

Applied Data Science Project

L 16 – Human Centred Design. Introduction: principles and tools



Why this module?

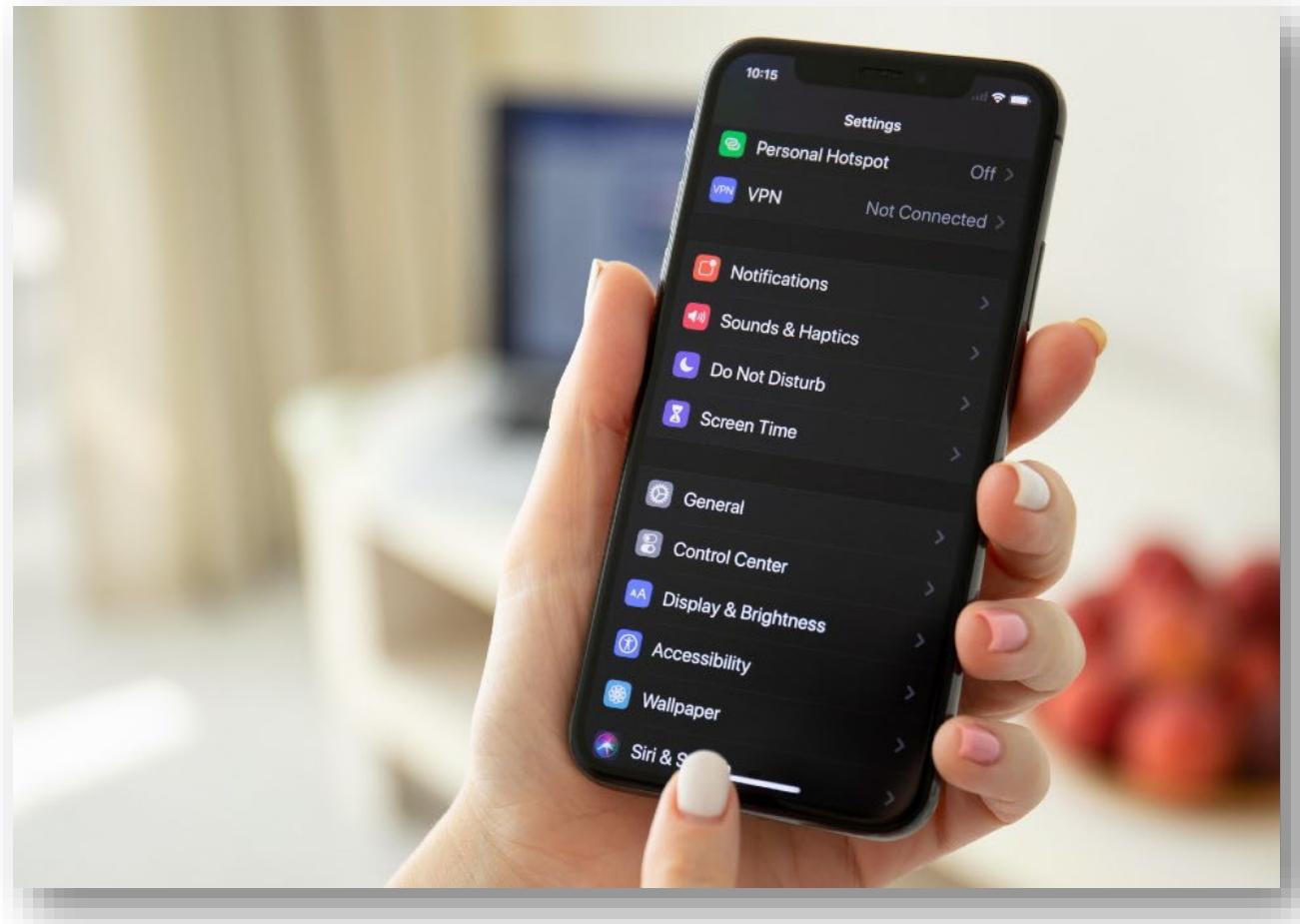
Every day, we use and **interact with intelligent systems based on data and making available data and information to us.**

Every step we experience is based on previous decisions taken by designers, developers, marketing people...

