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Imagining recycling, recycling designing, designing the image: Reutilisation as a design strategy

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Throughout history, recycling has become a solution for product development on several occasions. Beyond the ecological conscience that has been constituted especially from the 60s until the present time, this practice has served to solve different problems: technical, conceptual or even social. During the 20th century some seating furniture was made in which the recycling of materials and parts of objects has given rise to real design milestones and has helped, without being its main purpose, to create a sustainable image. This article attempts to tell the story of these pieces and their ecological context, to show the operation of reuse as a project strategy and as part of a holistic process that seeks to respond to technical, functional and conceptual issues, beyond the merely ecological.



THE IMAGE OF RECYCLING

Since the creation of the concept of ecology in 1866 by the German philosopher and naturalist Ernst Haeckel, a process of transformation of the way we look at nature has been gradually but constantly developing. From 1960 onwards, this process became more intense, leading the

most advanced countries to rethink their relationship with the environment at different levels and proliferating an attitude of awareness of the protection and respect for the planet and its limited resources. This was a consequence and, at times, the cause of the materialization of various actions of a social, political and business nature that seek collective solutions to address environmental problems.

In particular, it has resulted, over the past few years, in close collaboration between civil society, academia and agencies¹ and UN funds and programs. This movement has led to environmental² awareness campaigns, to summits, meetings and conferences

on land and climate³, to changes in environmental law -initiating strategies to improve legislation⁴- and to the responsible modification of inadequate business practice, all for the sake of sustainable development⁵. However, some companies and agents in this chain, taking advantage of this phenomenon that could be misunderstood as a fashion, turn these ecological attributes into a simple “hollow” image in which production does not follow minimum sustainability standards. Through the so-called *greenwashing*⁶, users are induced to perceive values of a product that they do not really have, or at least, not completely.

Although the design field has also been affected by these ‘greenwashes’, a great awareness has been created throughout the production chain (from the creator to the user, including the producer) which has often resulted in responsible and fair design, paying special attention to its material nature, complexity, processes and life cycles. All this has led to the creation of an ecological image, this time veracious, but which sometimes limits the designer’s project strategies to the field of ecology, relieving other important issues such as form, function or symbolism to a secondary place.

The efforts made since the 1960s until the boom in recent years have led to the promotion of environmental education, the creation of activities and training systems in design schools, as well as the development of research into new bio-materials⁷ and their circularity. Being biodegradable, compostable, renewable, recyclable are some of the inherent characteristics of the responsible product today; however, there is another aspect that far from being novel, emerges as a fundamental resource and project strategy, also providing a clear image of awareness: reutilisation. This strategy is far from innovative; indeed, it can be said to be as old as mankind.

Throughout history there have been episodes where the reuse of materials or object elements has become the key and solution for a product. Beyond awareness, this practice has served to resolve issues of different significance, solving technical and conceptual problems or even claiming social reasons, designing from the material and its implications. In particular, in the 20th century we find some examples in which the recycling of materials and parts of objects, understood in a broad sense, has given rise to real design milestones that have marked its history and have helped, without being its main purpose, to create an ecological image. Taking the chair as a plot typology, below are different examples that show the operation of reuse as a tool and design strategy that seeks to respond to other issues, beyond the merely ecological (fig. 01).

DESIGN RECYCLING

Recycling is a process inherent in Nature from the beginning. Through biochemical, physical or geological processes in which matter and energy are used in a cyclical way, a balance of ecosystems is reached.

Human beings, in their capacity to adapt to the environment, have used this resource: first, by taking advantage of and using the materials, just as they found them in nature; later, by converting them into raw materials, processing them and, finally, recycling them. One of the ways of recycling is reutilisation, if understood as defined by Blanco in his book *Notes on Industrial Design*: “the re-cycling of a part, material or product to make a new one or to recover the used material”⁸.

