2007 Chair

a restoration case study for
cyclicality of resources

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# Table of contents

I  Abstract ................................................................................................................. 5
II Key words .................................................................................................................. 5
III Acknowledgements ................................................................................................. 6

1.0 Introduction .......................................................................................................... 7
    1.1 What Got Me Here ............................................................................................ 7
    1.2 Introduction To The Project ............................................................................ 8
    1.3 Theoretical Base: Cradle To Cradle Strategies ............................................. 9
    1.4 Merging Strategies ......................................................................................... 11

2.0 Analysis .................................................................................................................. 12
    2.1 The Unpicking Method .................................................................................. 12
    2.2 The Original Elements .................................................................................. 14

3.0 Why Local ............................................................................................................ 15

4.0 Action: The Restoration ....................................................................................... 16
    4.1 The Finishing .................................................................................................. 16
    4.2 Fleece For Filling ............................................................................................ 18
    4.3 The Textile .................................................................................................... 20

5.0 Alternatives Materials, Tools And Methods .................................................... 22
    5.1 But First, Coffee ............................................................................................. 22
    5.2 Non-plastic Vegan Leather .............................................................................. 23
    5.3 Sponge Foam .................................................................................................. 23
    5.4 Possibility For Versatility ............................................................................... 24
    5.5 Sweet Prototype .............................................................................................. 24

6.0 Conclusion ............................................................................................................. 24
    6.1 The 2007 Chair And What’s Ahead ................................................................. 24
    6.2 Process Reflection ............................................................................................ 25

7.0 References ............................................................................................................ 27
    7.1 Art .................................................................................................................... 28
    7.2 Figures ............................................................................................................. 28
    7.3 Other ............................................................................................................... 28
I. Abstract

As a change agent in this project, my mission is to inspire and motivate fellow up-cycle designers, renovation artists and DIYers to join the vision to accomplish a more sustainable furniture and interior design market, along with architects, engineers and other professionals who work in the field. In this report I will be describing my process of applying the Cradle to Cradle strategies as a theoretical tool and guide for change, through analyzing the production of a chair, restoring and updating it to enable a biological cycle of its materials. The primary user of the chair is myself, the up-cycler, as an encouragement for sustainable DIY practices around old furniture for your own home.

II. Key words
Cyclicality, DIY, furniture restoration, up-cycling, sustainable materials, Cradle to Cradle.
III. Acknowledgements

I would like to thank my parents, who have been giving me inspiration and craft role models since I was a kid; all the tutors Anna-Karin Arvidsson, Daniel Gustafsson, Mathilda Tham, Stephan Hruza, Stephanie Carleklev, Åsa Ståhl, and my classmates, who have been supporting me throughout this project with the right insights and feedbacks; my boyfriend, Sebastian Helgesson, for driving me every remote place I needed visit for this project to go on; my good friends Selena Krivić and Amanda Lenko, who reminded me about possibilities and gave me extra insights; Robert Ullmann, owner of Alpackagården, who provided me with his alpaca’s fleece and instructions on how to proceed with the wool work (also want to thank the alpacas for their fluffy and valuable wool); my folk højskole teachers, Kirsten Svenningsen, who taught me how to sew and introduced me to the concept of up-cycling design, and Mikel Hvid, who further introduced me to wood work; and finally, I want to thank everyone else who has been evolved directly and indirectly throughout the whole journey.
1.0 INTRODUCTION

1.1 What Got Me Here

Since I can remember, my mother and father have always been crafters, and that became present in my own life very early, being my parents’ partner in crafts. Textile with my mom and wood with my dad. I lost touch with crafts for a while, during high school, but it came back to life when I spent five months in a Danish folk high school, where I learned to use a sewing machine and started working with wood by myself. That experience was what led me to the Design + Change program, during which I explored a wide amount of up-cycling design and DIYs.

Along the nearly three years studying sustainable design, I started noticing that the numerous DIY videos and tutorials about packaging up-cycle and furniture restoring out in the internet, turned out to be a down-cycle, as it downgraded the initial product and, later on, made recycling harder. Do It Yourself is a good concept, but only when we know what we are doing. As I said, I have done it myself during the past few years. Among packages turned into pencil holders and boxes covered with textile, I have story about a headboard.

Being an international student, living in Scandinavia for nearly four years, I missed the comfort of living in a cheaper country, Brazil. I missed my parents’ house, where I had my dream bedroom. Back then, I was about to move to a new apartment. I wanted to have something from my room in Brazil, to make Växjö my new home, so I decided to make myself a headboard, similar to the one I had in my bedroom at my parents’ house. I had a few furniture that I wouldn’t need in the new apartment. I used their material to make myself the so desired headboard.