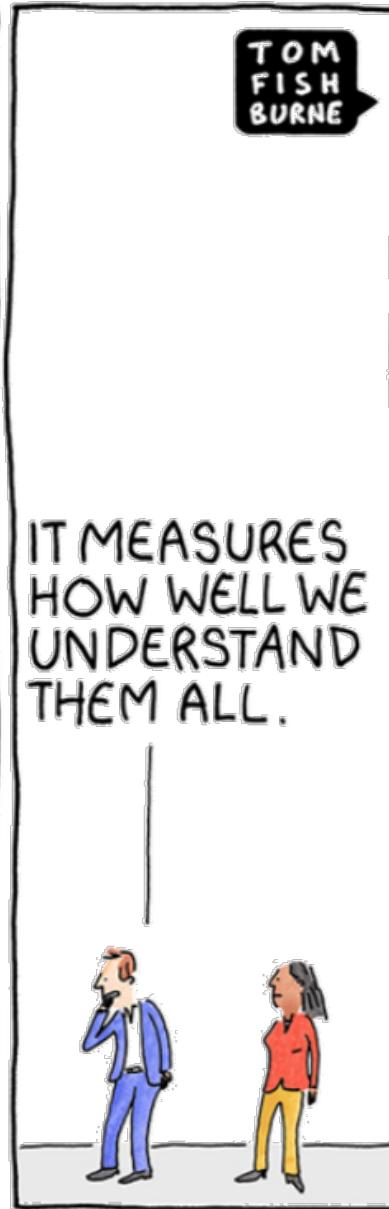
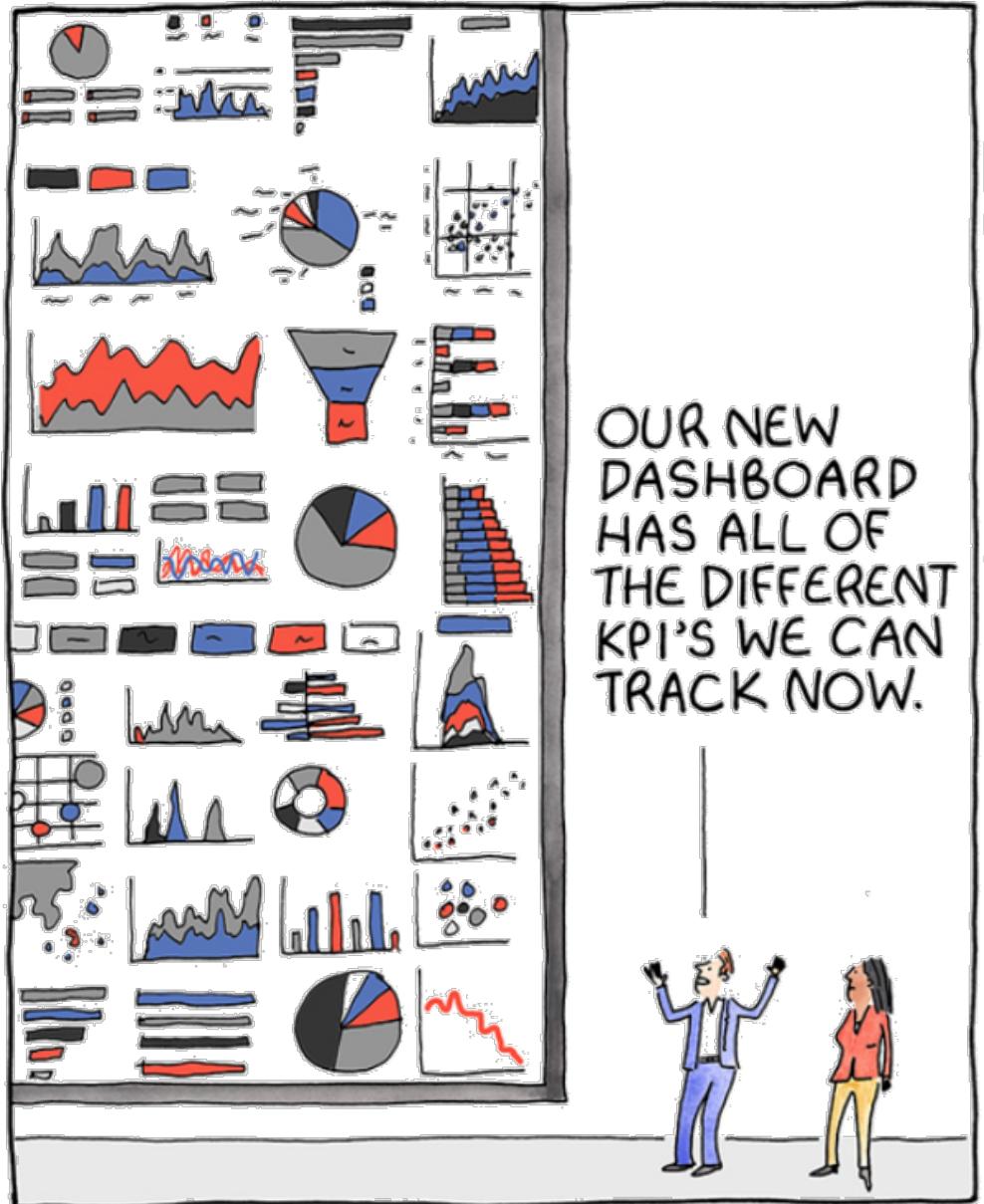
Our views about the systems, their usage and the users directly **affect the people's actions and produce impacts.**

- Positive (access, friendliness, connection...)
- Negative (privacy violations, waste of time, financial resources or mental energy...)

Regardless they are consequences of personal choices, automatic default settings, or algorithms, in general they depend on the **design strategy behind it.**



Expectations



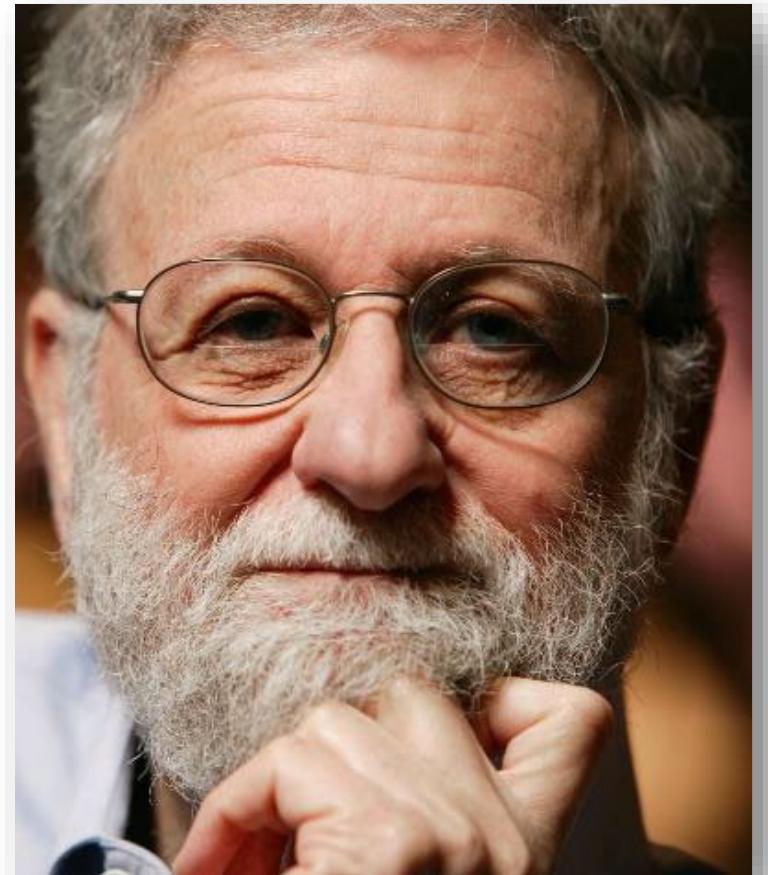
Result

© marketoonist.com

*"Artifacts pervade our lives, our every activity.
Technology, potentially, makes our daily life more comfortable and pleasant...
But at the same time, **it adds complexity and complication**".*

TECHNOLOGY PARADOX

*Complexity and difficulties are inevitable
when increasing the number of features.
A **good design can minimize it**".*



What are data

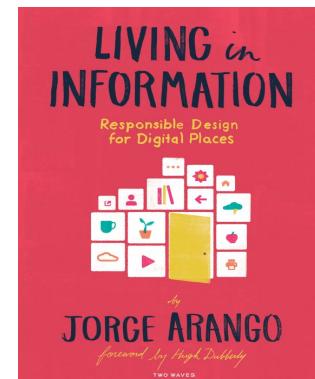
For people?

