

PROJECT DESIGN METHODS AND UPCYCLING OF FASHION PRODUCTS IN BACHELOR CURRICULA OF FASHION DESIGN COURSES

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Abstract

There is a discussion about the impact of the fashion industry in the environment and how the relevant players can act to mitigate its impacts. Universities can have an important role to prepare future designers and engineers to the Fashion Industry according new principles focused in sustainable design, circular economy, clean production processes and recycling (upcycling and downcycling) of final products before go to landfill. Cradle to Cradle, written by William McDonough and Michael Braungart, discussed many concepts and approaches to deal with these tasks. Also, the Ellen MacArthur Foundation wants to inspire a generation to re-think, re-design and build a positive future circular economy. The circular economy of fashion products requires a new consumer, a citizen "Homo Sustentabilis", that think in all his actions to preserve the maximum as possible the environment to the future generations.

The curricula of the different courses in Fashion Design needs to be upgraded continuously to tackle with these new challenges. Project design methods can be defined to the Curricular Units of bachelor students in fashion degrees, including approaches to sustainability and circular economy as possible outcomes. Upcycling and downcycling are the topics that this paper will discuss. The experimental process developed by the authors includes the design process of fashion denim disposed by the consumers at the end-of-life. This textile material (denim) has many possibilities to the designers and can be used as raw material to other industries and fields.

At different levels, this research can incorporate knowledge in recycling process of this material to the textile and clothing industry, can promote the use of this textile products in other fields (new modern urban architecture incorporating denim fabrics and accessories) and can develop other categories of products by moulding polymers with denim fabric inside the polymeric matrix.

The linkage between the project design process and the industry will be highlighted by the future collaboration in the training of new designers in a learning-by-doing process with the university labs and textile factories. Innovation processes in this particular fields can benefit from a close action and cooperation between the main players of the Portuguese textile and clothing cluster. New fashion designers will be ready to face this demanding from the "green consumers" in a better way if they can apply and test their creativity and design process in action.

Keywords: Project design, upcycling, fashion industry, bachelor degree, circular economy, curricula university.

1 INTRODUCTION

The concern with sustainability is growing, many claim that the concept of sustainability arose in the 70s, in meetings organized by the ONU. The term is related to the act of preserving or conserving and has been increasingly used in relation to the actions of human and the environment.

According to Boff [1], "Sustainability represents the procedures we take to allow the Earth and its biomes to remain alive, protected, fed with nutrients to the point that they are always well preserved and up to the risks that may arise".

In general, it is possible to affirm that the central idea of sustainability is the preservation of the most varied resources existing on the planet in order to make it possible to continue, which also includes social, environmental and economic issues [2]. Although the concept of sustainable development emerged in the 1970s, the greater concern with regard to more sustainable means of production and the number of discussions on this topic has gained a greater proportion recently due to the climate changes that are being caused by global warming. The fashion industry is one of the most responsible for the negative impacts on the environment, they are polluting products generated by the textile and

clothing industry that work with accelerated production and excessive consumption. There is a discussion about the impact of the fashion industry on the environment and how the actors considered relevant can act to reduce their impacts. The entire accelerated production and purchase process coming from the fashion industry ends up generating a large volume of discard both by the industries, through residues and scraps from production cuts and by consumers who, when purchasing new products, end up discarding old pieces.

In view of this, universities can play an important role in preparing future textile designers and engineers for the fashion industry according to new principles focused on sustainable design, circular economy, clean production and recycling processes (upcycling and downcycling) of final products before to be disposed of in landfills. These issues have already been discussed by several authors, in the approach entitled Cradle to Cradle [3], the authors propose a methodology for the creation of industrial products and systems that can be more effective and regenerative for the environment, enabling the transition to a circular economy in place of the current linear economy.

Through the circular economy there is a quest to design products, services and business models that exclude the production of waste and pollution, making it possible to keep products and materials in use for as long as possible, thus ensuring the regeneration of the material resources used [4]. It is essential that future designers understand the importance of rethinking and redesigning, reusing materials in order to extend the life cycle of materials.

The use of existing products is one of the factors of great importance when it comes to sustainability, as it seeks new functions and ways of reusing parts of a product in other products, thus contributing to the reduction of the environmental impact generated by the discards [5].

According to the Ellen MacArthur Foundation [6], climate change is more and more worrying, with total emissions of greenhouse gases from textile production about 1.2 billion tons annually. This data is important to help raise the awareness of the new generation of consumers and professionals in the fashion industry and encourage everyone to rethink, redesign and build a circular economy with less negative impacts for the future.

Themes such as sustainability and circular economy need to be included in the curricula of fashion design courses for raising awareness, (as citizens and consumers) and training professionals who think about how their actions can preserve the environment as much as possible for future generations. Specific knowledge on the reuse of materials through approaches on downcycling and upcycling themes present in this project is important.

