

Eco-Printing: Embodying Botanical Aesthetics and Sustainable Innovation in Textile Design

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Abstract

If each era develops movements and sensibilities in response to the needs of its time, a century apart, *Art Nouveau* and sustainable fashion establish a dialogue between affinities and divergences. Although born in different contexts, both express an aesthetic quest that opposes the standardization imposed by industrial production. In the face of new climate emergencies, new sensibilities arise, not only aesthetic but also environmental. In this context, eco-printing stands out as a technique that not only offers a concrete alternative to industrial dyeing methods, contributing to the reduction of water pollution, but also restores to fashion an aesthetic inspired by nature, with its imperfections and uniqueness, which make each piece unique. Through the use of leaves and flowers, this practice allows for unrepeatable patterns without resorting to harmful chemicals. Small businesses such as *Rosso di Robbia*, which specializes in natural dyes, and Lazzaro vintage shop promote this eco-conscious approach, challenging linear production processes and proposing a more mindful model of consumption. Their work shows how it is possible to combine aesthetics and environmental responsibility, offering a concrete alternative to disposable fashion and encouraging a cultural change in the textile sector.

Keywords: Sustainable Fashion; Eco-printing; Upcycling; Vintage; Ethical Consumption.

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Introduction

Art Nouveau was characterized by using organic forms and floral motifs to integrate art, craft, and nature into a single aesthetic language. This movement was not limited to decoration but represented a response to growing industrialization, opposing serial production and promoting a return to craftsmanship and quality materials. In a contemporary context marked by increasingly pressing environmental urgencies, sustainable fashion takes up this ideal tension, proposing an alternative vision to the linear production model that has characterized the textile industry in recent decades. The fashion industry is, in fact, among the most environmentally impactful sectors, with intensive consumption of natural resources and a high rate of pollutant emissions.¹ The textile sector, which includes clothing, leather goods and footwear (TCLF), is among the most globalized supply chains, employing about 2.2 million workers only in Europe.² However, this production system has a high environmental cost: fabric dyeing and finishing account for 20% of global water pollution,³ and the textile industry produces about 8% of the world's greenhouse gas emissions.⁴ In addition, the spread of fast fashion has incentivized a rapid and indiscriminate consumption pattern, exacerbating the exploitation of natural and human resources and generating vast amounts of waste,⁵ less than 1% of which is recycled.⁶ In response to these critical issues, eco-printing stands out not only as an aesthetic innovation but also as a concrete strategy to reduce the textile industry's environmental impact.⁷ Adopting eco-printing is part of a broader redefinition of production practices that promotes a circular approach based on enhancing natural resources and reducing waste. This study examines the relationship between aesthetics and sustainability in fashion, analyzing the role of eco-printing in the transition to more responsible production models. Through a qualitative approach, the principles and applications of this technique will be investigated, as well as the experiences of local realities such as *Rosso di Robbia*, a holistic fashion business specializing in natural dyes, and Lazzaro, a vintage shop, both located in Rimini (Italy), which adopt strategies for the recovery and valorization of vintage and second-hand materials and garments. The goal is to demonstrate how the integration of eco-friendly processes can mitigate the environmental impacts of the textile industry and contribute to a cultural redefinition of fashion, promoting more ethical and eco-efficient consumption practices.

Affinities and Divergences between *Art Nouveau* and Sustainable Fashion

Before delving further, it is necessary to briefly address the comparison between *Art Nouveau* and sustainable fashion. Visual and thematic references to botanical aesthetics recur across various periods in art history. Among these, *Art Nouveau* has occasionally been cited for its celebration of organic forms

1. Fabiana Frota de Albuquerque Landi, Claudia Fabiani, Benedetta Pioppi and Anna Laura Pisello, "Sustainable management in the slow fashion industry: carbon footprint of an Italian brand," *The International Journal of Life Cycle Assessment*, Vol. 28, no. 10 (2023): 1229–1247, <https://doi.org/10.1007/s11367-023-02205-6>.
2. "Textiles and Clothing Industries Online," European Commission, accessed February 16, 2025, https://ec.europa.eu/growth/sectors/fashion/textiles-and-clothing-industries_it.
3. "Press Release: Kornit Digital Commits to Saving 4.3 Trillion Liters of Water and 17.2 Billion Kilograms of Greenhouse Gas Emissions, and Reducing Overproduction in the Fashion Industry by 1.1 Billion Items by 2026," *Dow Jones Institutional News*. New York: Dow Jones & Company Inc, 2021.
4. Platform for Accelerating the Circular Economy (PACE), "Circular Economy Action Agenda: Textiles," Hague, Netherlands: PACE in partnership with Accenture, 16.
5. Cesarina Mason, Michela Pauluzzo Rubens and Rana Muhammad Umar, "Recycling habits and environmental responses to fast-fashion consumption: Enhancing the theory of planned behavior to predict Generation Y consumers' purchase decisions," *Waste Management (Elmsford)*, Vol. 139 (2022): 146–157, <https://doi.org/10.1016/j.wasman.2021.12.012>.
6. Waste and Resources Action Programme (WRAP), "Textiles 2030 Annual Progress Report 2023-2024," Banbury, UK: WRAP, 2024, 4. <https://www.wrap.ngo/resources/report/textiles-2030-annual-progress-report-2023-24#download-file>.
7. Ray Subhasid and Lipsa Nayak, "Marketing Sustainable Fashion: Trends and Future Directions," *Sustainability*, Vol. 15, no. 7 (2023), 6202, <https://doi.org/10.3390/su15076202>.