Phenomena that occur and that begin to exist as data **if and when** someone decides to **observe, count and classify** them.

The data are built and reflect the choice behind it
(when deciding what to observe and how to measure it)

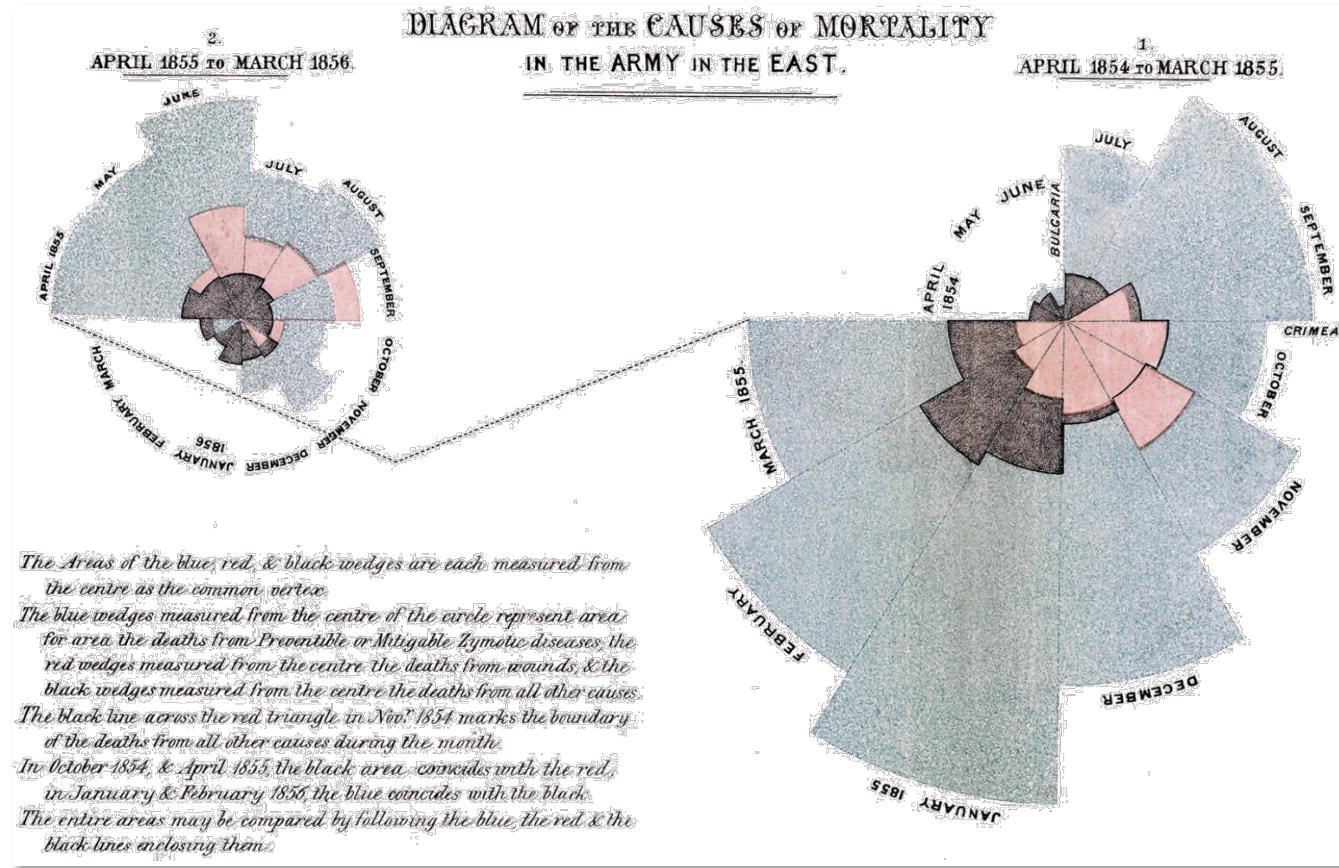
Data answer questions and serve goals.

We make the experience of data and through data.



Jorge Arango. [Living in Information.](#)
[Responsible Design for Digital Places](#). 2018

