

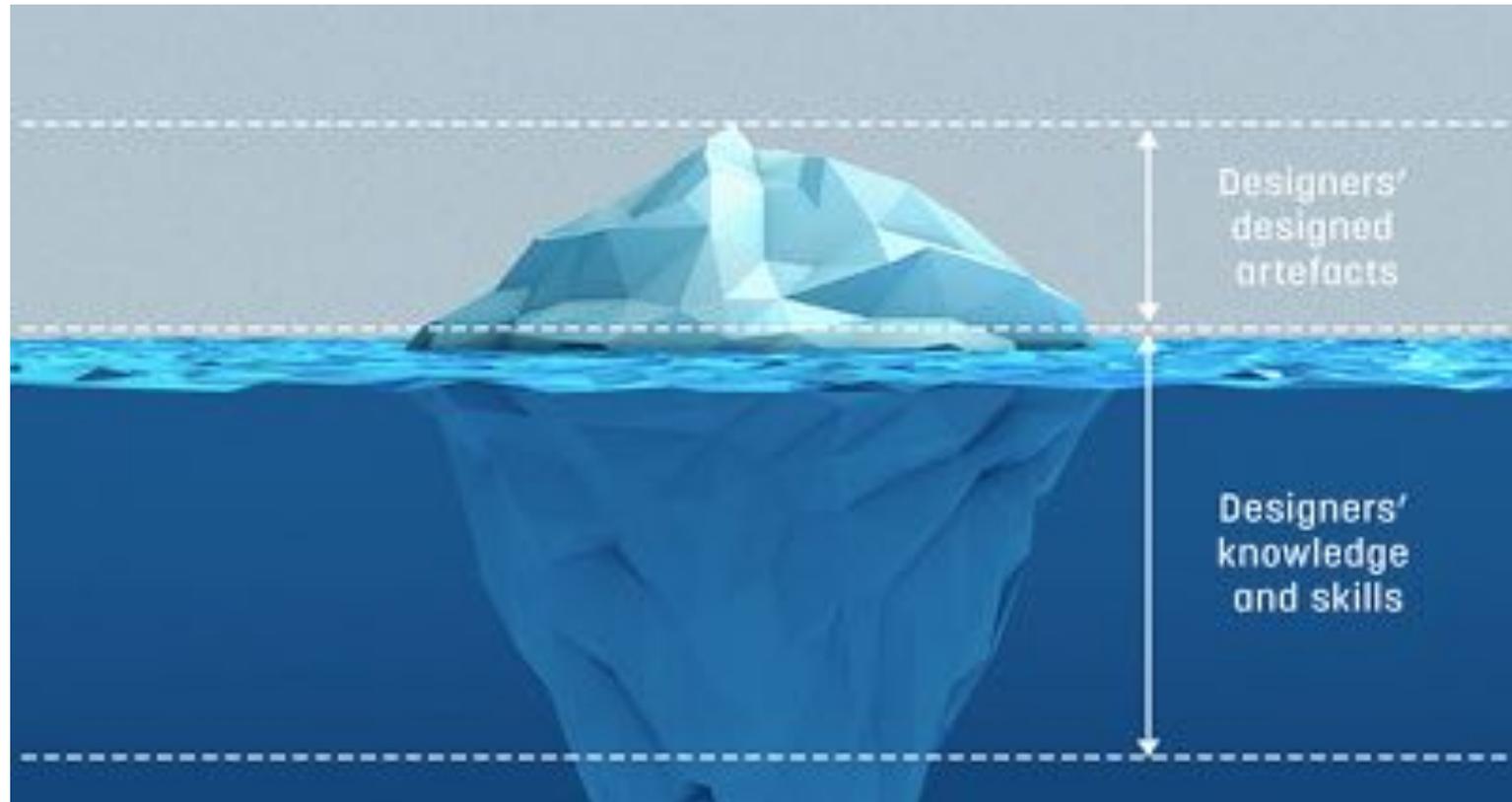
# Sustainability's Role in Artefacts Design Evolution

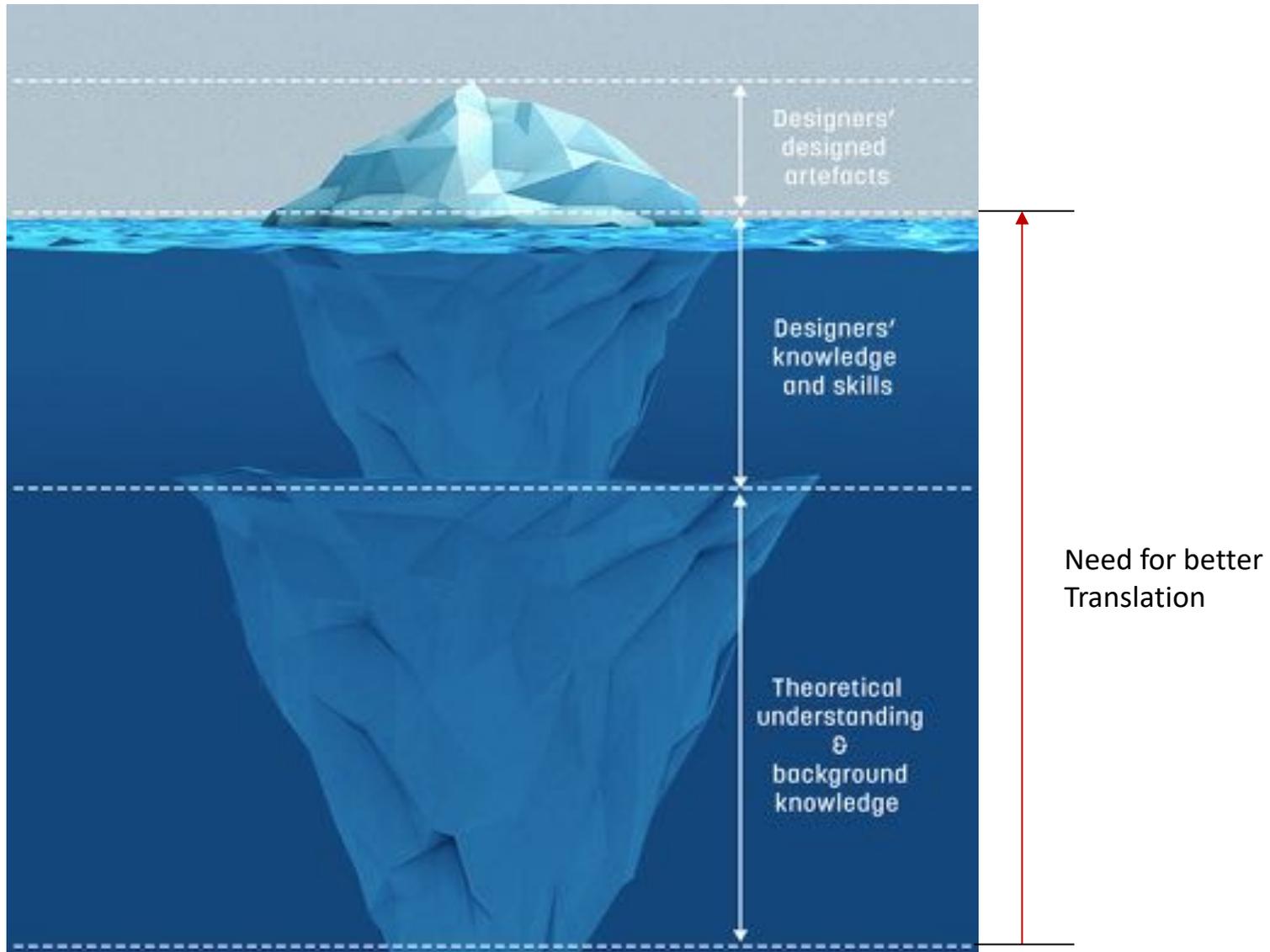
Wanjun Chu

[chu.wanjun@liu.se](mailto:chu.wanjun@liu.se)

Machine Design, IEI, Linköping University

For lecture in Sustainable design





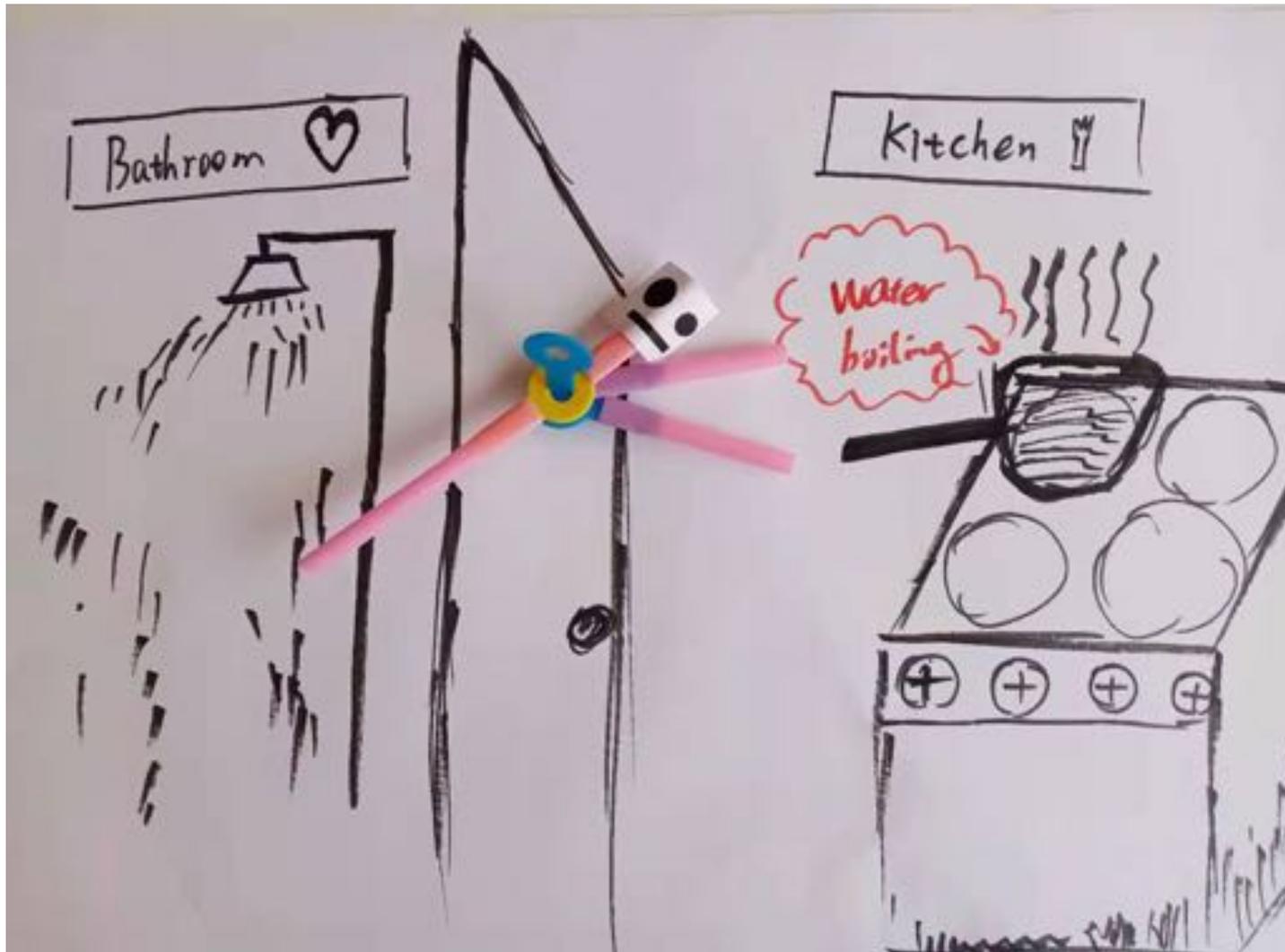
## Brain Exercise Time

In your daily life...