and ornamental richness. However, it is essential to acknowledge that such parallels are primarily formal in nature and do not suggest direct or explicit inspiration. If one were to consider the ethical dimensions underpinning sustainable fashion, the Arts and Crafts movement may offer a more pertinent precedent. Its opposition to nineteenth-century mass industrial production, and its advocacy of craftsmanship, manual labor, and a symbiotic relationship with nature, resonates more closely with the philosophy of eco-printing, which emphasizes slow processes, traceable materials, and an organic aesthetic emerging directly from contact with botanical matter. Nonetheless, eco-fashion distinguishes itself fundamentally from these historical movements through its ethical and ecological commitments, which constitute its ideological core. Environmental sustainability, social equity, and regenerative practice define today's textile production in ways that far exceed the aesthetic and social concerns of the past. Eco-printing, in this sense, reframes the relationship between art, nature, and production through a profoundly contemporary lens. Yet, acknowledging the primarily formal nature of the connection to *Art Nouveau* does not preclude the possibility of identifying deeper conceptual affinities. *Art Nouveau* pursued a reintegration of art and life, seeking to counter the aesthetic homogenization of industrial production by elevating individual creativity and adapting art and design to a rapidly changing world.⁸ Its aesthetic project was also an existential one, offering not only a visual style but a holistic lifestyle. Similarly, sustainable fashion promotes artisanal values in opposition to overconsumption and serial production, emphasizing quality, local economies, and the uniqueness of the handmade object. This shared sensibility emerges clearly in their treatment of materials. While *Art Nouveau* favored the artistic use of wood, glass, and metal — processed with innovative techniques for refined visual effects — sustainable fashion privileges biodegradable, recycled, or waste-derived textiles. In both cases, the material itself becomes a conceptual medium. Unlike *Art Nouveau*, which operated outside an ecological framework, eco-fashion places environmental consciousness at the heart of its philosophy. Its rejection of disposability echoes the *Art Nouveau* ideal of durability and timelessness, though reframed within a discourse of responsibility and long-term sustainability. Both movements articulate a vision of beauty that transcends superficial ornamentation and aspires to ethical and spiritual significance. *Art Nouveau* aimed to integrate art into everyday life, elevating it to an aesthetic and spiritual dimension. At the same time, sustainable fashion develops an ethical awareness that includes respect for the environment, workers in the production chain, and the end consumer. The relationship with nature represents a further element of continuity, understood not only as decorative inspiration but as an aesthetic and philosophical principle aimed at creating harmony between man and the environment, the same harmony sought even today by green fashion. *Art Nouveau*'s engagement with nature was both decorative and philosophical, aiming to create harmony between humans and the environment — an aspiration mirrored in contemporary green fashion. Botanical influences, often drawn from colonial-era expeditions, permeated *Art Nouveau* imagery, as European explorations enriched its aesthetic with floral motifs and exotic plants imported from China, India, and South America.⁹ Nonetheless, this interest in materials from other continents also extended to precious stones and metals, many of which were extracted through colonialist exploitation practices.¹⁰ Today, the floral aesthetic is no longer associated with elitist exoticism but with the ethical enhancement of natural resources. However, forms of economic colonialism persist: while *Art Nouveau* appealed to an elite clientele, responsible fashion aims to transform the industry on a large scale, making its products more accessible by countering the exploitation of cheap labour in Southeast Asian countries, where working conditions and environmental impacts are often critical.¹¹

8. Charlotte Ashby, *Art Nouveau : Art, Architecture and Design in Transformation*. (London: Bloomsbury Visual Arts, 2022), 11. To further explore the role of craftsmanship in the modern era and its resistance to industrialization, and the relationship between craft, design, and contemporary art, see: Paul Greenhalgh, *The persistence of Craft the Applied Arts Today* (New Brunswick, N.J: Rutgers University Press, 2003).

9. James A. Compton, "Wisteria Sinensis on the slow boat from China: The journey of Wisteria to England," *Curtis's Botanical Magazine* (1995), Vol. 32, no. 3-4 (2015): 248-93. Also: Lynn Voskuil, "Robert Fortune, Camellia Sinensis, and the Nineteenth-Century Global Imagination," *Nineteenth-Century Contexts*, Vol. 34, no. 1 (2012): 6-7. <https://doi.org/10.1080/08905495.2012.646553>.

10. Ashby, 142-143.

11. Tsan-Ming Choi, Lipan Feng, and Yongjian Li, "Ethical fashion supply chain operations: product development and moral hazards," *International Journal of Production Research*, Vol. 61, no. 4 (2023): 1058-1075, <https://doi.org/10.1080/0020>

In cultural terms, *Art Nouveau* combined nostalgia and innovation through a pluralistic aesthetic deeply informed by historical and archaeological references. Its theoretical constructs, such as “truth to materials” and “fidelity to function,” sought to navigate the expanding material and visual culture of the early twentieth-century,¹² allowing artists to balance modernity and nostalgia.¹³ Similar tensions animate sustainable fashion, which merges future-oriented innovation with the revival of traditional, low-impact techniques such as eco-printing. This shift reflects a broader redefinition of aesthetic agency in response to ecological urgency. While it would be historically inaccurate to position sustainable fashion as a direct outgrowth of *Art Nouveau*, it is nonetheless possible to trace meaningful parallels and divergences. Eco-fashion does not inherit the *Art Nouveau* aesthetic per se; rather, it echoes its ambition to respond creatively to the cultural and environmental imperatives of its time. In this regard, the two movements may be seen as engaging in a retrospective dialogue that reconsiders the definitions of beauty and design from an ethically informed and socially attuned perspective.