1859

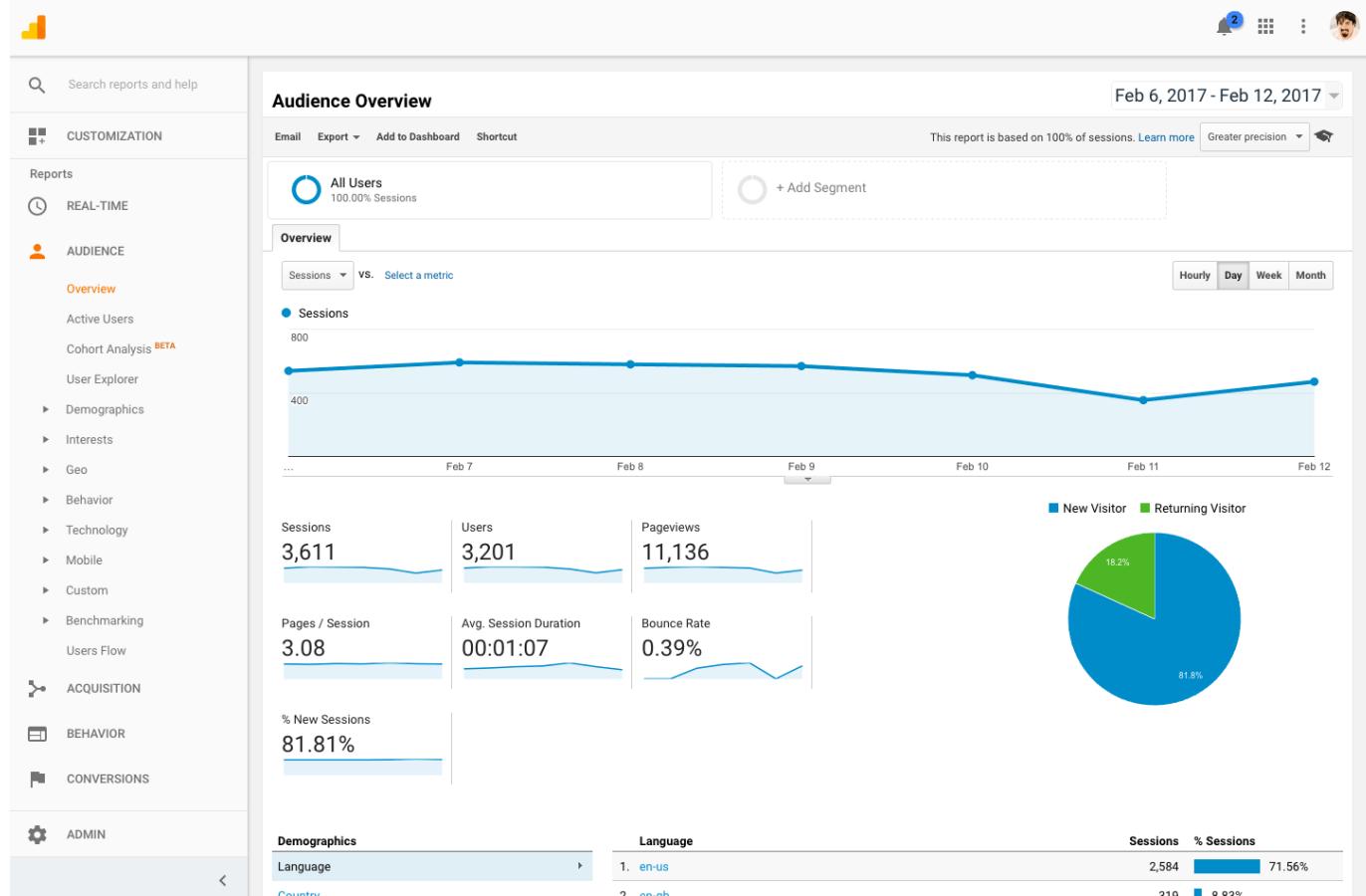


The first visualization of complex data.



The nurse Florence Nightingale began to track the causes of death of British soldiers in military hospitals during the Crimean war and **invented** the **polar chart** to display the pieces of evidence and communicate them.

2005



Dashboards are becoming more accessible.

Web-accessible dashboards that allow different types of actors to **view data and monitor complex phenomena**.

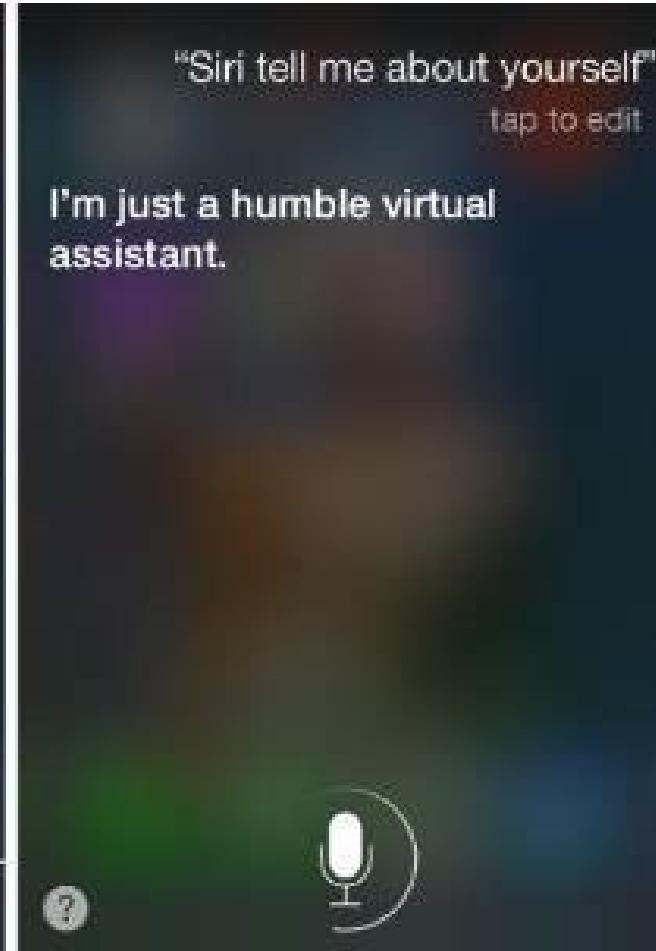
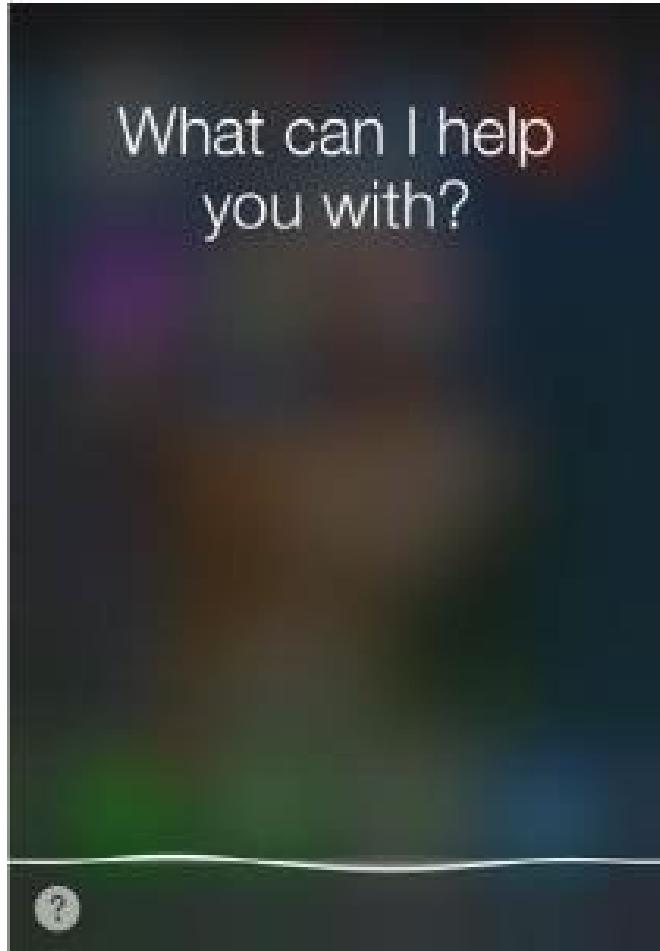
2014



➤ The so-called **quantified self** rises, thanks to the mobile and wearable self-tracking apps allowing to measure and analyse any kind of activities.

