YOU WILL NEVER BE ME

PERSONALIZING BIOFABRICATED HANDBAGS WITH USER GENETIC MATERIAL

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Data Availability Statement: All relevant data are within the paper and its Supporting Information files.
Competing Interests: The Author(s) declare(s) no conflict of interest
DOI: 10.36253/fh-2701

Abstract

Handbags symbolize women's emancipation and can evoke powerful memories of people and events. However, they are primarily made of leather, which is not aligned with consumers' growing environmental concerns. As the next generation of women's handbags should reflect women's values and advancements in material science (The Women's Museum of California, 2017), exploring ways to personalize next-gen materials could lead to greater consumer acceptance. Guided by the hypothesis that a biofabricated handbag can be personalized with genetic material to symbolize its user's environmental concerns and display advancements in material design, this study started with secondary research and then progressed to material testing and prototyping as the main method of inquiry for investigation. The result is a handbag composed of bacterial cellulose and human hair that represents a potential use of user genetic material to personalize biofabricated products that carry psychological significance.

Keywords: *Material Meaning; Next-Gen Textiles; Fashion Symbolism; Bacterial Cellulose; Bio-fabrication*

INTRODUCTION

DEFINITIONS

Biofabrication: producing complex biological products from raw materials such as living cells, biomaterials, and molecules (Mironov et al., 2009).
Conspicuous consumption: buying goods and services to signal wealth and incite respect or envy rather than for their practical value (Farnam Street, 2019).
Genetic material: can be a gene, a part of a gene, a group of genes, or the entire genome of an organism.
Leather: animal skin with the hair removed that typically goes through cutting and tanning treatment; faux/synthetic/current-gen leather: fabric made of synthetic materials as an alternative to animal skin.
Product attachment: the emotional bond that a consumer experiences with a significant object.
Projected image: the image a person wishes to project – often through the use of products (Klein as cited in Laronche, 2011); brands also project consumers' character and status via brand image (Shukla, 2008).
Signaling: a method of communicating personal information to others in a costly way, ensuring credibility (Farnam Street, 2019). Animals and humans use signals to communicate positive attributes and accomplishments without using language. For instance, a peacock's tail demonstrates to potential mates that the bird is likely strong, healthy, and intelligent, having survived with such extravagant plumage. Similarly, individuals use costly signals to express their

accomplishments.
Social status: a measure of respect and esteem linked to one's societal position (Encyclopaedia Britannica, n.d.); it can be achieved through accomplishments or ascribed from factors like birth. It influences relationships, organizations, and marketplaces (Anderson et al., 2015) and is often signaled through the conspicuous consumption of luxury items (Veblen, 1994). As the absence of status is undesirable (Kraus et al., 2009), status pursuit through consumption becomes a goal.
Status consumption: the process of gaining status from purchasing and using high-status goods (O'Cass & Frost, 2002).
Symbolic function: the ability to use symbols to represent or stand for perceived objects and events.
Symbols: tools for abstraction (Gordon, 2024) that can be as powerful to unite as they are to divide (Green, 2019). As Wally Olins (as cited in Green, 2019) stated, people want to belong and then display symbols of belonging, which creates in-groups and out-groups. However, symbols are subjective and depend on one's background and worldview (Gordon, 2024).
Utilitarian feature: an object's feature that is useful or functional; however, users might have different intentions when acquiring the same product.

