

# Marbled is the new green. Polymeric polychromy as a contemporary code of sustainability.

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## ABSTRACT

The increasing environmental and symbolic criticism of plastic materials - once celebrated for their modernity and accessibility - highlights a growing disconnect between industrial material practices and contemporary sustainability values in design. There is a need to better understand how aesthetic choices such as polychromy intersect with ecological awareness, particularly in the use of synthetic materials in product, furniture, and interior design. The study builds upon design theory, material culture studies, and sustainability discourse. It situates plastics within a broader historical and socio-political context, examining their role in shaping mass production and aesthetic standards in the twentieth century. The framework also engages with current debates on decentralization, social innovation, and material ethics. The research aims to (1) analyze the evolving perception of plastics in relation to sustainability and aesthetics; (2) investigate the role of color (polychromy) in these perceptions; and (3) identify and map emerging practices that reflect a shift toward more ecologically and socially responsible design models. From a methodological point of view, the study employs quantitative and qualitative desk research, including literature review and case study analysis, to examine historical trends, current initiatives, and design practices related to the use and perception of plastics. Findings indicate that the traditional models of centralized, industrial plastic production and re-processing - once associated with progress and democratization (De Fusco, 2007) - are in crisis. Public perception has shifted due to increasing awareness of plastic pollution and its health and environmental impacts (Kießling *et al.*, 2017; Joseph *et al.*, 2016). This shift has spurred both grassroots and institutional responses, including bans, design innovations, and alternative production models. Polychromy, historically tied to synthetic materials, now plays a symbolic role in expressing ecological values, material reuse, and social engagement. The study concludes that a new chromo-material paradigm is emerging - characterized by ecological awareness, decentralized practices, and aesthetic reinterpretation of synthetic materials. This phenomenon is historically traceable, widely diffused, and indicative of broader systemic transformations in design. The research contributes to understanding how color and material choices are becoming critical tools in advancing sustainability and rethinking industrial production in design fields.

**KEYWORDS** Marbled plastic, Confetti texture, Aesthetics of sustainability, Open recycling, Circular economy, Diversified series

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## 1. Introduction to chromo-material inhomogeneities in design practices

Natural materials have, by their own nature, specific peculiarities, often assimilated to local characteristics, and non-uniformities of visual and tactile features: variations, textures, veins, capillarities. We can consider, for example, the different types of wood, plant fibres, stones, leathers, metals and their oxidation processes, soils and clays. Historically, even "artificial building materials", so the ones deriving from substantial transformation processes on natural materials, have always maintained chromatic characterisations that are specific, diversified and identifying from time to time. These granulometries, small defects and air bubbles can be seen as clear traces of their typicalities, and so of the links, with their territories, their techniques and their cultures of origin. Consider, for example, terracotta, cocciopesto, conglomerates, artisanal glasses, grits, Venetian terrazzo. Starting from the first applications in the 20th century, chemical-based polymers introduced, instead, the possibility of obtaining, without painting interventions, chromatically and tactilely uniform and stable shapes. For Renato De Fusco "it is possible to distinguish a first imitative phase (the historical plastics) from a phase of the material as a surrogate of others (the plastics of scarcity), up to the surprising developments of it due to technological advancement (the plastics of opulence)" (De Fusco, 1985). The material that most characterized the twentieth century, therefore, was initially used, for both commercial and even ecological purposes, as a replacement for more precious materials, or materials that were difficult to find, declared illegal or, simply, no longer ethically acceptable (materials such as ivory, animal bones and horns, coral, turtle shells, furs). In large-scale production processes, therefore, the standardization of "light recognizability" (Manzini, 1986), of "performance democracy" (Branzi, 2008) and of the monochromaticity of goods produced in plastic favors a new design paradigm that became a global phenomenon with the economic boom of the post-war period. The "promise" of polymers is to provide large social groups with cheap, light, available, homogeneous products, all "equally perfect". «In the 1950s and 1960s, the production of various new materials, especially plastics, represented, for many designers, the ideal tool for pursuing innovation and the well-being of society. These materials were attributed a strong symbolic and political value, aimed at expressing concepts and ideals, such as those of freedom, equality and democracy» (Cecchi, 2019). This post-Marxist ideal proposed, through plastic goods, a new model of universality that, however, tended to exclude the concepts of difference and localism and that, relying on a general optimism, failed to grasp the socio-environmental implications that, in a few decades, have generated global