- Diet
- Sport
- Books read
- Finance
- Dreams
- ...

2012



Digital assistants, enabled by AI provide natural language interactions, making the system behind even more transparent (seamless input and output).

The data lifecycle

DATA

Quantitative description of an observed phenomenon.

Data, per se, have no intrinsic meaning.

For example, data on cancer occurrence in a population are relatively meaningless without context. By comparing them with other populations or other time intervals, we can get a deeper understanding.

INFORMATION

Data can be transformed into **information** when sorted, processed and represented in a usable format.

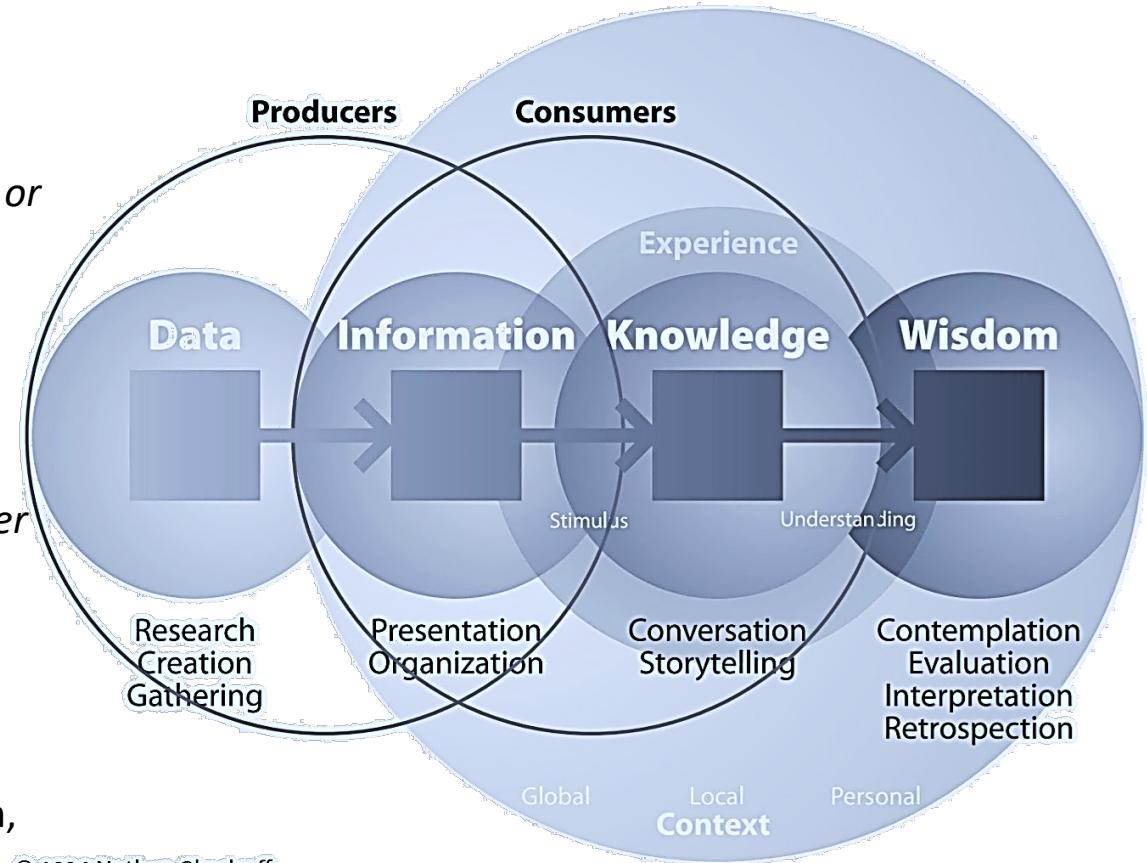
For example, the National Health Service in the UK can take data on cancer incidence in many populations, compare rates over time and geography, and represent trends to be examined.

KNOWLEDGE

Knowledge is the process by which we examine information to find out how it can be used to formulate and test hypotheses, take decisions, plan, do actions

WISDOM

The acquired knowledge and expertise from the data, allow us to **judge the data** and critically evaluate their quality, meaning, application.



© 1994 Nathan Shedroff

The continuum of understanding and information visualization

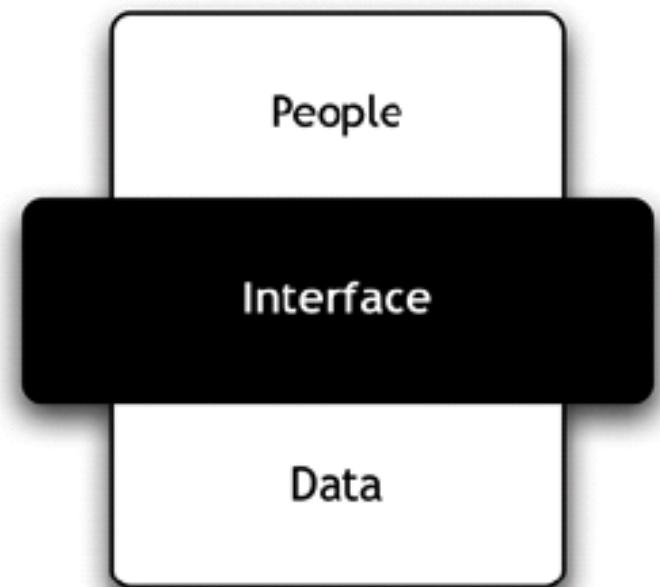
HCD | CORE PRINCIPLES

We make experience through interfaces

The user interface is the **representation** of a system's features (functions, data, content) in a way that allows the user to turn intention into action.

It is the surface level of the system where **data and information are made available as sensorial phenomena** tailored for human perception, cognition and action.

The interface is a communication tool, applying conventions and rules enabling the person to experience the system/service (through its representation).