A Holistic Perspective on the Evolution of Sustainable Design

Beginning in the second half of the 1960s, which coincided with the spread of Arte Povera, design began to incorporate more explicit environmental considerations,¹⁴ influenced by the rise of ecological movements and a growing awareness of the need to preserve natural resources. During this period, a holistic idea of production and design began to spread, anticipating the principles of the circular economy: prioritizing resource regeneration, reuse, and recycling, modelled on natural systems, and considering the entire product life cycle. All global waste-reducing challenges are closely interconnected, such as pollution, biodiversity loss, and resource scarcity, and transdisciplinary strategies are required to address their complexity. Thus, the need arises to respond to a global issue, even in design. However, despite new awareness and early steps toward more sustainable fashion, these efforts have fallen short. Today, the textile industry is still highly impactful, using about 1% of the world’s oil for synthetic fibre production, highlighting a significant gap in materials management strategies and the circular economy.¹⁵ There are several alternatives for limiting environmental and social impacts. For instance, ethical design integrates functionality, aesthetics, and environmental commitment through, for example, the recycling of innovative materials.¹⁶ In this perspective, circular processes that consider the entire lifespan of natural materials favour a low-impact production model characterized by short supply chains based on solidarity-based principles of transparency and fairness.¹⁷ Another solution is the sale of second-hand or vintage garments, whose market is continuously expanding. Specifically, the second-hand clothing market has experienced exponential growth, reaching a value of US\$197 billion by 2023 and is projected to increase by an additional US\$100 billion by signalling a shift in consumption behaviour toward more eco-aware solutions.¹⁸ Against this backdrop, examples of sustainable and holistic fashion are emerging

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12. Ashby, 161.

13. Richard Warren, *Art Nouveau and the Classical Tradition* (London: Bloomsbury Academic, 2018), 16–28. In the fashion industry we find pioneering figures such as Paul Poiret and Henri Toulouse-Lautrec, for example. Poiret was an innovator who revolutionized clothing design by introducing flowing and natural lines, abandoning the corset and drawing inspiration from nature, with floral and organic motifs typical of *Art Nouveau*. Similarly, Toulouse-Lautrec, although primarily a painter, had a major impact on fashion through his illustrations, which integrated elements of *Art Nouveau* and profoundly influenced the way clothing was presented in the era.

14. Chun-Yuan Chen, Po-Hsien Lin, Yen-Yu Kang and Chih-Long Lin, “The Global Design Ranking: A Case Study of Design Awards Phenomenon,” *Education Sciences*, Vol. 13, no. 2 (2023), doi:10.3390/educsci13020113.

15. Platform for Accelerating the Circular Economy (PACE), 47.

16. Lebo Maduna and Asis Patnaik, “Introduction to Sustainable Fibres for Fashion and Textiles,” in *Sustainable Fibres for Fashion and Textile Manufacturing* (Elsevier Ltd, 2023), 42–45.

17. Delphine Gallaud and Blandine Laperche, “Building Region-Based Sustainable Development: Vocabulary and Tools,” in *Circular Economy, Industrial Ecology and Short Supply Chain* (United States: John Wiley & Sons, Incorporated, 2016), 49–51.

18. Statista Research Department, “Statista. Secondhand apparel market value worldwide from 2021 to 2028,” accessed February 16, 2025, <https://www.statista.com/statistics/826162/apparel-resale-market-value-worldwide/>.

among small local businesses, such as Michela Pasini's *Rosso di Robbia* and Lazzaro vintage shop, which will be analysed below.

Eco-Printing Merging Nature and Craftsmanship

About 70% of textiles collected for reuse are exported overseas,¹⁹ but a significant proportion may turn into waste instead of recycled. In recent years, the emergence of responsible practices such as reuse, up-cycling, or natural dyeing techniques has marked a turning point in the textile industry, offering themselves as an alternative to traditional mass production models and promoting the transition to a circular economy. In this context, eco-printing, a technique that makes it possible to decorate textiles using natural dyes extracted from flowers and leaves and other organic material, eliminating the use of polluting chemicals, fits in harmoniously.²⁰ Eco-printing enhances the aesthetic value of reclaimed textiles and transforms them into unique works of art, the result of a natural process. The growing adoption of this methodology is also due to the renewed interest in natural dyes, which has declined since the twentieth-century in favour of synthetic dyes.²¹ However, the growing environmental and health concerns related to artificial dyes²² have encouraged a return to more sustainable methods, which can impart additional properties to fabrics, such as UV protection, antibacterial and antifungal activity, and deodorizing effects.²³

Natural dyeing techniques follow a well-established process, including etching, boiling and fixing natural dyes, ensuring the stability of textile fibres and colour rendering. The fabric — which should preferably be made of natural fibres (cotton, linen, silk or wool) to promote the absorption of natural dyes — undergoes treatment with natural mordants, such as metal salt, which ensures colour fixation and which affect both the colour shade obtained and its durability.²⁴ However, eco-printing follows a separate process, unlike traditional natural dyeing, which involves extracting the dyes and immersing the fabric in a dye bath subjected to boiling.²⁵ This technique is not limited to uniform colouring but transfers natural plant shapes and colours directly onto the textile fibre, creating unique patterns. Eco-printing involves selecting dyeing materials such as leaves, flowers, husks and barks arranged on the fabric. The adorned