crises that are evident today (Fig. 1). Gaetano Pesce was one of the first designers to radically criticize this propagandistic idealization of the homogeneity of polymeric materials and, more generally, the desire of companies, which were increasingly globalizing and addressing mass markets, to "reduce human needs to standards" (Martino, 2007). Pesce himself, who has been experimenting for years with less "dictatorial", rigid or "boring" possibilities of using plastics, rubbers, resins and foams, states: «it is with the ideology of functional-rationalism that the most sublime and hidden repression of the consumer has stabilized, bartering it with social motivations. [...] And our life has significantly lost spontaneity, replaced to the point of nausea by everything that prevents the free and individual self-determination of taste» (Pesce, in Baroni 1982). With Pesce, plastic becomes a diversified, empirical, spontaneous, heterogeneous, random material. It is conceived as open in its manipulative, aesthetic and expressive possibilities. Pesce then intuits, well in advance, the possibility of imagining production processes of proximity and low complexity, typical of the technological equipment of current fablabs. "I believe that many of today's materials, if studied carefully, would allow us to bring the factory into the home just as information technology has allowed us to bring the office into the home. Some chemical processes can be brought into the home and some products no longer require specialised labourers and production places far from the users. Instead, without this detachment between object and consumer, it will be possible to give shape and color to the specific needs of each person" (Pesce, interview with C. Martino, April 2001, in Martino, 2007).

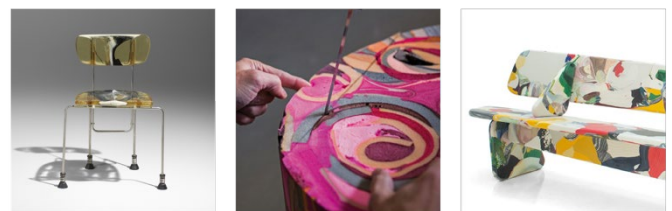


Fig. 1. Limited editions. From left to right: Gaetano Pesce (Italy) chair model "543 Broadway" 1993, Massimiliano Adami (Italy) "Gommapiuma Décor" 2013, Dirk van der Kooij (The Netherlands) "Menhir bench" 2014. The three products included in this collection are made using three different processes and materials (resin, sponge, melted plastic). These are limited edition products, each with its own distinctive aesthetic, where the designers have intervened to maximize the aesthetic effect of variation and chromatic mixture.

## 2. Distributed models of polymeric recycling. The emergence of a new aesthetic of the sustainable

Gaetano Pesce's reflection can be interpreted as the premise for a phenomenology that is globally widespread today. In pre-industrial society, the design and production of artifacts took place within a specific and narrow local community and was based on its resources and knowledge (Vitta, 2001).

The last 150 years of industrial evolution, then, have been dominated by linear models of production and consumption, which involve in manufacturing goods from raw materials, sold, used and then discarded as waste, through centralized, specialized production models based on economies of scale and dislocated with respect to consumption centers. This model largely replaced a traditional economy that maintained high levels of reuse and regeneration but required more labor and yielded lower returns on investment (Maffei & Bianchini, 2015). It generated unsustainable levels of resource consumption and waste production. The contemporary economy currently seems stalled in a system in which everything, from the economics of production to contracts, and from regulation to people's behaviour, continues to uphold the linear model of production and consumption, but this system has shown its limits and is weakening with the rise of several trends: awareness of the exhaustibility of resources, stricter environmental regulations, digital technologies for tracking materials, and changing consumption patterns (more access-oriented than ownership-oriented). Those patterns are pushing towards alternative models based on the concept of circularity and the idea of organising human activities in distributed systems.



*Fig. 2. Critical Design. From left to right: Johé Bruneau (France) "Énergie Fossile" - 2019, Shahar Livne (Israel) & Violetta Barba (Italy) "R.evolutionary matters" 2019, Studio Swine (UK). The aesthetics that emerge from plastic melting processes can also be found in artistic and critical design projects that aim to stimulate speculative contestations of the current production system.*

The circular economy has thus emerged as a key topic of discussion in political and economic and academic

debates about industrial production, energy efficiency, and sustainable development (Moreno, Charnley *et al.*, 2016, 2018, 2021). It emerges as a paradigm capable of transforming the relationship between ecological systems and economic activities. Studies that have recently increasingly focused on this model have developed numerous tools and methodologies to support the transition to more sustainable production and consumption patterns (Rotondo, B., Bakker, C., Balkenende, R., & Arquilla, V., 2025).

