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Circular Economy
And Circular Design

This chapter aims to explain what design is, but above all what Circular Design is: a discipline that can support and facilitate the Circular Economy. Again, what are the principles on which Circular Design is based and which are considered 'sustainable'?

Are you ready for this journey into Circular Design?



Hi! I'm Greenix*

* I am from Sustainova and I will guide you on this journey!

Disclaimer

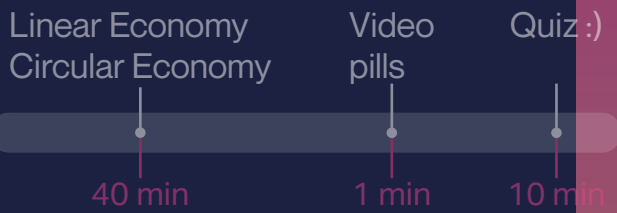
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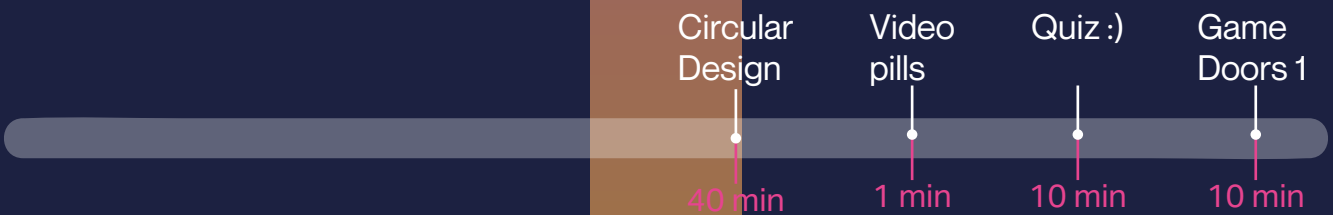
Just a reminder...

Small Module



...Look for the secret codes!

Medium Module



You have completed macro-theme 1!



Medium

Module

01

Design:
what is it?
Page 04

02

Circular
Design
Page 09

03

Circular Design
Strategy
Page 17



If you need guidance:

Glossary

Pages 08, 16, 21



**Design: what it is,
when it emerged and
how it develops.**



When you see words like **this**, it means that their meaning can be found in the final glossaries!

Design is a discipline that lies at the intersection of engineering and art, and that strives to look to the future while preserving past experience and present awareness.

It isn't easy to find a single definition, but the one coined in 1971 by ICSID (International Council of Societies of Industrial Design), now called WDO (World Design Organization), is a good starting point:

“ Industrial design is a **creative activity** whose aim is to determine the formal qualities of **objects produced by industry**. These **formal qualities** are not only the external features but are principally those **structural and functional relationships** which convert a system to a coherent unity both from the point of view of the *producer* and the *user*. Industrial design extends to embrace all the aspects of **human environment**, which are conditioned by industrial production.⁰¹

01. Source: 'Industrial Design definition history'. World Design Organization.

However, today design has expanded its scope for intervention and action. The World Design Organization also provides a new definition:

“ Industrial Design is a **strategic problem-solving process** that drives innovation, builds business success, and leads to a **better quality of life** through innovative **products, systems, services, and experiences**. Industrial Design bridges the gap between what is and what's possible. It is a trans-disciplinary profession that harnesses creativity to resolve problems and co-create solutions with the intent of making a product, system, service, experience or a business, better. At its heart, Industrial Design provides a more optimistic way of looking at the **future** by reframing problems as opportunities. It links **innovation, technology, research, business, and customers** to provide new value and competitive advantage across **economic, social, and environmental spheres**.

We can note how the definition has been enriched with further

concepts: design is recognised as a strategic problem-solving process, aimed at improving quality of life, through the creation of products-systems-services-experiences. The accompanying keywords are: future, innovation, technology, research, economy, consumers, economic-social-environmental sphere.

Today, there are many forms of design: design affects every aspect of everyday life. We talk about industrial design - i.e. the design of consumer goods - graphic design, communication design, web design for the design of websites and applications, interior design, service design, interactive design, and so on. We could make this list even more detailed, but what's important to realise is that **'design' is a container of many 'smaller' disciplines that are concerned with identifying solutions to problems arising in different fields.**

For this reason, 'design' is a word that is 'abused' and overused today, so much so that it has lost its original meaning. A product is often considered 'designed' simply because it's aesthetically appealing, up-to-date and technological, but that doesn't necessarily make it an object of design.

