

Biomimicry

Biomimetics, Bionics or Biotechnology

Biomimicry takes natural eco-systems as the starting point for the introduction and construction of new materials, products and buildings. We can use nature in two ways as a source of product innovation.

Nature as mentor: biomimicry is a new science that studies nature in order to imitate its principles or to gain inspiration from its materials, forms, processes and systems, the objective being to use them to solve human issues.



www.ecouterre.com/10-eco-fashion-garments-inspired-by-nature-and-biomimicry

Nature as the measure: biomimicry uses an ecological standard to assess the ‘correctness’ of innovations. Everything that does not correspond with its environment falls away.

Sources and useful links

Biomimicry: Innovation inspired by nature
Jeanine M. Benyus, 2002. Harper, New York

biomimicry.net
www.biomimicrynl.org/nl
www.biomimicryinstitute.org
www.asknature.org
www.biomimicryeuropa.org

Practical example cards

EX.20

Ecodesign tools

Methods and tools - ecodesign techniques

A tool, such as a template or a software application, can be used to analyse a product or service in order to generate more sustainable alternatives. There are now already more than 105 different types of ecodesign methods and tools. The Ecolizer 2.0 and the OVAM SIS Toolkit - both developed by OVAM - are two examples of tools that can support designers with ecodesign and sustainable designing. Charter & Tichner (2006) published an overview in order to simplify the selection of a suitable method or tool. Provided below is a similar overview by Van Doorselaer (2012) that classifies tools according to the criteria scope-quality and cost-time (based on Duflou, 2010).



The tools are classified according to the criteria 'complexity', 'objective' and 'phase in the development process'. In addition, a classification can also be made of quantitative versus qualitative tools. It is important - but not easy - to select the right tool, which can support you in your intended objective, and which you can apply within the conditions applicable at that time, such as, for example, time and money constraints.

Sources and useful links

Charter and Tischner, 2006. Sustainable solutions. Developing products and services for the future. Van Doorselaer, 2012. Sustainable product development, Universitas Remmerswaal, 2002. Environmentally oriented product development Academic Service, Netherlands. Additional information about Ecolizer 2.0 and SIS Toolkit: www.ovam.be/ecodesignlink/en

Practical example cards

EX. 1, EX. 5, EX. 6, EX. 8, EX. 15, EX. 19, EX. 24, EX. 28

Ecolabels

Environmental quality label

An ecolabel is a quality label that - on the basis of a number of predetermined criteria - is awarded to products or services that are less harmful to the environment than qualitatively similar products or services. As a general rule, an independent institution or public authority awards an ecolabel. The manufacturer that wishes to obtain an ecolabel for a product it considers to be environmentally friendly submits an application. The competent authority then analyses the environmental impact of the product or service across its entire life cycle, ranging from raw materials, production, distribution and consumption, up until and including its eventual disposal. Products with an ecolabel are recognisable by a special logo on the product or packaging.



Various countries use a (national) ecolabel system. Many companies also develop their own label to make their activities concerning ecodesign or sustainability visible to external interested parties. This occurs after internal screening with their own criteria. This does not make it easier for the consu-

mer. Not only has there been a sharp increase in ecolabels, the consumer also finds it difficult to separate the wheat from the chaff: which labels meet certain quality standards and which do not? For these reasons, in 1992 the European Union introduced the European ecolabel for products and services within the European Union.

Sources and useful links

European ecolabel: www.ecolabel.eu

Overview of ecolabels globally:

www.ecolabelindex.com

Overview of labels in Belgium: www.labelinfo.be

Database in which the environmental claims for various products are visualised by a simple rating system based on stars: www.ecorate.eu

Practical example cards

EX. 5, EX. 6, EX. 7

Effects on people and the environment

Environmental and social impacts

In order to indicate the importance of ecodesign and sustainability, it is relevant to discuss the effect on people and the environment that arise from our current way of life.

There are 3 main categories of environmental impact:

- ecological damage;
- damage to human health;
- depletion of fossil resources

Examples of environmental impact are eco-toxicity, land use, depletion of fossil materials, acidification, fertilisation, greenhouse effects ...

We can also classify environmental impact according to its geographical scale: is the impact local, regional, continental, global ...?