Have you performed any sustainable or unsustainable doings through interacting with artefacts (products or services)?

If true, please illustrate the scenario



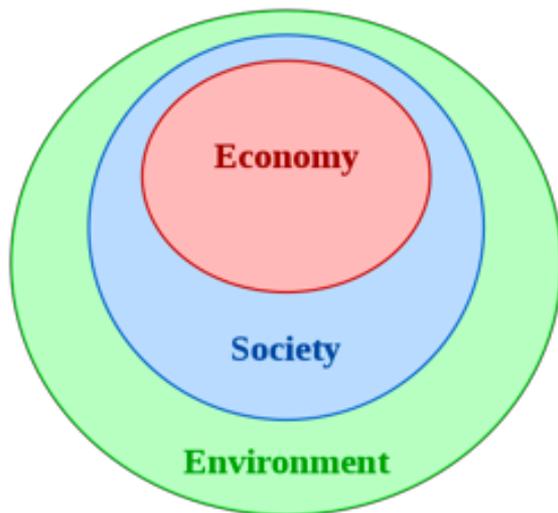




# Content:

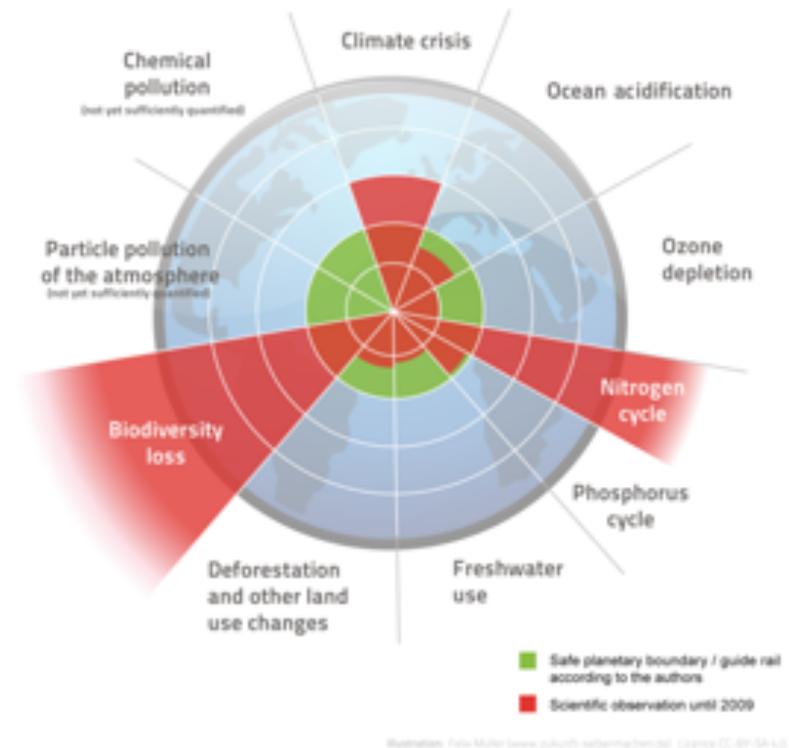
- The concept of sustainability
- Design evolution
- How to do system thinking in sustainable design
- Design workshop (if time allows)

## The "Three pillars of sustainability"



## Planetary Boundaries

after Johan Rockström, Stockholm Resilience Centre et al. 2009



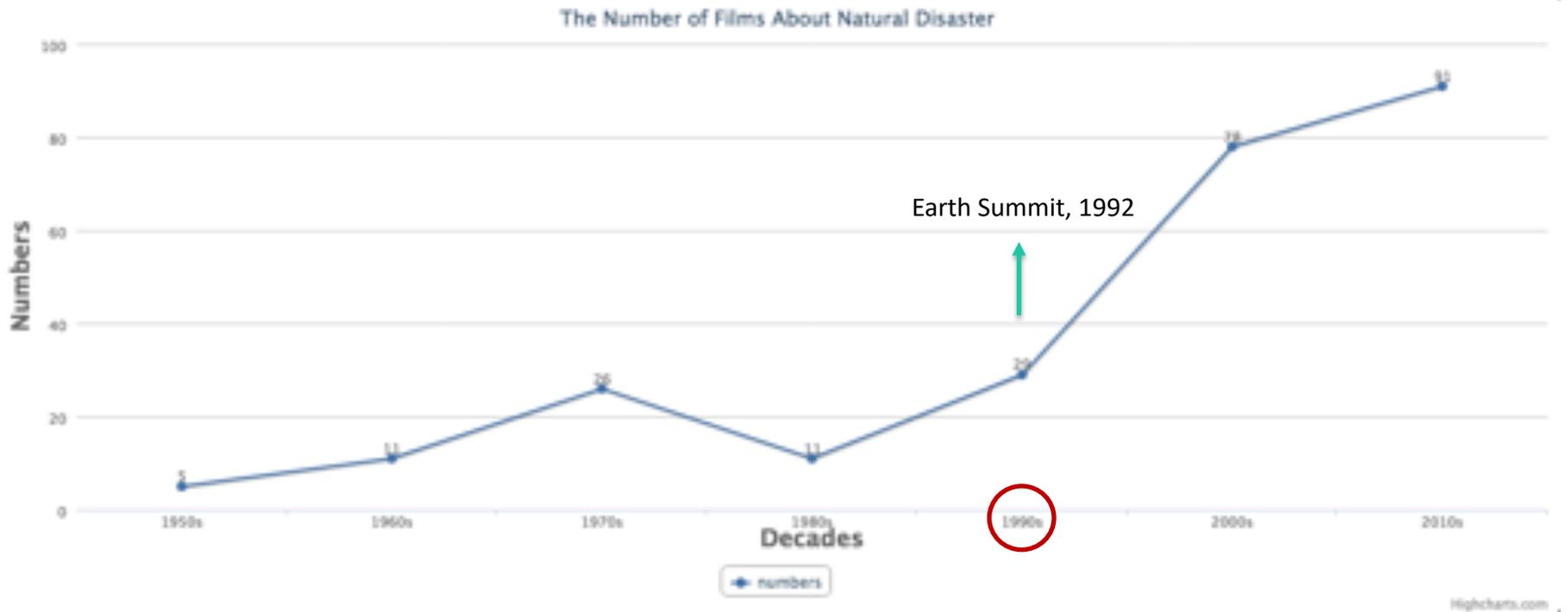
# Who needs sustainability?

"Nature doesn't need people, people need nature; nature would survive the extinction of the human being and go on just fine, **but human culture, human beings, cannot survive without nature**"



Harrison Ford

# Films about natural disaster



Data retrieved: [https://en.wikipedia.org/wiki/List\\_of\\_disaster\\_films](https://en.wikipedia.org/wiki/List_of_disaster_films)

# Sustainable Development



1. No Poverty
2. Zero Hunger
3. Good Health and Well-being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation, and Infrastructure
10. Reducing Inequality
11. Sustainable Cities and Communities
- 12. Responsible Consumption and Production**
13. Climate Action
14. Life Below Water
15. Life On Land
16. Peace, Justice, and Strong Institutions
17. Partnerships for the Goals

# Sustainable Development

## SUSTAINABLE DEVELOPMENT GOAL 12

Ensure sustainable consumption and production patterns

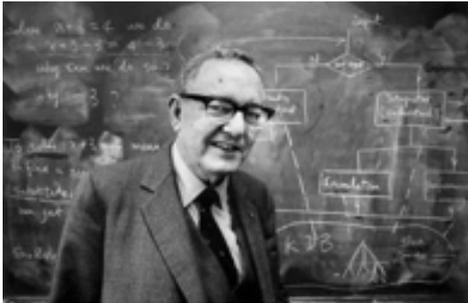


Oslo Symposium, 1994,

sustainable consumption and production (SCP):

*"the use of services and related products, which respond to basic needs and bring **a better quality of life** while **minimizing the use of natural resources** and toxic materials as well as the emissions of **waste and pollutants** over the life cycle of the service or product so as not to jeopardize the needs of further generations".*

# Design evolution



Source: Article1000.com

Herbert Alexander Simon (1916 – 2001)  
Nobel Prize in Economics in 1978  
and the Turing Award in 1975.

“Most of the environment what we encounter during our daily life is not natural but ***made by humans***.

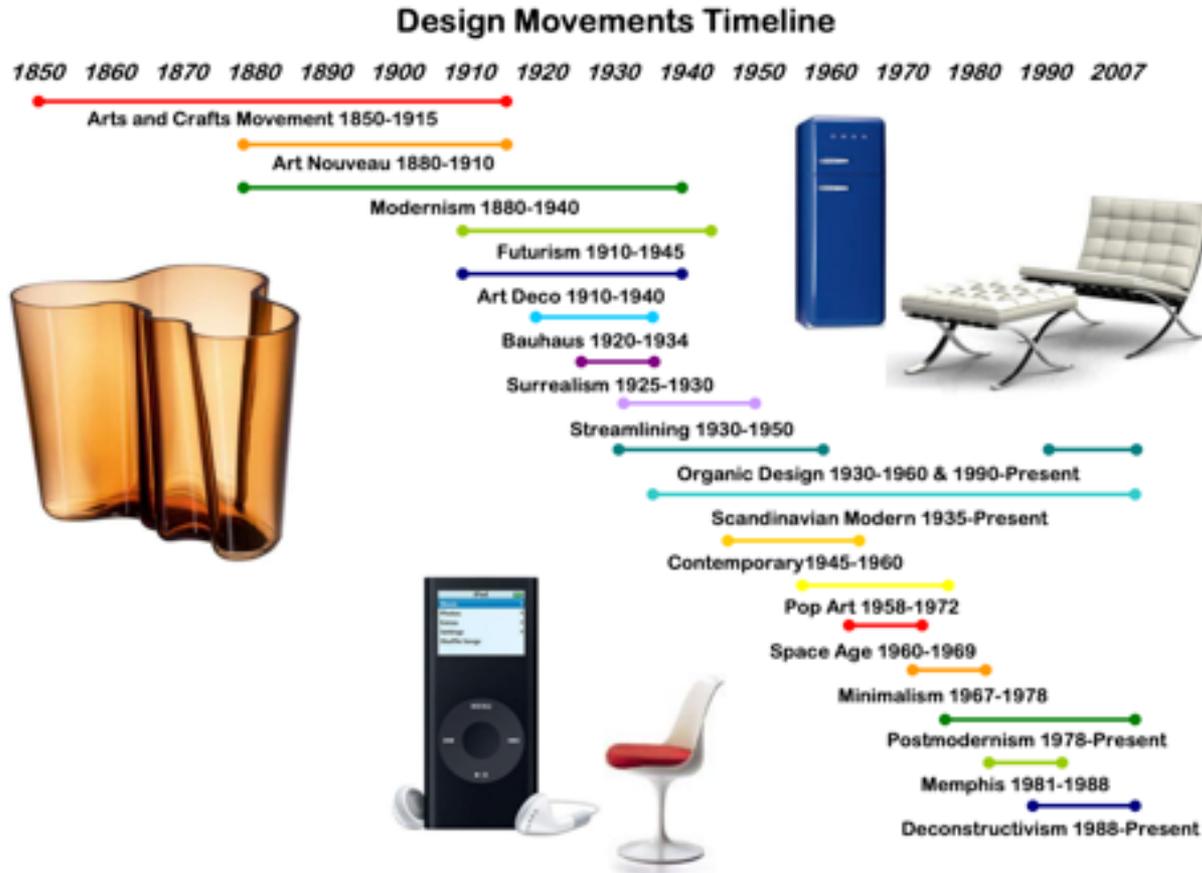
Perhaps we would need, besides the natural science, a science that would study this artificial environment produced by humans themselves – ***the science of the artificial?***”

