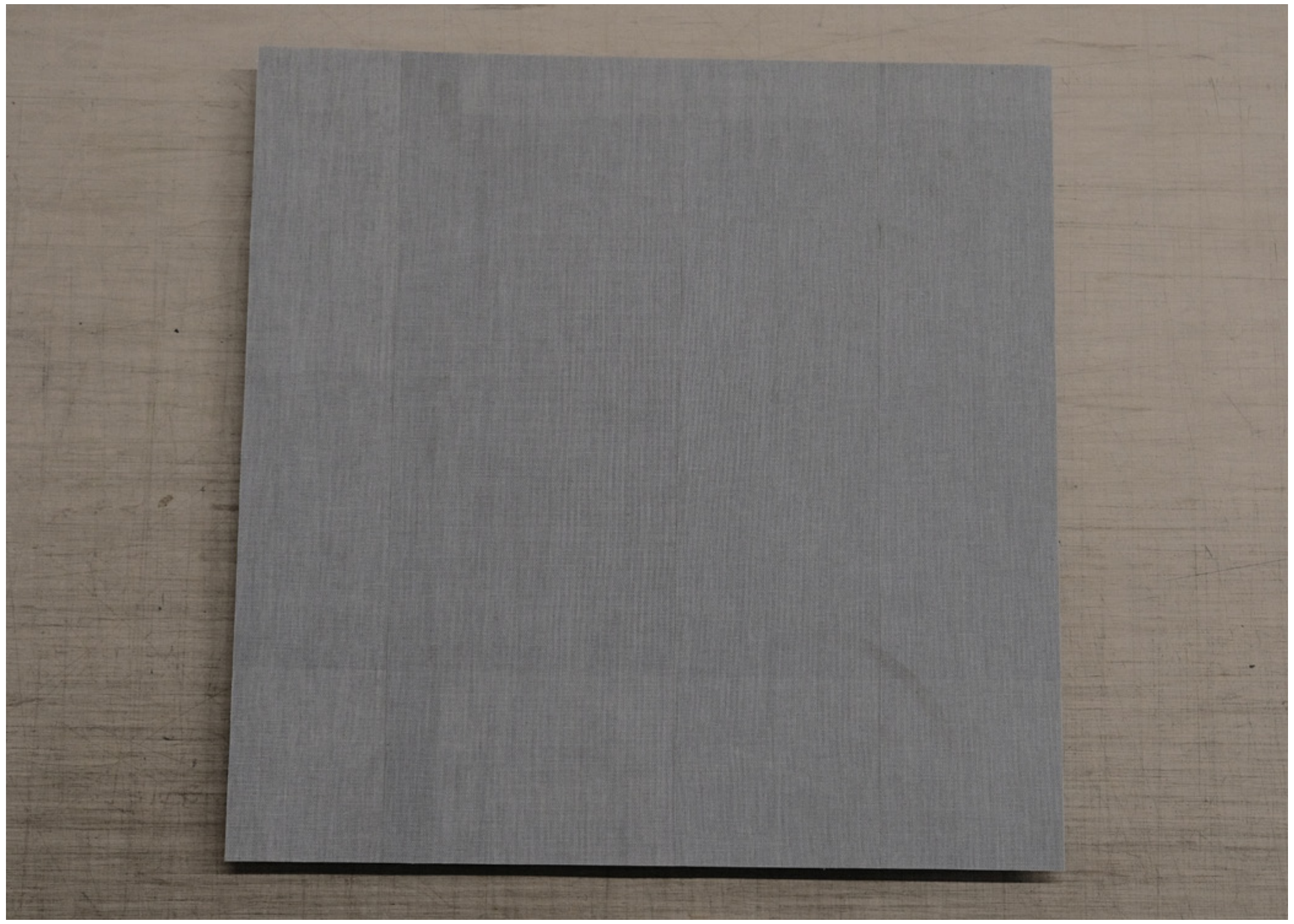
Finnished panel

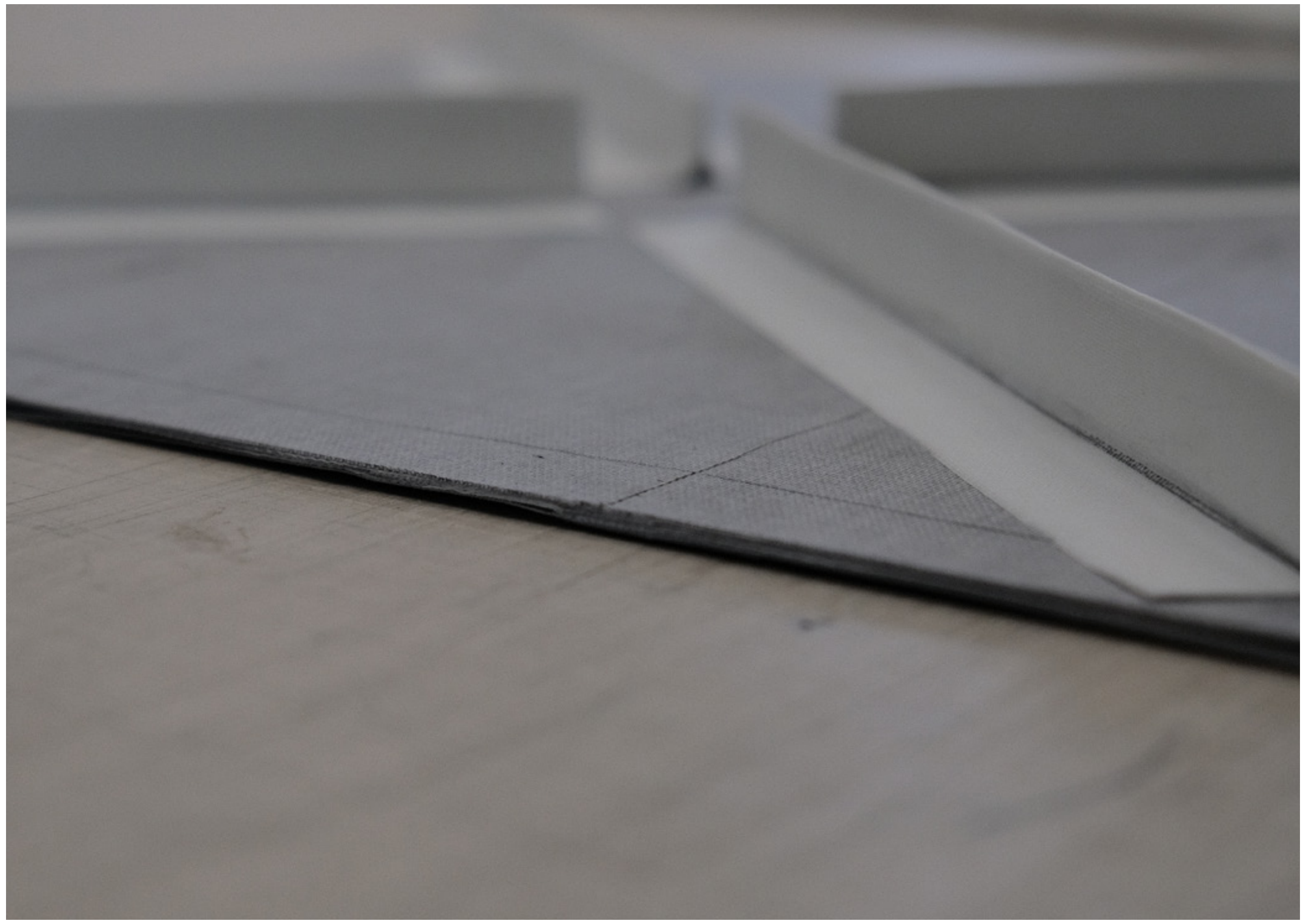
Joining with the fan on axle

I have used a very similar principle of joining to produce the profile. In this case, the format of the material I was working with changed, as I used exclusively strips on a reel, as these enabled the profiles to be produced quickly. Firstly, I built a machine that rotated the aluminium profile at the right speed, which means that it had to rotate fast enough to not burn through the material with the hot air, and slow enough to heat the material to the point where the layers would adhere to each other well. The aluminium tube was coated with silicone spray to prevent the material from sticking too much. I heated and wound the material on the profile to the desired number of layers, and finally heated and squeezed it further to smooth out any irregularities in the surface. The final step in the profile production was to cut it to the desired measurements, where I could cut the profile evenly using the lathe principle. That method turned out to be impressively quick and effective way of doing a profile as the whole process needed less than 5 minutes in total to produce a round profile.

Joining and smoothing

Separation of the tubes





Panel and detail of the reinforcement

An overview of the round profiles made in different thicknesses

Pendant lamp made with the tube

Shaders made wiht the modified panels

Panel implemented in a coffee table

04 Analysis and main insights

The insights and new things and concepts learnt can be divided into three main groups. The first is the theoretical data, or interesting things that were learnt in the process, the second is the results of experiments and new observations during the course of the work and the third is just the organisational side of things that extends over the whole process, because there have certainly been lessons in terms of organising the process and working with industry in a limited time frame.

Insights before experimentation

It is interesting to note that an industry involved in the manufacture of large products does not necessarily have a lot of waste. Of course there is waste in this industry and often there is a very large amount of material left over in terms of overlapping halls, but in the case of tarp company they do not have that much waste, mainly because of the way they produce. They have standardised all the parts of the tarpaulin halls so that any scrap from one product can easily be used in the next. This is largely due to the fact that the products, although different in size, are made up of the same elements that are repeated more or less often depending on the customer's needs. Larger offcuts can therefore be converted into reinforcements or used to make certain smaller parts such as doors and the like.