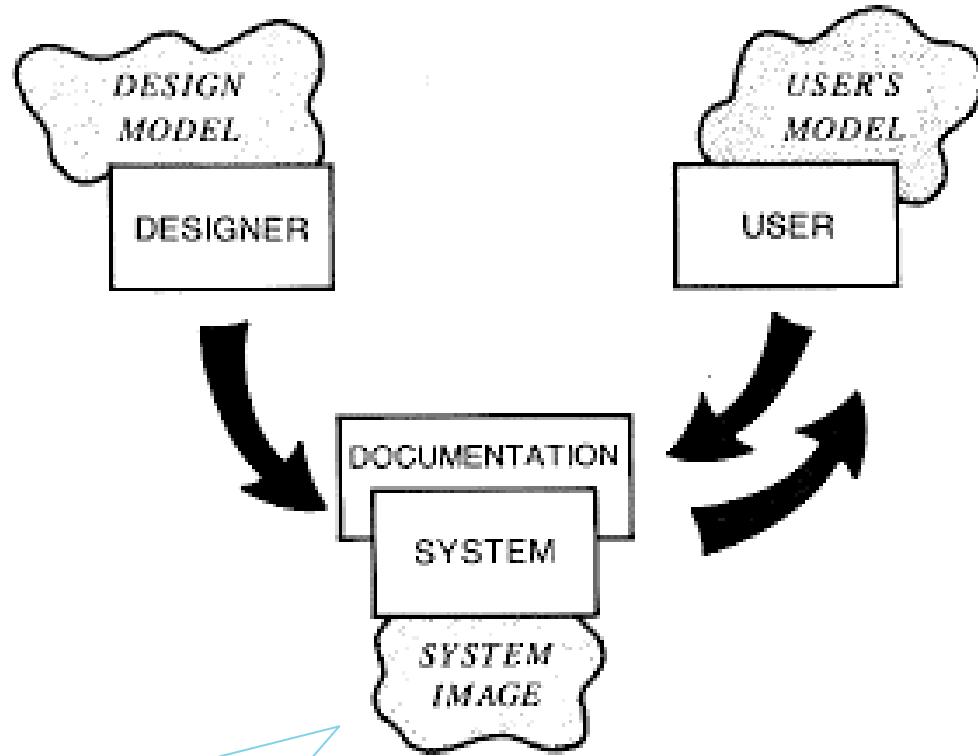


1 project, several mental models

We all create mental models that explain and organise our actions and interactions with the world.

The mental models we create derive from **what we can perceive of a system, its structure and visible behaviours.**

If the system image is incomplete, inadequate, or inconsistent, a weak usage experience will occur.



*The system image is the mental model materialised by design activities, and that will be developed.
It is like a text open to interpretation*

Norman, D.A. The Design of Everyday Things, Basic Books, 1988; 2019

From data to experience

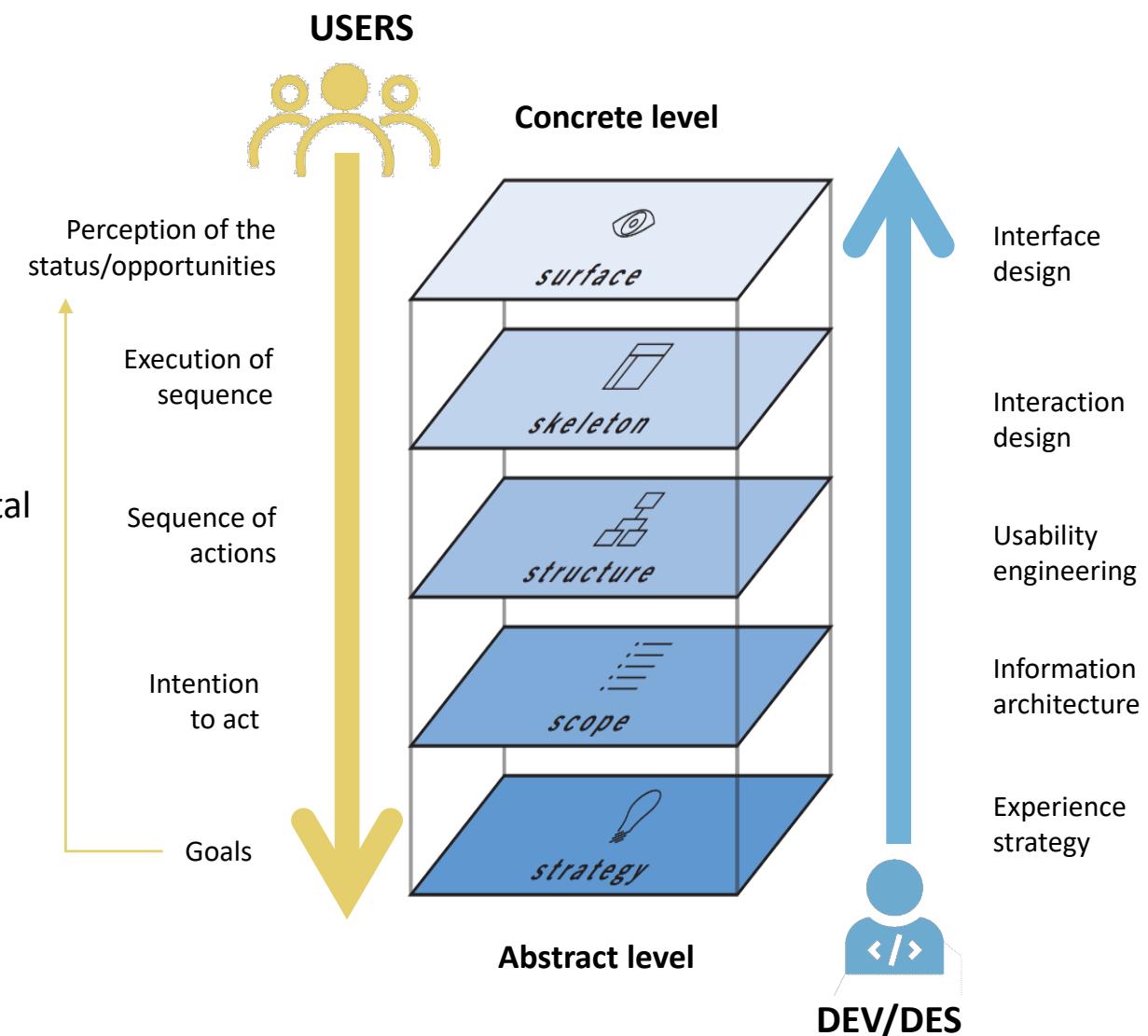
Design and use share the same path, that is twofold:

The users go **FROM CONCRETE TO ABSTRACT**

The designers/developers go: **FROM ABSTRACT TO CONCRETE**

If the perceptible elements will not adequately «explain» the conceptual model behind, the user will get to a dysfunctional mental model of the system/service.