19. Ellen MacArthur Foundation, "A new textiles economy: Redesigning fashion's future," 86.
20. Ashgan Abdel Fattah, Mohamed, Amr. M. Nassar, Fatma H. Galal and Shaima M. N. Moustafa, "Development of Antimicrobial and Insecticidal Silk Fabrics via Eco-Printing with Natural Dyes from Agricultural Wastes," *Fibers and Polymers*, Vol. 25, no. 8 (2024): 2953–65, doi:10.1007/s12221-024-00625-1.
21. Bhuiyan, M.A. Rahman, A. Islam, A. Ali and M.N. Islam. "Color and Chemical Constitution of Natural Dye Henna (*Lawsonia Inermis* L) and Its Application in the Coloration of Textiles," *Journal of Cleaner Production*, Vol. 167 (2017): 14–22, doi:10.1016/j.jclepro.2017.08.142.
22. Ecologically, releasing wastewater containing synthetic dyes contributes to water pollution, compromising ecosystems and biodiversity. In addition, the persistence of some non-biodegradable compounds promotes the accumulation of pollutants in soil and water resources. From a health perspective, exposure to such dyes can cause skin irritation, allergic reactions and, in some cases, long-term toxic effects for workers and consumers.
23. Barbara Pizzicato, Severina Pacifico, Diana Cayuela, Gabriela Mijas and Marta Riba-Moliner, "Advancements in Sustainable Natural Dyes for Textile Applications: A Review," *Molecules (Basel, Switzerland)*, Vol. 28, no. 16 (2023): 5954, doi:10.3390/molecules28165954. Also: Benson Dulo, Tobias De Somer, Kim Phan, Martijn Roosen, John Githaiga, Katleen Raes and Steven De Meester, "Evaluating the Potential of Natural Dyes from Nutshell Wastes: Sustainable Colouration and Functional Finishing of Wool Fabric," *Sustainable Materials and Technologies*, Vol. 34 (2022).
24. Dhara Shukla and Padma Shree Vankar, "Using Chemical Management System in Natural Dyeing Process to Make It Sustainable" in *Natural Dyes for Sustainable Textiles* (United Kingdom: Elsevier, 2024), 37–53. Also: Irena Šabarić, Ana Sutlović, Jana Filipčić and Franka Karin, "Contribution of Plant Transfer Printing to Sustainable Fashion," *Sustainability*, Vol. 16, no. 11 (2024): 4361. In addition, the use of plant-based bio-mordants, such as turmeric and pomegranate, offers a viable alternative to synthetic mordants, further reinforcing the positive ecological impact of this practice. See also: Fazal-ur-Rehman, Shahid Adeel, Salman Liaqat, Muhammad Hussaan, Rony Mia, Bulbul Ahmed, and Haddar Wafa, "Environmental Friendly Bio-Dyeing of Silk Using *Alkanna Tinctoria* Based Alkannin Natural Dye," *Industrial Crops and Products*, Vol.186 (2022): 115301.
25. It is proper to point out the difference between natural dyes, which are soluble organic compounds, and pigments, which are insoluble colouring substances consisting of solid particles that do not dissolve in solvents but are fixed on the surface of a material.

fabric is then wrapped around a cylindrical support such as a wooden or metal stick and is steamed or boiled, a process that promotes the release of the natural dyes and the transfer of plant shapes onto the fabric, which pierce through the different layers of rolled fabric, creating a dynamic and shaded effect with delicate and natural colour transitions.²⁶ After cooling, the fabric is opened, revealing the unique design that, as no synthetic dyes or harmful chemicals were used, did not produce environmental footprints.²⁷ The textile industry consumes about 215 trillion litres of water annually²⁸ and produces 8.3 billion tons of plastic, of which 6.3 billion tons become waste,²⁹ of which, ultimately, about 23 million tons of plastic end up in the oceans each year,³⁰ even polluting drinking water systems.³¹ Natural colouring techniques are proposed as an effective solution to mitigate these effects as the raw materials used in eco-printing consist mainly of leaves, flowers, barks and roots: reusable materials that eliminate the risk of contamination of soil, air and water resources.³² At the same time, such methodologies protect the health of workers and consumers, as they exclude the use of toxic substances. The bioactive properties of certain plant compounds, such as anthocyanins and flavonoids, also offer antibacterial and anti-inflammatory benefits.³³ Eco-printing has passed the OEKO-TEX Class 1 standard, a certification system that ensures fabrics are free of harmful chemicals by a margin of 60%, ensuring safety for use on underwear, swimwear and baby clothes.³⁴

Eco-printing thus represents a perfect synthesis of creativity and sustainability. In addition to the ecological benefits noted here, this technique possesses an aesthetic value that celebrates a return to nature, evoking a sense of reconciliation with the organic rhythm of the natural world in a sensory way. It is not limited to a decorative aesthetic; rather it embodies a form of resistance to the hyper-production and consumerist excess of modern society, for giving old clothes a completely new look incentivizes their reuse instead of buying new ones.³⁵ Through recovering and enhancing pre-existing textile materials, this practice takes the form of an ode to sustainability and an invitation to reflect on the beauty of what we often overlook. In an age dominated by industry, eco-printing becomes an act of resistance, a return to a more intimate, more authentic practice capable of offering a new expressive dimension to textile design and strengthening a profound link between ethics, aesthetics and respect for the environment. Moreover, this practice, which restores life to pre-existing materials, invites us to reconsider the concept of “novelty”. Eco-printing is not a process that pushes production in unlimited quantities but enhances what already exists, intriguing a reflection on the value of things and their durability. In this sense, dressing becomes an act of care, awareness and respect for the cycle of life, where body and environment are in constant dialogue. Nevertheless, it is also an invitation to rethink beauty, moving away from artificial aesthetic canons and appreciating the imperfection and variety that nature offers, but rather, an