Although we recognize that the circular economy benefits from interdisciplinary research, technical aspects dominate theoretical reflection. Authors like Ann Thorpe point out that circularity should be considered a social issue with a technical component, not the other way around (Thorpe, 2010). This contribution aims to explore the social significance of aesthetic changes related to sustainability by linking the polychromaticity of new plastic products charged with ecological principles to distributed systems and the concept of cosmopolitan localism.

Cosmopolitan localism, a term coined by Wolfgang Sachs of Germany, refers to a place-based way of life in which solutions to global problems are designed for local circumstances and adapted to specific social and ecological contexts, while being globally connected to exchange information, technologies and resources (Sachs 1999 in Manzini 2009, 2012, 2013). If we apply cosmopolitan localism to production systems and reverse chains, we find that it is similar to models based on the principle of distributed systems. This is a model that has a long-standing history in computer science and describes an environment in which the various components are distributed over several networked devices. More recently, this concept has also been explored in the fields of design and urban planning (Manzini, 2021; Sennet & Sendra, 2022).

In the field of polymer production, this trend became widespread thanks to laboratories experimenting with ideational and creative processes. These processes lead to product design, but also to the conception of technologies, devices, and strategies for recycling and production. These strategies are based on the aforementioned concepts and often combine the phases of collection, recycling, ideation, and production within a single organizational unit, using low-complexity, low-specialization and low-cost technologies (Fig. 2).

The wide diffusion and participation in plastic recycling processes seems to be proportional to the demonisation of this material caused by its misuse for disposable applications. Through excessive functional specialisation (Pietroni, 2014), these applications have exaggerated the incongruence between the post-consumer material's

lifetime and its use time, even when compared to other materials.

Precious Plastic is the global open-source digital commons macro-project that experiments with and disseminates an alternative plastic recycling model. Active in 92 countries since 2013, it defines an “action network” as an ecosystem that enables a global community of people to collaborate on plastic recycling, open design, and open manufacturing projects. This network has produced a new, uniform material and color language that is reproduced almost identically in all nodes of the system, independent of the specificities of the places and contexts in which production takes place. The variability recognisable in Precious Plastic products, as well as in the products of the cases explained below, is due to chromatic differences caused by the unpredictable nature of the recycling process, which combines plastics of different colors. Thus, the recycling production process leaves an expressive mark on the product, which takes on a specific characterisation and finish that symbolically challenges dominant production models.

The various experiments inspired by the Precious Plastic project have evolved the dissemination of this model, for the most part using machines and tools whose level of automation is low, so that the manufacturing process includes manual activities that produce uncertain, varied and random surfaces that materialise in polychromes and irregular shapes, generating this new identity image of sustainability. Subsequently, even industrial or laboratory activities utilising more sophisticated technologies and higher levels of specialisation have reproduced the same aesthetics. This demonstrates the affirmation of a recognisable ecological message endowed upon products with this polychromatic characterisation.

### **3. Phenomenology of "Thermoplastic Marbling": a mapping proposal**

The origin of the use of recycled plastic as a production material can be traced not only to recent Western environmental practices, but also to contexts of emergency and survival where reuse and recycling have historically emerged from primary needs [2].

Starting from these specific contexts and historical conditions, the research develops a theoretical framework and an exploratory mapping project, “Marbled is the New Green,” based on the observation of these phenomenologies. From this map, a new contemporary color code clearly emerges, representing a novel “post-natural” sustainability aesthetics. These new veins and textures of recycled plastics define a specific expressiveness for this material, also reminding of the visual postmodern

experiments carried out in the 1980s—such as the work of Ettore Sottsass and the Memphis Group.

With the aim of mapping the diffusion of the new contemporary code related to polychromies resulting from the recycling of polymer waste, a phenomenological analysis was conducted on the web, and the structuring of a dataset formed the basis for the collection and selection of significant cases at a global level.

The collection of significant projects firstly was carried out by consulting the map available on the *Precious Plastic* website, particularly within the *workspace* category, which refers to initiatives involving experimentation, design, and dissemination of the practice. This was supplemented by research into projects developed by established companies that have promoted this new aesthetic at leading sector events (from design to art). Furthermore, starting from those, the research broadened through a chain reaction that led to the recognition of large and small initiatives, from official websites to dedicated social media pages, to little-known collaborations that contribute to the dissemination of the phenomenon at various levels.