BACKGROUND: POSSESSIONS AND THEIR INTRINSIC MEANINGS

Signaling high status brings social benefits. As a result, individuals are likely to invest significant resources to achieve and signal high status to others (Desmichel et al., 2020); and regardless of the source, consumers express 'iconic meanings in their lives' through quotidian spending (Holt et al., 2003). Possessions, then, can not only literally be an extension of one's self - as when one has a tool that allows them to do things they would otherwise not be capable of - but also symbolically. The latter can be exemplified by trophies and uniforms that show others how one can be a different person than one would be without these artifacts (Belk, 1988). The same happens with clothing and accessories, as they indicate to society who someone is and how they should be treated (Buse & Twigg, 2014), and even though individuals seek distinction, there is still an ambition to be similar to other members of a group (Grotts & Johnson, 2013). Therefore, fashion can be considered an artifact of the extended self since fashion products can express and confirm individuals' identities socially (Belk, 1988).
The problem is that "within the feminine sphere, objects became, first and foremost, symbols, sacrificing their utilitarian features to their symbolic functions" (Sparke, 1995). Handbags, for instance, have been used for millennia, but they took on a new significance, especially after World War I, symbolizing women's emancipation (Rosenberg et al., 2020). As women's roles and responsibilities change throughout their lives, handbags must adapt in size and style to suit their needs (Buse & Twigg, 2014). Nevertheless, they are more than just practical objects that are visually consumed daily (Grotts & Johnson, 2013). They also serve as fashion symbols that reflect their owner's societal image (Rosenberg et al., 2020), as 'memory objects' (Ash, 1996) that carry memories from a specific time in their owner's life, and even as self-extensions (Belk, 1988) that enables users to accomplish tasks they otherwise could not. Rosenberg et al. (2020) also describe the handbag as an ever-present product that is 'taken for granted in women's lives' and point out that the absence of a handbag reveals as much as the presence of one. Its potential to comprehend numerous and creative adjustments is what 'speaks to its iconicity' (Rosenberg et al., 2020). So, as Smith and Ekerdt (2011) suggest, they are meaningful artifacts because of their identity and biographical connections.
However, leather, the primary material used in handbag production, is related to ethical and environmental questions (Kim, 2010; Queensland University of Technology, n.d.) that contradict consumers' growing environmental concerns (Statista, 2022). Consequently, according to the Women's Museum of California (2017), the future of women's handbags will reflect 'the values of the women of the future' and 'the next great breakthrough in material science', which aligns with the increasing environmental awareness among women regarding the implications of using materials like leather for accessory production (Lee, 2011).
Biofabrication is at the intersection of biology, engineering, and design (The Business of Fashion, 2018) and allows for the creation of premium materials like leather while promoting less environmental damage. It also does not involve animal slaughter and avoids material waste, as items can be easily produced (and personalized) on demand (The Business of Fashion, 2018). Thus, exploring ways to introduce biofabricated materials to products that carry psychological significance, such as handbags, could lead to greater consumer

acceptance of this material shift and result in positive environmental impacts.

RESEARCH METHODOLOGY

This investigation is underpinned by one research question:

Could a biofabricated handbag be personalized with user genetic material to symbolize its user's environmental concerns and display advancements in material design?

This study, defined by Koskinen et al. (2011) as Constructive Design Research, uses the development of a product or system for knowledge creation. This research methodology integrates the actual research and design process through prototyping, as explained by Wensveen & Matthews (2015), to generate insights and, subsequently, artifacts because prototyping allows for immediate feedback on success or failure. The prototypes used in this research serve several roles as defined by Wensveen & Matthews (2015): as a vehicle for inquiry, where the process of making the prototype contributes more to the research than the artifact itself; as an experimental component, to test specific hypotheses embedded in the artifact; and as a research archetype, used to demonstrate the research. Both generalized knowledge and relevant implementations will be acknowledged (Stappers, 2007). This research approach can be characterized as qualitative (Bloomberg & Volpe, 2016) as it focuses on uncovering and understanding the significance of experience while also being open to change, allowing findings to guide future investigations, but also includes quantitative elements, which were used to seek evidence to support hypotheses primarily concerning material properties and can be described as experimental research that follows strict guidelines to test or validate a theory. Traditional secondary research was also conducted to build an understanding of the relevancy of the study and identify the most substantial opportunities to address that. This involved examining both pertinent academic papers and grey literature, including industry reports.

RESEARCH RATIONALE

UTILITARIAN FEATURES VS. SYMBOLIC FUNCTIONS

Throughout history, bags have evolved and adapted their form to fit societal needs, transitioning from waist pouches in medieval times – 'the smaller the pouch, the higher the social status' - to shoulder bags in the Middle Ages (Rosenberg et al., 2020). In the eighteenth century, they became feminine objects when a handle was added (Rosenberg et al., 2020). By the late nineteenth century, they refocused on functionality as women entered the workforce (Fogg, 2009). After 1940, the shoulder bag re-emerged to serve the new urban commuter (Fogg, 2009), and from the 1950s, handbags became a fashion staple, reflecting social trends like conspicuous consumption.