Reusing came before recycling⁹. Since prehistoric times, transforming certain materials such as metal, fabrics and minerals was a complicated and expensive task. The practice of reutilisation was then extended, coexisting with that of recycling, although not as we know it today. After the industrial revolution, in which the processing of materials was simplified, to reuse ceased to be a common operation, resurfacing in times of warlike conflict when, due to scarcity, there was a special need to make use of either the material or the components of objects.

It was precisely during the inter-war period that the first modern cantilever chair¹⁰ was created back in the mid-1920s. That piece, in addition to being the cause of a legal dispute already known for its original authorship¹¹, was based on an ingenious exercise of reutilisation carried out by its creator Mart Stam. From 1925 onwards, the young architect began experimenting with small diameter gas tubes which he joined with elbows that allowed him to create right angles and great functional possibilities. These experiments led to the first *cantilever chairs (Freischwinger)*, which were later built from steel tubes.

The chair proposed an innovative morphology of great formal purity that adapted to the concept of modern architecture and the spirit of a new era. This piece was exhibited at the 1927 Stuttgart exhibition¹², where it was very well received, especially because of the oscillating effect achieved by the flexible curved steel structure that gave a sensation of suspension in space¹³. Although the chair was considered to be “structurally rigid and visually overpowering”¹⁴, it opened the way to a new concept of furniture from the formal creation of the object, but from the constructive perspective too (fig. 02).

As Giulio Carlo Argan explains, “it is no longer a question of moving from matter to form. Since the starting point is already a form (the metal tube), the process is a formal construction: from unity to complexity through successive projections”¹⁵. In this case, the material and its form determine both the design and the construction process, since the starting point is a specific morphology that, at the beginning, comes from the gas pipe. This new construction principle creates the image of modern furniture, constituting, together with other similar chairs of the time, a milestone in the history of design.

After the Second World War, design’s horizon underwent a transformation motivated precisely by the consequences of the war. On one hand, there had been great advances in industry and materials, due to the innovation developed for combat. This situation led to a drunkenness of creativity and material experimentation that would characterise the 1960s and 1970s. On the other hand, however, just after the war ended, there was a concern about material resources that led to rationing plans in different sectors.

In addition to the latter and as a consequence of the former, from the 1960s onwards there was a new interest in recycling and reutilisation, promoted by the initial ecological currents. However, at the end of the 1950s, the Castiglioni brothers made some original proposals which, according to Zabalbeascoa, “were both an open door to the recycling of objects and the decontextualisation of elements of industrial manufacture”¹⁶. “In fact, as Dardi and Pasca point out in their book *Design History Handbook*, this way of understanding product development based on the association of different elements from different fields and recognising the potential of existing anonymous objects has turned them into “unquestionable points of reference”¹⁷.

The recognisable Castiglioni style has generally been linked to Marcel Duchamp’s *ready-made*. Although the artist’s work was limited to the field of art¹⁸, the Castiglioni’s products had a practical purpose, as well as a conceptual intention that distilled irony (typical of 1960s pop art) and incited critical reflection (a characteristic of that time). The concept of *ready-made* in design can be understood as “the operation of relocating objects by moving them from one context to another”¹⁹. For this strategy to be effective at a semantic level, it was necessary for decontextualisation to take place with respect to its original use, inciting reflection and creating confusion, as in Duchamp’s works, but also responding to the new function.

At the end of the 1950s, the Castiglioni brothers used this project method based on reutilization in the industrial production of furniture. As a result of this exercise, in 1957 their well-known works *Mezzadro* and *Sella*²⁰, which were presented for the exhibition “Shapes and Colours in Houses Today” organised

in Villa Olmo in Como. Both were the result of the association of different pieces from the artisan and industrial world, mainly from the transport sector. Although there was already a precedent²¹, in the *Mezzadro* stool the Castiglioni used a suspended tractor seat to give it a use in another context by transforming the domestic space²² (fig. 03). Besides that, in the *Sella* they use a bicycle seat connected through a steel rod to a hemispheric support, “capable of a ‘dynamic balance’”²³.