The collection and selection of data determined the structure of a dataset that seeks, within the variety of initiatives, to group together information concerning quantitative and qualitative data enabling their evaluation and the creation of initial thematic clusters specifically combining:

- geographical data concerning the continent and country from which the project propagates;
- quantitative data that relates the presence of projects in the respective country and a selection of these based on specific criteria (see Fig.3);
- qualitative data relating to the type of polymer waste used (often influenced by local needs/issues) and the production technique, whose process varies depending on the context of experimentation and production (from the use of low-complexity machinery in laboratory settings to processes and techniques used in industry).

To date, the research considered 704 projects spread across 93 countries, of which 16 (17%) are in America, 17 (18%) in Africa, 25 (27%) in Asia, 2 (2%) in Oceania, and 33 (35%) in Europe. The selection criteria, based on the ability of each experience to generate real economic/productive or eco-social/cultural impacts through market diffusion, led to the selection of a total of 118 projects, distributed as follows: 43% in Europe, 30.6% in America, 17.3% in Asia, and 4.5% in Africa and Oceania respectively. Furthermore, these are case studies that are not only reaching the market, but also feature a designing or experimental quality that is not limited to the replication

of objects generically attributable to open-source practices, but rather characterise their own production based on the cultural message they intend to convey, the prevailing waste of that particular context, the project designed to respond to specific needs, specific rituals, a specific imagery, or developed based on their technical capabilities or availability in terms of machinery.

The qualitative analysis provided within the dataset, considering materials and production techniques, allows the interpretation of how this colour scheme emerges technically. Although the processes are implemented at different levels of complexity in terms of machinery and equipment, the underlying production technique remains the same in many instances, as is the case with thermo-pressed panels or injection-moulded objects, two production processes that are among the most frequently used both in laboratories and in industry. In terms of materials, on the other hand, there is a prevalence of HDPE (High-Density Polyethylene) and PP (Polypropylene), i.e. polymer waste among those most commonly and daily produced and which are best suited to treatment and processing even in laboratory/craft environments, unlike, for example, PS (Polystyrene), a common waste but more suitable for transformation in specially equipped production environments [3].

These are projects, therefore, that come from different countries and contexts and share not only a globally widespread material resource but, above all, the ethical and aesthetic values of this new colour scheme. Projects that are linked by their ability to transform waste into product, and product into message.

The productive aspect of this phenomenon was then the key to understand the various market levels that such initiatives have reached through the commercialization of their goods, thereby contributing to the global diffusion of this chromatic code as a manifestation of a widespread activism.

Following the initial survey, in fact, it was deemed necessary to expand the dataset from a qualitative point of view with further categorisation based on the different typological areas of application. The production categories identified are: (i) non-industrial/small-scale, (ii) semi-industrial/medium-scale, and (iii) industrial/large-scale. These categories make it possible to interpret the phenomenon across multiple dimensions: production context and impact, project objectives, technological complexity, and productive capacity.

From a typological perspective, instead, projects were observed across four main areas: material and surface design (panels, textures, and finishes), furniture, product, and experimentation both chromatic and material (Fig. 3).

In these domains, plastic is no longer merely a problematic material but becomes a visual language, capable of telling stories of places, communities, and identities.

Specifically, trying to give references to those categories, among the semi-industrial and industrial projects, it is worth mentioning manufacturing companies such as Polygood by The Good Plastic Company (Netherlands) and Plastiz (Italy), where recycled polystyrene is transformed into cladding panels. Despite differences in technique and polymeric base material, architectural components can also be obtained through small-scale non-industrial processes, as it occurs with FabBrick, in France, which produces bricks and surfaces from synthetic textile waste (mostly waste from the fashion industry) using compression and gluing rather than melting (Fig. 4).

In the furniture sector, the transition from non-industrial/small-scale to semi-industrial production is driven by projects that combine social impact, local value, and formal experimentation: in Costa Rica, The Recycle Studio; in Kenya, Flipflop Design, which blends traditional craft techniques and materials with plastic recycling to create furniture and public structures; and in Algeria, Precious Plastic Refugees, which involves refugee communities in the production of school furniture generating educational, occupational, and symbolic value. In these cases, the material quality and chromatic variability of recycled plastic become a powerful narrative medium.