My worst flaw is to be compulsive. I thought I would do the best thing in the world by taking some plywood from an old (still
useable) shelf, taking the foam off an (not so) old mattress and using the half of my curtains’ fabric. I wanted to do it good, but I ended up throwing perfectly good material in the trash. In the end, the headboard smelled bad due to the foam that was used. I turned it into an ottoman/table. The table was not very functional and more material (from a coffee table I used as base) was wasted.

It is uncomfortable to expose this process. It is a shame that it took me half a shelf, a third of a mattress and some plywood thrown away for me to realize how harmful “up-cycling” can be. However, I do not regret anything, because it led me to change my practices and come here to share this story with you, who are reading this report. If you have passed through a similar realization or just don’t want to pass through it, if you are interested in changing the way you restore furniture or if you want to start practicing restoration in a responsible way, this report is for you.

1.2 Introduction To The Project

In this report I will be exposing my process and merged strategies of the Cradle to Cradle production cycle, in special the steps in between production and disposal. My goal is to show a way to convert a product from the old fashion and outdated linear-life to the circular-life, applying one of the values of this report, cyclicality, that will be based on a literature review about books and journal articles written about the subject (page 11). I will also develop an argument around geography and locality (page 15), that goes back to a Sustainable Interior Design Week course, how these are a standard guide for sustainable use of resources and how they provide us with challenged and windows of possibilities. Versatility comes as a value

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2 Intensive online course provided by Ugreen Interior Design.
for future possibilities, (page 24) as an extra strategy for the practical maintenance of the final product and the easy reuse and recycling of an added element of the product.

As I write this report about my experience with my case study - a chair rescued from Norremark’s recycling station, in northern Växjö - and the conclusions I noted on the theories and methods I used, I dedicate it to my target group: fellow furniture restoring practitioners, designers, DIYers and anyone who may be attracted by this area; in the hope of reaching and influencing change making in the moments of a cycle that we can intervene at, even though we are not involved in the first moments of the cycle, the design, planning and industrial production.

Figure 1 shows a graphic I developed in order to better visualize the moments of a product’s life I will be approaching: the reuse stage.

1.3 Theoretical Base: Cradle To Cradle Strategies

In an article for the *Journal of Industrial and Production Engineering*, the authors of *Product design and business model strategies for a circular economy* (Bocken et al., 2016) developed a
discussion on strategies for product cyclicality terminologies, by Stahel, and also based on McDonough and Braungart Cradle to Cradle. The paper assembles a complex literature review and develops a discussion with “sub strategies” within Stahel terminologies in a clear way. For that reason, I will be referring to this literature review, reflecting on my own experience along the way.

*Strategies for resource cycles* are sets of tools for economists, engineers, manufacturers and designers to facilitate change-making on their own professional areas. The professional area is within each stage of the timeline in figure 1 and this is the stage a professional finds themselves is what I like to call *fields of sustainable responsibility*. The field and stage you act/work on is where you find the most potential for a positive change. The strategies make it easier the comprehension of the theoretical dimension and the visualization of the physical and material practice of design and production, being it in the beginning or the end of the product’s life timeline.

The first terminology mentioned on Bocken’s article is called *slowing resource loops*. It comes with a few sub strategies, to mention a few: *design for long-life products*, which is linked to *choice of materials*, at the first moments of the cycle; and *design for product-life extension*, at the *reuse* phase, where restoration and up-cycling comes in, along with this project.

The second terminology is *closing resource loops*. Closing the loop essentially means giving the material of a product the opportunity to go back to early stages of production: *Cradle to Cradle*. From the three divisions presented by the authors, the relevant one for this paper is the *biological cycle*. This sub strategy is only suitable for biodegradable products, that is, any material or resource that is decomposed by bacterias or other organisms in nature. As this project aims the reintroduction of the materials into nature, which is widely referred as *cradle to cradle*, instead of the traditional *cradle to grave*
linear-life-product. When transforming a *cradle to grave* product, into a *cradle to cradle* product, we start a cycle from the reuse stage, possibly repeating a few of the earlier moments like the *choice of materials*. In the best case scenario, the *cradle to cradle* cycle would ideally have no end. After all, *In nature nothing is created, nothing is lost, everything is changes* (Lavoisier, 1789). However, a few materials take longer to change or be transformed in nature. This is when we, change-makers come in, choosing the best possible material option, multiplying the number of cycles as much as possible.