To John Steinbeck (as cited in Farnam Street, 2019), "the most beautiful things in the world are the most useless; peacocks and lilies, for instance", but that does not need to be true in the material world as users might have different intentions when acquiring the same product. For instance, one can see a designer bag and think it is impractical and overpriced, while another might see it as a strategy to express their social identity (Buse & Twigg, 2014). Just as symbolic functions are relative (Farnam Street, 2019), utilitarian functions can also be. Thus, one does not depend on the other, contradicting the idea that handbags sacrifice their utilitarian features for symbolic functions (O'Cass & Frost, 2002). A good example is Hermés' *Birkin* bags, a line of the most luxurious designer handbag models that was designed according to Jane Birkin's brief for her perfect bag (Boyd, 2013). At the same time that it is a symbol, it is also respected for its utilitarian features – which could be one of the reasons for its tremendous success.

However, leather, which is the product of removing hair from animal skin (Fashionary, 2020), is still the primary material in handbag production and presents ethical and environmental issues (Kim, 2010; Queensland University of Technology, n.d.), which do not reflect consumers' growing environmental concerns (Statista., 2022). As an example, PETA (People for the Ethical Treatment of Animals) reports that over a billion animals are killed annually for their skins and hides (PETA Australia, n.d.) and that two to three crocodiles are needed to make one *Birkin* bag (The Guardian, 2015). So, the fact that a handbag, which should be used to reflect its user's personality, is currently both generic – as signature bags are purchased by millions of women who likely do not share the same characteristics – and an easily counterfeited symbol that negatively impacts the environment is a matter of controversy.

ADVANCEMENTS FOR BAG DESIGN: BIOFABRICATION

Materials tell the story of civilization, as seen in the stone, iron, and bronze ages because when materials evolve, they enable new products and solve old problems (Miodownik, 2014). However, while handbags appear to have been made from the same material for thousands of years (Rosenberg et al., 2020), car manufacturers, considered an equivalent symbolic artifact for males (Klein as cited in Laronche, 2011), continually evolve towards more sustainable practices. As per Kim (2010), the stages of raw material extraction, manufacturing, distribution, use, and disposal/recycling of products are potential threats to the ecosystem in design, implying that to reduce environmental impacts, either people's relationship with products or the product itself needs to change. Consequently, due to the enforcement of stricter laws worldwide, there has been an increase in demand for alternatives to leather, including current- (synthetic) and next-gen replacements (Material Innovation Initiative, 2024).

Next-generation materials are substitutes for traditional materials like leather, fur, and exotic skins and are defined by the absence of petrochemicals and animal products. Ideally, such materials should be durable, recyclable, and biodegradable (Material Innovation Initiative & The Mills Fabrica, 2021). However, due to natural properties and investment differences, their development cannot be directly compared to fossil-based ones. Thus, it is essential to understand that setting rigid expectations for next-gen materials is unrealistic (Lee et al., 2021).

Biofabrication, at the intersection of biology, engineering, and design, allows for the creation of materials like leather without environmental harm or animal death (The Business of Fashion, 2018). By merging synthetic and natural advantages (The Business of Fashion, 2018), biofabrication reimagines leather by shifting its production from a subtractive to an additive process. This technology is expected to shape the future of women's handbags, mirroring the values of environmentally conscious women since the next generation of women's handbags should reflect 'the values of the women of the future' combined with 'the next great breakthrough in material science' (Women's Museum of California, 2017). Thus, if women are becoming more environmentally aware of the consequences of using materials such as leather to produce accessories (Lee, 2011), this should be reflected in the future of handbags. By investigating ways to personalize biofabricated materials used to produce psychologically significant products like handbags, this material transition could be more easily accepted by consumers.

GENETIC MATERIAL ADDITION

Belk (1988) explains two hypotheses regarding 'the extended self' that are worth considering. The first is that body parts 'are among the most central parts of the extended self', and the second is Sartre's idea that giving goods to others is a means of extending oneself - because since gifts remain associated with their givers, the latter can be extended into the recipient's life. Additionally, solid emotional connections concerning physical items are developed when they are used to indicate identity (Belk, 1988), which can explain the importance of fashion goods in the lives of many consumers. In theory, as leather is animal skin with the hair removed (Fashionary, 2020), a leather product is also eternally connected to an original genetic material. Consequently, if possessions are viewed as a part of one's self, personalizing the primary matter of a personal product with genetic material, a process enabled by biofabrication, could be a way of explicitly (and eternally) symbolizing one's extended self or of their loved ones. Especially with gifts that involve leather goods, since leather is already a material that can 'evoke almost ancestral memories' (Fairs, 2012).