For a better understanding of these issues, this project will continue with an experimental process involving upcycling. The experimental process to be developed by the authors includes the design process using denim disposal. Denim was chosen because it is a resistant textile material, produced on a large scale and that generally presents its qualities preserved when discarded and can be used as a quality raw material for other industries.

The development of this research aims to collaborate to incorporate knowledge in the recycling process of this material for the textile and clothing industry, to promote the use of these textile products in other fields (architecture, interior design, accessories) and/or to develop other categories of products by molding of polymers with denim.

The link between the project design process and the industry will be highlighted by the future collaboration in training new designers in a process of learning by doing developed in university laboratories and textile factories. The innovation processes in this particular field can benefit from close action and cooperation between the main players in the Portuguese textile and clothing cluster. In addition, new designers will be better prepared to better face this requirement of “green consumers” if they can apply and test their creativity and design process in practice.

2 METHODOLOGY

The methodological structure applied in the first phase of this study is qualitative, in which the forms of knowledge search are carried out through bibliographical, documentary and exploratory research. An analysis of the state of the art and the ways of reusing existing denim is necessary, as well as a search for creation methods and techniques developed by other professionals for the elaboration of this type of product. In the second phase of the work, called empirical or practical, it is intended to develop a more experimental work, with a proposal to create products through the upcycling of denim residues.

For this, the study of creative processes is essential because the research to be developed requires an analysis of existing processes, combined with a search to satisfy sustainability issues, through the generation of ideas to find innovative solutions. For the creation process, it is necessary to look at the problem more carefully, trying to perceive what is not normally perceived, ignoring the common, being this different perception, capable of leading to new and surprising ideas [7].

The present study is based on the fundamentals of the circular economy and consequently sustainability, since the circular economy aims to develop products and services in a more sustainable and less polluting way possible. The reuse of textile waste is capable of bringing materials back to the production chain from the final stage of the product's life cycle. The study intends to take this thought and encourage other designers and fashion professionals to delve deeper into sustainable issues related to the fashion industry. This qualitative analysis of methods is aimed at finding a new way to extend the life cycle of textile denim waste through upcycling. The choice of denim as a study material was made because it is a textile material with great potential and at the same time with a high environmental impact production.

Denim is one of the most polluting textiles in the textile chain (both in relation to the production of the raw material, cotton; and in relation to the consumption of water in the washing processes). According to data, the global area dedicated to cotton cultivation has not changed in the last 70 years, however, this cultivation has impoverished and degraded the soil. Annually, are used 200 thousand tons of pesticides and 8 million tons of fertilizers, which means that to produce 1 kg of cotton 0.35 to 1.5 kg of chemicals are needed, contaminating soils, rivers, lakes and underground aquifers. With regard to water, an average of 93 billion cubic meters of water are spent per year in the textile industry, and this expenditure mainly refers to the production of raw materials such as cotton, the dyeing and drying stages and during use by consumers. In addition to all these worrying data on manufacture, after the products are consumed and discarded, only 20% of the clothes are collected for reuse or recycling and less than 1% of the materials used in the manufacture of the clothes are recycled to make new pieces clothing [8].

Denim waste can be reused and returned to the production chain. The term reuse refers to the reuse of materials already existing in the industry through the application of these materials in a new product, minimizing the amount of waste generated by companies [9]. The reuse of materials is done through the recycling process that encompasses two different methods: upcycling and downcycling.

The term upcycling is related to the reuse of material in the format in which it was discarded, and it can be reused without involving any "reprocessing of the waste", which in addition to preserving the characteristics of the material also avoids an extra energy expenditure for the processing of the waste. It is exactly this factor that differentiates upcycling from downcycling, where "reprocessing of material" is necessary.

In the downcycling recycling process it is necessary that the material is collected, processed so that it can only be reused, so it is not a totally ecological action, since it reduces the quality of the product and may need some aggressive processes to the environment to be able to transform the waste into a new raw material [10].

Upcycling is not just related to the conservation and reuse of materials, but to a recovery that is attributed again to the product, preventing it from being discarded [11]. In the Upcycling process, materials that would be discarded are reinserted, all the material is transformed into a new product with a new function, without the need to undergo any chemical process [12].

There are residues that need to be reprocessed before being inserted back into the production chain, but this is not a rule and the important thing is to know how to assess and differentiate the needs of each material in order to preserve its characteristics as much as possible and to avoid unnecessary energy wear.

At the same time that its denim production is polluting, this product is highly resistant and widely accepted worldwide, with no evidence that it will stop being produced. This resistance of the product also makes many of the discards are in excellent conditions for reuse without requiring the recycling process (downcycling). The reuse of this material does not eliminate the damage caused in its production, but it has the intention of prolonging its life cycle and avoiding as much as possible that it is discarded unnecessarily.

The development of a product from the use of waste brings the possibility of putting a material back to use, allowing a new life for materials that have already consumed large amounts of water, energy, chemicals and extensive areas of cultivation. They are materials that still have great textile value but

that would be discarded and incinerated or accumulated in landfills. For Manzini and Vezzoli [13] design is part of the problem, however, it can become an agent that promotes sustainability when looking for new design alternatives.