DESIGN BEFORE STARTING DEVELOPING.



The Human Centred Design approach

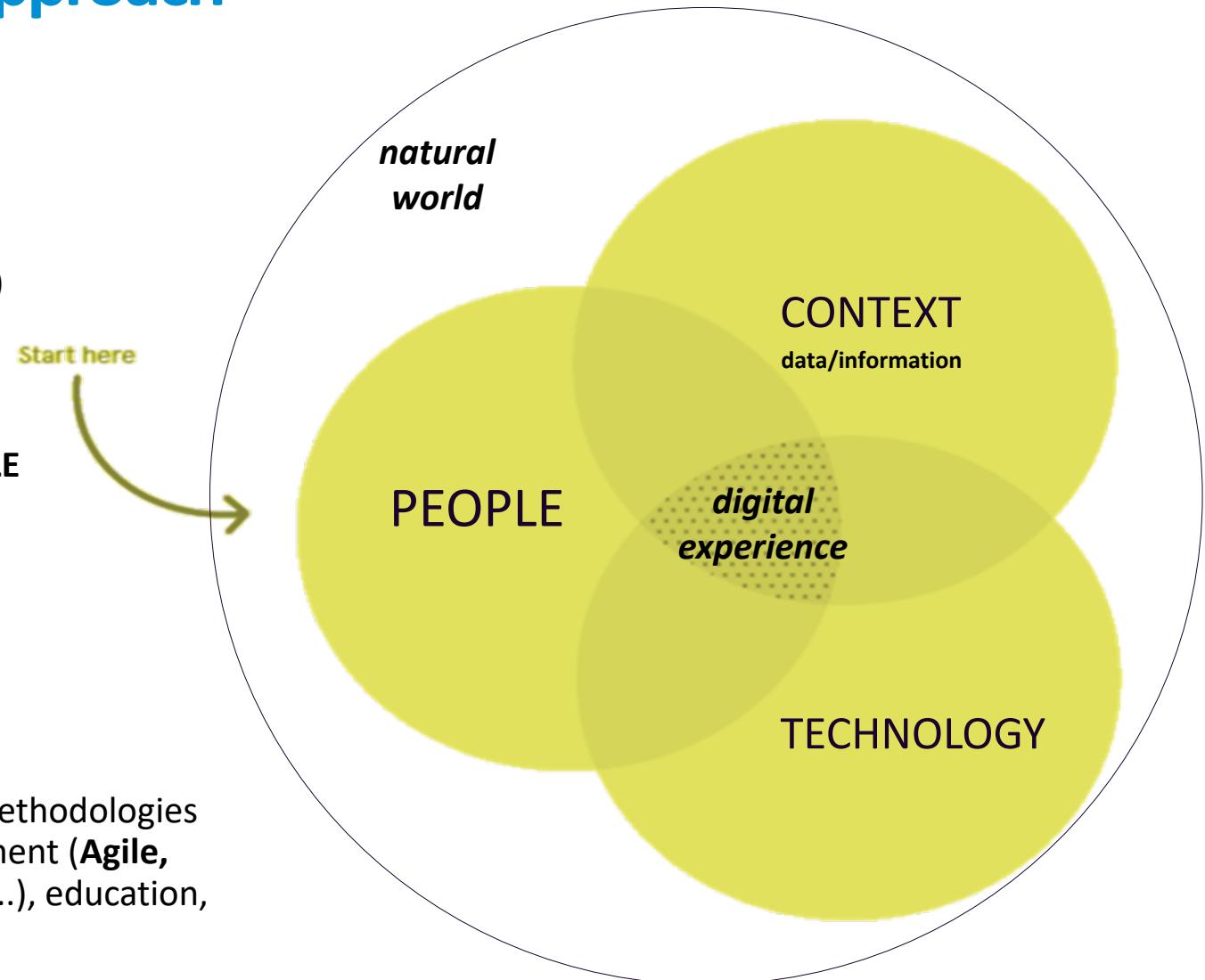
The **Human Centered Design** (HCD) is a design approach defined by the psychologist Donald Norman's seminal work.

It reinterprets the human-computer interaction (HCI) in a psychological key, widening the **focus** from the product/system to the **people who use it**.

In this perspective, **EVERY SYSTEM INCLUDES PEOPLE** interacting with it a specific context. Here, data and information works as **SOCIAL CONSTRUCTS** that human beings generate, use, exchange, and enrich them.

The approach is the common background of many methodologies worldwide applied in the fields of software development (**Agile, Lean, Scrum**), design (**Design Thinking, UXD, Sprint ...**), education, social innovation, ...

It is also formalised in several ISO Standards.



Widen the perspective

Google Design

“Designers must be embedded in engineering and coding teams to keep the AI and machine learning efforts real—to keep them part of the world.”

Paola Antonelli
MoMA's Senior Design Curator



IDEO

Data science is a discipline of human-centered design.

“When data science, interaction design, and engineering experts come together, we’re able to introduce radically new experiences and systems.”

DEAN MALMGREN
PARTNER, IDEO CHICAGO



“Not keeping into consideration the **relationship between the digital tools** we create/develop/manage and **human behaviours**. Keep on leaving those **relations misunderstood and uncontrolled**, might have **unintended consequences** and encourage the development of **very negative phenomena** for individuals, communities and populations.”

[Dovremmo studiare meglio gli effetti dei social network sul comportamento collettivo – Il Post](#)



Human Centred Approach mindset

HUMAN CENTRICITY

People are an integral part of the system. The design and development process must incorporate the needs and perspectives of **direct and indirect beneficiaries**.