The effects on mankind - the social impact of products - must be viewed throughout the entire chain: supply, production, distribution, consumption and end of life. Themes that are relevant for all interested parties in this chain are: human rights, minimising child labour, health and safety at the workplace, policy and manage-

ment, transparency and engagement of business partners and banning corruption and crimes. Geographical classification can also be applied to social themes: local level (micro), within the community (meso), and national or international level (macro); e.g. local economic group, community development, involvement of interested parties.

Sources and useful links

Environmental and social impact of our current way of life (see Part I, Chapter 02):

www.d4s-de.org

MIRA, the Environmental Report on the Flemish Environment: www.milieuraapport.be

Practical example cards

EX. 5, EX. 6

End of life cycle

Design for recycling - design for disassembly

The last phase in the life cycle of a product is the end of life phase. This is the moment in which the product or service no longer has added value for its current owner or consumer.

Various types of products have a different life span. The life span of packaging for food is very short, while products in the construction sector sometimes have a life span of dozens of years.

LADDER VAN LANSINK ²⁸



www.twentemilieu.nl/educatie/methode-ladder-van-lansink

The anticipated life span of a product in part determines which ecodesign strategies are the most interesting and efficient for lowering the environmental impact of the product.

Lansink's Ladder provides a preferential hierarchy for the way in which people can approach the end of the life cycle of a product or service. The preference is for methods at the higher steps of the ladder.

Sources and useful links

Design for recycling, Europese Commissie:
ict.jrc.ec.europa.eu/glossary/design-for-recycling-dfr

Design for disassembly:
www.activedisassembly.com

Inspiration for implementing design for recycling creatively: www.superuse.org

Practical example cards

EX. 5, EX. 6, EX. 8

Energy and resources

Energy efficiency - consumables

Energy is required throughout the entire life cycle of products: for the extraction and processing of materials, for the production of products and services, in the consumption phase and for the end of life phase. Here as well we must consider the entire life cycle of the product or service in order to obtain a view of the scale of energy consumption: which phases of the life cycle are responsible for a major share of energy consumption and which energy sources are used? You should focus on these phases.

The focus on energy efficiency during the design, extraction, manufacture and/or disposal, usually is a part of cleaner production (see Folder LC. 14). In the consumption phase, you can focus on high efficiency of products and services, and consequently on low energy consumption. In addition, you can also focus on consumer behaviour (see card LC. 7), so that in this way energy consumption decreases.

Resources are by-products that are required to enable the functionality of the product or service,

and which are disposed of after consumption. Examples are: coffee filters and coffee for preparing coffee, vacuum cleaner bags, batteries (non-rechargeable) ... Here as well you can try to guide consumer behaviour such that, in this way, the use of resources declines.

Sources and useful links

Eco-efficiency: www.ovam.be/eco-efficientie
 Communication platform concerning sustainable and renewable energy: www.power-link.be
 Repository for information concerning energy efficiency: www.energieefficiëntie.be
 Programme concerning intelligent energy within Europe: ec.europa.eu/energy/intelligent/index_en.htm

Practical example cards

EX. 5, EX. 6, EX. 7 EX. 8, EX. 22, EX. 28

Consumer behaviour

Design for sustainable behaviour - design with intent

Within the life cycle of a product, the consumption phase is the most familiar to most people. The challenge during the design process is to estimate the behaviour of the consumer and to guide it toward sustainable behaviour.

In order to influence consumer behaviour in the direction of more sustainable behaviour, a few insights are required:

- What is the current consumer behaviour? (practices)
- What is the behaviour we wish to obtain? (design with intent)
- What mechanisms can we use to change behaviour?
- How can we maintain the new behaviour?



Holle Bolle Gijs in the Efteling (NL)

Sources and useful links

Presentation, Prof. Boks, Design for sustainable behaviour:

www.youtube.com/watch?v=hFnJMrrB65s

Design with intent:

www.danlockton.com/dwi/Download_the_cards

Example files

EX. 3, EX. 4, EX. 5, EX. 6, EX. 18, EX. 23

Introduction to ecodesign

Sustainable design - design for the environment

An introductory lesson about ecodesign forms the foundation for further examination of other, specific themes that can be provided as learning content. You can present the following components in this introductory lesson:

- the meaning of ecodesign and its position within sustainable development;
- the impact of current production and consumption patterns on mankind and the environment;
- the relevance and history of ecodesign;
- ecodesign tools and the importance of selecting the most relevant tool;
- overview of relevant themes that can be discussed further.