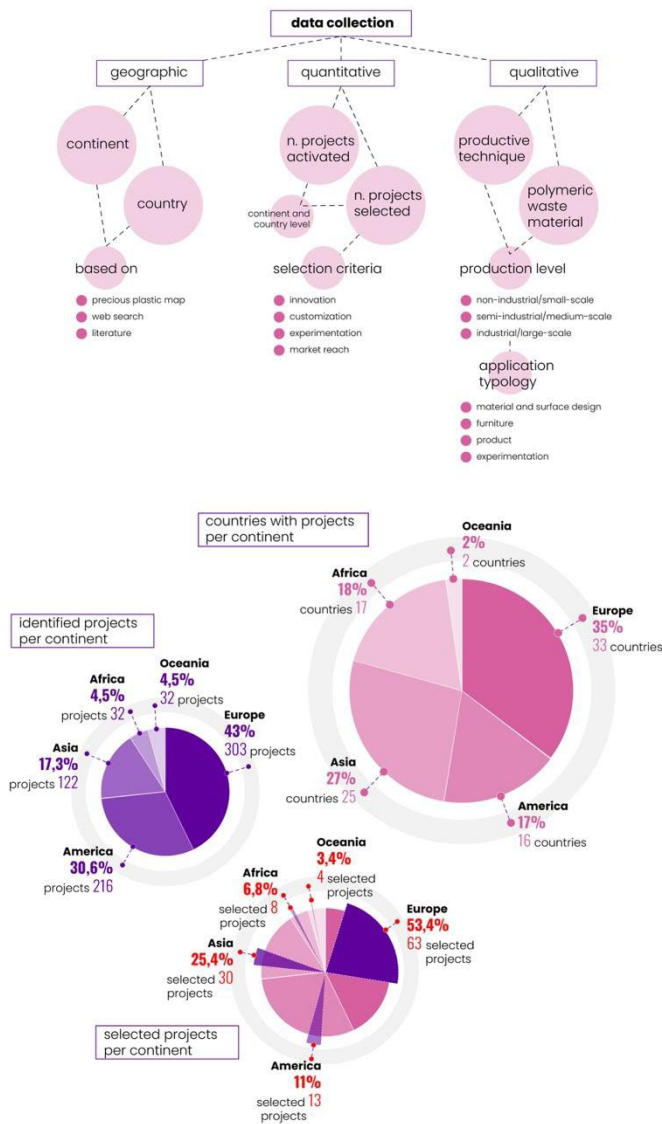


Fig. 3. From top to bottom: Methodology for collection and selection of data for the structuring of the dataset. Quantitative data collected related to the number of countries per continent where projects matching the research intent were found; the number of projects found per continent; the number of projects selected per continent. This numerical data shows, despite the large number of projects, which continents have the highest number of projects meeting the selection criteria.

In the industrial furniture segment, projects like Maximum (France) emphasize user-driven color customization and textured aspects of the process; Samsara (India), Luken by Paola Calzada Arquitectos (Mexico), and Space Available (Indonesia) demonstrate how the “marbled” aesthetic is not just a formal solution resulting from recycling, but a coherent design language: recycled plastic becomes a “noble” material, carefully crafted and returned

to the user as a sign of environmental, social and cultural commitment.



Fig. 4. Finishings. From left to right: Polygood by The Good Plastic Company (Netherlands), Plastiz (Italy), Fab\_Brick (France). The first two images show the results of the thermo-pressing process, made by using the “sheetpress” machine. The bricks made by Fab\_Brick in the third image are still representing an output of a process that uses pressure but combined with glue rather than high temperatures. The general output given by pressing process of the three projects is related to the “confetti” aesthetics.

In the non-industrial/small-scale product domain, recycled plastic often materializes in small yet highly communicative objects, such as those created by Re=Comb (UK), Sjølove (Norway), and Boomplastic (Poland). As mentioned, this material-chromatic phenomenology has a global scope. Despite this, it is possible to observe practices that attempt to recover an object-based dialogue with local culture. Projects like Precious Plastic Amman (Jordan) or SeyTreasure (Seychelles), for example, exemplify this purpose by designing symbolic objects that reflect local identity and geography, while emphasizing the educational and environmental message of the process (Fig. 5). These laboratories act as a vehicle for information and training for the communities in which they operate.



Fig. 5. Social impact and local identities. From left to right: Precious Plastic Amman (Jordan), Flipflop Design (Kenya), SeyTreasure (Seychelles). The use of low-complexity technologies enables social projects involving people who are not specialized in productive activities. The projects in the pictures show an aesthetics that is closer to extruded/injected objects, showing a more mixed/shaded color blend related to the marbled aesthetics. Between them, the Flipflop project, is emblematic in embodying the traditional imagery and manufacturing capabilities related to the territory.