The second reason for the low scrap rate is the fact that the company uses a very reduced range of materials for production. In terms of materials practically everything is made of one material and iron structures. In terms of colours, they also use very few different colours in a very limited palette, practically just white to a few shades of grey, which makes the scrap suitable for use in the next products because they know it will not stand out. The only constant is that the scraps remain as pieces in the form of openings, as they are too small to be a viable material for use in production. This scrap is therefore expected to be generated at a rate of about one container every six months. In this sense, the scrap is still a potentially good source of raw material, as these scraps should be of virtually identical shapes and therefore worthy of further consideration after the project has been completed.

As far as the amount of scrap itself is concerned, I assume that there is already a huge amount of discarded technical textiles in Slovenia, which still have all the characteristics, but due to their size are no longer useful in the primary industry. Since the companies with which we are cooperating are relatively large for the Slovenian territory, but at the same time quite small in global terms, the potential for collecting this type of scrap is much greater in Europe. Shading company discards approximately 1m3 of mosquito net waste per week. This figure increases during the season. However, it is important to note that there are dozens of companies producing this type of product in Slovenia, which means a regular supply of material should they decide to use the leftover netting in their products. Although the production of mosquito nets is more intensive during the summer due to increased demand, production does not stop throughout the year, as they are often installed together with windows when windows are replaced during renovation or construction of new buildings.

In my opinion, companies often produce scrap that is already in a usable format and therefore does not need to be specially adapted before it can be used in the manufacture of new products. In the case of shading company, there is a large amount of acrylic scrap that would be suitable for the manufacture of various smaller products, as the scrap is suitable for sewing. Similarly, tarp company's scrap is suitable for welding small openings or applications where smaller areas need to be covered (e.g. in other products or in the manufacture of tents for the construction of vents, etc.). The key insight is that companies do not simply deal with everything that can be made from the materials they use, but that they make specific products and need specific materials and dimensions for them. Therefore, if a material is dimensionally inadequate despite all other characteristics, it is not used in the company. However, some larger scrap in its current form could easily be used directly in other products, perhaps in a production of product details of the same company, or in other companies that only produce smaller products.

Organisational lessons

One of the main lessons I learnt is that multi-stakeholder processes take much longer than you initially expect if you assume that the things you are working on will be done quickly, according to a set timetable. In the case of the project, one of the lessons was certainly that I should have invited the stakeholders earlier so that they had more time to respond and possibly clarify my project with them further, but in my case I contacted them and worked with them within two weeks period and I didn't want to prolong the process because that would have meant running out of time for experimentation and all that such a process entails. In terms of contacting companies, quite a few did not respond to the invitation to participate, but at the same time, an equally valuable insight is that the companies that did choose to participate showed that they have quite a lot of unused capacity and a willingness to participate.

The process has clearly shown the need for an initiative to utilise this type of material and implement concrete solutions in this area. Although there is currently no regulation on the financial burden of producing this type of waste, companies are becoming more and more aware of it and the fact that companies that lead the way in this aspect will also benefit financially and, above all, will have a great advantage over companies that only become aware of the problem when the regulation situation changes.

Another important lesson from the project is that it is necessary to think about the technology that might be needed as early as possible, because not having access on time and organising on the spot is very time-consuming and the process eats up time that could be spent experimenting with the material. Fortunately, during the process I was able to arrange to use the Krater production space, where I had access to both the oven and the hydraulic press, which helped the project enormously. However, it was most efficient to prototype certain things myself in a workshop with basic tools and some skill, as arranging for special tools can often cost a lot of money and take a relatively long time to produce.

Insights from experiments

The most important finding, which was not entirely expected, is that you can actually use a material that has only been heat-treated and laminated into a panel or profile. The fact that we can make the material reusable without adding new materials or binders is key because it means we are keeping the material as it is and not contributing to the already difficult recycling of these materials. This keeps us at the level of waste minimisation, which is the most efficient way to manage resources. The fact is that the format of the material produced in this way is weaker than what could be obtained by adding resin, but in terms of the life cycle of the material, this is still possible after the material in its current form has ceased or lost its function. In this case, the sheets can be delaminated or torn and mixed with resin or other binder and reused before we get to the point where the material is effectively useless and the most efficient way is likely to be incineration to generate heat energy (Recycling Options for Coated Technical Textiles, n.d.).

The use of leftover slat curtains to make profiles has proved to be very useful as the leftover blinds are very similar in width, due to the fact that all curtains are cut to a standard width. This also allows a degree of knitting or control over the orientation of the trimmings when they are placed in the panel format. However, the orientation and any reinforcements make a big difference to the mechanical properties of the panel. The panels have been adapted to some extent in this respect as they are all cross-laminated (i.e. layers facing each other at 90º).