26. Rohit Kumar, Ramratan, Anupam Kumar and Devanand Uttam. “To study natural herbal dyes on cotton fabric to improving the colour fastness and absorbency performance.” *Journal of Textile Engineering & Fashion Technology*, Vol. 7, n. 2 (2021), <https://doi.org/10.15406/jteft.2021.07.00267>. In addition, the type of fibre affects the way it is dyed: for example, although wool and silk are both protein fibres, their different amino acid composition requires specific conditions to ensure optimal dyeing, for further study see also: Hao-Cheng Jiang and Ren-Cheng Tang, “Low Temperature Reactive Dyeing of Silk: An Investigation into Dyeing Conditions, and Strength Loss and Friction Damage of Fabric,” *Journal of Industrial and Engineering Chemistry (Seoul, Korea)*, Vol. 134 (2024): 207–16, doi:10.1016/j.jiec.2023.12.051.
27. Šabarić, I., et al., 4361.
28. Platform for Accelerating the Circular Economy (PACE), 16.
29. Tony R. Walker, “(Micro)Plastics and the UN Sustainable Development Goals,” *Current Opinion in Green and Sustainable Chemistry*, Vol. 30 (2021): 100497.
30. Stephanie B. Borrelle, et al., “Predicted Growth in Plastic Waste Exceeds Efforts to Mitigate Plastic Pollution,” *Science (American Association for the Advancement of Science)*, Vol. 369, no. 6510 (2020): 1515–18.
31. Tejaswini, M.S.S.R, et al., “A Comprehensive Review on Integrative Approach for Sustainable Management of Plastic Waste and Its Associated Externalities,” *The Science of the Total Environment* 825 (2022): 153973–153973.
32. Šabarić, I., et al., 4361. See also: Livia Rosa Lara, Isabel Cabral and Joana Cunha, “Ecological Approaches to Textile Dyeing: A Review,” *Sustainability*, Vol. 14, no. 14 (2022): 8353.
33. Mohamed, Nassar, Galal and Moustafa, 2953–65.
34. N. N. Mahapatra, “Eco-Processing of Textiles,” in *Textiles and Environment* (United States: Woodhead Publishing India PVT. LTD, 2015), 12.
35. Šabarić, I., et al., 4361.

imperfection that gives life to the uniqueness of each garment, reflecting an organic beauty, but also a continuous metamorphosis of colours and shapes.

Consumer Choices and Challenges in Ethical Fashion

Evolving consumer preferences reflect a growing environmental awareness and drive significant changes in consumption patterns, orienting the market toward more eco-conscious choices. Despite this new awareness, fast fashion consumption remains dominant due to its affordable prices, convenience and ease of access.³⁶ However, trends indicate a growing inclination toward slow fashion, with data confirming a US\$4.5 trillion economic opportunity for circular business models.³⁷ As agents of change, new generations influence the market through their choices and push companies to integrate environmentally friendly materials and ethical production processes. According to a theory endorsed by the Colasante et al. study, consumers are divided into two macro-categories. They can be defined as compulsive buyers, i.e., those who prefer fast fashion and buy garments frequently without particular attention to their provenance or durability, or reflective buyers who adopt a more conscious approach and identify with slow fashion principles, showing that the likelihood of buying second-hand garments is significantly higher among slow fashion consumers, as items sold in second-hand markets belong to earlier collections and are less attractive to fast fashion consumers.³⁸ Therefore, sustainability is emerging as a new cultural value, in which the purchase of eco-friendly or vintage products is not just an economic choice but a statement of ethical and identity principles that can prove to be as altruistic (e.g., for reasons of social justice, environmental protection, social responsibility) as selfish (e.g., for self-expression, self-esteem, sense of accomplishment).³⁹ This change reflects a transition from quantity to quality in purchasing preferences. The adoption of green practices extends beyond clothing, turning into a true lifestyle: growing numbers of people are choosing to reduce meat consumption, limit their use of plastic, and opt for environmentally friendly means of transportation. Such a phenomenon is particularly evident among younger generations, such as Millennials and Gen Z,⁴⁰ who show a greater propensity to support brands committed to sustainability and are willing to pay a premium price for products perceived as an investment in the future. Consumers' support for ethical fashion influences their willingness to pay a premium price and purchase intention.⁴¹ Thus, the symbolic value of sustainability is becoming a key purchasing criterion, often outweighing practical characteristics to promote more virtuous production practices. In addition to price, other barriers persist that do not facilitate the spread of low-impact fashion. These include many different consumer motivations, which can be identified and can be as individual as social or cultural.⁴² For example, in addition to the economic issue, consumer-related pressures exist, such as obsolescence imposed by the fast fashion industry and a limited supply of sustainable garments. According to Jung Choi et al., these obstacles can be traced to three main categories.⁴³ The first concerns a lack of knowledge, skills, and time, compounded by a lack

36. Maria Kélvia Ferreira de Araújo, Rafael Fernandes de Mesquita, Fátima Regina Ney Matos and Michelle do Carmo Sobreira, "Fashion Consumption Practices of Millennials Women: Between Fast and Slow Fashion," *Revista de Administração Da UFSM*, Vol. 15, no. 4 (2022): 615–33.