Other experiments fall within the fields of critical or authorial design. The plastic sculptures by Johé Bruneau (Lyon) or the installations by Shahar Livne (Israel), whose bench *Metamorphism: Deep Time* offers aesthetic and philosophical reflections on the evolution of materials across geological time, transforming plastic into a metaphorical, narrative, and critical medium.

Several companies, recognizing the relevance of this emerging aesthetic, have integrated it into their own catalogs, sometimes for dedicated collections or collaborations, generating further diffusion and affirmation of this visual code in the world of product design, furniture and finishes. Camper (Fig. 6), for example, has introduced recycled plastic in the production of shoe soles, encouraging customers to return used ones and to become part of a closed-loop system. In high-end furniture, the collaboration between Heatherwick Studio and Magis led to the creation of the IN-SIDE armchair. In the material and furniture sector, the company EcoPixel promotes this movement by arguing that "we should see products as a precise amount of material that can be re-used for something else" and by spreading the pointillism, exemplified by the *Chaise Longue Alex* by Alessandro Mendini, as a chromatic and compositional potential in balance between color, shapes and postmodern iconicity.



*Fig. 6. Industrial productions. From left to right: Camper (Spain) Roku -2024, Heatherwick Studio + Magis (Italy) In-Side - 2024, Faro Barcelona (Spain) "Lampara confetti". This grassroots aesthetic of sustainability, which began in small workshops and home experiments, now appears to have become well-established, as evidenced by the products shown in these images. It has also been embraced by large companies, which are starting to integrate circular processes to reuse their own waste and produce items that maintain color diversity.*

The analysis of mapped projects (Fig. 7) shows that the "marbled" aesthetic has become, indeed, a globally recognized code. At a social, economic and productive level, between informal and industrial practices, between the south and north of the world, between low-tech approaches and industrial processes, plastic is the "common raw material" and is expressed through ever-changing artefacts in a global and interconnected landscape.

#### **4. Conclusions**

From the mapping and analysis activities, it clearly emerges the possibility of codifying a new design model for polymeric products that uses color to define a new aesthetic of sustainability. These new ways of manipulating polymers propose new chromatic, semantic and material characterizations which, in a certain way, contribute to educate "to have a new, native aesthetic experience of the sustainable world, fundamental for the transition towards new economic, productive, social and cultural paradigms. The sustainable product will not, in fact, be just a depleted copy of the non-sustainable product; instead, it has to be more beautiful, stronger in aesthetic terms, more convincing" (Caggiano, 2020). To some extent, realizing in a plural and expanded dimension some of Gaetano Pesce's intuitions, these examples go beyond the authorial dimension, and they place chromatic variability as a value of uniqueness and tolerance. They do not demonize plastic, but they understand it and guide it in processes that propose a change of meaning of its own nature. Plastic thus becomes a "human" material, "artisanal" even if not "anti-industrial", "typical" even if still atopic and capable of undergoing both manual transformations and new digital manufacturing technologies. It takes on, in its new condition of only partially controlled polychromaticity, a peculiar and unexpected dimension. This aesthetic condition brings the synthetic material closer to being recognized as a material having its own new naturalness. This condition allows polymers to be capable of symbolizing an holistic model of sustainability that makes aesthetics, ecology, economy and social dimension coexist.