Back to the primary *choice of materials* stage. The third strategy, *narrowing resource flow*, is specifically to the reduction and efficiency of materials (*reduce*).

On all the three strategy terminologies, the professional finds a theoretical base and path to be followed, a path for positive change in the furniture world, wether you act on the design, manufacture or reuse stages of the timeline (figure 1). It unites professionals that work within each moment of the cycle and those who take furniture restoration or manufacture as a hobby.

### 1.4 Merging Strategies

In an attempt to transform the linear into circular, I will be merging two of the strategies and apply them to my chair case study: *design for product-life extension* and *closing resource loops* with a *biological cycle*. Extending the life of the rescued wooden chair with upholstered seat (figure 2) and adapting it to a *biological cycle* as sustainably as possible. This way, instead of extracting value (down-cycling) we would be adding value (up-cycling.) In order to do that, any added material must have the
least impact possible.

In order to uncover and discover what I need to know about the chair, before renovating it, I will be using the unpicking method. Unpicking is a design method that facilitates the analysis of the big picture of a project, a concept, a service, a product, etc. You disassemble it so that you can analyze how it is built and what can be improved. An upholstered chair is more complex than it seems at first look. There is the structure, mostly composed of wood, and there is the seat, which has more than three materials with their own little universes. Besides **structure** and **seat**, I also like to divide it into **macro** and **micro** elements and their individual components. Macro elements are the ones you identify when you look at them - wood, fabric, foam, metal, etc. The micro elements are hidden in between the lines - glue, oils, pegs, etc. Unpicking is the best method to analyze the elements of a product. The components are the chemistry, the formulas present in an element. Research is the method for the element’s components. During my process I have used many ways of research, reading articles, contacting manufacturers, reading labels, asking people who know about a material.

### 2.0 Analysis

#### 2.1 The Unpicking Method

**The Structure**

As mentioned previously, with the unpicking method I identified the elements of the chair, discovering things beyond the primary analysis, when the chair was entirely assembled. I started by taking the seat off the chair and analyzing the structure of wood. I

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3 Unpicking Workshop, by Marie O’Connor.
unscrewed off the wheels of the front legs and other visible screws (figures 3 and 4). After doing that I still could not disassemble the whole structure, which led me to assume that the chair’s parts were very well fit in (figures 5 and 6) or with some sort of wooden peg (figure 7). It is very possible that they have used PVA glue to reinforce it.

The Upholstery

The seat of the chair (figure 8) is by far its most complex part. In the pictures below it is possible to see that the seat was upholstered with macro elements: a leather-like fabric, plywood, metal pieces and synthetic foam; and the micro elements: the components of the fabric, the PVA glue in the plywood, the polyester in the foam. It is expected that a lot of the material of a 14 year-old chair will be damaged when you unpick it. The upholstery’s fabric had stains and the foam had a few dots of mold in it (figure 9).
2.2 The Original Elements

Luckily, the 14 year-old chair still had the manufacturer’s label tattooed on it (figure 10). I have contacted the company to get further information on the material. They did not have much to say besides the wood that was used and where it was produced. By watching a few of their Youtube videos and assuming they had the same values back in 2007, the wood of the structure was made in massive wood. According to Jonas Fröjdh, whom I had contact with in the company, the chair as either made of birch or ash, two common trees in Småland. To find out more about the wood found on the seat (pic of the plywood), I asked my tutor, Stephan, who is a trained cabinetmaker, furniture designer and carpenter, for his valuable opinion. After hearing his advice, I concluded that the seat was made of plywood of the same wood from the structure and glued with PVA glue.

White glue, wood glue, or PVA\(^4\) glue, is still the best option for furniture manufacture, out there. It is widely used throughout the industries, for multiple purposes. Nowadays you can find white glues with very low VOC\(^5\) levels, making it even safer to use it. PVA is also decomposed under the correct conditions.

It is expected that the foam of a long used upholstery article would not be in the best conditions and you may uncover things you never thought were necessary. An example is the possible green contact glue that was keeping the foam sticked to the plywood. Seems to me not to be necessary, since there would be a textile around tightly stapled underneath.

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\(^4\) PVA: Polyvinyl acetate

\(^5\) VOC: Volatile Organic Compound, are a group of chemicals usually found in domestic items. A high level of VOC can toxic for our health.
Another thing that I found as I unpicked the seat were spots of mold on the foam. The foam that was used was a synthetic one, widely used by the furniture industry for upholstery, together with textiles like polyester, olefin, cotton and leather. The textile used for the seat in this Stolab chair was a faux white leather, which is most commonly made of plastic components. About the wheels, I couldn’t find out if they were original from factory or not.