As can be seen from the above-mentioned second definition provided by the World Design Organisation, aesthetics, function, value and technology are the consequence of complex choices concerning the target group of users involved, materials, production processes, market research, user experiences, ease of transport, sales, packaging, end-of-life and so on.

An object is of design when each of its material and immaterial phases/aspects/components has been conceived, designed and manufactured taking into account the entire world revolving around the initial idea.

Design, after all, is precisely that: **awareness**. And if we stick to what is written, we can say that there's no real rule as to what is design and what is not. We can only look at the whole process to

assess which objects, products, systems or services have been designed superficially and which ones consciously.

But who 'makes design'?

Clearly, the designer: a designer who accompanies the birth and development of the idea (also referred to by the term 'concept') in all its evolutionary phases, from the identification of the demand or need for the project to the planning of its life cycle, through the co-ordination of the figures involved in the chain leading up to the introduction of the idea in the market.

The designer is a professional figure whose emergence, according to certain disciplinary historiography, coincides with the industrial revolution of the 19th century: to be exact, with the **Great Exhibition of 1851 in London**.

Others, however, have broadened the perspective, glimpsing the origins of the industrial design process in the invention of the movable-type printing press (**Gutenberg**⁰²).

Finally, there are those who propose an 'anthropological' interpretation, linking its evolution to the *evolution of material culture itself*.

Regardless, the history of design is strongly linked to the history of the 19th and the 20th century, a period of mass industrialisation and re-design of everyday objects.

We don't intend here to retrace that history in its various meanings and currents, but what is important to emphasise is that **design has always accompanied the needs of society and the market**. So, perhaps today it may be able to support a more sustainable, circular model of production of goods.

02. Johannes Gutenberg is credited with the innovation of printing techniques through the introduction of "movable type": metal blocks with a character embossed on them.



From A to Z!

Formal qualities: This denotes an attribute (such as characteristics and peculiar aspects) that concerns the form or is inherent to the form.

User: A person who benefits from a good or a today service.



Circular Design: why is design important for the Circular Economy?

Let's take a step back and return to the three fundamental principles of the Circular Economy:

01. Design out waste and reduce pollution to ensure minimal release of **greenhouse gases** and hazardous substances and protect air, land and water.

02. Keep products and materials in use and in circulation, i.e. implementing various strategies to generate as little waste as possible.

03. Regenerate natural systems and use renewable resources.

Putting the 'pieces of the puzzle' together, it's easy to see how **design can help the Circular Economy to achieve its goals**, not only by looking to the future, but also by focusing on the whole process. It is, in fact, the process itself that needs to be reviewed through a sustainable lens, re-designed and re-thought to generate minimal waste, use renewable energy and look at waste with awareness.

In short, designers have work to do, so much so that a new design approach has emerged: **Circular Design**.

As just mentioned, Circular Design is a design approach that falls under the larger umbrella of Sustainable Design. **Sustainable design** '...creates long-term solutions and helps societies ensure the well-being of their people and harmony with the environment for generations'⁰³. Thus, sustainable design seeks to eliminate social, environmental and economic impacts (i.e. the increase of renewable energy and the reduction of exhaustible natural resources).

Like Circular Design, **Eco-Design** is a sustainable design approach that focuses on reducing environmental impact at each stage of the product life cycle, in order to provide **eco-friendly** products. We can say that Ecodesign precedes Circular Design, as it is intertwined with the **European Eco-Design Directive (2005/32/EC) established in 2005, which aims to make**

03. Source: 'Sustainable Design'. Interaction Design Foundation.

products durable and sustainable.

Over the years, Ecodesign has evolved into Circular Design and the substantial differences between the two approaches concern two macro-themes:

01. Life cycle impact and resource efficiency: the main objective of Ecodesign is to minimise the environmental impact at every stage of the product's life cycle - even if this means making it less efficient. The aim of Circular Design, on the other hand, is to be as resource-efficient as possible. Indeed, products must use fewer natural resources in order to reduce the amount of waste generated - even if this means generating a greater life cycle impact.

02. Reducing waste: Ecodesign assumes that (most likely) waste will continue to exist; Circular Design, on the other hand, argues that (ideally) materials and products should remain in circulation an infinite number of times.