So, personalizing biofabricated products with genetic material could open new possibilities and possibly boost sales. Examples include Marvel and Kiss' comic book, produced in 1977, which sold 500,000 copies and contained band members' blood mixed with red ink (Kaye, 2021), and Lil Nas X's 2021 '*Satan Shoes*', which sold out in less than a minute and contained a drop of human blood in each shoe's air bubble sole (Holland & Palumbo, 2021). Other examples include made-to-order products that also use genetic material to enhance product attachment (Chow, 2015) and fulfill the industry's growing interest in exotic and undiscovered domains (Tucker, 2016).

Self-grown fabrics from renewable resources are revolutionizing the textile and fashion sectors. The innovative idea of cultivating fabrics from renewable natural resources has spurred joint ventures between designers and scientists to investigate the application of these new materials in the textile industry. A notable example is bacterial cellulose, which was identified as an appropriate material for this investigation. It is a highly refined biopolymer generated through bacterial fermentation (Fernandes et al., 2021) that can be designed to present specific characteristics suitable for the manufacturing of clothing (Chan et al., 2018) and by biofabricating bacterial cellulose with genetic material, realistic results can be achieved. According to Lee et al. (2021), the main challenges associated with working with bacterial cellulose include viability on a large scale, the complexity of the Research & Development and the performance, aesthetic and manufacturability requirements of materials for the fashion and textile sectors, especially regarding appearance and odour. Additionally, the timeline for material innovation is measured in years, so it is unlikely that a material will generate a global impact in less than a decade of development, and partnerships between material innovators and brands should be established to ensure products will be developed meeting industry standards.

EXPERIMENTS: TESTING AND PROTOTYPE

ADDING GENETIC MATERIAL WHILE THE MATERIAL GROWS

The first experiment aimed to test the addition of genetic material during the growth of the material (in situ). To do that, human hair (provided by the researcher) was added to a liquid mixture that would later form the bacterial cellulose pellicle (fig. 01). This mixture consisted of water, black tea, sugar, and SCOBY (Symbiotic Culture Of Bacteria and Yeast). A second experiment included saliva. After a few days, the bacterial cellulose became visible on both containers and after two weeks of fermentation, the solid materials were extracted from the liquid. The results, however, looked like plain samples, even though one presented with hair on its surface. Since the saliva sample could not be differentiated from a plain one as the genetic material was not visible, the idea was discarded. The problem with the other one (hair) was that since the genetic material was not embedded within

Fig. 01

Fig. 02

it, the material could not be washed, resulting in a strong vinegar-like odor later. Finally, the material was laid on a patterned surface and set to air dry for about four days, yielding a sturdy, leather-like matter. However, the addition of genetic material needs further exploration.

ADDING GENETIC MATERIAL AS A LAYER

The result from the previous experiment was unsatisfactory because the genetic material was on the bacterial cellulose's surface, so the main goal of this experiment is to guarantee that the hair is integrated within the material. To do this, a layer of human genetic material (hair) was placed between two layers of bacterial cellulose (fig. 02) before setting it to air dry. The advantages of this method include simplified production as the bacterial cellulose can be produced 'plain' and at larger scales, with the genetic material added later. The fact that bacterial cellulose grows in accordance to the area size of the container (due to the exposition of its surface to oxygen), facilitates such overlapping because materials that have been brewed in similar-sized containers should present similar dimensions. Moreover, since the thickness of the wet material is considerably reduced after drying, overlapping two layers of bacterial cellulose generates a stronger material, especially because they were completely bonded when dried. Other benefits include being able to place the genetic material in specific areas, possibly creating details or patterns. In addition, plain samples can be washed, reducing the vinegary odour traditionally associated with bacterial cellulose, which was done before the genetic material layer was added. A disadvantage is the demand for this extra processing time. After drying, the material can be cut using scissors or a craft knife. The result is a (satisfactory) strong material that presents human genetic material fully embedded within it in a visually subtle way.