3.0 Why Local

Our homes are our intimate environment and it has been originally shaped according to the biome we find ourselves in. Climate, flora and (even) fauna’s aspects of a region need to be analyzed when designing sustainably. Questions to ask are: What kind of vegetation is available around me? What are cultural handcraft practices in my region? Is the carbon footprint of product X, from across the world, worth it, or is there a local Y product that can do the job just as good?

This is what makes sustainable design so intriguing. It challenges us to work with what we have rather than what we want, it opens possibilities we wouldn’t have under other circumstances and most of all, it creates original pieces and responsible projects, made with care for nature and humans. There is a reason why in tropical regions the use of coconut, cane furniture, woods from tropical trees and tropical plants themselves are widely spread. Nature is so amazing, that the specific materials you find around are often the ones you need to survive in that specific climate. The Brazilian biomes, for instance, inspired furniture designers like Joaquim Tenreiro to introduce the cane seats in chairs, like his widely known design Curved Chair (figure 11) to the market in the 40’s, a material of easy ventilation. This interior design style can be applied in countries with similar climate, with

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6 Five out of six biomes in Brazil, with a few latitude exceptions, are nest to most of the typical tropical materials and resources
small adaptions. That does not mean that you cannot have a few items that you collected during your trips or were gifted to you. However, when it comes to entire interiors, it does have a much bigger impact. Local does not mean sustainable, but if you are to choose within sustainable materials, local is best.

Just like interior designers, we, furniture renovation artists, up-cyclers and DIYers, should take the responsibility to make our renovations in the most sustainable way possible. Once we do the analysis, as shown in previous pages, we should start looking for the alternatives we have at hand.

From the elements I’ve mentioned before, there were two in particular that I would have to substitute: foam and textile; and add some finishing. When adding something new to a piece that is being renovated, we have to make sure that the item or feature is adding value to it and not taking its existing value. Remember: up-cycle, not down-cycle.

4.0 Action: The Restoration

Having the cradle to cradle base and having done the analysis, I can start applying the strategies and improving what was analyzed. I tried all I could to stick to local or, at least, national materials and providers.

4.1 The Finishing

The first step I took was to sand the whole chair’s structure, to take any superficial impurities, make the surface even and prepare it for a finishing. I had in mind three options of finishing: pigmented treatment oil, clear treatment oil or paint.
I tried a pigmented oil at home, using raps oil and a bit of mate herbs I had, for a clean green finishing. I boiled the mate with the oil in an attempt to extract the maximum of pigment from it. I applied a few layers of the oil in a similar wood piece I had at hand. This was not successful, the wood became yellow (figures 12 and 13). Later on, talking to a classmate, I realized that making an organic solution at home without proper knowledge could lead the wood to rot. For the next option’s trial I used organic linen oil with no pigments. From the sanding, the chair’s structure was not evenly pigmented and the oil did not change anything aesthetically (figure 14).

The third and last option was paint. I had never looked for biodegradable paint before, so I was not even sure it existed. The VOC of the paint is less than 1g per liter, that is 75 times less than the European Union’s maximum legal value for matte interior water based paints (EU, 2004). The paint (figures 15 and 16) I used is plant based, doesn’t cost much more than a good indoors paint for furniture and - the best part? - you don’t have to worry about getting toxicity in your lungs while you paint. This paint also has less than 1g per liter. Plus, I
love the result (figure 17). Living in Sweden for a few years made me enjoy the white wall in nearly all apartments I have been to and the neutrality of the furniture that compose them. A white chair will easily fit in an open house, for instance.

4.2 Fleece For Filling

For the seat upholstery I had a few options, that included coconut fiber, a possible experiment with loofah sponges, ecologic cotton and alpaca wool, which is called fleece. I eliminated the first two options for their remote crops and production. I contacted a few companies with the hope for a collaboration or donation of organic cotton. I had one response, from the which I am so thankful. Robert, owner of the Alpackagården, here in Småland, offered to provide me with the fleece I needed. Besides that, I went to the farm with other three people and spent some amazing few hours of a Sunday at the farm, learning about those amazing animals (figures 18, 19 and 20). Alpacas are animals with an Andean origin, that is, they are from the Andes mountains in South America, a cold and windy place. The south of Sweden has a warmer summer than the Andes.