37. Platform for Accelerating the Circular Economy (PACE), 10.

38. Colasante, Annarita, Idiano D'Adamo, Paolo Rosa and Piergiuseppe Morone, "How Consumer Shopping Habits Affect Willingness to Embrace Sustainable Fashion," *Applied Economics Letters*, Vol. 12 (2023): 1–6, doi:10.1080/13504851.2023.2290578.

39. Louise Lundblad and Iain A Davies, "The Values and Motivations behind Sustainable Fashion Consumption," *Journal of Consumer Behaviour*, Vol. 15, no. 2 (2016): 155–57.

40. Lundblad and Davies, 152.

41. Pérez, Andrea, Jesús Collado and Matthew T Liu, "Social and Environmental Concerns within Ethical Fashion: General Consumer Cognitions, Attitudes and Behaviours," *Journal of Fashion Marketing and Management*, Vol. 26, no. 5 (2022): 792–812.

42. Fiona Harris, Helen Roby and Sally Dibb, "Sustainable Clothing: Challenges, Barriers and Interventions for Encouraging More Sustainable Consumer Behaviour," *International Journal of Consumer Studies*, Vol. 40, no. 3 (2016): 309–18.

43. Yoon Jung Choi, Jen Ballie and Alka Puri, "Reincarnation: waste, reuse, repair and upcycling," in *Accelerating Sustainability in Fashion, Clothing and Textiles*, eds. Sandy Black et al. (London: Routledge, 2024), 300–302.

of awareness and consideration of the issue. Most consumers are not fully informed about the negative impacts of fast fashion, nor on the environmental consequences of greenhouse gas emissions and water footprints.⁴⁴ In addition, a frenetic lifestyle is also a further obstacle to the spread of more zero-waste consumption practices,⁴⁵ as buying second-hand or vintage clothing requires more time compared to the convenience of fast fashion. The second category of barriers is the lack of services, resources, and infrastructure needed to facilitate sustainable consumption practices. Many obstacles to more responsible consumption stem from inadequate public policies that do not ensure adequate availability, quality, and accessibility of public transportation services and green products.⁴⁶ Therefore, the absence of essential infrastructure makes it impractical and uneconomical to adopt ecologically virtuous behaviours. Finally, the third category concerns negative associations related to recycled or remanufactured clothing. Often, these garments are perceived as having poorer aesthetic quality and are associated with neglect or poverty. Contrary to the perception of neglect or poverty, vintage, second-hand, and recycled concepts are extremely rich in meaning, value, and history, carrying a cultural heritage and a unique narrative that differentiates it from mass-produced products. These apparels represent, on the one hand, the artistry of bygone eras, the quality of materials and artistry often superior to those of today, and on the other hand, a conscious consumption based on the search for authentic and distinctive pieces, nurturing a personal and original aesthetic.

Rosso di Robbia and Lazzaro Store Crafting Sustainability

Many small companies focus on disrupting overproduction by adopting more zero-waste approaches, valuing social and ecological aims over pure economic growth. *Rosso di Robbia* and Lazzaro are significant examples of a growing phenomenon in Italy, particularly in Emilia-Romagna, where companies adopting eco-friendly models are gaining increasing visibility. Emilia-Romagna, a region known for its manufacturing tradition, is also experiencing innovation in the fashion and trade sectors, with a strong commitment to eco-friendly practices.⁴⁷

The activity of Michela Pasini, the owner of *Rosso di Robbia*, lies at the intersection of textile craftsmanship, environmental sustainability and the recovery and enhancement of natural dyes. Her professional journey began in 2008 with a personal interest in vegetable dyeing techniques, which materialized in 2015 with the founding of the *Rosso di Robbia* brand. This reality represents a sustainable production model, specializing in the natural dyeing of yarns, fabrics and garments through the exclusive use of dyes of natural origin (i.e. extracted exclusively from plants and cochineal, an insect). The following analysis of the six dyeing methods adopted shows a precise choice to preserve and recover ancestral techniques. (1) Classical natural dyeing involves extracting the colour by decocting the plant in water, which is then filtered, then soaking the fabric and fixing the natural colouring through prolonged boiling processes. We can observe an example of the result in Fig. 1. (2) Eco-printing, in which the plant is placed directly on the fabric, rolled and steamed or immersed in boiling water, allowing both the colour and shape of the plant organism to be transferred onto the fibre. We find two examples of eco-printing performed by Pasini: the first is a fabric adorned with *Bidens ferulifolia* flowers (Fig. 2), and the second is a jacket finished with African daisies (Fig. 3). (3) The shibori technique, a Japanese method of reserve dyeing,

44. Anja Kollmuss and Julian Agyeman, "Mind the Gap: Why Do People Act Environmentally and What Are the Barriers to pro-Environmental Behavior?" *Environmental Education Research*, Vol. 8, no. 3 (2002): 240–41. See also: John Thøgersen, "How May Consumer Policy Empower Consumers for Sustainable Lifestyles?" *Journal of Consumer Policy*, Vol. 28, no. 2 (2005): 143–77.

45. William Young, Kumju Hwang, Seonaidh McDonald and Caroline J Oates, "Sustainable Consumption: Green Consumer Behaviour When Purchasing Products," *Sustainable Development (Bradford, West Yorkshire, England)*, Vol. 18, no. 1 (2010): 20–31.

46. Andrea Prothero and James A Fitchett, "Greening Capitalism: Opportunities for a Green Commodity," *Journal of Macromarketing*, Vol. 20, no. 1 (2000): 51–53.