Taking a step back, therefore, we can say that **Circular Design** - as a sustainable design approach - **places respect for human being and the environment at the centre of its intervention**, in an attempt to create and disseminate new production models and recover the value of the resources used (both in terms of materials and energy) through design choices that rethink products, economic models, systems, services, experiences and everything that can be re-considered through a sustainable lens.

To fully understand why Circular Design integrates so closely with the Circular Economy, we need to take a deeper dive into the role of Life Cycle Assessment (LCA) and its relationship with both concepts.

As we have said, Circular Design aims to reconsider the way products, systems and services are designed and used. It focuses on optimising the life cycle of these elements, aiming not only at reducing waste, but also at regenerating resources and minimising the overall environmental impact. This approach requires a

comprehensive view encompassing all phases of the product life cycle, integrating the production, use, reuse and disposal phases.

Life Cycle Assessment (LCA) is a key tool for analysing and assessing the environmental impact of a product, system or service throughout its life cycle. It not only considers the impact of the production stages, but also includes the extraction of raw materials, transport, distribution, use, reuse, recycling and final **disposal**. This approach makes it possible to assess the overall environmental impact and identify critical points along the life cycle where action can be taken to improve efficiency and reduce the overall environmental impact.

For this reason, it's crucial that LCA be given proper consideration, as it provides a detailed and scientifically valid overview of the environmental impact of products and processes. Circular Design uses this information to guide design decisions towards solutions that maximise resource efficiency, minimise waste and promote resource regeneration. In this way, **Circular Design and LCA support each other in the common goal of achieving a more sustainable and circular economy.**

If we want to give a precise definition of LCA, we can refer to that proposed by SETAC (Society of Environmental Toxicology and Chemistry) in 1990, according to which 'an LCA is an objective process of assessing the environmental burdens associated with a process, product or activity, through the identification and quantification of the energy and materials used and the waste released into the environment [...]. The assessment includes the entire life cycle of the product, process or activity, including the extraction and treatment of raw materials, manufacturing, transport, distribution, use, re-use, re-cycling and final disposal'⁰⁴.

The definition of LCA was later standardised by the ISO (International Organization for Standardization), which today defines ISO 14040 and 14044 (from 2006).

04. Source: 'Circular guide. Life Cycle assessment (LCA)'. Circularity.

In fact, an LCA study originally consisted of three phases:
01. Inventory or data collection.
02. Interpretation, to connect data to environmental impacts.
03. Improvement of the system through different tests and scenarios.

These three steps formed the basis of the two standards mentioned above, which respectively refer to the theoretical level that must make up a proper LCA (Standard 14040 - "Principles and Framework") and the guidance to be followed by the operator during its execution (Standard 14044 - "Requirements and Guidelines").

Today, an LCA consists of four phases (plus a 'zero' phase to define aims and objectives). In general, **the key objective of an LCA is to identify how to improve the environmental performance of a system.**



One of many :)



Let's look at **one example** to make this concept clearer.

According to HSU straw analysis, a research conducted by Humboldt State University, (by Lonny Grafman and Nathan Adler in 2018), comparing CO₂ emissions and the embedded energy in the production of straws made of different materials reveals significant considerations on the choice of metal straws over disposable plastic versions. Indeed, a single stainless steel straw requires 2420 kJ of energy to produce and emits 217 grams of CO₂, costing \$3.00. In contrast, a plastic straw requires only 27.2 kJ of energy and produces 1.46 grams of CO₂, costing only \$0.003. These data indicate that, despite the apparent robustness and reusability of stainless steel straws, they must be reused 102 times (in terms of energy) and 149 times (in terms of CO₂), respectively, to offset the environmental impact of production compared to a single plastic straw. This is not to say that we should prefer plastic straws over metal, but that user behaviour should also be considered as a key element in the whole design process (and in the Life Cycle Assessment).

Indeed, **the environmental impact often depends more on the end consumer's use of the product than its production**, which is why everyone's behaviour falls within the scope of Circular Design.

There is no way to create the 'perfect', 100% sustainable product or service: it would be impossible (and if it were possible, we would not be writing this text), but it is possible to employ measures to improve even just one stage of the entire production cycle.

What Circular Design must do is to re-design products so that they can be repaired, reconditioned, reused, shared and recycled. This should not be seen as regression but as a way to preserve the value of materials already in circulation and to create the 'materials of the future'.

Today, thanks to increasingly important experimentation and research in the field of Circular Design, innovative materials - including those that recover waste from other productions - are increasingly becoming viable alternatives to unsustainable products.