-- Simon, H. (1969) The Sciences of the Artificial.

# Design evolution

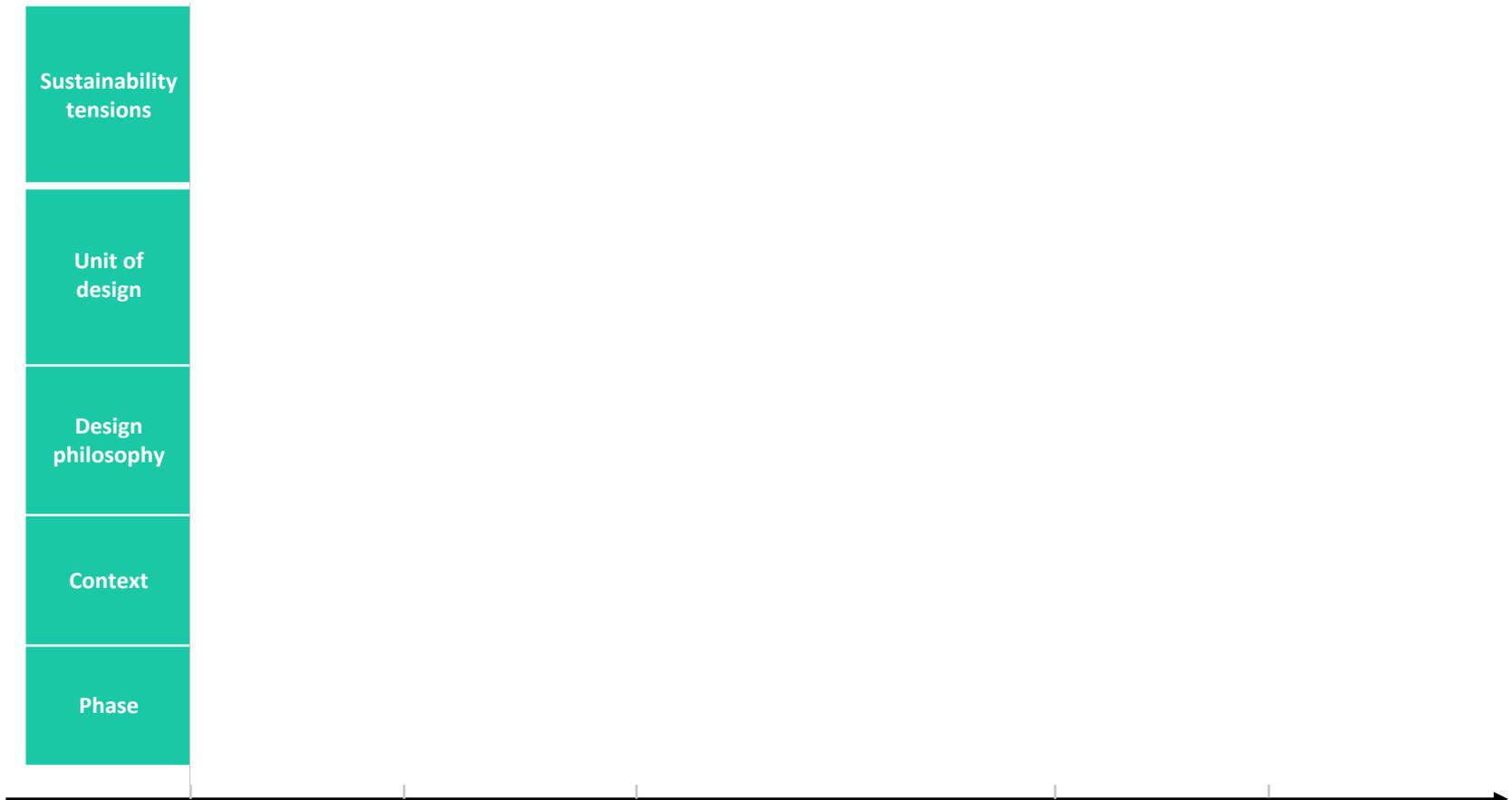


# Design evolution

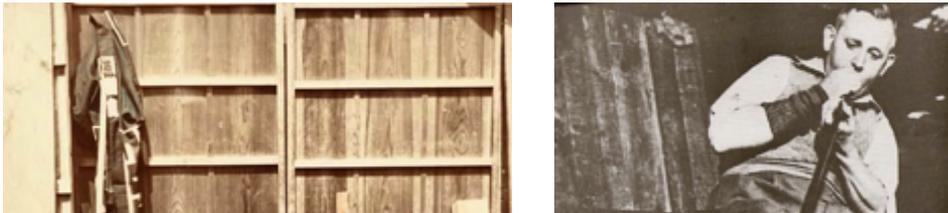


Source: <https://www.stedmunds.org.uk/wp-content/uploads/2016/05/Design-Movements-Timeline.pdf>

# Design evolution



# Design evolution



- **Phase 1: Arts and crafts**
- Context: Hand-made object, craftsmanship.
- Design philosophy: Self-expression, aesthetic value (beauty), unique spirit.
- Unit of design: Artefact itself.
- Sustainability tensions: Low-efficiency, over decoration, unnecessary use of resources in each particular object.

# Design evolution

<b>Sustainability tensions</b>	Low-efficiency, over decoration, unnecessary use of resources in each particular object
<b>Unit of design</b>	Artefact
<b>Design philosophy</b>	Self-expression, aesthetic value (beauty), unique spirit
<b>Context</b>	Hand-made object, craftsmanship
<b>Phase</b>	<b>Arts and crafts</b>

1850s

# Design evolution



- **Phase 2: Modernism**
- Context: Industrialization and mass production.
- Design philosophy: Affordable, pragmatic, functionality and simplicity.
- Unit of design: Artefacts and production.
- Sustainability tensions: Top-down, impose a certain vision, utopianism.

Source: [https://www.moma.org/explore/inside\\_out/2013/01/07/le-corbusier-kitchen-conservation-dismantle-reconstruct-and-serve/](https://www.moma.org/explore/inside_out/2013/01/07/le-corbusier-kitchen-conservation-dismantle-reconstruct-and-serve/)

# Design evolution

<b>Sustainability tensions</b>	Low-efficiency, over decoration, unnecessary use of resources in each particular object	Top-down, impose a certain vision, utopianism
<b>Unit of design</b>	Artefact	Artefacts and production
<b>Design philosophy</b>	Self-expression, aesthetic value (beauty), unique spirit	Affordable, pragmatic, functionality and simplicity
<b>Context</b>	Hand-made object, craftsmanship	Industrialization and mass production
<b>Phase</b>	<b>Arts and crafts</b>	<b>Modernism</b>

1850s                      Late 19th

# Design evolution



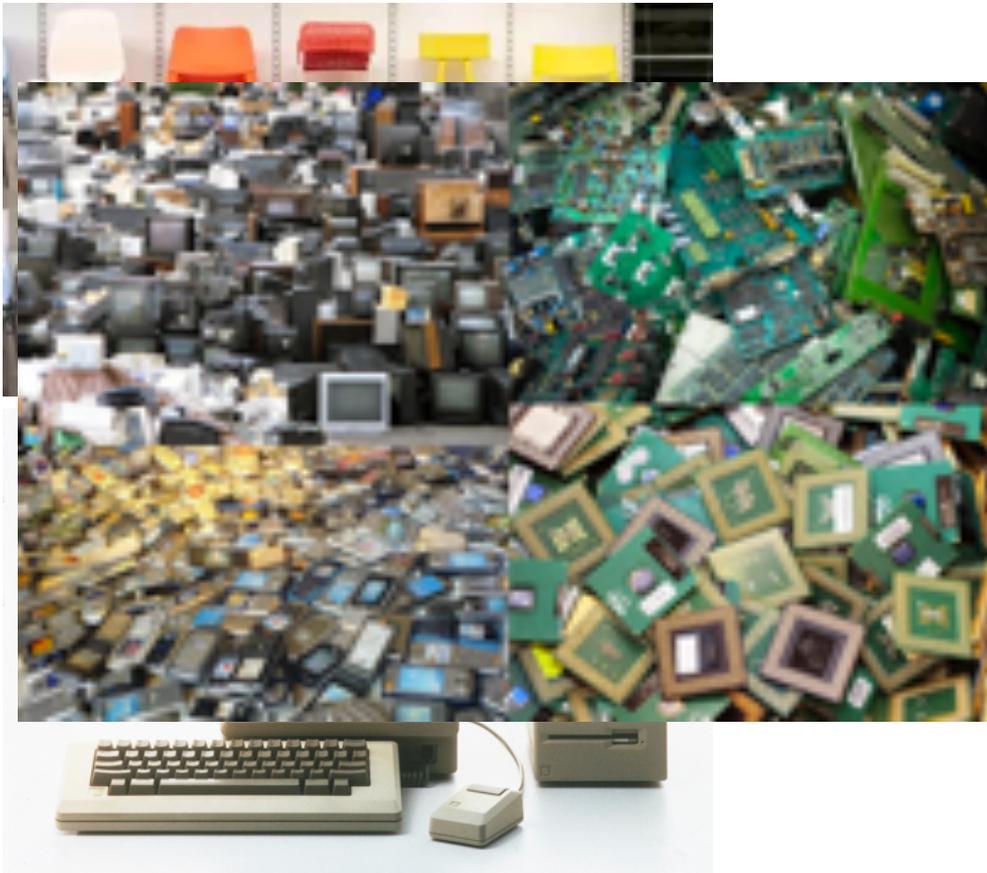
- **Phase 3: Consumerism (collective)**
- Context: Serving the collective good.
- Design philosophy: Democratization, bottom-up.
- Unit of design: Artifacts, production, and the users
- Tensions: Everything looks the same, homogenization.