<http://www.explora-tech.com/ecodesign.html>

Sources and useful links

Information about ecodesign:

www.ovam.be/ecodesignlink

Introduction to sustainable design; Part 1, Section 02 Design for sustainability: www.d4s-de.org

Introduction and history of sustainable product development:

www.groeneofferte.nl/kennisbank/duurzaam-ontwerpen-eeen-inleiding

www.groeneofferte.nl/kennisbank/geschiedenis-duurzame-productontwikkeling

Initial activities for introducing sustainability:

www.sda-uk.org/starters.html

Practical example cards

EX. 5, EX. 6, EX. 8, EX. 21, EX. 29

Closing cycles

Cradle to cradle - sustainable materials management - chain management

Currently, most material cycles are linear: raw materials are extracted, processed into products, used for a while, and at the end of the life cycle are incinerated or recycled into - often - inferior products. Only a few cycles are endless, in which the materials can continuously function without losing their qualities. An example that is often used for an intelligently closed cycle is the Aeron desk chair by Herman Miller, 94% of which can be recycled.

Cradle to cradle is about closing material cycles without thereby losing material or quality. In chain management, all actors within the entire chain of a product or service are examined and the attempt is to find common solutions that can close the material cycle.

Sources and useful links

Transition Network for Sustainable Materials Management.

www.plan-c.eu

Cradle to cradle netwerk:

www.c2cn.eu

Materials decree:

[www.ovam.be/onder Afval en materialen > Beleid > Wetgeving](http://www.ovam.be/onder/Afval_en_materialen/>Beleid/>Wetgeving)

Responsible chain management:

www.vbdo.nl/files/download/884/Ketenbeheer%20van%20risicomanagement%20naar%20waardecreeatie.pdf

Sustainable Materials Management, report:

www.petertomjones.be/content/view/353/1/

Practical example cards

EX. 5, EX. 6, EX. 8, EX. 14

Life cycle thinking

Life cycle thinking

Life cycle thinking forms the foundation for integrating ecodesign into the design process. This way of thinking takes into account the various phases of the life cycle of a product and/or service:

- job performance
- design
- production
- transport
- consumer stage
- disposal

Based on a variety of qualitative and quantitative tools, the environmental and social impact of a product and/or service can be determined across the entire life cycle, after which improvement trajectories can be developed. To this end, preferably the life stages with the greatest environmental and social impact are eligible.

Most life cycle tools target environmental aspects. In 2009, the United Nations Environment Programme (UNEP) developed guidelines for a social LCA.

Sources and useful links

European Research Centre on Life Cycle Thinking:

lct.jrc.ec.europa.eu

Life cycle scenario: www.ovam.be/ecodesignlink/en
Guidelines for a social life cycle analysis by UNEP: www.unep.fr/shared/publications/pdf/WEBx0167x-PA-GuidelinesforsLCAforproductsDUTCH.pdf

Environmentally-oriented LCAs from VITO:

www.vito.be/VITO/NL/HomepageAdmin/Home/WetenschappelijkOnderzoek/TransitieEnergieEnMilieu/LCA.htm

Film about the impact of product over the entire life cycle:

www.storyofstuff.org

Practical example cards

EX. 1, EX. 5, EX. 6, EX. 8, EX. 13, EX. 15,
EX. 16, EX. 28

Corporate Social Responsibility

CSR - Corporate Social Responsibility

CSR stands for Corporate Social Responsibility and is defined as “a continual process of improvement in which corporations voluntarily assimilate economic, environment-related and social considerations systematically in an integrated manner into the entire business operation, in such a way that consultation with the stakeholders or interested parties in the organisation take part in this process.”

CSR is a very broad theme in which ‘doing business’ does not conflict with attention for the dimensions: people, planet and profit. CSR includes all the business activities than can contribute to sustainable development. Because CSR is so broad, it can be interpreted in many different ways, such as cooperation with NGOs, environmental protection, employee competence development, employee commitment, etc.

Pact 2020 is a Flemish Government programme aiming to make CSR a widely known concept by 2020, spread across several companies and organisations.

Sources and useful links

CSR Network Flanders:

www.mvovlaanderen.be

ViA Pact 2020:

vlaandereninactie.be/actie/pact-2020

Practical example cards

EX. 5, EX. 6, EX. 9, EX. 17, EX. 26, EX. 27

Materials and the environment

Impact materials - Eco indicators

When selecting materials, it is important to consider their impact on the environment as well as on social and economic aspects during the entire life cycle of the product (see card LC. 10). Questions that must be addressed include:

- Are the raw materials renewable?
- What is the environmental impact of extracting them?
- What are the possible processing techniques and what is their environmental impact?
- Are additional surface treatment technologies required?
- What is the impact during the consumption phase?
- Can the materials be recycled?
- ...