PROTOTYPE CONSTRUCTION

For the final prototype construction, the dried bacterial cellulose, personalized with hair, was reinforced with paper. To make it, the bacterial cellulose was sewn using a '*Brother JA1400 Home Sewing Machine*' (needle size: 90/14; straight stitch, length: 1.8mm). The two sheets of bacterial cellulose (external and internal) were set to dry over different patterns to benefit from material properties and simulate multiple textures. However, only the external side was personalized with hair. The external side was sewn to thick paper (600 gsm), while the lining was sewn to kraft paper at 120 gsm. A challenge at this stage was that a little bit of material was accumulating on the needle every time it would pierce the bacterial cellulose, so the thread could not spin for long (the accumulated material was blocking the needle's eye). To solve this problem, coconut oil was applied to the sewing machine needle (and reapplied as needed) to enable the material to be sewn as a traditional fabric. In addition, in sections where the material could not be moved by the sewing machine because it did not present a dry feel (especially where there was no paper), a layer of baking paper was added between the sewing machine and the bacterial cellulose (and removed after sewing was finished). This was done to mimic traditional construction methods and demonstrate the material's potential as a direct substitute for incumbents.

Before constructing the final prototype, an appearance model made of paper was crafted as a guide, and Photoshop edits were utilized to ideate possible product designs. The bag dimensions (227 x 107 x 177 mm) follow common bag measurements found in the book *Bag Design* (Fashionary, 2017), as well as the strap length (max. 1260 mm) and an internal pocket to fit a passport (140 x 110 mm). The bag also features a flap and the hardware of the final product was crafted from laser-cut timber. The turn-lock, which reads 'you will never be me', is an association of the symbolic representation of one's self (and their genetic material) (fig. 03), and the idea is to substitute a brand's logo for a personal statement that can also be customized. Moreover, the bag can be worn around the waist or as a crossbody bag to enhance functionality by being suitable for multiple uses. The addition of genetic material (hair) is subtly visible (fig. 04) and establishes a perpetual link between the product