# Design evolution

<b>Sustainability tensions</b>	Low-efficiency, over decoration, unnecessary use of resources in each particular object	Top-down, impose a certain vision, utopianism	Everything looks the same
<b>Unit of design</b>	Artefact	Artefacts and production	Artifacts, production, and the users
<b>Design philosophy</b>	Self-expression, aesthetic value (beauty), unique spirit	Affordable, pragmatic, functionality and simplicity	Democratization, bottom-up
<b>Context</b>	Hand-made object, craftsmanship	Industrialization and mass production	Serving the collective good
<b>Phase</b>	<b>Arts and crafts</b>	<b>Modernism</b>	<b>Consumerism (collective)</b>
	1850s	Late 19th	1930s

# Design evolution



Source: <https://cms.qz.com>; Apple Computer, Inc.

- **Phase 4: Consumerism (Individual)**
- Context: Driven by individual desires, digitalization.
- Design philosophy: User-centered, personalized, immersive.
- Unit of design: Interaction between the users and their surrounding contexts.
- Sustainability tensions: Waste natural resource, over abundant products.

# Design evolution

<b>Sustainability tensions</b>	Low-efficiency, over decoration, unnecessary use of resources in each particular object	Top-down, impose a certain vision, utopianism	Everything looks the same	Waste natural resource, over abundant products
<b>Unit of design</b>	Artefact	Artefacts and production	Artifacts, production, and the users	Interaction between the users and their surrounding contexts
<b>Design philosophy</b>	Self-expression, aesthetic value (beauty), unique spirit	Affordable, pragmatic, functionality and simplicity	Democratization, bottom-up	User-centered, personalized, immersive
<b>Context</b>	Hand-made object, craftsmanship	Industrialization and mass production	Serving the collective good	Driven by individual desires, digitalization
<b>Phase</b>	<b>Arts and crafts</b>	<b>Modernism</b>	<b>Consumerism (collective)</b>	<b>Consumerism (Individual)</b>
	1850s	Late 19th	1930s	1970s, 80s

# Design evolution



Cradle to cradle, 2002

- **Phase 5: Green design movement**
- Context: Environmental and social concerns.
- Design philosophy: Be socially and environmentally responsible.
- Unit of design: Interaction between the users and the macro social and ecological environment.
- Sustainability tensions: Conflicts between the “big” needs and the user needs.

# Design evolution

<b>Sustainability tensions</b>	Low-efficiency, over decoration, unnecessary use of resources in each particular object	Top-down, impose a certain vision, utopianism	Everything looks the same	Waste natural resource, over abundant products	Conflicts between the “big” needs and the user needs
<b>Unit of design</b>	Artefact	Artefacts and production	Artifacts, production, and the users	Interaction between the users and their surrounding contexts	Interaction between the users and the macro social and ecological environment
<b>Design philosophy</b>	Self-expression, aesthetic value (beauty), unique spirit	Affordable, pragmatic, functionality and simplicity	Democratization, bottom-up	User-centered, personalized, immersive	Be socially and environmentally responsible
<b>Context</b>	Hand-made object, craftsmanship	Industrialization and mass production	Serving the collective good	Driven by individual desires, digitalization	Environmental and social concerns.
<b>Phase</b>	Arts and crafts	Modernism	Consumerism (collective)	Consumerism (Individual)	Green design movement
	1850s	Late 19th	1930s	1970s, 80s	20th

# Design evolution

## OUTLINE OF A CIRCULAR ECONOMY

### PRINCIPLE

1

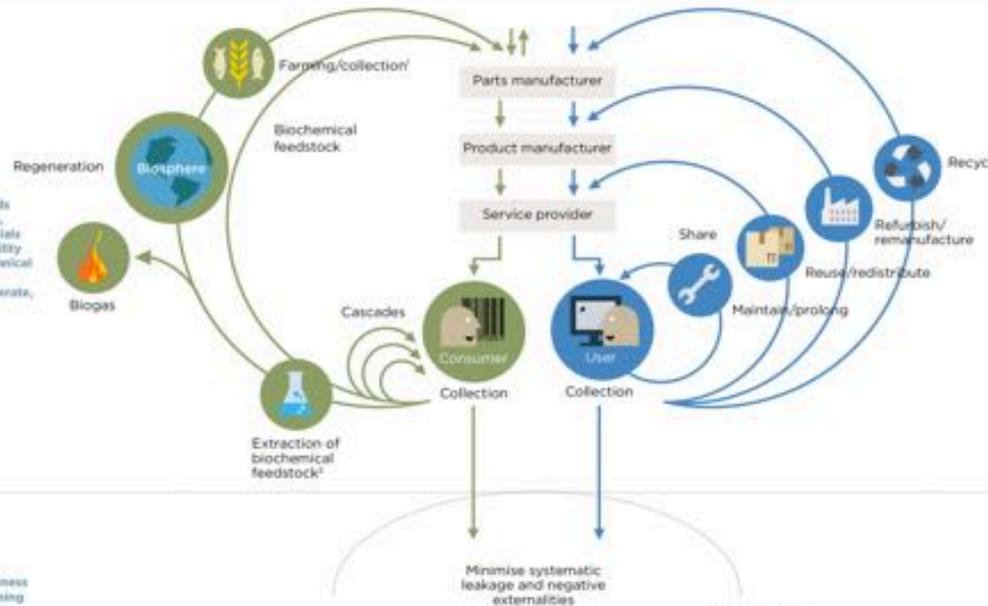
Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows  
ReSOLVE levers: regenerate, virtualise, exchange



### PRINCIPLE

2

Optimise resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles  
ReSOLVE levers: regenerate, share, optimise, loop



### PRINCIPLE

3

Foster system effectiveness by revealing and designing out negative externalities  
All ReSOLVE levers

Minimise systematic leakage and negative externalities

1. Hunting and fishing  
2. Can take both post-harvest and post-consumer waste as an input  
Source: Ellen MacArthur Foundation, JPL, and McKinsey Center for Business and Environment. Drawing from Braungart & McDonough. Credit to Credit (C2C).

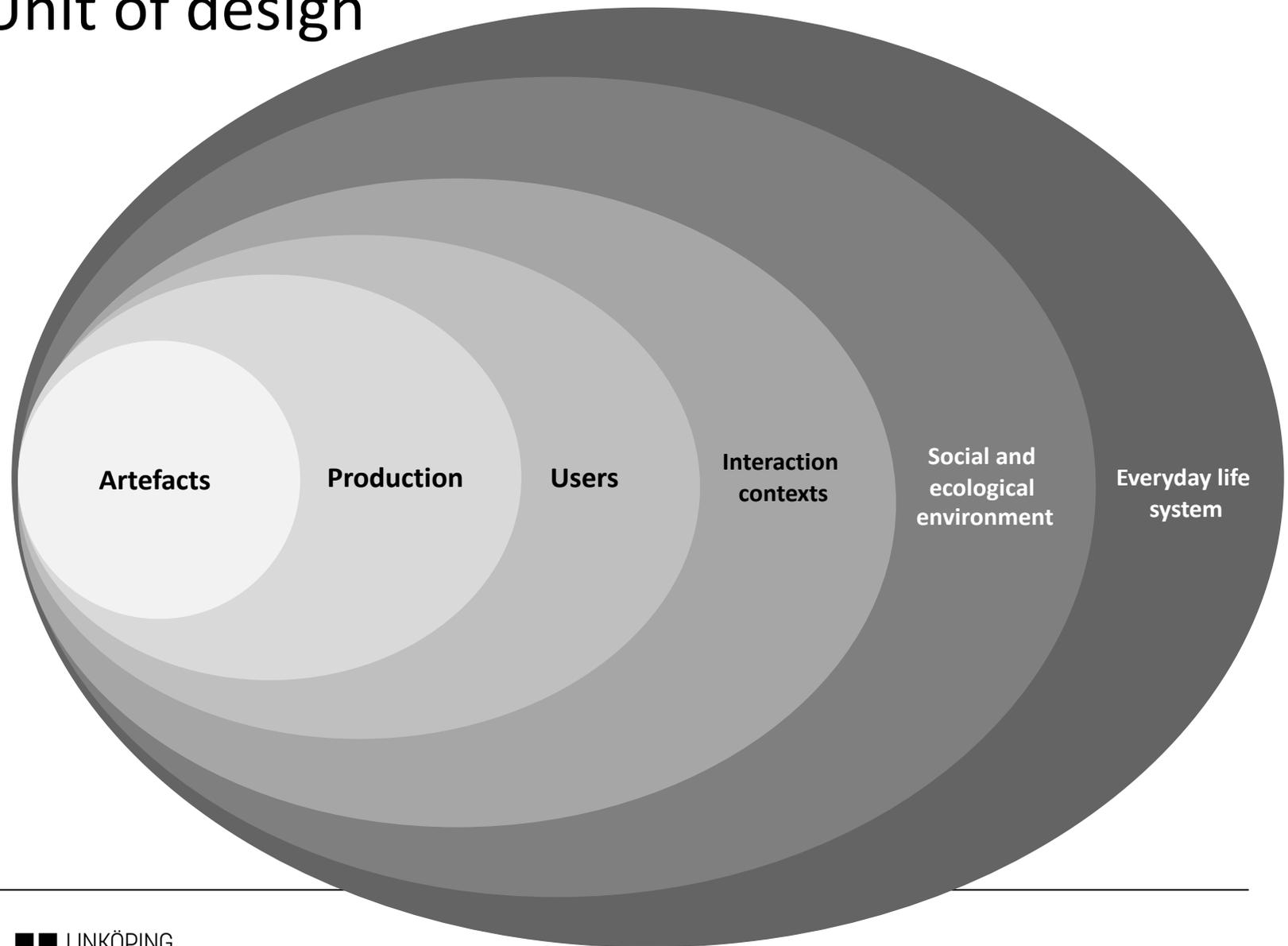
- **Phase 6: Ecological system thinking**
- Context: Sustainability issues.
- Design philosophy: Principles and strategies that lead to a sustainable future .
- Unit of design: The whole system.