This piece, close to the world of ‘juggling’, is an example of functional adaptation, since it was designed as a ‘telephone stool’ for unusual postures, allowing the movement of the body (fig. 04). Each stool was a milestone not only in terms of semantic innovation through its assembly methodology and its desire to decontextualise, but also constituted a new design methodology through reutilisation (here called *ready-made*) that responded to a functional end, like any other design piece. Innovative at the time, it was not until 1970 that Zanotta began to produce the *Mezzadro* stool and until 1983, the *Sella*.

These marketing dates are not surprising, given the social and economic context of that time. In the late 1960s and early 1970s, citizen and institutional movements began to emerge around the environmental issue²⁴. The concept of ‘ecologically sustainable development’ was proposed in the 1967 UNESCO intergovernmental conference for national use and conservation of the biosphere²⁵. Three years later, the first Earth Day was celebrated, from which the symbol of recycling designed by Gary Anderson became known and several volunteer programs on the ethics of reutilisation and recycling were organized. In the same year, the Environmental Protection Agency was created, as well as a series of laws aimed at protecting the environment.

Regarding the design point of view, in 1971 Victor Papanek²⁶ published his book *Design for real-world* (the introduction of which was written by Buckminster Fuller), which represented a significant ideological change, introducing a new discourse on design, ethics and ecology, and becoming a reference point over time (since it initially had less impact on the profession)²⁷. The text, as Torrent explains, was “a wake-up call reminding designers of their social responsibility and demanding that they carry out activities that respect the environment”²⁸. This book included a project by the author, carried out together with George Seeger, which consisted of a radio receiver for impoverished countries, based on the reuse of elements such as a discarded juice can (fig. 05). Two years later, he launched *Nomadic Furniture* with James Hennessey, a manual promoting the environmentally friendly DIY philosophy. Papanek’s vision spread through design schools and conferences, but without major changes in the professional practice of design at the time.

In 1972 the Club of Rome warned in its report “The Limits to Growth”²⁹ about the inversely proportional relationship between the planet’s existing resources (limited) and the population (progressively increasing). This achievement of events provoked in many designers a feeling of ecological responsibility that had to revert into sustainable design and into visible actions in their field. As a result, the Global Tools association was created in Florence in 1973, which brought together various protagonists of Italian design associated with the radical groups SuperStudio and Archizoom and references such as Mendini, Sottsass, Pesce, with the aim of promoting the use of materials and processes that are responsible with the environment³⁰. In this line, new designs began to emerge that exhibited these values, such as the Wiggle chair (1972) by Frank Gehry or the Consumer’s Rest (1983) by Frank Shreiner (Stiletto)³¹.

In 1981, Ron Arad founded his design studio One Off, in which he developed an interest in creating unique pieces, in some cases handmade, rather than large-scale mass production, typical of industrial design. Among them is his well-known Rover armchair (fig. 06), a model that marks Arad’s beginning as a designer, created from scrap metal from a junkyard. The armchair consisted

of a leather seat that came from a Rover V8 2L car and a support structure made of two curved Kee Klamps' steel tubes³². Interestingly, the first two copies were bought by the famous fashion designer Jean Paul Gaultier that same year. Despite the fact that from this moment on the armchair enjoyed great popularity, Arad produced a limited number of pieces, determined by the available quantity of usable seats.

This design piece that seems to be at the point where art (*ready-made/objet trouvé*) and recycling converge, did not intend to participate in either of them, as stated in the book *Ron Arad. No discipline*. In this text, he explains that his work has been misinterpreted "as an environmental statement" or "as a manifesto"³³. The piece however responds to simpler questions: a greater ease of execution and a desire to create a different model (although it shared a certain formal resemblance to a 1924 chair by Jean Prouvé³⁴). However, despite all this, Arad uses recycling as a design technique, from which he creates an iconic piece. Due to the social and cultural context in which ecological awareness was growing, the Rover chair became an example of reuse that transcended the designer's will. In fact, the limited edition of this model, due to the restricted number of pieces within its reach, causes it to be understood even more as an object with an ecological vocation that does not go beyond the line of consumption typical of the industrial design³⁵.