A scan of the entire life cycle is thus desirable. For this you can use the LiDS wheel and the Eco indicators (see card LC. 2).

Various material groups have specific points of attention on the level of environmental and social impact. Insights into this support a more sustainable choice of materials.

Sources and useful links

Know your materials:

www.sda-uk.org/materials/index.htm

Plan C, network concerning sustainable material management: www.plan-c.eu

Ecolizer, an ecodesign design tool:

www.ecodesignlink.be/en/ecodesign-tools-1/ecolizer-1

Materials and the Environment: Eco-informed Material Choice by Ashby M. Publisher: Butterworth-Heinemann

Practical example cards

EX. 1, EX. 5, EX. 6, EX. 14

Product-service combinations

PSS - product service system - system innovation

With a product-service system (PSS), you examine the functionality that you wish to offer to your clients (e.g. clean clothes). This functionality can be fulfilled by a product (washing machine), a service (dry cleaning) or by a combination of both (laundromat). A PSS is thus a value proposition consisting of a combination of product component(s) and service component(s), and whereby the business model is set up in such a way that the ultimate client needs can be fulfilled in the best possible manner.

PSSs are divided into 3 types, depending on the relative size of the product or service component.

- Product-oriented PSS: the client becomes the owner of the product that is sold together with a number of additional support services. Example: maintenance contract or help desk.
- Use-oriented PSS: the supplier remains the owner of the product and offers use of the product according to a certain formula. Example: leasing, car sharing
- Result-oriented PSS: the supplier provides a solution to a specific need of the client. The supplier selects, owns

and manages the resources and infrastructure to obtain that result.

Example: laundromat

Sources and useful links

New Business for Old Europe: product-service development competitiveness and sustainability. Book by Tukker & Tischner (ed.) (2006). From: Greenleaf Publishing.

SCORE network: www.score-network.org

Report, “Producten worden diensten: een duurzame waardepropositie voor Vlaanderen”:

[www.ovam.be/under Publications](http://www.ovam.be/under/Publications)

Bike dispenser, an example of PSS:

www.groeneofferte.nl/cases/bikedispenser

Play-it-forward, game about sustainable business models: www.businessmodeldesign.be

Practical example cards

EX. 2, EX. 21

Cleaner production

Cleaner production - eco-efficiency - lean manufacturing

Cleaner production is the continuous application of an integrated preventive strategy for processes, products and services in order to increase their efficiency and reduce the risks for people and the environment (UNEP Production and Consumption Unit).

Eco-efficiency combines economical improvements with more efficient consumption of raw materials and emissions prevention (World Business Council for Sustainable Development/WBCSD). When a company consumes less energy, water and material to make the same amount of product, costs decline and the company becomes more competitive. thereby the environment gains profit (less energy, less water, less materials) and also the company (fewer costs and greater competitiveness).

A few aspects that are addressed in eco-efficiency are harmful substances, energy efficiency and reusable energy, reducing the consumption and loss of raw materials and water, closing cycles (materials, water, energy) and protecting biological and social diversity, etc.

'To measure is to know' is heavily emphasised in eco-efficiency: only by measuring can you know how things stand and where and how much you improve.

Sources and useful links

Information from OVAM:

www.ovam.be/eco-efficientie

WBCSD. Cleaner production & eco-efficiency. Complementary approaches to sustainable development. Report: www.wbcsd.ch

Clean Production Strategies:

www.cleanproduction.org/library/Factsheet1_Clean_Production.pdf

Practical example cards

EX. 6, EX. 7

Systems thinking

Complexity - Wicked problems

With systems thinking, one attempts to achieve and maintain an overview of the whole system instead of focusing on separate components without considering which role that part plays in the greater whole. The behaviour of a system - the bigger picture - is thereby considered as a relationship of interacting sub-systems in which feedback constantly occurs and plays an important role. The simple chain of cause-effect relations is thus abandoned. A holistic perspective is needed in order to be able to study a system by means of systems thinking. Systems thinking in itself is not a theory, method or technique, but rather a way of thinking in order to understand and be able to encompass the complexity of reality.



www.except.nl

Systems thinking often works on complex problems for which no simple solution can be found.