Source: World Economic Forum

# Design evolution

<b>Sustainability tensions</b>	Low-efficiency, over decoration, unnecessary use of resources in each particular object	Top-down, impose a certain vision, utopianism	Everything looks the same	Waste natural resource, over abundant products	Conflicts between the “big” needs and the user needs	
<b>Unit of design</b>	Artefact	Artefacts and production	Artifacts, production, and the users	Interaction between the users and their surrounding contexts	Interaction between the users and the macro social and ecological environment	A sustainable everyday life system
<b>Design philosophy</b>	Self-expression, aesthetic value (beauty), unique spirit	Affordable, pragmatic, functionality and simplicity	Democratization, bottom-up	User-centered, personalized, immersive	Be socially and environmentally responsible	Principles and strategies that lead to a sustainable future
<b>Context</b>	Hand-made object, craftsmanship	Industrialization and mass production	Serving the collective good	Driven by individual desires, digitalization	Environmental and social concerns.	Sustainability issues
<b>Phase</b>	Arts and crafts	Modernism	Consumerism (collective)	Consumerism (Individual)	Green design movement	Ecological system thinking
	1850s	Late 19th	1930s		1970s, 80s	20th

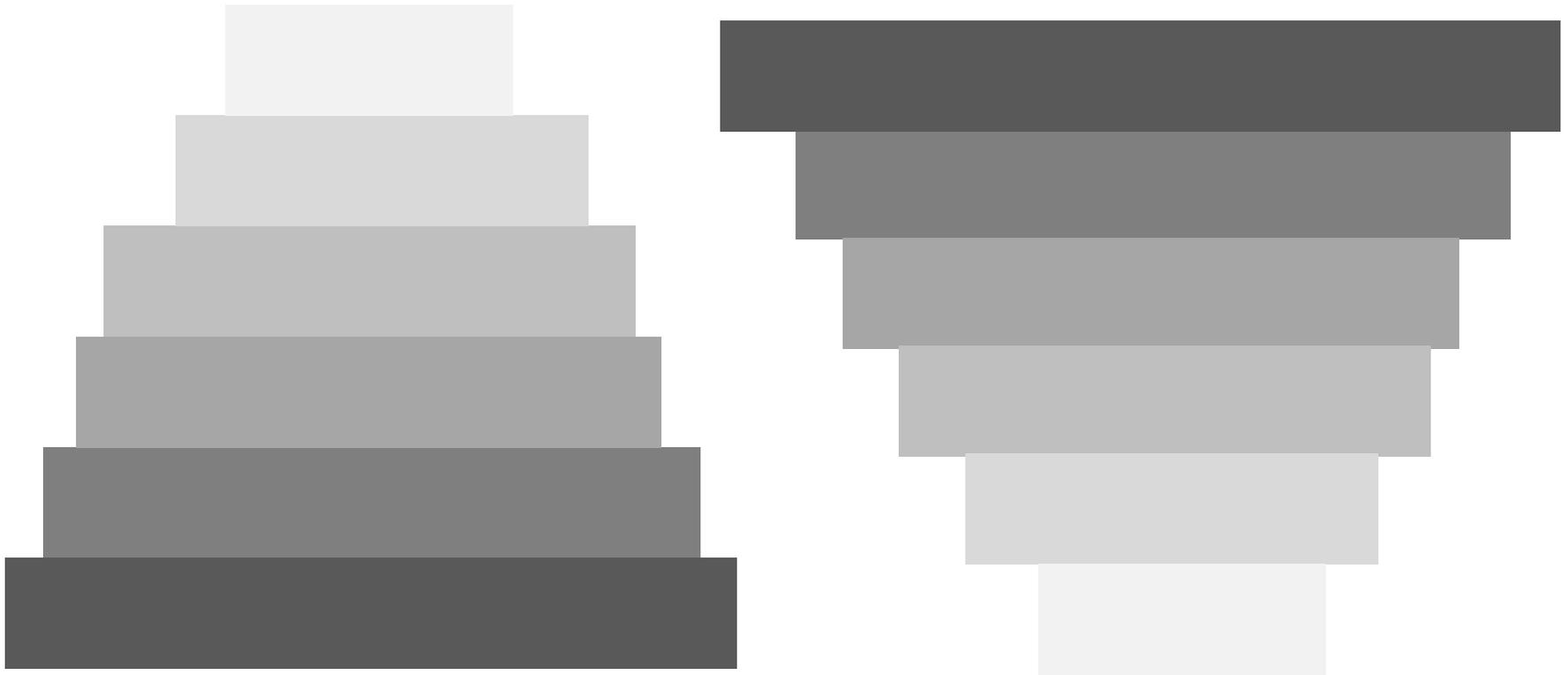
# Unit of design



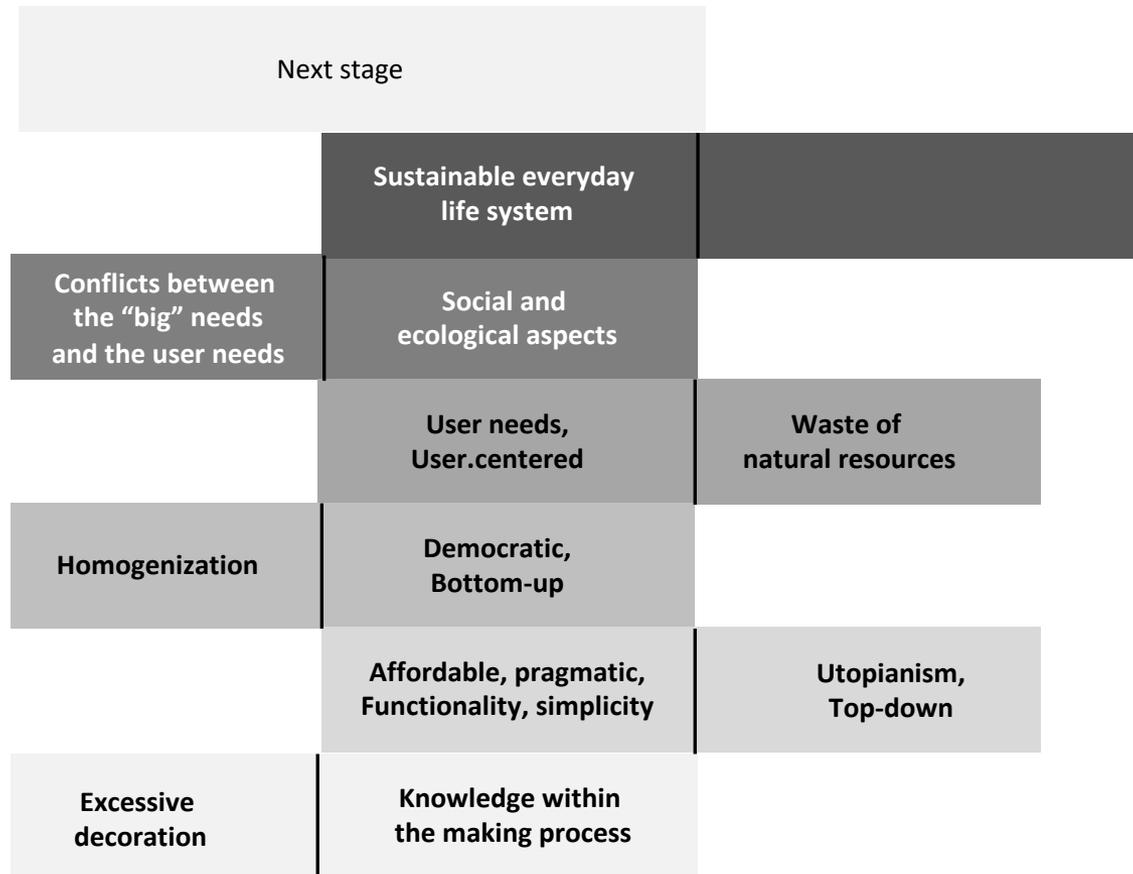
# Design evolution

<b>Sustainability tensions</b>	Low-efficiency, over decoration, unnecessary use of resources in each particular object	Top-down, impose a certain vision, utopianism	Everything looks the same	Waste natural resource, over abundant products	Conflicts between the “big” needs and the user needs	
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<b>Design philosophy</b>	Self-expression, aesthetic value (beauty), unique spirit	Affordable, pragmatic, functionality and simplicity	Democratization, bottom-up	User-centered, personalized, immersive	Be socially and environmentally responsible	Principles and strategies that lead to a sustainable future
<b>Context</b>	Hand-made object, craftsmanship	Industrialization and mass production	Serving the collective good	Driven by individual desires, digitalization	Environmental and social concerns.	Sustainability issues
<b>Phase</b>	Arts and crafts	Modernism	Consumerism (collective)	Consumerism (Individual)	Green design movement	Ecological system thinking
	1850s	Late 19th	1930s		1970s, 80s	20th

# The development of the leading Design philosophy



# The development of the leading Design philosophy



What does it mean to design for sustainable everyday life system?

What should be considered in the system?

What does it mean to design for sustainable everyday life system?

What should be considered in the system?

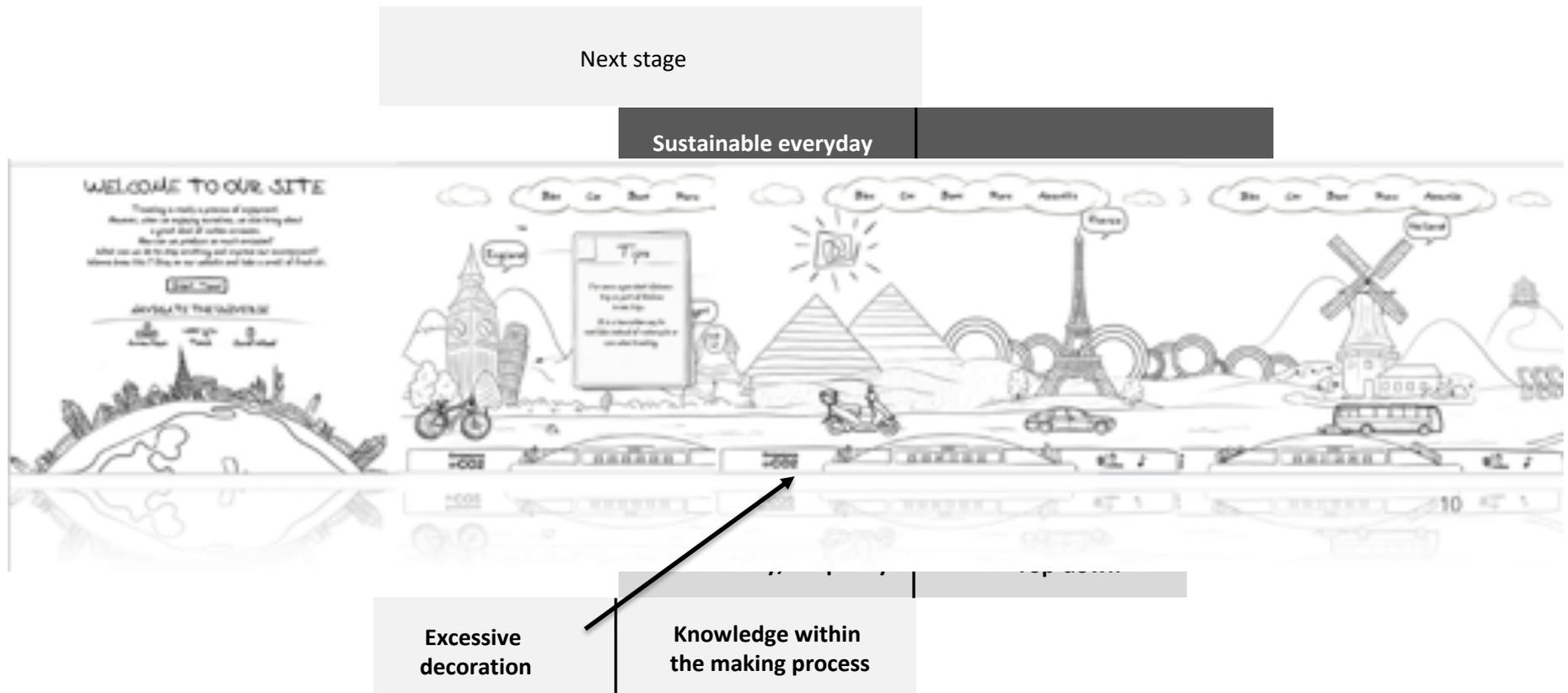


1. **Mediating tool used in user activities.**
2. **Taking both the user doings and the artefact design into consideration.**
3. **Use theoretical concepts from psychology and sociology from as the framework for design.**