In the late 1980s, the environmental movement and recycling became more effective and viable when modern materials processing took off, despite having started its theoretical approaches three decades earlier. By the middle of the following decade, most developed countries had already begun to propose policies for environmental protection and waste management. In this context, the Brazilians Fernando and Humberto Campana created in 1991 the first Favela chair (**fig. 07**), built with pieces of discarded wood glued altogether, inspired by the Brazilian favelas. In this model produced by Edra³⁶, the designers bet not only on the use of nearby materials and on the reutilisation of objects or components, but also on a design "born" directly from the material, a feature that characterized other of their works, as Torrent explains: "*In the conception of many of their products, first it is the material, then the form, which is derived from its properties; and finally, they approach the function taking into account the ergonomic conditions*"³⁷.

However, in this case, this design process not only conditions the formal result of the piece, but also provides a discourse, creating a narrative design with an emotional component, a differentiating feature of the end of the century products. The Campana brothers' design is impregnated with Brazilian culture, its roots and its tradition, from which, on the one hand, they extract the practice of reuse and, on the other, they preserve the artisan heritage, collaborating with local workers³⁸. Due to the narrative capacity of their works, they have sometimes been considered as social claims of the reality of their country. His pieces manage to condense the local essence of Brazilian culture, but in a universal format corresponding to contemporary design, combining craft production and industrial technique³⁹.

In the same year as the Favela chair, Droog's Yew Remy⁴⁰ created his Rag chair (**fig. 08**), made from different layers of clothing and fabric, which are compacted and joined together with several bands placed in two directions. The chair can be purchased ready-made but there is also the option for the user to recycle his own clothes, giving the product an emotional charge. Therefore, the operation is not just an exercise of reusing materials, but one that involves the user's emotion: "*Each piece is unique; a treasure chest of memories*"⁴¹. In this way objects would be brought back to life with a double meaning: that of reutilisation and that of the crystallization of the consumer's memory. This character causes that, in spite of being an artisan product, it is not considered of limited edition, since each piece is different according to the materials found and used, even according to the identity of its buyer through its recycled clothes.

This piece, as well as others by Remy⁴², distills a new conceptual creativity that became the representative iconic theme of the design company Droog. This association has collaborated with designers now recognized as Hella Jongerius or Richard Hutten, "*delivering homeopathic doses of reflection on our behavior, habits and vices and virtues to act through things*"⁴³. Due in part to the success achieved by the group, The Netherlands became the home of the new conceptual design and a point of attraction for research and experimentation, typical of Dutch design. One example is the Design Academy in Eindhoven, linked to many of the designers who have innovated in terms of the recycling and reutilisation of materials, such as Piet Hein Eek or Dirk van der Kooij⁴⁴.

THE DESIGN OF THE IMAGE

Today, recycling has become an industry, which, as such, moves with its parameters, benefiting from research and development to find new techniques, as well as experimenting with its weak points. In it, as has been seen, moved by ecological currents, many designers take recycling as their main story in the development of their work as an image or identity. This has happened, partly, because companies and movements, social and political, have also assumed recycling as a commercial or propaganda value. These practices leave other relevant aspects in the background throughout the history of design and objects of use. These are not only cardinal issues such as function or the study of form in relation to beauty or its ergonomics, but also other fundamental ones, perhaps more ethereal, such as symbolic, emotional or narrative character. Recycling is understood then, as one more requirement to design that complements the whole. It is a responsibility of the designer in his professional deontological task, moving away from the recurrent image of recycling as a stamp to be able in order to carry out an ecological design.

In this sense, after the analysis that has been carried out, different examples created during the 20th century can be contemplated in which different designers produce a list of pieces through the reutilisation of objects, their components or materials, with a purpose that transcends ecology, but from which they are not unrelated. In each case, the author uses recycling in the form of *ready-made* or reutilisation as a project strategy to tackle issues or problems of varying significance.