At Apackagården, Robert has around 40 alpacas, from the which he gets over 70kg of fleece every year. The fleece is taken without any anesthesia or sedation. There are three qualities, each from different
parts of the body of an alpaca. Quality A is the best of them and it is taken from the upper part of the animal. Quality B, from the legs. Quality C is from everywhere else. In order to produce yarn of good quality the fleece must be at least 5cm of length. As quality C is not long enough and not in the best parts of the animal, it is the one used for fillings. Robert gave me a full bag of fleece (figure 21 and 22) and told me to wash (figure 23) it with organic olive oil soap (figure 24), for keeping the fleece as natural as possible. Unfortunately, I did not find olive oil soap made in Sweden, so my choices were Morocco or Greece.

Fleece is an interesting material to work with. It takes a lot of time and work to clean and even more time to make it fluffy after it dries. It took me about 4h to untangle all of it, and the volume changes enormously (figures 25 and 26).

7 “Loelle Olive Soap is produced by hand by a carefully selected women’s cooperative in Morocco. This gives the women a stable income and better welfare.”
The time spent in this specific part of the restoration makes me think about slowing down things in the rushed daily life. It is not only a therapeutic moment, where you have the time to be with your mind on and your thoughts, but also a moment to reflect on what you are doing. Who is usually doing this work when I buy something make of sheep or alpaca wool? Isn’t this person’s time just as worth as mine? This is when I realized the obvious, something that is in the core of DIY. The more time you spend with your own hands on something, the more value you attribute to the thing.

4.3 The Textile

As for the textile, I did the same as for the filling. I contacted a few Swedish companies, where they have organic fabric to sell. One company, Tygverket, replied me kindly, offering me a few scraps of textile. However, as I write, I still haven’t received the package. As a back-up plan, I order both fabric⁸ (figure 27) and sewing thread⁹ (figure 28) from another store, in Malmö.

I did a few tests with a versatile seat double-sided cover. The two cover sides would offer more options according to the mood and the decoration of the room the chair is on, allowing to copy the model for more options of color and patterns. This was made in an attempt to make the chair adapt the owner. If you get tired of the one side, you

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⁸ 100% cotton; organic: cotton canvas off-white and cotton off-white with flowers

⁹ 100% cotton; organic: off-white sewing thread
flip it, if you are tire of both you can is reuse the cover or its fabric for something else, like a bag or a cover for a stool. However, after my trials it did not work well and it would have been hard to put on and off. This option still stands, but needs more time for trying out different ways to achieve the right shape of a seat in an easy way.

So I ended up doing a traditional finishing, with staples. I made a cushion with the alpaca wool and used it as if it was the classic foam. Afterwards, I followed the usual steps for upholstering. See figures 29 to 34:

I feel very happy about the result (figure 35, 36 and 37) and the process. This journey has been teaching me a lot about materiality and the whole process of sustainable furniture restoration and has given me hope and a good expectative for future projects like this. Honestly, the chair is not as comfortable as it was before, but it is more comfortable
than sitting on a chair with no upholstery. We just have to compromise, it is a price we have to pay for sustainability.

5.0 Alternative Materials, Tools And Methods

Sustainable design doesn’t only come with challenges. Some alternatives are limited by geography and climate, but others are global. In our world’s diversity of biomes, hemispheres, coordinates, latitudes and longitudes, we have other options and new doors and windows are open for our imaginations. To prove that alternative does not always mean speculative, I have selected a few examples on alternative materials used for restoring, as well as producing an original and sustainable DIY piece.

5.1 But First, Coffee…

Besides the material I have mentioned, there are numerous more possibilities for sustainability that fit particular climates and regions as well as the whole world. Have you ever stained paper with coffee, to make it look like an ancient parchment? What about using it to stain wood to give it a beautiful and organic finishing? That is what I saw on an instagram page10 I follow, called Muda Por Dentro (Change From Inside). Gabriel Resende, the artist behind it,

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10 Muda Por Dentro Instagram (@mudapordentro), by Gabriel Resende.
shows a step by step video on how he transformed a simple wood board into a sophisticated desk (figure 38), using 1:1 instant coffee and rubbing alcohol as wood stain. The posts in this account are directed to DIY and renovation of Gabriel’s apartment, who puts together traditionally Brazilian materials, like straw and cane, with tropical and modern interior style. This is a good example of local interior design, that reflects the regional nature.