In the following page we provide just one of many examples, but if it piques your curiosity, we come to your rescue with this **'Material Design Map'**: a 'material library' - i.e. a collection of sustainable materials (in this case) - that is endless...or almost endless!

Circular Design uses several strategies to achieve its goals, including the **9+1 Rs**, that is to say, the **10 rules for moving from a Linear to a Circular Economy**. We'll look at them in detail in the following section⁰⁵.



Scan the QR-Code or click on the text!



Material Design Map

05. Source: Larae M. & Tian D, (9 November 2023). 'R-Strategies for a Circular Economy'. Circularise.

Best practice



Looking for a real case study?
Here it is! Scan the QR code
and find out!





Disposal: The set of activities that enable the transformation of waste into secondary raw materials and into residues to be sent to landfill.

Eco-friendly: A product, production process, etc., that does not have a negative impact on the environment or the surrounding ecosystem.

Greenhouse gases: Gases in the atmosphere that affect the earth's energy balance. These gases generate the so-called greenhouse effect. The main greenhouse gases, carbon dioxide (CO₂), methane and nitrous oxide, are naturally present in the atmosphere in limited concentrations. However, anthropogenic sources have significantly increased their presence since the beginning of the last century.



**Strategies of the 10 Rs for a
Circular Economy: what they
are and what they're for.**

As mentioned earlier, **'the 10-R strategy' is helpful in the transition from a Linear to a Circular Economy**, enabling sustainable design and production by understanding the different stages of resource use and waste management.

The 10 Rs are to be imagined as positioned within a 'hierarchy', as they are sequential solutions to problems of 'unsustainability'.

Indeed, the Rs are divided into **three categories**:

01. Refuse, Rethink and Reduce: focus on smarter (and sustainable) design.

02. Reuse, Repair, Refurbish, Remanufacture and Repurpose: focus on extending the life cycle of the object.

03. Recycle and Recover: focus on the application of materials considered as 'waste'.

Below, we will elaborate on **each 'R'**.

01. Refuse: if we had to define it in one sentence, we could say **'refusing to use new raw materials that are harmful to the planet'**. Sometimes, it also means 'refusing' to create something completely new, because it would mean implementing new materials and new technologies. Wouldn't it be more sustainable to work on existing products?

02. Rethink: it can be considered **the most powerful 'R' of all**. After all, isn't the transition from a Linear Economy to a Circular Economy based precisely on 're-thinking'? 'Rethink' can be applied to every stage of a product's life cycle: how can I make it better? How can I make it more sustainable? How can I make it less harmful to the planet and to humanity? How can I bring about more responsible behaviour? How can I educate consumers about sustainability?

03. Reduce: is simply the reduction of the indiscriminate use of raw materials in favour of their conscious use, in order to also **reduce**

the waste generated.

04. Reuse: remember the example of metal straws? **Reusing a product as many times as possible** is sometimes what really makes the difference in terms of sustainability. Of course, this implies that the product is designed to last (a key concept of the Circular Economy).

05. Repair: very often we throw away a product as soon as it breaks, without giving it or allowing it a chance to be repaired. Maintaining and repairing a product are, in fact, two fundamental aspects for prolonging the life of the product.

06. Refurbish: literally, to 'renovate'. **Refurbishing an old product to adapt it to new requirements.**

07. Remanufacture: unlike 'Refurbish', 'Remanufacture' involves the **integration of still perfectly intact product components into new products with the same function.**

08. Repurpose: differing again from 'Refurbish' and 'Remanufacture', 'Repurpose' involves **incorporating discarded components from one product into a completely different product** in order to achieve an alternative purpose.