Stam uses the gas pipes (pre-existing parts) to solve a technical problem that allows to create an innovative shape with new features such as flexibility. Here, recycling, although remaining as an exercise of experimentation, meant a change of the constructive, functional and formal paradigm that even configured the image of modern furniture. The Castiglioni brothers carried out a *readymade* exercise, which was ironic, typical of the context (on one hand, that of consumption typical of the pop era and, on the other, of an ecological culture that was beginning to awaken). This assembly operation not only gave rise to a new formal image, but also achieved the decontextualisation of the objects, responding to a functional circumstance. Arad, however, carrying out a conceptual exercise, presented a piece built with discarded waste, constituting, far from being his main will, a true example of recycling. The piece is a sample of experimentation with new materials and forms. The Campana brothers use recycling as the thread of their narrative, based on Brazilian culture. Their aforementioned example becomes an image of a social reality and the result of the application of traditional artisan knowledge, but with a universal spirit. Finally, Tejo Remy offers a vision of recycling that involves the user in the project and gives the piece its identity through the reutilisation of its own clothes (**fig. 09**).

These examples, which offer different approaches to the concept of recycling or reutilisation as a design strategy, have gone down in history as recognized milestones, especially in the field of formal innovation. But they have also contributed, probably with-

out seeking it, to the transmission of an ecological consciousness that has been growing as the century has progressed. The narrative of these cases is constructed by understanding the context in which each piece arises, interweaving the contributions of these designers with the advances and events that are emerging around recycling in design. This allows us to appreciate how, with the increase of sensitivities and movements at a social, political or business level, more products are emerging that incorporate recycling as another characteristic of the design process. Recycling was then a line of creation and a way of acting and, although it was initially proposed as an ideological attitude or a political positioning, due to the plastic characteristics of the results, it was gradually defined as a design strategy with its own entity.

This situation was probably accentuated because when some of these cases are produced (with the exception of the Arad and Droog part), the parameters and characteristics of reutilisation are dissolved by the industry. The exercises then become prototypes for recycling and reutilisation, since they are subsequently made with pieces edited directly by furniture companies. In the process of realization and commercialization they move away from their design genesis in which recycling appears as a design tool. On the other hand, this aspect reinforces the idea of considering reutilisation as a project methodology that allows design from the material itself. The result offers a strong and effective image on these products that awakens the awareness of other designers, attracted, among other reasons, by this character linked to their material reality.

Although the works analysed do not strictly comply with the values of recycling, they all constitute inspiring examples to continue with this line and have helped to create an image that allows this practice to become increasingly common nowadays. Beyond the desirable commitment of designers to these values, these projects use this strategy of using materials as a tool to solve other problems. And not only that, but through the manipulation of these elements they manage to understand this practice as a project strategy, trying to integrate all the objectives of a good design. Recycling, in this case, is not the only purpose or a marketing tool, but a way of doing, a way to raise awareness and a way of designing.

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Notes

01. Among the best known international non-governmental organizations are WWF (World Wildlife Fund) and Greenpeace, created in 1971. At an institutional level, the defense of nature was carried out by the so-called green parties, which initially emerged in the countries of northern Europe, such as Sweden, Denmark or France.

02. Budget lines for 'environmental education' have been invested in order to reverse the situation by raising awareness of nature's problems, increasing ecological knowledge, and providing principles for sustainable development.

03. The Earth Summit is the international meeting of heads of state to reach consensus on the environment and related issues. The first one took place in Stockholm in 1972 and was a milestone in the development and treatment of issues related to the protection of the planet. Subsequently, they have been held in Rio de Janeiro in 1992 and 2012 and in Johannesburg in 2002.

04. Environmental or Nature's rights, which are included within the branch of public law, emerged with the 1972 Stockholm Declaration with the aim of regulating the relationship between human beings and nature. These framework laws on the environment are in charge of protecting the planet from the actions of people, taking into account different aspects such as pollution, biodiversity or resources.