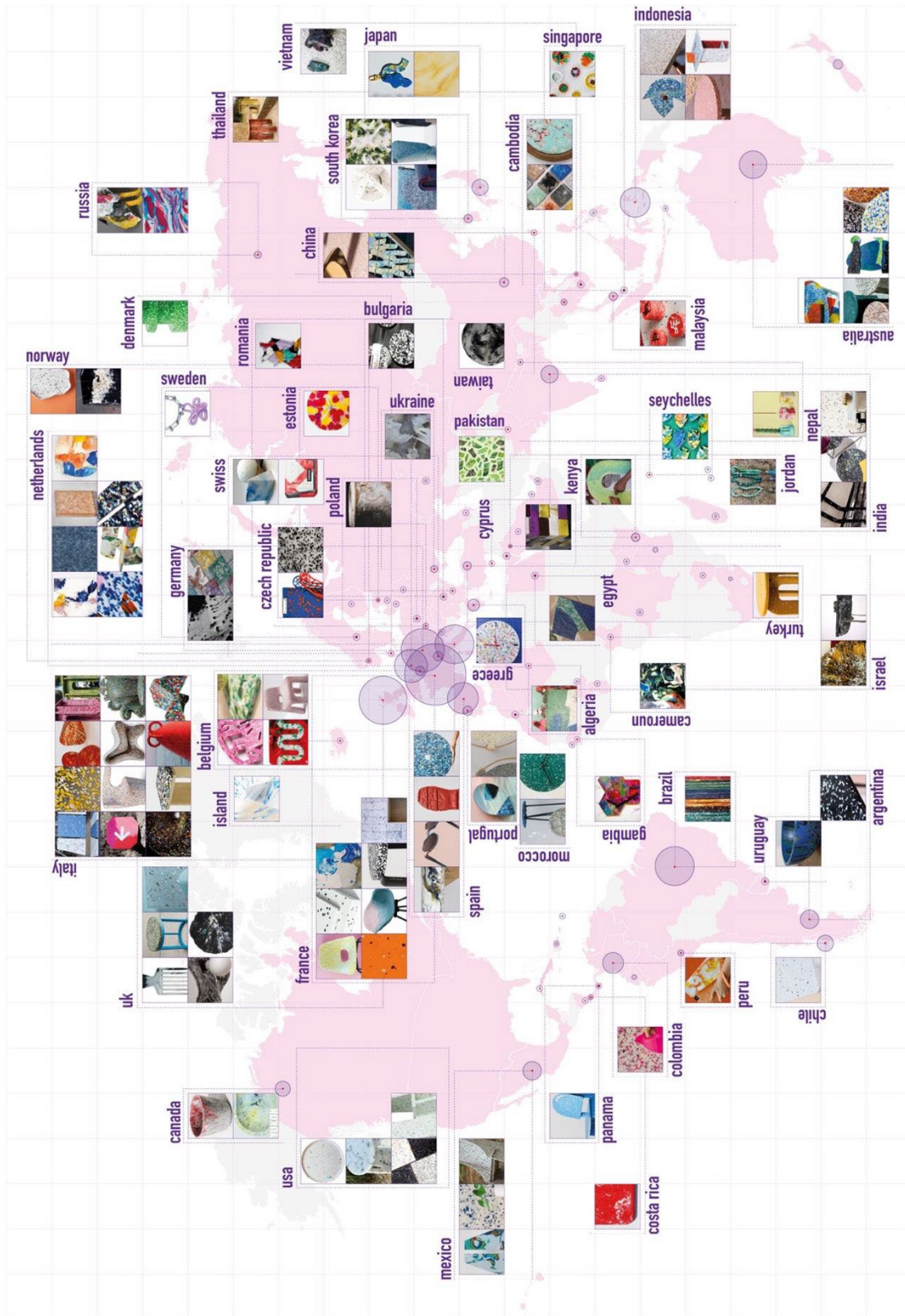


Fig. 7. Global map of selected initiatives. The size of the circles proportionally indicates the quantitative data of the projects identified in each country, of which the selected projects that contribute to the diffusion of the polychromatic code, through their presence - at various levels - on the market, have been highlighted through images.

## 5. Conflict of interest declaration

The authors declare the non-existence of any actual or potential conflict of interest including financial, personal, or other relationships with other people or organizations within three years of beginning the submitted work that could inappropriately influence, or be perceived to influence, their work. No financial/personal interests have affected the author's objectivity(s).

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## Notes

[1] Although this text is the result of shared work by the three authors, Ivo Caruso did the writing of paragraph 1, Susanna Parlato of paragraph 2, and Iole Sarno of paragraph 3. The abstract and conclusion were produced collectively.

[2] A key example is Cuba during the so-called Special Period - Officially known as the "Período especial en tiempos de paz" - (1991–2000), an economic and political crisis following the collapse of the Soviet Union. In a country that was suddenly isolated and consequently lacking in terms of essential goods and raw materials, the population was forced to reinvent everyday tools and objects, relying on locally available resources

and their own technical skills. This condition led to a form of domestic plastic recycling ante litteram, documented by Cuban designer Ernesto Oroza and French designer Pénélope de Bozzi in their publication "Objets Réinventés". These early experiments represent what the authors call a "domestic industrial production", where objects were produced using aluminum casting, extruded - through the construction of a machine inspired by the one used in churros production - or injected plastic, processes in which the real invention was not the object itself, rather the ingenious adaptation and self-construction of machines built by each "popular creator". As Oroza states: "The need for raw materials converts these places into very selective "black hollows". All the plastic objects from the surroundings were absorbed by the mechanism, a kind of industrial cannibalism." (Oroza, 2010). This scenario describes not just a survival strategy, but the emergence of a diffuse creative and productive process, one of the earliest expressions of design based on recycled polymers. Although born out of necessity rather than ecological ideals, the Cuban experience anticipated the kind of distributed production and democratized processes that would soon become widespread globally.

