Extended Abstract
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Re-Imagining Garment Cutting Waste: Fashion Hacking, Zero-Waste, and the Power of Negative Spaces

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Introduction

The fashion industry generates a significant amount of textile waste, accounting for 10-15% of the total fabric used only during the garment cutting stage (Rissanen, 2007). These offcuts are typically considered useless residues, but they can be reimagined as valuable resources for the creation of new products through an innovative approach that combines Otto von Busch's theory of fashion hacking (2014) with the zero-waste design discussed by Timo Rissanen and Holly McQuillan (2018) as a tool for optimizing the cutting process. The integration of digital tools like Ai-powered tools and digital prototyping software has been widely studied to optimize fabric usage and minimize waste in fashion design to facilitate sustainable production (Salomé, 2024). Research highlights how these technologies enable zero-waste pattern development (McQuillan, 2019), reduce physical prototyping (Vrljanac et al., 2023), and optimize fabric placement through AI-driven solutions for pattern optimization (Glogar et al., 2025; Lee, 2023a), automated fabric placement (Bui et al., 2025), efficiency (Choi, 2024), and cost-efficient digital simulations (Kabakibi et al., 2023). High-end and fast fashion brands have adopted these tools to enhance pattern efficiency and minimize textile waste (Lee, 2023b; Morandi & Tonelli, 2023; Ramzan et al., 2024). Similarly, sportswear companies employ AI-based cutting software and simulations to improve sustainability and resource efficiency (Choi, 2022; Glogar et al., 2025).
These studies collectively underscore the transformative potential of AI and digital prototyping in advancing sustainable fashion practices while their implementation in fashion education enhances waste reduction strategies (Herring, 2025).

Negative Spaces

Purpose of the research

This contribution aims to explore the implementation of the zero-waste design approach in fashion, with a specific focus on the offcuts from the cutting stage, here defined as "negative spaces" of both the pattern and the cut garment. The main scope and priority of this study is to find new use for existing and ongoing cutting waste from industry and, at the same time, is on how design can change approaches in cutting to begin with. The goal is to investigate a new perspective that considers the textile waste generated during the cutting stage as "negative spaces" – "containers" (Torres, 2024) rich in value and meaning – which, instead of being discarded, can be transformed into new textile products for the fashion industry or related sectors. In this context, the designer becomes a "transmuter" of waste, permeating it with economic, social, cultural, and productive value through hacking operations within the design process. Waste material is thus interpreted with a different sensitivity, allowing us to discern "the various visible and invisible components of the cosmos" and to reshape and revalue "the remnants of something we no longer need or want in our lives" (Binotto & Payne, 2016, p.6).

Methodology

The concept of viewing offcuts from a different perspective is central to this exploration. When observing a single offcut, it may appear as an insignificant amount of fabric. However, when the same pattern is reproduced multiple times, the cumulative quantity of discarded fabric becomes substantial. These offcuts represent the negative spaces of both the garment and the fabric. The term "negative" in this context carries a dual meaning: on one hand, it refers to waste generated from the fabric during the cutting process; on the other hand, it carries an artistic connotation, where the negative space

serves as a complementary part of the overall composition, imparting a positive dimension.
This dual perspective raises important questions: How can a designer redefine the value of this waste and shift the way it is perceived? How can these materials be brought from invisibility to visibility? Designers possess a unique capability to make waste visible and assign it new value, but the process behind this transformation warrants closer examination.
From a methodological standpoint, improving the cutting stage and assigning new value to offcuts or "negative spaces" are key objectives. Two approaches are identified as pathways for achieving this: first, modifying garment patterns to align with zero-waste design principles, ensuring that the aesthetic and functional requirements, such as fitting, are preserved to meet consumer expectations. Second, in cases where zero-waste patterns are unattainable, developing a consistent marking system for the cutting stage is proposed. This approach ensures that identical offcuts are produced, enabling their integration into new garments or accessories.
The proposed methodologies could serve as the foundation for workshops aimed at educating students and training professionals. These sessions would disseminate the findings and promote the adoption of sustainable practices in pattern design and fabric cutting.

First outcomes

Initial experimentation was conducted using digital tools, in preparation for working with physical scraps. The first step involved selecting a pattern to study and creating a layout optimized for the cutting table. In the absence of layouts from manufacturing, a pattern from the CLO3D library—a simple white women's shirt in size EU 38—was used as a realistic reference. The focus at this stage was not on the garment's shape but on the optimization of fabric usage (fig. 1). Traditional pattern layering methods were compared to zero-waste design approaches, analyzing the resulting negative spaces.