# 1. Designing mediating tools

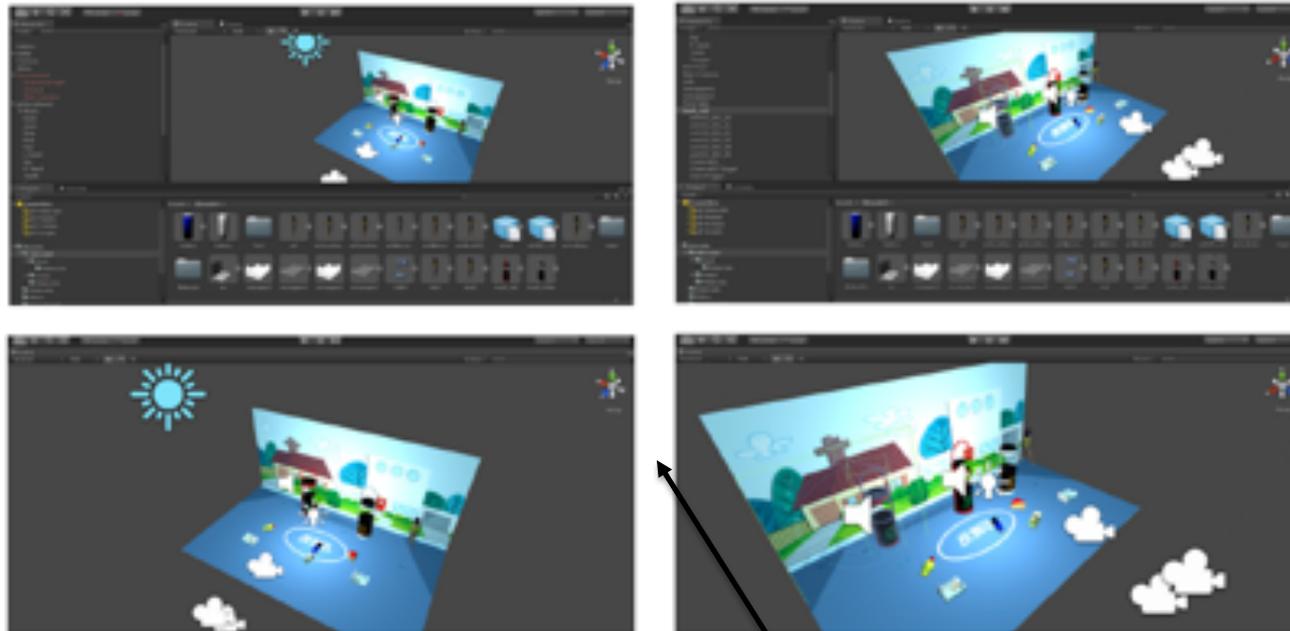
*“If you want to change how someone thinks, give up; you cannot change how another thinks. Give them a tool, the use of which will lead them to think differently.”*

--Buckminster Fuller

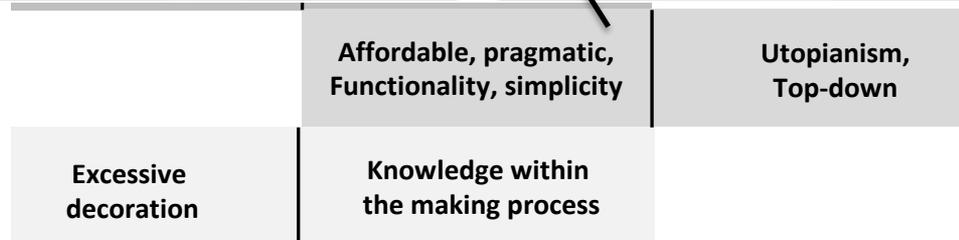


# 1. Designing mediating tools

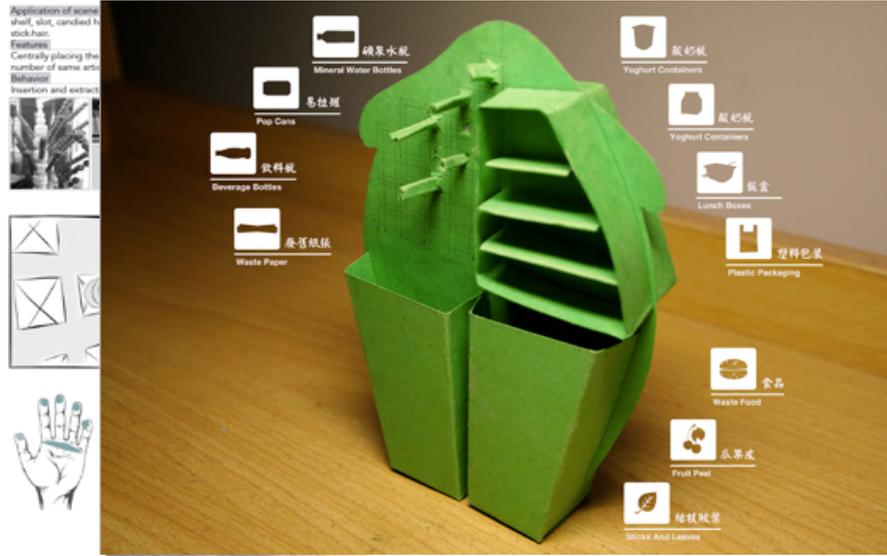
*“If you want to change how someone thinks, give up; you cannot change how another thinks. Give them a tool, the use of which will lead them to think differently.”*



nster Fuller



# 1. Designing mediating tools



ERGONOMICS AND SHAPE DESIGN

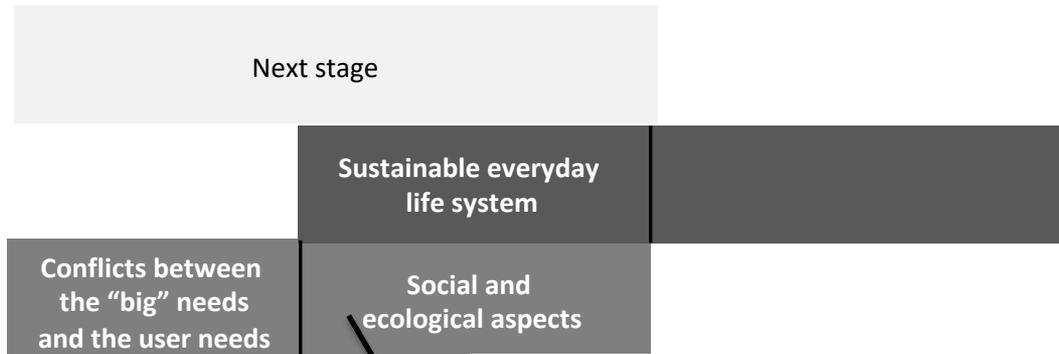


	<b>User needs, User centered</b>
<b>Homogenization</b>	<b>Democratic, Bottom-up</b>
	<b>Affordable, pragmatic, Functionality, simplicity</b>
<b>Excessive decoration</b>	<b>Knowledge within the making process</b>

# 1. Designing mediating tools

*“If you want to change how someone thinks, give up; you cannot change how another thinks. Give them a tool, the use of which will lead them to think differently.”*

--Buckminster Fuller



## PHASE II STRENGTHEN THE TOURISM



The cultural tourism resources in Tanhuailin have not been fully developed, for the reason that tourists are not familiar with the distribution of folk art in Tanhuailin. The arrangement of streets in historical Tan Hualin is irregular, leading to the fact that tourists fail to be interested to rave here.

However, in our opinion, this is the right advantage of Tanhuailin richly endowed by nature. Taking advantage of applications on mobile phone terminal and labyrinth geographical location and layout of historical Tanhuailin, we design a game application. Without the help of maps, the marker locations can be found in complex streets of historical Tanhuailin, correspondingly travellers can draw the map of Tanhuailin by themselves, and the marked locations are the right places where folk arts are exhibited.

So, through the use of mobile phone application, we not only increase tourists' interests but also help to promote Tanhuailin historical culture to travellers.

### MAIN FUNCTIONS

The whole map will disappear after 30-second display

Open the detector; the current position is located based on GPS

According to the compass and tips of construction details, the specified target will be found. The users can draw their own maps to indicate the scenic spots they pass by

As a reward, when a target is found, the detector will be enlarged

At the end of the trip, the hand-painted Tanhuailin maps which were drawn by you, can be released and shared, in order to attract more tourists.

## NEW WAYS OF POLYMERIZATION

According to a German report, in 2010 World Cup, there emerged an amazing phenomenon in the correlation between the city's public space and the virtual space of networks and media. Every important contents of World Cup attracted tens of thousands of audiences to gather on the squares or streets to watch the game together. So I start to think that new media not only integrate with the urban space, but also could polymerize citizens, especially for young mans to communiacte and enjoy the happy time we used to have before. This is the interface and interactive ways I think will happen in the future.

In the public space, people can connect the network of the phone with new media. In doing so, the camera of the phone can be automatically started. The video photographed by the phone can be broadcasted on the screen on the air. In that way, every body can make himself into a photographer. The camera of every device can capture the individual splendid moment.