5.2 Non-plastic Vegan Leather

In the forests of Brazil, the enormous leaves of a tree called Alocasia Macrorrhiza, creates a great leather-like sheet that can be used as textile for multiple use. The Brazilian company Nova Kaeru11, in collaboration with Italhide S.p.a.12, an Italian manufacturer of traditional, fish and reptile leather, launched a new product called beLEAF™ (figures 39-41). The product received an award for best natural material, in 2019.

5.3 Sponge Foam

High quality organic cotton and wool are quite hard to find and are very valuable goods and the plastic based foam is outdated in times of sustainable urges. Another vegetable based solution is the loofah13, the natural sponge that we trust enough to have it in contact with our skin. The plant is used in dozens of markets out there: cleaning, sewing, decoration,

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11 www.novakaeru.com.br/
12 www.italhide.eu/
13 Loofah: Luffa acutangula.
etc. The rest of loofah is used by the automotive industry, for upholstery of vehicle seats (Carvalho, 2007).

5.4 Possibility For Versatility

Although my double-sided cover did not work well for my specific chair, it is very viable for others. This is not a new idea at all, but it is underestimated. It doesn’t have to look like a crochet sheet that grandmas use on their armchairs. You can leave that vintage look behind, if it does not fit your interior design, and stick to modern ideas of covers that are not even noticeable. This opens a door for user/owner personalization of their purchased item. It allows meta-design to be applied: you design for the user to design further on, putting out their own individual touch to the piece.

5.5 Sweet Prototype

Sustainable materials should be applied since the first steps of production and restoration: prototyping and trying out. One of my evening furniture course classmates, Salwa Albouza, used marshmallow as foam material for quick and temporary prototype of chairs (figure 42). It is a surprising and creative material for prototypes. It may not be a thing for real furniture, but, considering that the marshmallow would be cleaned by the heat of a bonfire for instance, this is a great example of organic cycle and the decomposer is the human’s own digestive system.

6.0 Conclusion

6.1 The 2007 Chair And What’s Ahead

Applying the Cradle to Cradle strategies was more realistic than I thought it would be. It is important to acknowledge that it will never be
100% sustainable, but it is our responsibility to do the best we can. I found Stahel’s strategy terminologies, combined with Bocken’s article to be very helpful in explaining this complex world of cyclicality of resources and clarifying for all fields of sustainable responsibility to find their change-making tools.

The chair will be in my home as, not only a chair, but also as a reminder of how viable it is for many other sustainably restored chairs to exist and an incentive, an example of resilience and persistence, for me and others who visit me.

I am hopeful that the 2007 chair is a first project within a series of cyclicality of resources. I would also love to try change-making as a designer in other areas of the product’s life timeline.

6.2 Process Reflection

This project gave me a great opportunity to reflect on past projects, for instance the headboard’s one. It showed me how it is possible to do it different with a bit more effort and - I won’t lie - a lot more research, that is worth it in the end. No production or restoration will ever be perfect and we learn more and more from each change making we attempt to do.

One thing that has been bothering me is the lack of documentation. Although this is the most documented project I’ve ever done, it is still missing pictures of the process and reflections of everyday I worked on something. Another thing that bothers me is the plans I did and missed. More organization would have been great.

Although, those weaknesses, among other ones, are part of the learning process. They ended up being my individual reflection of the outcome stronger. In most projects I have experienced, the learning experiences and their natural upgrading consequences weighted more than the result itself - many times, the project is the process itself. I have learned and have been learning a lot - both social and practical skills - from others around me and my tutors, who do their best to help me on this project. I
learned that I have to take it easy, trust the process, be transparent about the process while documenting it. I also learned that the first drafts and prototypes will never be perfect. In fact, they are not supposed to be. We are supposed to work on them, over and over, until we are satisfied with the result. Persistence is the key trait for all change making to be effective.
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7.2 Figures

Figure 11: H. Gallery, (year?), Curved Chair [image] Available at: https://hgallery.com/ [accessed on April 23rd of 2021]

Figure 38: Resende, G. 2021, Home Office Desk [image] Available at: https://www.instagram.com/mudapordentro/ [accessed on April 23rd of 2021]

Figures 39 and 40: Nova Kaeru, 2019, BeLeaf leather [images] Available at: https://www.novakaeru.com.br/ [accessed on April 28th of 2021]

Figure 41: Perini, R. 2019, beLEAF™ used on a stool [image] Available at: https://specialtyfabricsreview.com/ [accessed on April 28th of 2021]

Figure 42: Albouza, S. 2021 prototype chair made with marshmallows.

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