Reinforcements were added to the panels to increase their structural strength. These consisted of strips that were not initially included in the production of the panels. Later it turned out that the advantage of the long strips was precisely that they were of a constant width and at the same time several tens of metres long, which was ideal for the production of rotational profiles such as the later round profile. The same was true for the reinforcements, as I was able to make pieces of the strip with consistent dimensions, which were later cut to the dimensions of the panel. Both the orientation of the panels and the size, geometry and position of the stiffeners would naturally have required more adjustment and testing to achieve optimum results.

The fabrication method that has proved to be the most successful and flexible so far, regardless of the scrap pieces, was unexpected. While heat pressing this type of scrap has produced some really good results, they were not repeatable when I started to test the process with different pieces, some of which may or may not overlap, which was the most realistic way to do it at that point. This means that I don't process each cut separately, but rather simulate a conveyor belt that would glue the scraps back into the panel in a relatively messy way. Spot heating and pressure with a hand roller was sufficient and ideal as this method ensured that every part of the scrap surface stuck together, not just the thickest parts as with the hydraulic press. This method also eliminated the problem already mentioned of using larger plates, which cooled the material and did not stick together properly. Spot heating for about one second is sufficient to bring the material to the point where it will stick.

The nets proved useless in the heat lamination process, but were extremely useful in the resin-based manufacturing technique, acting as an excellent reinforcement in the material and allowing the material to be extremely strong with very little resin used. As a result, the material was three layers thicker and correspondingly stronger, without using any more binder. I think this is a very environmentally friendly way of manufacturing because we are retaining a material that is not recyclable in itself, but we are adding new properties that make it very durable and long-lasting which is significant from a sustainability point of view.

Travel to first CIRCE convention

05 Linking back

Resource consumption issues

the conscious use of the resources we extract from the environment. The crises we are increasingly experiencing today are essentially crises of sustainability and our current inability to be resilient. The findings contribute to the fact that in a European Union that is extremely productive and manufactures a lot of good quality products, we also have a lot of leftovers that are left on the table that we are unable to pick up because we still do not see the value in them. I hope that the project will provide insights that will help us to see that there is value in the by-products.

Clean by-products in particular are key resources because they are immediately usable and often still retain all the properties of virgin materials. The key is to make use of them, and in many cases this means optimising production and new products, or the opportunity for new companies to make new products from the leftovers. The project is a starting point to move in a direction where a number of smaller companies could come together and convert their scrap into panel and profile formats, thereby increasing their product portfolio. I think there are many such opportunities also in other sectors. However we would need many other alternatives to produce the products we need in the European Union.

Integration of cultural and creative economies and local context

One of the things we can learn indirectly from the project is that for many of the problems we have in production that are related to environmental issues, there is no need for new technology or unknown methodology. In fact, it is not even a question of new solutions, but of integrating different skills. Design as a mediator and conversation starter can contribute a lot to these issues, as designers are fundamentally used to bringing together different skills and disciplines and transferring applied knowledge from different backgrounds into production.

The cultural and creative industries are key to this reflection, as their diversity can make a significant contribution to accelerating change in the area of residual production. The key point is that companies should be more aware of the potential of the resources they leave on the table, but this does not happen very often due to the narrow view of their production. That is why outsiders are so important, because they can bring fresh insights into issues, or even shed light on issues that are ignored and not perceived as harmful. There is definitely also a big part in the fact that we need as many opportunities as possible, in the form of incentives or similar systemic levers, to encourage companies to work with the cultural and creative sector. Of course, it is important that the creative sector remains open to cooperation and is able to be flexible, because often the objectives of the industry are not quite the same, but it is the aspect of the environmental crisis that is important, that concerns us all and brings us together to look for common denominators and solutions.

There needs to be an awareness that the cultural creative industries also contribute to unsustainable production, as we designers are often guilty of not opting for sustainable solutions. More than the general unsustainable production, however, it seems to me that the clear point that emerges from the Techre project is that it makes sense to act in an area that we are familiar with and that is local to us both conceptually and geographically. I myself have been involved in the field of technical textiles, which has been present in Domžale, the town where I come from, since the Yugoslav era. At the same time, it also means that a lot of knowledge can be found in a small area. The beauty of it is that local problems are almost always transferable to other areas. Solutions of this kind can easily be implemented anywhere in the world, regardless of geography, and thus have enormous impact. So it makes sense to encourage local initiatives and people to work in local communities, where they can come up with solutions quickly and without too many unnecessary emissions. The key is to be aware that such projects and initiatives also need to be given a big enough voice to spread and become practice elsewhere.

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