[3] Some projects do not report - on their websites or social media pages - technical specifications relating to the technologies and materials used, which is why it is not currently possible to include them in the dataset in quantitative terms. Nevertheless, within the dataset there is a clear prevalence of the techniques and materials indicated, and in particular for the former, it is possible to detect them from the objects' output, which reports specific features in terms of texture, shape and colour distribution.

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## References

- Baroni, D., in AAVV, Un'industria per il design, Lybra imagine, Milano, 1982, p. 374.
- Branzi, A., La democrazia funzionale. In Branzi, A., Il Design italiano 1964-1990, Electa, Milano, 2008, pp. 58-79.
- Caggiano, S., Sustainable aesthetics, in Interni Magazine, June 2020, retrieved <https://www.internimagazine.com/design/projects/sustainable-aesthetics/>
- Cecchi, M. E., Diversità, diseguaglianza e differenza: Gaetano Pesce. Confronto con il designer su temi e riflessioni progettuali di ieri e di oggi, in Della Piana, E., Gunetti, L., Scodeller, D., Italia: design, politica e democrazia nel XX secolo, atti del IV Congresso AIS/Design, Torino, Edizione Politecnico di Torino, 2020, p. 343.
- De Fusco, R., Made in Italy, storia del design italiano, Editori Laterza, Bari, 2007, p. 131.
- De Fusco, R., Storia del Design, Editori Laterza, Bari, 1985, p. 333.
- De Bozzi, P., & Oroza, E. (2002). Objets réinventés: la création populaire à Cuba. Editions Alternatives.

Joseph, N., Kumar A., Majgi, S.M., Kumar, G.S., Prahalad, R.B.Y., Usage of plastic bags and health hazards: a study to assess awareness level and perception about legislation among a small population of Mangalore city, *J. Clin. Diagn. Res.*, 10, 2016.

Kiessling T., Salas S., Mutafoglu K., Thiel M., Who cares about dirty beaches? Evaluating environmental awareness and action on coastal litter in Chile, in *Ocean Coast. Manag.*, 137, 2017, pp. 82-95.

Manzini, E., Jégou F., (2003) *Sustainable Every day. Scenarios of Urban Life.* Edizioni Ambiente, Mi-lano of Art and Design Helsinki

Manzini, E. (2015). *Design, when everybody designs: An introduction to design for social innovation.* MIT press.

Manzini, E. (2020). *Politiche del quotidiano, progetti di vita che cambiano il mondo.* Edizioni di Comunità

Manzini, E., (1990). *Artefatti: verso una nuova ecologia dell'ambiente artificiale.* Domus Academy.

Manzini, E., (2021). *Abitare la prossimità: Idee per la città dei 15 minuti.* EGEA spa.

Manzini, E., *La materia dell'invenzione,* Arcadia, Milano, 1986, p.34.

Manzini, E., Vezzoli C., (2007) *Design per la sostenibilità ambientale,* Zanichelli.

Martino, C., Gaetano Pesce, *materia e differenza,* Marsilio, Venezia, 2007, p. 51.

Menu, Baptiste. *Réactions en chaine Interview with Ernesto Oroza.* Azimuts 35, Cite du design, 2010.

Moreno, M., De los Rios, C., Rowe, Z., & Charnley, F. (2016). A conceptual framework for circular design. *Sustainability*, 8(9), 937.

Okorie, O., Charnley, F., Russell, J., Tiwari, A., & Moreno, M. (2021). Circular business models in high value manufacturing: Five industry cases to bridge theory and practice. *Business Strategy and the Environment*, 30(4), 1780-1802.

Pietroni, L. (2014). Gli oggetti "usa e getta": l'ipertelia. *OP. CIT.*, (151), 53-53.

Rotondo, B., Bakker, C., Balkenende, R., & Arquilla, V. (2025). Integrating Circular Economy Principles in the New Product Development Process: A Systematic Literature Review and Classification of Available Circular Design Tools. *Sustainability*, 17(9), 4155.

Thorpe, A., (2010). Design's Role in Sustainable Consumption. *Design Issues*, 26(2), 3–16. <http://www.jstor.org/stable/20749938>

Wastling, T., Charnley, F., & Moreno, M. (2018). Design for circular behaviour: Considering users in a circular economy. *Sustainability*, 10(6), 1743.

<https://www.preciousplastic.com/>