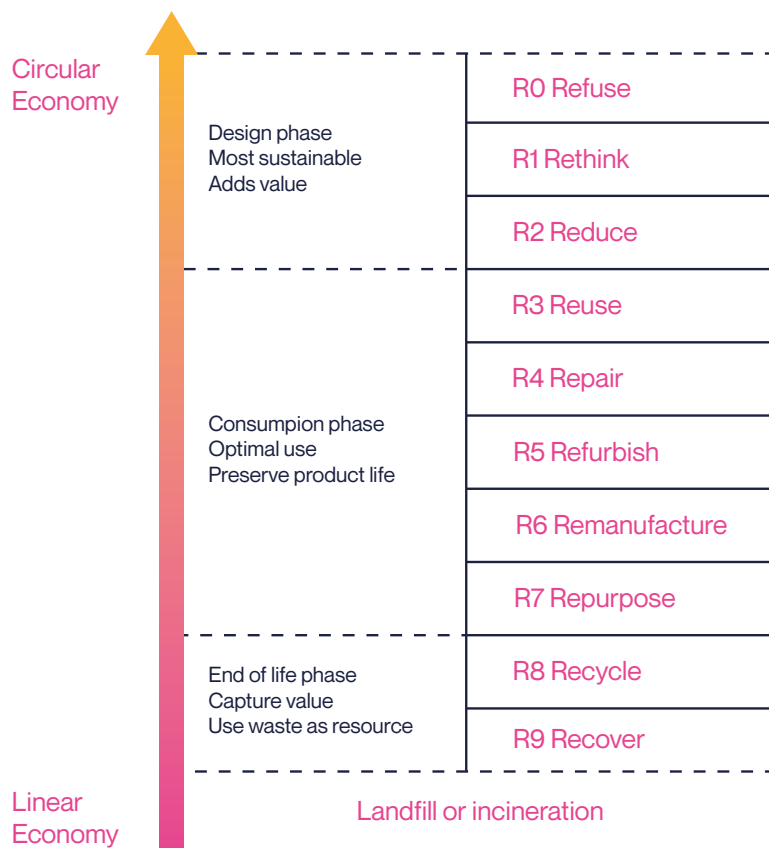
09. Recycle: recycling involves the **transformation of a product into a new raw material** and occurs when that product can no longer be used. Just think of the 'Sea Stone' case study in the previous section and how shells, with no possibility of application in the previous R, were recycled to generate a new material.

10. Recover: **recover energy from materials**, such as composting organic waste, which can generate energy through anaerobic digestion.

The 10 Rs are a useful tool to accompany circular design, but also the everyday choices we make in our own daily lives. It's important to remember that our planet's resources aren't unlimited and their use and disposal always have consequences: we can try to make these positive.

If you'd like to learn more about this subject, see the **Interactive Book 'The Materials Journey'** that you'll find within our platform.

Image source: Larae M. & Tian D., (9 November 2023). 'R-Strategies for a Circular Economy'. Circularise.





From 01 to 10!

01. Refuse: refusing to use new raw materials that are harmful to the planet.

02. Rethink: re-designing a product in order to make it better and more sustainable.

03. Reduce: reducing of the indiscriminate use of raw materials in favour of their conscious use, in order to also reduce the waste generated.

04. Reuse: reusing a product as many times as possible.

05. Repair: maintaining and repairing a product in order to extend its life cycle.

06. Refurbish: restructuring an old product to adapt it to new requirements.

07. Remanufacture: integrating product components that are still perfectly intact into new products with the same function.

08. Repurpose: incorporating components discarded from one product into a completely different product in order to achieve an alternative purpose.

09. Recycle: transforming a product into a new raw material. Recycling takes place when that product can no longer be used.

10. Recover: recovering energy from materials, such as composting organic waste, which can generate energy through anaerobic digestion.

Keep the 10 Rs in mind!

Design

An object is design when each of its material and immaterial phases/aspects/components has been conceived, designed and manufactured taking into account the entire world revolving around the initial idea.

Life Cycle Assessment

As a tool of Circular Design

01

Definition of the goals

LCA steps

02

Data collection

03

Interpretation of the data

04

System improvement

1. Reduce

2. Reuse

Three of the 10 Rs

3. Recycle



Scan the QR-Code for a useful video pill to review the topics!

It will take you just 1 minute: what are you waiting for?



References

Section 01

'Industrial Design definition history'. World Design Organization.

website

'Industrial Design'. World Design Organization.

website

Section 02

'Sustainable Design'. Interaction Design Foundation.

website

'*Directive 2005/32/EC of the European Parliament and of the Council*'. Official Journal of the European Union.

.pdf file

Quist Z. (2024). 'Guide to sustainable product design (2024 Update)'. Ecochain.

website

'Life Cycle Assessment (LCA)'. Circularity.

website

'HSU straw analysis'. ARRPOPEDIA

website

'Material Design Map'. WeVux

website

Larae M. & Tian D. (9 November 2023). "R-Strategies for a Circular Economy".Circularise.

website

Section 03

'The 10 R's of circularity'. House of Thol.

website