47. The manufacturing sector in Emilia-Romagna is adopting more sustainable models, focusing on energy efficiency, circular economy and environmental certifications; this information, however, refers to large and medium-sized enterprises, while small and micro enterprises have more difficulty in initiating sustainable practices. Regione Emilia-Romagna. *Profilo di sostenibilità delle imprese in Emilia-Romagna. Report 2024* (Bologna: Regione Emilia-Romagna, 2024): 16.

involves folding, binding, and compressing the fabric between two rigid wooden surfaces before immersion in the dye bath, creating characteristic patterns due to the fibre's partial resistance to dye absorption. (4) Batik uses hot wax to create patterns on fabric, acting as a barrier that prevents dye penetration. Once the wax is removed, intricate, sharp-edged designs emerge, offering a graphic effect, resulting in a resist-effect similar to the shibori technique but with greater graphic detail. (5) Painting with natural dyes allows for direct application of natural dyes with a brush to the textile surface, allowing greater design control and more artistic freedom. (6) Woodblock printing uses engraved wooden matrices to imprint colour on fabric, combining traditional craftsmanship and reproducibility of ornamental patterns.



Figure 1: Fabric after the final boiling stage of natural indigo dyeing



Figure 2: Example of an eco-printing technique with *Bidens ferulifolia* flowers



Figure 3: Example of a jacket decorated with the eco-printing technique using African daisy

In addition to being a green alternative to chemical colouring, Pasini's approach is distinguished by the predominant use of independently harvested raw materials. Plants used include *Coreopsis tinctoria*, *Coreopsis grandiflora*, African daisy, Japanese indigo, and mimosa. Also found in her garden are *Bidens ferulifolia*, madder, ford, marigold, geraniums, Japanese maple, among others. The dye plants used are mainly derived from Pasini's garden (as shown in Fig. 4) or from a wild collection, with specific attention paid to seasonality and local availability.⁴⁸



Figure 4: Flowers grown at *Rosso di Robbia*'s garden — purple: African daisy, yellow: *Bidens ferulifolia* and some fern leaves

However, to meet specific colour requirements, it is sometimes necessary to use natural dyes of exotic origin purchased from selected local suppliers. This practice highlights the tension that exists between the desire for absolute zero-waste sustainability and the production needs arising from market requests in response to a growing demand for transparency from the textile industry: according to the Fashion Transparency Index 2023, only 23% of brands publish their methodology for identifying risks related to water and chemical use.⁴⁹ At *Rosso di Robbia*, a rigorous approach is taken in natural dyeing, excluding techniques that compromise ecological standards. An emblematic example is eco-printing; recent industrial trends involve using plastic layers to achieve sharper prints on uniform backgrounds, preventing the spread of colour to subsequent layers. Although aesthetically compelling, this practice raises critical environmental issues related to plastic waste production and microplastics release, with consequent implications for human health and the ecosystem. There are alternative solutions to avoid the

48. Pasini, Michela. Personal communication, January 10, 2025.

49. While 32% of brands publish the water footprint produced within their operations, only 24% publish the water footprint at the manufacturing level, and just 3% provide data on the water footprint related to raw materials, sourced from: Fashion Revolution, *Fashion Transparency Index 2023* (London: Fashion Revolution, 2023): 15.

problem, such as the use of biodegradable paper or films; nevertheless, these eco-printing options have limitations both from a technical point of view because they are not reusable and are only in small formats and from an economic point of view because they are costly. This choice reflects a broader debate in the eco-printing industry, divided between those who favour a “pure” approach and those who introduce more impactful materials, highlighting how the definition of sustainability can vary depending on production trade-offs and industrial practices. The implications of this practice raise questions about the very definition of sustainable fashion and the actual reduction of environmental impact. What emerges is a critical reflection on the different levels of ecological engagement in the textile industry and the importance of communicative transparency that can genuinely inform the consumer about the sustainability of the final product. Another problem is that product labels do not require sufficient specificity in detailing the production process. In particular, ethical labels tend to use ordinal or ratio formats.⁵⁰ However, consumers often interpret them in a binary manner, relying on iconic and nominal interpretation rather than in-depth information content analysis, which reduces the effectiveness of labels in conveying accurate and detailed information regarding the product’s production and disposal processes. Still, many

sustainable fashion designers, brands, and retailers are increasing in number, and labels such as ‘ethical,’ ‘eco,’ ‘fair trade,’ ‘organic,’ ‘natural,’ ‘sweat-shop free,’ ‘recycled,’ and even ‘second-hand’ or ‘vintage,’ have all been used to persuade customers that the fashion products they purchase are environmentally friendly and ethically sound.⁵¹