These and other issues involving sustainability in product creation must be passed on to fashion students in order to shape the professionals of the future. In the process of creating designers, the impacts caused on the environment must be questioned, and it is the designer's responsibility to guide this process also by ecological criteria. And it is from the awareness of the role of the designer in this change of thought that it becomes important that since its formation, the professional is prepared to deal with issues related to sustainability throughout the product development project.

Professionals in the fashion industry must be prepared to enter the job market, acting as agents that promote sustainability, being able to apply environmental, social and economic requirements in their projects. "The role of industrial design can be summarized as the activity that, linking the technically possible with the ecologically necessary, gives rise to new proposals that are socially and culturally acceptable" [13].

It is essential, for the development of professionals of the future, which this knowledge about sustainability in the development of projects occurs in the training of professionals. The curricular units of the design and fashion courses must emphasize the environmental issue. And in order for projects to have environmental issues applied, students need to be able to put the acquired knowledge into practice even within the higher education institution, allowing them to verify the entire process.

This study follows the research phase in search of ways to reuse denim in order to contribute to the development of sustainable products and also to be used in future practical learning processes to be developed in university laboratories and textile factories. In view of the analyzed products, two products were selected that represent relevant studies of reuse of denim residue and that may serve as a basis for the follow-up of the study in search of future improvements and / or innovations in the area.

3 RESULTS

3.1 Analysis – early stage

In this first phase, several products were analyzed and among the conceptual projects and products already commercialized, the two considered most relevant in terms of reusing waste of denim through upcycling are highlighted. In the first project, from denim, a material used to create furniture is developed and in the second project frames for glasses are developed, as they can best be seen below:

3.1.1 Bahia denim

The designer Sophie Rowley reuses waste from denim and created a product similar to marble for creating furniture Fig.1. This product was selected for the differential it represents because it reuses denim to develop a light and resistant material capable of being used to create pieces of furniture. Post-consumer denim residues and production residues from the fashion industries are used, the residues are layered on top of each other, and joined with a kind of resin. The pieces are sculpted in different shapes and can be used for furniture, wall panels or any other internal surface.

Rowley[14] states *"By applying a set of industrial and craft processes to these waste materials, I was able to experiment until the materials took on completely new aesthetics and were almost simulating natural materials such as stone or wood."*



Figure 1. Bahia denim[14]

3.1.2 Mosevic

The brand of eyeglasses Mosevic (Fig.2), develops the products through residues of denim. The denim fabric comes from the post consumer, and for the development of the material several layers of the fabric are placed stacked on top of each other and pressed in molds, these molds are covered in a special synthetic resin that creates a composite and resistant material, as if it were a “solid denim”. After this process, the glasses are cut and the frames undergo a stone washing process to restore the classic look of the jeans.



Figure 2. Mosevic[15]

3.2 Empirical work - future studies

In the second phase of this study, we will try to explore the possibilities of reusing denim disposal. The idea is to use waste, whether pre or post consumption for the creation of new surfaces. For this, it will be necessary to deepen the studies on technologies that can be applied and the development of creative processes for the elaboration of a new material that will later be analyzed and applied to the products and use considered most suitable for the structure.

The whole process will be of creation and experimentation, exploring different creative solutions in search of a better and / or new reuse for denim residues. The study intends to find a new solution or an improvement that enhances an existing product in which the main focus is to reuse waste that would be discarded, transforming it into a new material and a new use.

4 CONCLUSIONS

The industry in general, but mainly the fashion industry, is changing. The industry is experiencing a need to create solutions and products that cause less damage to the environment, while at the same time needing to find solutions to the damage and waste already caused, such as the disposal of textile waste in the environment.

In the initial phase of this study, projects were researched, whether conceptual or already commercialized, regarding the use of denim residue through upcycling for the development of new materials and products. In view of the analyzed projects, two were highlighted, considered more relevant, in which it is possible to verify the potential and versatility of denim for the development of products in addition to clothing. Through the upcycling of denim it is possible to collaborate with the reduction of this type of waste involving less energy expenditure than in the recycling process (downcycling).

Product analysis brings important insights into the different types of materials that can be created and the potential for waste that future fashion professionals need to know about. The analyzed projects bring knowledge about denim and awaken creativity for possible new creations through the mixing of materials.

For further studies like this to be carried out, university education based on the principles of circular economy and sustainability is of great importance to train professionals and consumers with environmental awareness for the development of new products. Obtaining knowledge about the amount of waste discarded and the potential that this material represents can collaborate with the training of new generations of professionals in the field of fashion who will be the future creators of products.

Therefore, this study goes to the second phase, the experimentation phase of new ideas involving denim residues and upcycling for the development of new materials based on the studies analyzed and aims to place this experimentation within universities as a way of providing students with the possibility of put into practice knowledge about sustainable product development.

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