05. Sustainable development is understood as one which does not compromise resources, allowing the needs of future generations to be met. However, as stated by López Ricalde, López-Hernández and Ancona Peniche, this concept, since it was coined in 1983 in "Our Common Future" until today, has undergone numerous modifications and is currently a subject of debate. LÓPEZ RICALDE, Carlos David; LÓPEZ-HERNÁNDEZ, Eduardo Salvador; ANCONA PENICHE, Ignacio, "Desarrollo sustentable o sostenible: una definición conceptual", *Horizonte Sanitario* 2005, vol.4, n. 2.

06. *Greenwashing* is an evolution of the traditional term of *Whitewashing*. This concept

is used to refer to the communication/image strategy of some companies that try to market their products, through deception or manipulation of information.

07. An increasing number of designers, companies and academic centers are devoting their resources to researching new materials. See the dedicated issue of the research journal of Elisava. *Temes de Disseny #34: Material interactions in the human-made milieu* or texts like FRANKLIN, Kate; TILL, Caroline, *Radical Matter: rethinking materials for a sustainable future*, Thames&Hudson, 2018 or MYERS, William; ANTONELLI, Paola, *Bio Design: Nature, Science and Creativity*, Moma, 2012.

08. BLANCO, Ricardo, *Notas sobre diseño industrial*, Nobuko, Buenos Aires, 2007, p. 130.

09. Cfr. FIELL, Charlotte and Peter, *The story of design: from the Paleolithic to the present*, Goodman, London, 2016, pp. 14-19.

10. According to Rosalia Torrent, the first cantilever chair made of iron could have been exhibited at the 1851 Universal Exhibition in London. TORRENT, Rosalía; MARÍN, Joan M., *Historia del diseño industrial*, Cátedra, Madrid, 2005, pp. 68-69.

11. The well-known cantilever chairs made by Mart Stam, Marcel Breuer and Mies van der Rohe became part of a debate about their ownership, which is typical of the period and of the changes that were taking place at the level of concept and production. Until now, stylish furniture was designed according to a model governed by formal (stylistic) parameters such as the Adam or Smith style chair, in which the intellectual property of each piece remained diffuse or in the background. However, with the introduction of new forms, new materials and industrial processes, the design process had undergone a modification that affected authorship. Curiously, contrary to what seemed to be the case in theory, if we take to account the democratizing character with which modern design had emerged, far from the individual artist's stamp. In order to deepen the conflict between the three authors, it is recommended to consult

LÓPEZ MARTÍN, Pablo, *The Chair of Discord: Small scale as a field of experimentation in modernity*. Breuer, Mies and Stam, Doctoral Thesis directed by Emilio Tuñón Álvarez, Universidad Politécnica de Madrid, 2015.

12. See: KIRSCH, Karin, *The Weissenhofsiedlung, experimental housing built for the Deutscher Werkbund, Stuttgart 1927*, (Trad. Michael Knight), Dt.

13. VILLANUEVA FERNÁNDEZ, María; GARCÍA-DIEGO VILLARIAS, Héctor; 'Tecnología posible', rita_redfundamentos, n. 12, November, 2019, p. 93.

14. TORRENT, Rosalía; MARÍN, Joan M., *Historia del diseño industrial*, cit. p. 19.

15. ARGAN, Giulio Carlo, *Walter Gropius and the Bauhaus*, Gili, Mexico, 1983, p. 51.

16. ZABALBEASCOA, Anatxu, *Chairs: history of the chair*, Gustavo Gili, Barcelona, 2018, p. 87.

17. DARDI, Domitilla; PASCA, Vanni, *Design history handbook*, Silvana, Cinisello Balsamo, 2019, p. 207.

18. BLANCO, Ricardo, *Notes on Industrial Design*, cit., p. 129.

19. *Ibid.*, p. 155.

20. Other works made with similar parameters were the Toio lamp, produced by Flos in 1962, composed of a car headlight as a lighting element and a telescopic element similar to a fishing rod with rings through which the cable ran. Also, the Lampadina lamp made with a large luminaire and a film reel on which the cable is wound and works as a support. DARDI, Domitilla; PASCA, Vanni, *Design history handbook*, cit., p. 207; WHITE, Ricardo, *Notes on industrial design*, cit.