In terms of textile materials, Pasini mainly uses fabrics of natural origin, including silk, wool, linen, cotton, and hemp, although there may be amounts of synthetic fabrics within them. Finally, she has always preferred sourcing scraps and offcuts from end-of-production materials. She also acquires antique fabrics, such as cotton sheets from flea markets, silk from parachutes, and antique hemp fabrics manufactured in Romagna, using them to create garments. These antique fabrics and vintage or used apparels, having not undergone intensive treatments, are particularly good at absorbing colour. Pasini’s continuous search for usable materials has brought her closer to the reality of the Lazzaro shop, where she has found an extensive alternative in fabrics, taking old garments from the shop and reselling the textiles through the same channel in a creative collaboration with the store. Lazzaro is a vintage boutique and social cooperative located in the historic centre of Rimini. It specializes in selling vintage and second-hand clothing, plus promotes sustainability through the promotion of creative activities such as upcycling on discarded garments. The project was born in 2018, aiming to enhance donated clothing unsuitable for direct distribution, creating a virtuous circle between solidarity, culture and youth entrepreneurship. The store stands out for its attention to the quality and history of garments, offering customers unique pieces accompanied by cultural and photographic references that they often communicate through attentive communication in their Instagram profile. It collaborates with several local realities, including *Rosso di Robbia*.⁵² Unsold garments, often characterized by creases, damage, wear, holes and stains, are transformed by Pasini through an upcycling process that includes dyeing, embroidery, and creative sewing. In this context, *Rosso di Robbia* deals with the redevelopment of defective garments, transforming them into unique pieces through artistic processing, contributing to the creation of mini-collections intended for resale, as exemplified by Fig. 5, 6 and 7, which show some items of the capsule-collection dedicated to indigo colour, created in the summer of 2024. Specifically, Fig. 5 shows the clothes rack with the garments made *ad hoc* for the indigo capsule-collection, with all the upcycled pieces by Pasini, Fig. 6 presents an example of a jacket realized with the implementation of the shibori technique, and in Fig. 7 we can notice an example of Pasini’s work of embellishment of imperfections, in this case a non-fading stain was highlighted with red sewing. In the Indigo collection,

50. Robert P. Hamlin and Lisa S McNeill, “Marketing Tactics for Sustainable Fashion and the Circular Economy: The Impact of Ethical Labels on Fast Fashion Choice,” *Sustainability*, Vol. 15, no. 13 (2023): 10331.

51. Ozdamar Ertekin, Zeynep and Deniz Atik, “Sustainable Markets: Motivating Factors, Barriers, and Remedies for Mobilization of Slow Fashion,” *Journal of Macromarketing*, Vol. 35, no. 1 (2015): 53–69.

52. Lazzaro collaborates with several entities, including the Psicromatici, a group of people who recover and redesign old clothes as a therapeutic activity, and with the Faculty of Fashion Cultures and Practices of the University of Bologna — Rimini Campus, providing clothes for studies and creative projects.

Pasini first collaborated with the Lazzaro team to carefully select the most suitable pieces and outline the project together. She then worked on blazers, robes, and other discarded garments, applying colouring, embroidery, and sewing treatments. Through upcycling, Pasini intentionally highlighted holes, stains, and imperfections with brightly coloured threads or using creative intervention techniques. By doing so, she emphasized the beauty of flaws and the passage of time, celebrating the lived history embedded in each garment.



Figure 5: Indigo capsule collection by *Rosso di Robbia* and Lazzaro



Figure 6: Jacket made using the shibori technique



Figure 7: A creative example of upcycling where imperfections are highlighted through Pasini's intervention

Rosso di Robbia represents an emblematic example of how artisanal practices can be integrated into a more eco-efficient production paradigm while addressing challenges related to market demand and raw material availability. Its activity is part of a broader context of rediscovery and enhancement of traditional dyeing techniques, emphasizing the potential of an approach that merges aesthetic research, historical knowledge, and environmental consciousness. This model not only promotes quality artisanal production but also fits into a circular economy context and focuses on reusing and enhancing natural resources to raise awareness of more low-impact practices in the fashion industry. In this sense, eco-printing establishes a strong connection with the principles of *Art Nouveau*, a movement that rejected industrial standardization in favour of craftsmanship and organic aesthetics. Just as *Art Nouveau* celebrated the integration of nature into artistic expression, eco-printing embraces botanical forms, allowing natural elements such as leaves and flowers to shape textile patterns directly. This technique not only restores an appreciation for material uniqueness but also challenges the environmental impact of industrial dyeing by eliminating harmful chemicals and reducing water pollution. Through this approach, eco-printing embodies an aesthetic philosophy that values imperfection and a commitment to sustainable innovation. Thus, the collaboration between *Rosso di Robbia* and Lazzaro encourages the recovery and valorization of used clothing and preserves historical memory. In this scenario, Lazzaro emerges not as a simple vintage clothing store but as a reality whose activity is based on a rigorous process of collecting, selecting, and marketing second-hand garments. It also promotes social inclusion with initiatives aimed at involving vulnerable segments of the population and finally creates a close bond with the local community and consumers, as opposed to the depersonalizing shop experiences of large chains.

Conclusion

Although separated by more than a century of difference, *Art Nouveau* and sustainable fashion have significant affinities beyond mere aesthetic choices. Both movements respond to the dynamics of serial production and consumerism that dominate their respective eras, aiming to recover a more human dimension of art and creation. However, this dialogue invites more profound reflection on the differences between a past perceived as ‘inexhaustible’ and a present that must come to terms with ecological and social challenges. *Art Nouveau* reacted to mass production, while renewable and vintage fashion faces ecological challenges where, through practices such as eco-printing, it confronts us with new questions, such as what the actual cost of a product is; trying to answer them by seeking an aesthetic evolution that does not give up ethical and ecological principles, in a new holistic perspective, rooted in an awareness that extends far beyond aesthetics. However, despite progress, the textile industry continues to impact the planet significantly, and there are still few (albeit valuable) achievements through eco-friendly recovery techniques or developing markets for used garments. Nevertheless, small initiatives such as *Rosso di Robbia* and Lazzaro are realities that fuel these reflections, inviting us to question concepts of “novelty,” “new,” and “old,” proposing a more responsible change in consumption habits.

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