## DIFFERENT THEMES

春  
spring  
281 189 66

夏  
summer  
162 217 200

秋  
autumn  
252 196 67

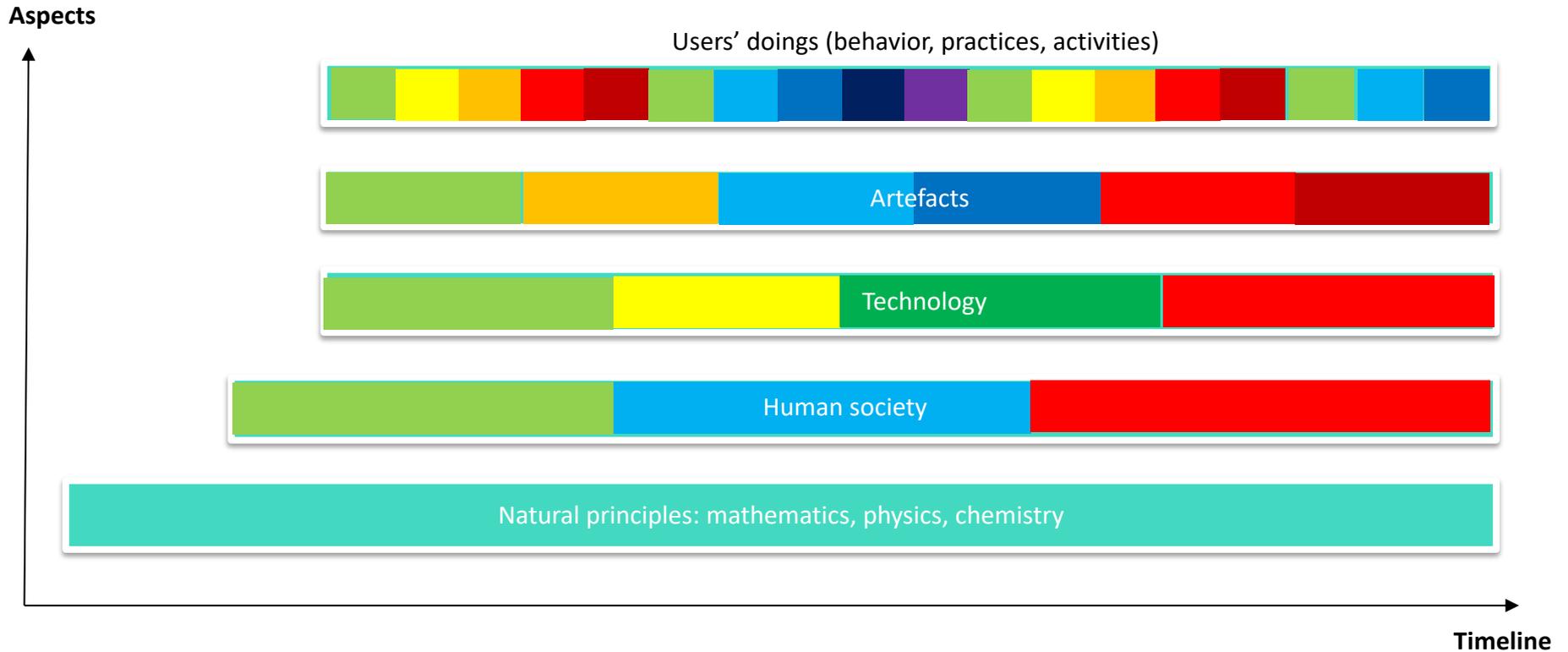
冬  
winter  
162 217 206

The UI's dominant tone of the new device will change with the local seasons, thus endowing it with the local characteristics. The style is of the simple Metro kind for the use of people of different regions.



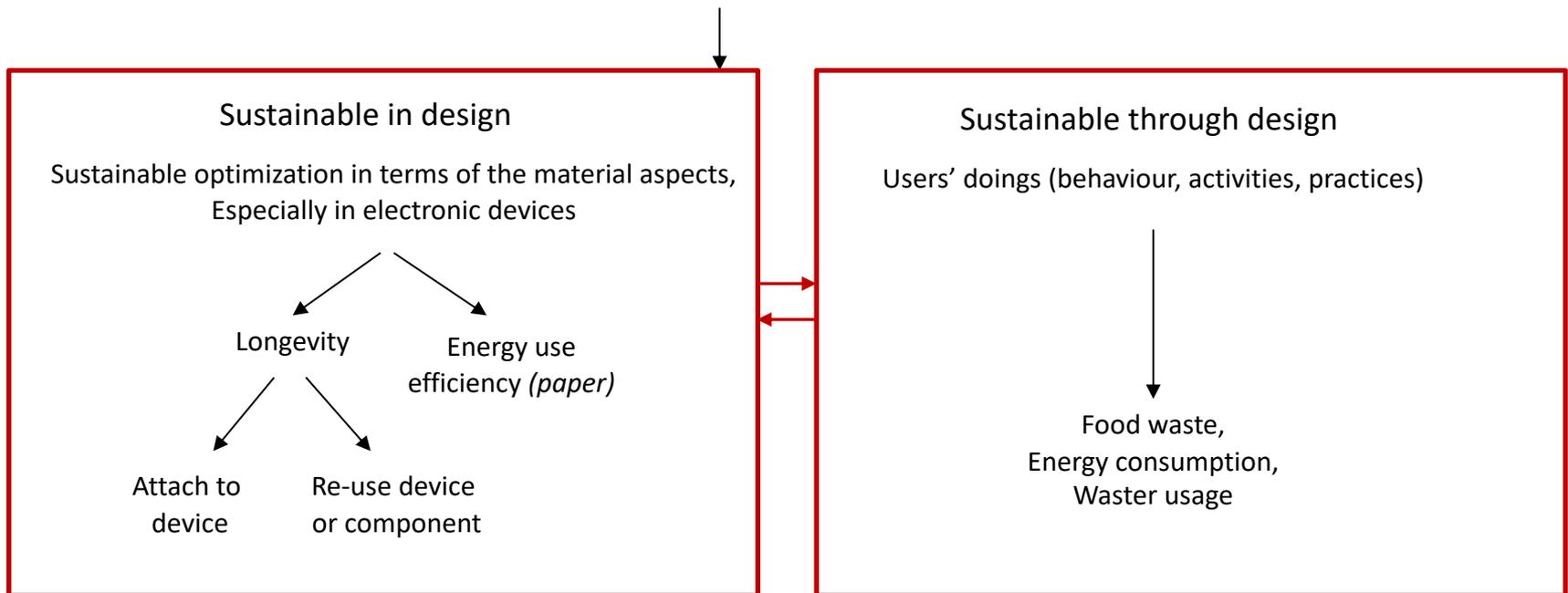
In the interactive media space, the effect of culture and art communication will be infinitely magnified. The genuine spread of the local custom can attract not only local young people to stay, but also people of foreign cultures, from thousands of miles away to learn it in an interactive means. That is of great help for the cultural inheritance of the ancient city and also for its sustainable development.

## 2. User doings and the artefact design



## 2. User doings and the artefact design

Sustainable Interaction design (SID) (Blevis, 2007)



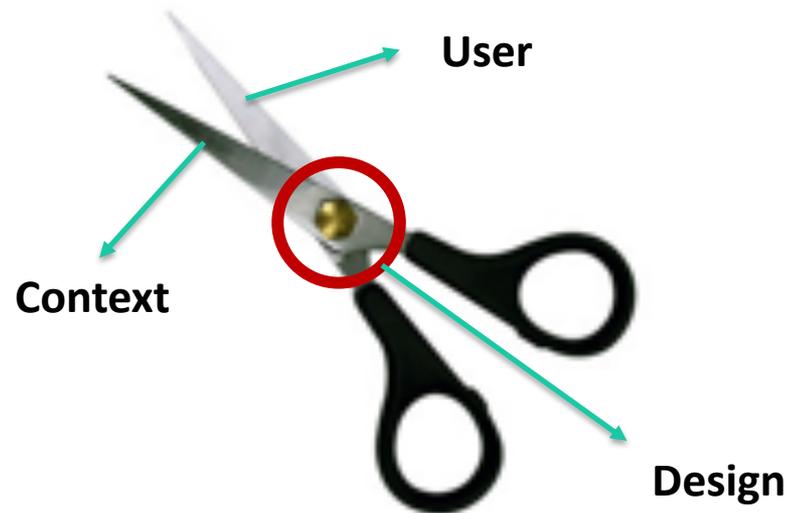
## 2. User doings and the artefact design

(C10) RICH, CROSS-MODAL AND UBIQUITOUS: Users increasingly look for, and businesses encourage, a collection of services that interact and support each other, providing a richer experience overall [46]. They also increasingly use services in the 'background' of their attention to provide ambient experiences and/or control through the Internet of Things [10]. Hence users use services more often, and use multiple services simultaneously. This increases the demand for services in general, and so amplifies the impact of the other nine factors.

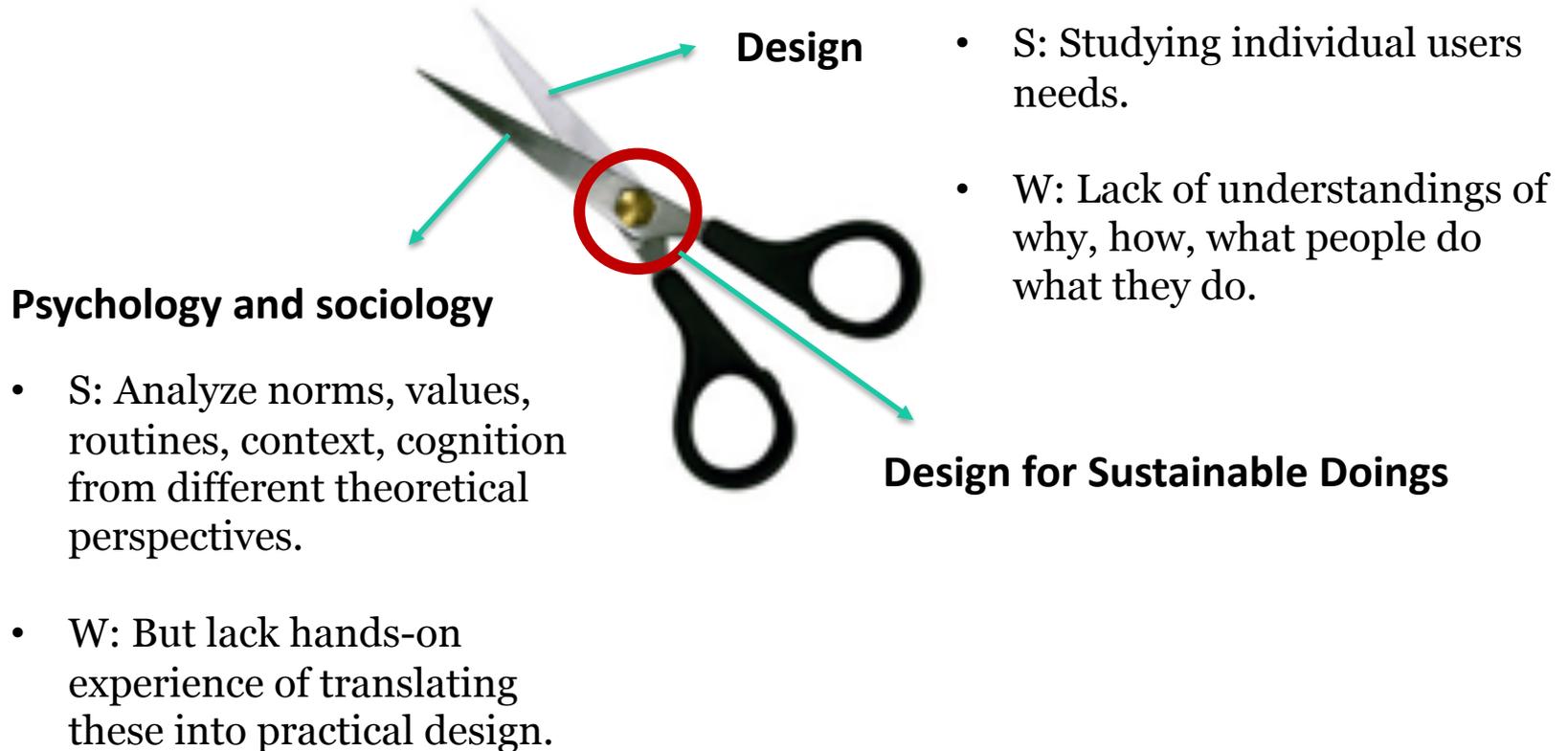
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### 3. Theoretical concepts from psychology and sociology