Fig. 3

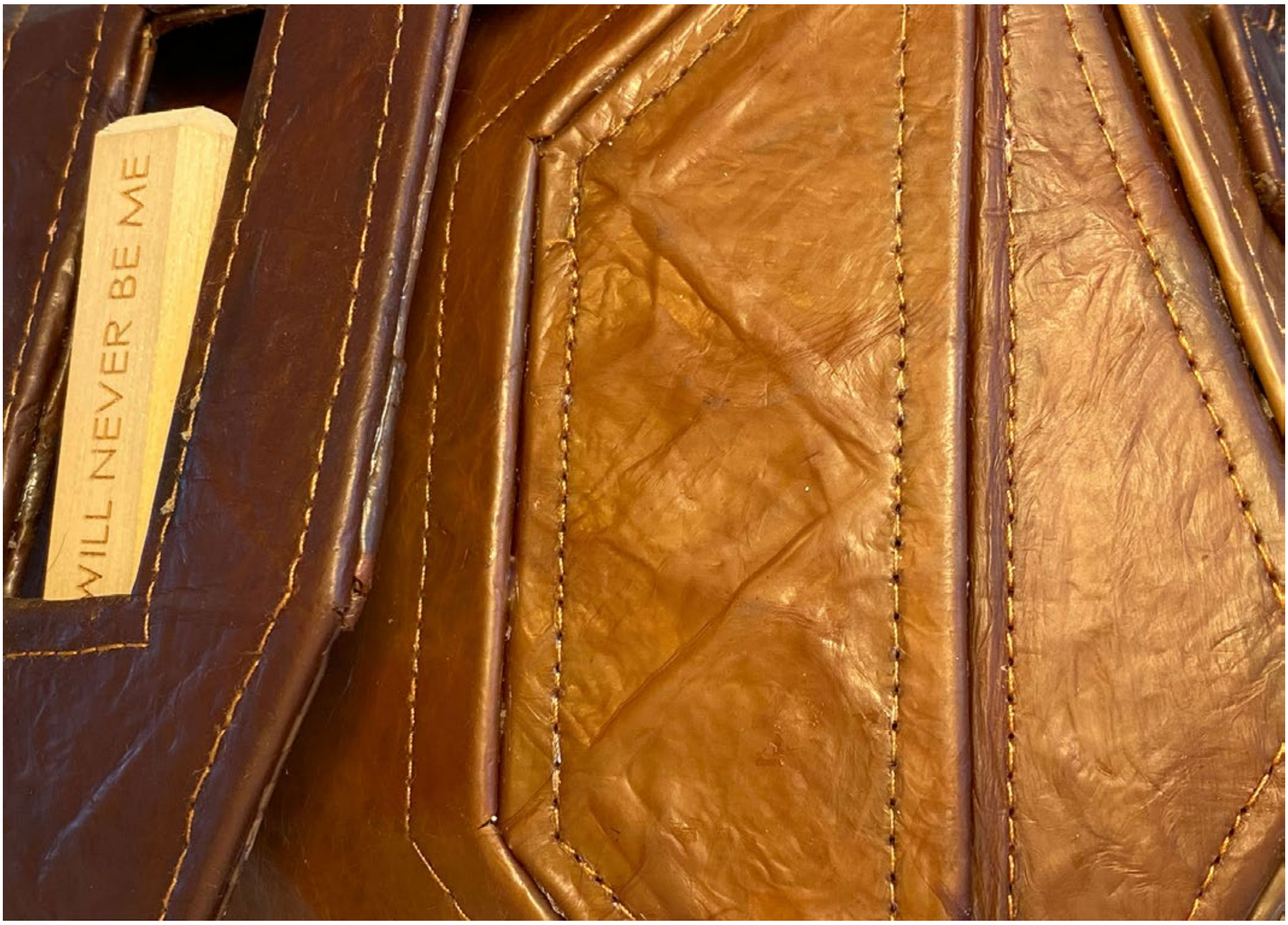

Fig.4

and its provider.

CONCLUSION

In summary, this research aimed to explore the personalisation of biofabricated handbags with users' genetic material to symbolize consumers' growing environmental concerns and advancements in material design. To address this question, interdisciplinary prototypes were created and tested, leading to the design of a biofabricated leather handbag made of bacterial cellulose embedded with human hair. The study primarily relied on material and appearance prototypes to test construction methods and material properties, considering small-scale production viable. Even though the material's mechanical properties, such as durability, strength, and water resistance, were not compared to traditional ones, the findings demonstrate that adding a user's genetic material to the biofabrication process of a handbag is feasible and can symbolize its user by physically connecting them to the product's primary matter in a hard-to-fraud way.

That is significant because, despite the environmental damage promoted by the fashion industry, the Bags & Accessories segment (Statista, n.d.) and the global synthetic leather market (Grand View Research, 2024) continue to grow. However, so does the concern for more sustainable materials and practices (Material Innovation Initiative, 2024). Consequently, it makes sense to produce personal products that symbolize users better. Biofabrication merges the advantages of both synthetic and natural materials (The Business of Fashion, 2018), and by exploring ways to incorporate biofabricated materials into products that trigger psychological signals (e.g., handbags), this material replacement can gain wider acceptance among consumers by remaining eternally maintain a physical connection to its genetic material provider and contribute to positive environmental impacts. Furthermore, traditional construction methods have proven effective and could facilitate this transition. The final design is a robust bag made of bacterial cellulose embedded with user genetic material, representing a potential use of user genetic material to personalize biofabricated products that carry psychological significance.

ACKNOWLEDGMENTS

An Australian Government Research Training Program Scholarship supports this research.

CAPTIONS

[Fig. 01] Testing the addition of human genetic material (hair) while bacterial cellulose grows (during fermentation) (Author/designer: Isabella Alevato).

[Fig. 02] Introducing human genetic material (hair) as a layer in-between two of bacterial cellulose; (Author/designer: Isabella Alevato).

[Fig. 03] This biofabricated material is an almost literal self-extension eternally connected to its genetic material provider (Author/designer: Isabella Alevato).

[Fig. 04] The final product was constructed using traditional bag construction methods to elicit the material's capacity to work as a direct leather replacement (Author/designer: Isabella Alevato).

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