21. According to Charlotte and Peter Fiell in their book *1000 Chairs*, there was already a precedent for a chair made from a tractor seat, designed by Benjamin Baldwin in 1953. FIELL, Charlotte and Peter, *1000 chairs*, Taschen, Cologne/New York, 2005, p. 311.

22. The *Mezzadro* stool has both handcrafted and industrial components, with references to different types of transport. It recovers the theme of the world of agriculture thanks to using the seat of a rural vehicle such

as the tractor. In addition, the cycling sector is represented in the fastening element while the nautical field is collected in the beech wood piece. <https://www.zanotta.it/en-us/products/furnishing-accessories/mezzadro>

23. The stool seals, also takes as a reference the world of transport, in this case cycling, combining this idea with the creation of a support that together with the two legs of the user allows to achieve stability. As the firm Zanotta states, "it is reminiscent of the milker's stool", returning once again to the connection between the rural and industrial worlds. <https://www.zanotta.it/en-us/products/furnishing-accessories/sella>

24. The role of Rachel Carson, who published the text *Silent Spring* in 1962, is relevant at the beginning of this decade. In this book, she described the harmful consequences of the environmental impact of chemical products on Nature. Her ideas influenced the ecological mobilisations of the decade. CARSON, Rachel, *Silent Spring*, Critica, Barcelona, 2001.

25. TORRENT, Rosalía; MARÍN, Joan M., *Historia del diseño industrial*, cit. p. 411.

26. Victor Papanek, designer, anthropologist, teacher and writer, Austrian by birth and American by adoption, has been for many a reference point for responsible design, from a critical and ethical perspective. He is the author of several books, among which are PAPANÉK, Victor; HENNESSEY, Jim, *Nomadic Furniture*, Pantheon Books, New York, 1973; PAPANÉK, Victor; HENNESSEY, Jim, *How things don't work*, Pantheon Books, New York, 1977; PAPANÉK, Victor, *The Green Imperative: Ecology and Ethics in Design and Architecture*, Thames and Hudson, New York, 1995; PAPANÉK, Victor, *Design for the Real World: Human Ecology and Social Change*, (1st edition, 1971), Thames & Hudson, London, 2011.

27. MARGOLIN, Víctor, *Las políticas de lo artificial. Ensayos y estudios sobre diseño*, (Trad. Gabriela Ubaldini), Designio, Mexico D.F., 2005, p. 130.