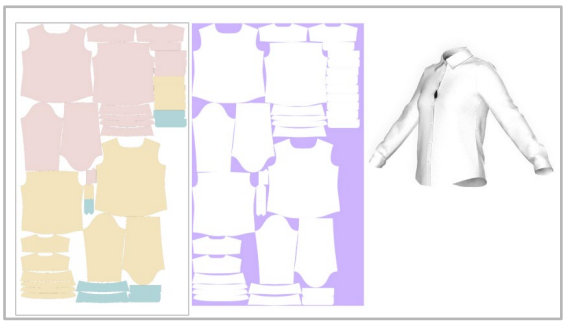

Figure 1. Negative spaces that come out from traditional pattern layering methods. © The author.

Digital tools were employed to generate these negative spaces, which were then draped in CLO3D (fig. 2) to create a visual representation of the fabric's potential for reuse. Subsequently, physical experimentation was conducted using a cutting table, to enable the creation of tangible offcuts, with the support of technicians and researchers at the Science Park's Do-tank Center during a visiting research period at The Swedish School of Textile - University of Borås. For the initial prototype, second-hand cotton bed sheets were selected as the material for testing. The cutting process produced positive spaces, which were used for garment construction, while the negative spaces were retained for further experimentation.

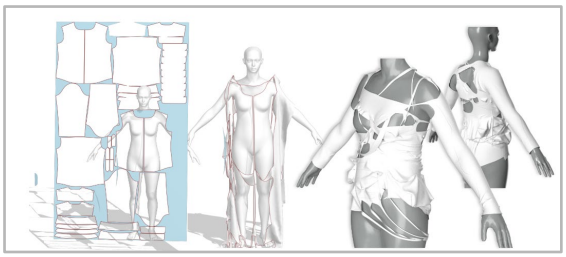

Figure 2. Digital draping session with negative spaces. © The author.

Additionally, a workshop was conducted with first-year BA Fashion Design students of The Swedish School of Textile at University of Borås enrolled in a course focused on form and material. Participants worked with offcuts sourced from previous assignments and waste bins within the Garment Construction Lab (fig. 3). This collaborative exercise provided valuable insights into the creative potential of textile waste and reinforced the importance of integrating these concepts into educational practices.

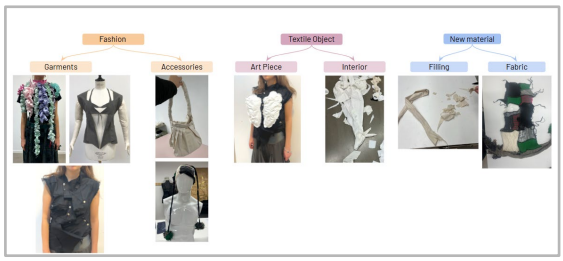

Figure 3. Workshop outcomes. © The Author.

This experiment aims to explore whether it is possible to repurpose fabric scraps to create new items, preserving the value of the cut fabric rather than discarding it as waste. It is based on the idea that designers have the power to reshape how we perceive and engage with materials, transforming offcuts into valuable products.
At the same time, fabric scraps resulting from the cutting process can be seen as "containers" of meaning. As textile artist Marion Baruch observes, "[...] In these leftovers is contained all the industrial and social work from which they derive, and in some way, they reveal the contradictions of this flow involving the social and cultural production of our society" (Torres, 2024). These intrinsic values give fabric scraps a profound significance, making it essential to preserve and communicate their meaning. Educating consumers, workers, and companies to recognize this value is a crucial step toward fostering a more responsible and conscious approach to materials.
Just as hackers, fashion designers can now use their skills to develop new approaches and new methodologies through which to decode fashion and alter the system. Through this approach, designers have the opportunity to transform and give new value to textile materials by giving a new identity to pre- and post-consumer waste.

Conclusions

The contribution aligns with broader reflections on sustainability and the concept of refashioning (Gwilt & Rissanen, 2011), analyzing how waste can be transformed into valuable resources through design. This research highlights the critical importance of exploring innovative approaches to reshape the fashion supply chain and reimagine the way garments are currently produced. By focusing on the cutting stage and pattern placement, the study aims to develop a new methodology that minimizes or eliminates fabric waste during production.
The dual approach, encompassing both digital and physical experimentation, has demonstrated the potential of digital tools while emphasizing the indispensability of manual and artisanal expertise. Without the tactile knowledge gained from working fabric on a mannequin, digital modeling—though creative and artistic—risks failing to meet the practical needs of the fashion industry. It may lack the sensitivity to address critical aspects such as seam positioning, edge preservation during processing, and compatibility with cutting technologies used in industrial workflows.
This integration of digital innovation with hands-on craftsmanship not only enriches the creative process but also ensures that the proposed methodologies align with the operational complexities of the fashion system. By bridging these two worlds, the research contributes to a sustainable transformation of garment production, addressing waste reduction while maintaining the functionality and aesthetic quality demanded by the industry. Finally, the concept of “negative spaces” not only fills the physical void left by offcuts but offers a new creative and sustainable narrative in 21st-century fashion and design. The author is ongoing working on this research as part of her Doctoral research project at University of Florence, and she’s planning to continue the study further to better, and deeply, understand the possibilities of digital tools to improve the fashion design process and the cutting stage.

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