Various methods and techniques have indeed been developed that function as support for analysing patterns, connections and relations between the different elements of a system. They make it possible to investigate and understand a system holistically.

Sources and useful links

Bill Bryan, Michael Goodman & Jaap Schaveling (2006). Systems thinking. From: Academic Service. Presentation on wicked problems: issuu.com/shiftn/docs/wicked_problems_intro_issuu

Practical example cards

EX. 5, EX. 6, EX. 10, EX. 11, EX. 12, EX. 17, EX. 25

Future thinking

Scenario-planning

It is helpful to once in a while consider the present and the past, but in the context of sustainability, it is also important to look to the future. Future-oriented thinking ensures that you go in search of opportunities, and thereby take into account a wide range of factors (see card LC. 15, Systems thinking)

It is not possible to predict the future. However, there are ways to look to the future and to gather indications around certain developments that may occur, keeping in mind certain influencing factors.

Trends thereby form an important source of information. A trend formulates an expectation that is based on the past and present.

You can also work with future scenarios. These are not predictions, but several qualitative images of the future. Various future scenarios are often developed, each of which gives a radically different view of the future. In this way we obtain insight into possible situations that can arise and we can already start thinking about how we will deal with this situation. In this context, the future scenario is used as a strategic instrument. A scenario can

describe the situation or the objectives. It can be drawn up narratively (text, drawings ...) or analytically (schemes).

Sources and useful links

Presentation on future scenarios:

www.plateau-net.com/downloads/Futureconsult_SP.pdf

Example scenarios concerning climate change:

www.futurescenarios.org/content/view/full/27146

Examples concerning future thinking:

www.shiftn.com/projects/filter_by/futures_thinking

Practical example cards

EX. 10, EX. 12, EX. 25

Packaging and distribution

Sustainable packaging

“Good packaging has never turned a poor product into a good product. But bad packaging can turn a good product into a poor product.” *(Pack4ecodesign)*

The first necessity when designing packaging is to focus on protecting the product. Optimal ecodesign packaging protects the product sufficiently and has the least possible environmental impact over its entire life cycle.

Packaging can be adapted using a variety of strategies: the amount of material, reducing size, redesigning,

making it more stackable, recycling materials, reusing packaging or materials, or renewing the packaging concept. In addition to applying possibilities for improving packaging, you can also analyse the environmental impact of the current distribution method. In this way you can look for alternative forms of distribution that can lower the environmental impact.

Sources and useful links

Ecodesign of packaging: www.pack4ecodesign.org/index_en.html

Preventive programme of PROEurope, the Packaging Recovery Organisation Europe: www.pro-e.org

Practical example cards

EX. 5, EX. 6, EX. 8



www.pelicanpr.co.uk/packaging-pr-news/packaging-pr-sustainable-packaging-a-myth

Ecodesign legislation

Ecodesign directive - legislation

There exists various legislations and directives concerning ecodesign worldwide. Applicable to Belgium is the European Commission Ecodesign Framework Directive, which applies to all Member States. The Directive on ecological design for energy-using products (2005/32/EC)

- Also known as the Ecodesign Framework Directive - presents requirements for the ecological design of energy-using products. The Directive focuses on products with substantial sales figures, a negative environmental impact and the potential to improve environmental performance. Blow dryers and computers are two examples. The Commission on a product-by-product basis under supervision of a panel of experts from the Member States establishes implementation measures. Products that meet the minimum requirements of the ecodesign implementation measures receive the CE label.

Currently the ecodesign directive only addresses energy-using products. The Commission has hereby expanded the scope of the directive to all energy-related products. One example of this is a shower head whose water consumption influences the energy required.

In addition to European Ecodesign legislation, the WEEE Directive (Waste Electrical and Electronic Equipment Directive) is also relevant for designing products and services. This directive aims at electrical and electro-technical waste. In addition to recycling, reuse and other forms of reusing are encouraged.

Sources and useful links

European Commission Framework Directive on Ecological Design: www.ovam.be under *Waste and materials* > *Policy* > *Legislation* > *European legislation*
European legislation and directives concerning ecodesign: ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/index_en.htm

WEEE Directive: ec.europa.eu/environment/waste/weee/index_en.htm

Materials Decree: www.ovam.be under *Waste and materials* > *Policy* > *Legislation*

Practical example cards

EX. 5, EX. 6