28. TORRENT, Rosalía; MARÍN, Joan M., *Historia del diseño industrial*, cit., p. 411.

29. The Club of Rome is an NGO created in 1968 in Rome by a group of researchers, academics, scientists and politicians who shared a concern for the environmental situation and analysed the problem from a global, long-term perspective, taking into account different views and aspects (energy, resources, population). In 1972 the report 'The Limits to Growth' by Donella Meadows, a biophysicist and environmental scientist, was published. It concluded that if the situation at that time, taking into account parameters such as demography, resources and human action, did not change, the limits of the planet would end in a century.
30. TORRENT, Rosalía; MARÍN, Joan M., *Historia del diseño industrial*, cit. p. 411.
31. ZABALBEASCOA, Anatxu, *Chairs: history of the chair*, Gustavo Gili, Barcelona, 2018, pp. 87-88.
32. It was an economical scaffolding system created in the 1930s. ANTONELLI, Paola, *Ron Arad: no discipline*, Museum of Modern Art, New York, 2009, p. 27.
33. Idem.
34. FIELL, Charlotte and Peter, *1000 chairs*, cit., p. 502.
35. Vitra has launched limited editions of the Rover model in materials such as rust and chrome, thus forgetting the principle of reuse used by Arad.
36. <https://www.edra.com/en/vis-prod/101174>
37. TORRENT, Rosalía; MARÍN, Joan M., *Historia del diseño industrial*, cit., pp. 393-394.
38. His commitment to Brazilian society is not only part of the design process of the Favela chair, but also led to the foundation in 2009 of the 'Campana Institute': a center that deals with "design as a tool for transformation through social and educational programs. This project, in which foreign and national institutions, companies, organizations and public and private entities collaborate, has three objectives: "the rediscovery of artisan techniques, the development of social inclusion and the preservation of the work of the brothers for future generations". <http://campanas.com.br/institute-2/>.
39. The Campana brothers' work is characterized by the reinvention of traditional craft techniques, from a more contemporary perspective. Furthermore, the Brazilian reality is conducive to the incorporation of reutilisation as a tool for creating products, due to social differences, understood as an operation to exploit resources when there is a shortage. With these principles, the Campana brothers "undertake a personal search for waste and production surpluses". MORTEO, Enrico, *Design: From 1850 to the present* (Trad. Barbara Burani), Electa Arte, 2009, p. 400.
40. The Droog collective was created in Amsterdam in 1993 by art critic Renny Ramakers and product designer Gijs Bakker, resulting in a series of conceptual objects. It was at the Milan Furniture Fair in 1993 when they presented, under the title 'Droog Design', a list of objects made with materials from the industry or created from the ready-made operation. Its repercussion caused a Dutch design trend recognizable in other countries, which launched a group of designers to fame, becoming a reference in the history of design. Droog defines itself as: "a conceptual design company" focused on issues that affect people in order to contribute to society with its products. The process is considered fundamental and they call their work "anti-disciplinary". <https://www.droog.com/> concept; WOODHAM, Jonathan Michael, *A dictionary of Modern Design*, Oxford University Press, New York, 2016.
41. <https://www.droog.com/webshop/product/rag-chair>
42. Among Remy's work there are other pieces that come from the reutilisation of objects and that are also part of the conceptual design world. Those include Milk Bottle Lamp (1991) or 'You Can't Lay Down Your Memory' Chest of drawers (1991).
43. DARDI, Domitilla; PASCA, Vanni, *Design history handbook*, cit., p. 244.
44. The Dutch designer Piet Hein Eek has developed a sustainable design based on recycling wood, which has resulted in 'imperfect' furniture, due to the method of craft production, made from discarded materials.

See: FRASER, Max, *Boek: Piet Hein Eek*, BIS Publishers B.V., 2006 On the other hand, the designer Dirk Vander Kooij, also Dutch, has experimented with the recycling of synthetics from an innovative and current perspective, including 3D technology as a fundamental part of the process. This methodology is a proposal consistent with the needs of the planet but also adapted to the advances of new production systems applied to the field of furniture (<https://www.dirkvanderkooij.com/pages/about>).

This practice has also been used in other countries by a large number of designers, including the Englishman James Plumb, who has made a wardrobe from used suitcases, or the Spaniard Álvaro Catalán de Ocón, who has created his PET Lamp collection from recycled plastic bottles, among many others.

Images

01. Examples of reused materials in furniture design.
02. Gas pipeline structure and photographs of Mart Stam's chairs at the 1927 Stuttgart Exhibition. Source: Thonet and book *The Weissenhofsiedlung, experimental housing built for the Deutscher Werkbund, Stuttgart 1927*, by Karin Kirsch, 1994.
03. Drawing and photographs of the Mezzadro stool of the Castiglioni brothers, 1957. Source: Zanotta.
04. Drawings and photograph of the Sella stool of the Castiglioni brothers, 1957. Source: Zanotta.
05. Cover of the book *Design for real world, 1971*, by Victor Papanek and the inside page showing Papanek's radio project, made with a juice can.
06. Prototype by Jean Prouvé (left). Photographs and drawings of the Rover chair, 1981, Ron Arad (right). Source: FIELL, Charlotte and Peter, 1000 chairs, Taschen, Cologne/ New York, 2005; *Ron Arad. No discipline*, New York: Museum of Modern Art, 2009.
07. Partial photograph of the side of the Favela chair by the Campana brothers, 1991. Source: Edra.
08. Rag chair, designed by Tejo Remy, 1991. Source: Droog.
09. Seating furniture made by the reutilization of objects, components or materials.