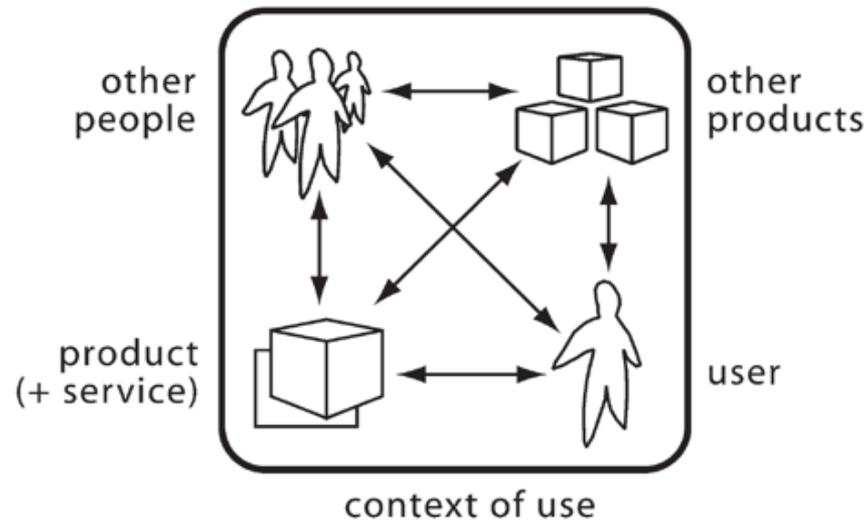
- “Understanding behaviour requires an understanding of both context and cognition, design is well placed to address where the blade cross.”  
(Lockton, 2013)



### 3. Theoretical concepts from psychology and sociology



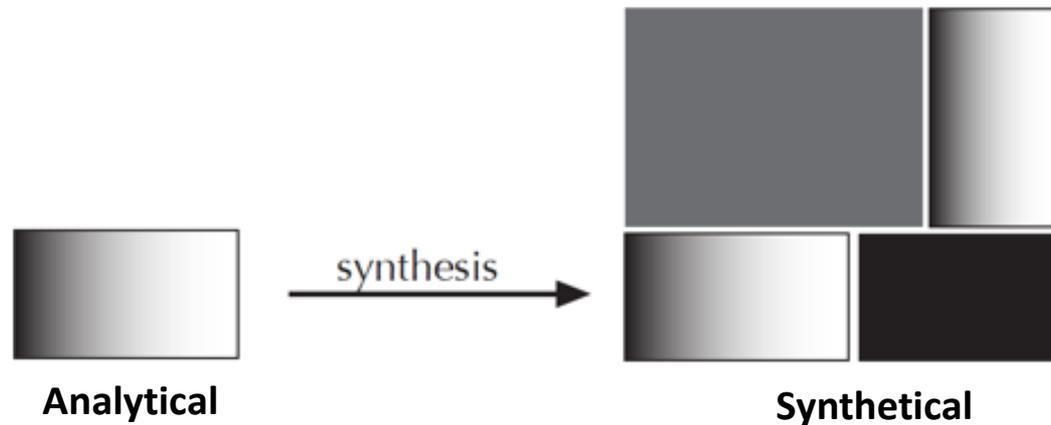
### 3. Theoretical concepts from psychology and sociology



- Today's products are often **product–service combinations**, function in networks with other products, other people are also involved in or affected by a person's product use.

Source: Wever et al., 2008

# Design Approaches – analytic and synthetic



- Develop better understanding about **why, where and when** to intervene users' behaviour in a more sustainable direction.
- Product influence can not be gained without including the **context**, such as people, culture, and history.

Source: Nynke, 2013

Theoretical perspective	Practice Theory	Activity Theory	Social Psychology Theory
Unit of study	Practice as the unit of study	Activity as the unit of study	Behaviour as the unit of study
Emphasis	how people perform their routinized behaviour and why they perform it	Why people carry out specific activities and how people act in activities	What determinants influence individuals' behaviour under specific conditions
Scope	System level: context of practices, practices' evolution, and cross-cultural diversity	Complexity of activity: people, mediating artefacts, objects, context, activities' development and transformation.	Individual level: exploring and explaining individual behaviour determinants
Design approach	Practice-oriented design	Activity-centred design	Design for Sustainable Behaviour  Interaction-oriented Design
Goal for design intervention	From a design intervention to resource reconfiguration of the practice	Mediating role of artefacts, designing mediating tools that influence people's actions	From a certain vision of 'sustainable behaviour' to an intervention in practice
Feature of interventions	Disruptive and deliberately intended to lead to a reproduction of practice	<i>(No clear summary of this cell can be found yet, the aim is to identify it in the literature review paper I am planning to write, see section 5.2)</i>	Redesign of artefacts, targeting at specific behaviour determinants, 'smoothly fit' into existing practice
Critiques	No distinct boundaries when it comes to analysis and design	<i>(Same as the cell above)</i>	Too restricted view: design based on existing artefacts with a pre-set aim of certain sustainable behaviour

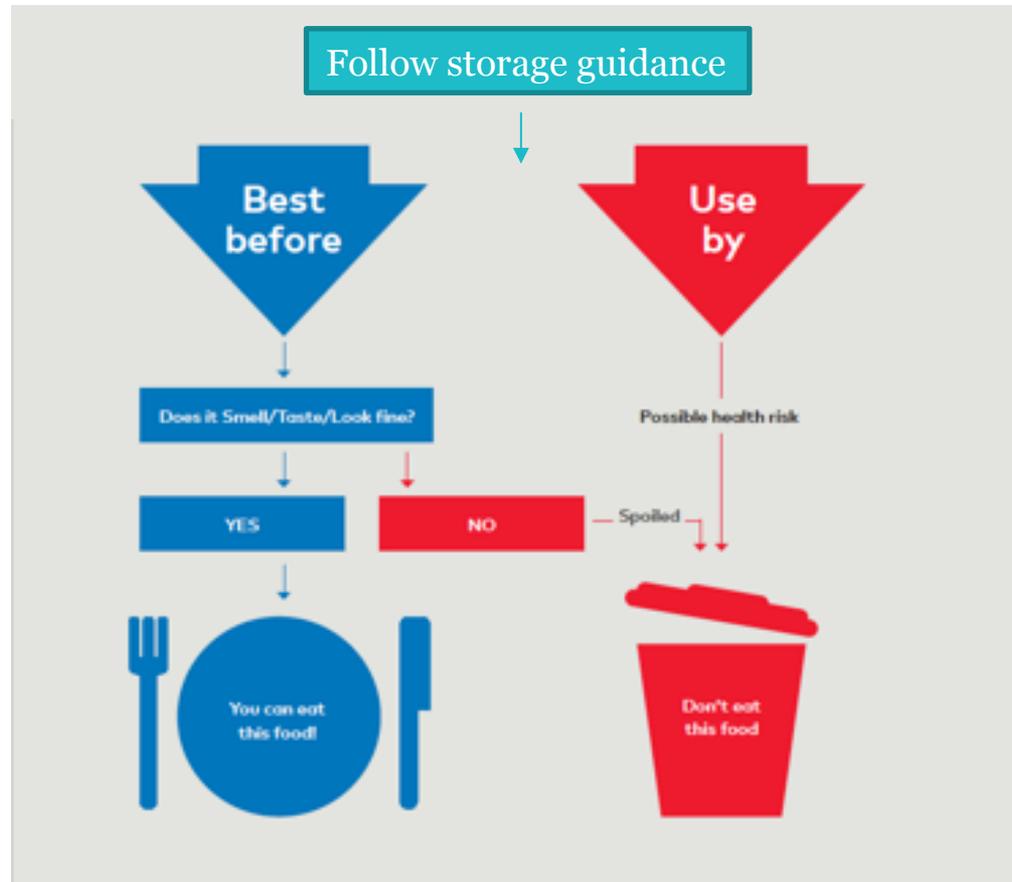
# Time for Packaging and food waste design exercise!

# Design brief: Background

- One-third of the total amount of food is wasted every year.
- 48% of avoidable food waste in UK: not being used within shelf life.
- Misunderstandings of date labels (best-before and use-by) accounts for 20% of avoidable food waste in UK.
- On-pack information attributes: date labels and storage guidance, affect consumer food waste.
- Depending on individual and the different food type, people usually rely on their own sensory perceptions, or rely on date labels, or in combination, to judge food quality and safety.

# Design brief: Problem

- The perfect sustainable consumer behavior model:



# Design brief: Problem

Analytical aspects	Summary of tensions
Socio-cultural context & Development	Lack of efficient ways to incorporate food waste concerns with consumers' existing motivations in judging food safety and quality.
Socio-cultural context & Development	Food industry practitioners focus on using date labels to better inform consumers' purchasing behavior. For example, give discounts to dairy products, breads, fresh produce, and meats when the products are close to their expiration date. However, consumers' interaction with labels at household levels have been largely neglected due to the lack of economic incentives.
Socio-cultural context & Development	Limited space on packaging. Lack of motivation to present information that does not necessarily improve products' sales performance.
External mediating tool	Consumer's confusions over the meanings of different types of date labels, particularly 'Best-before' and 'Use-by' date.

External mediating tool	The on-pack date and storage information is not contextualized to align with consumers' daily food consumption activities (e.g. lack of guidance on how the product should be stored, and how long it can last after first opening).
Internal mediating tool	Consumers' lack of knowledge on the use sensory perceptions. And lack of interests to search and learn the relevant knowledge.
Interplay between mediating tools & Social interaction	Consumers' food-related knowledge and awareness have been gradually lost in the changing socio-cultural context. Given the spectrum between the use of sensory perceptions and on-pack labels, consumers' over reliance on either end of the spectrum can lead to food safety and waste issues.

# Design brief: Problem

Based on the identified phenomenon, and your own observations and reflections of

how you, your friends, and your relatives use the label information,

propose a design, to be specific, interactive products (can be digital or physical) to mediate the household food waste problem.

Thank you!

[www.liu.se](http://www.liu.se)

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