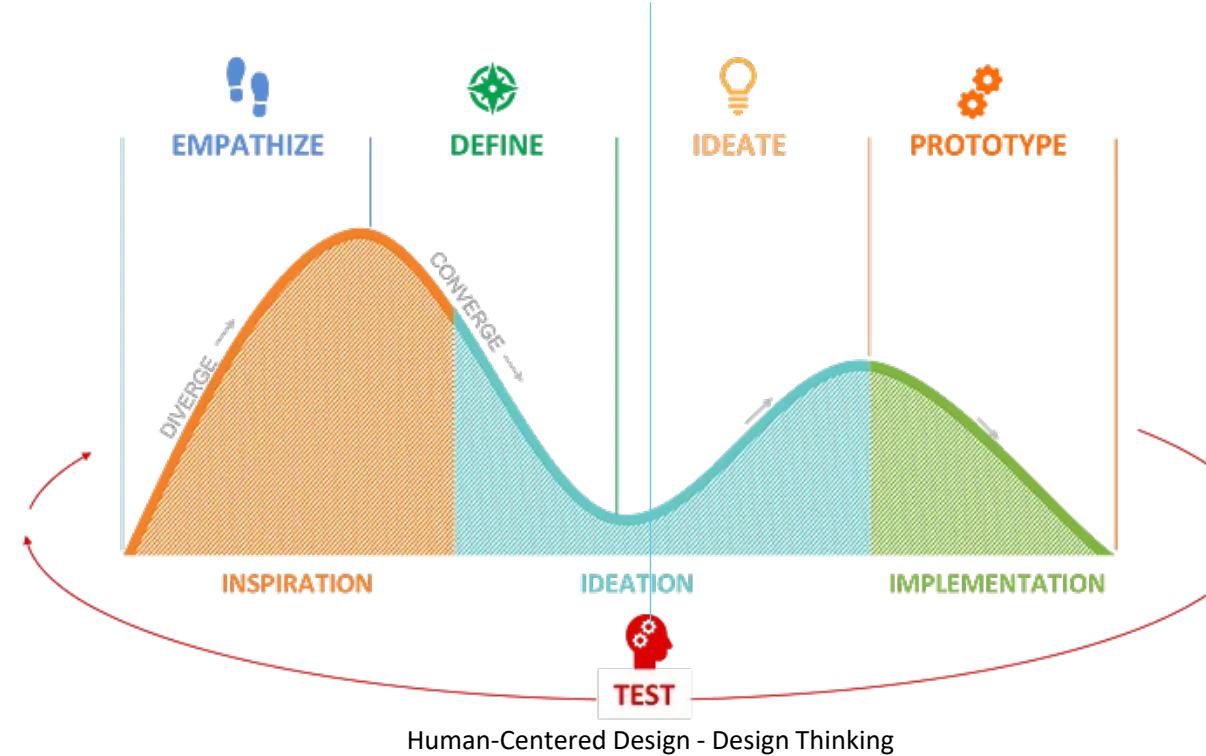
ITERATION AND FEEDBACK

Start by design, then develop. Then test and design again.

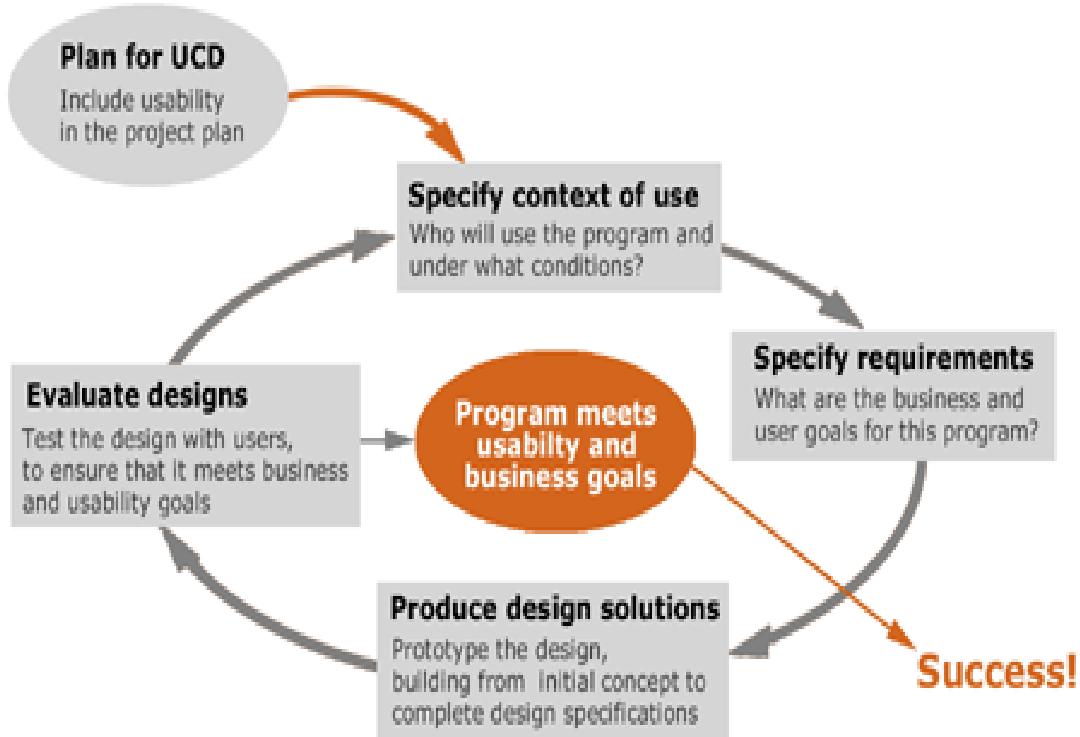
Test during the development, to create space to make **mistakes**, learn from different perspectives, progressively improve, and take better decisions.

DATA-DRIVEN APPROACH

Be consistent and stick to the real context, and collect data from the field. Combine big and small data (qualitative) to know the ecosystems in dept. Keep in consideration the **human variability** factors, to be inclusive and exhaustive.



The final aim



The User Experience

NORMA ITALIANA	Processi di progettazione orientata all'utente per sistemi interattivi	UNI EN ISO 13407
	Human-centred design processes for interactive systems	GENNAIO 2000

The standard provides guidance for **user-oriented design activities** during the whole life cycle of the interactive systems. It focuses on the design process management and provides guidance to reach and assess the ultimate goal of the user-centred design process: usability, more recently updated in terms of user Experience (UX).

USER EXPERIENCE

ISO 9241-210 (2020)



The user experience or UX includes aspects of **quality** and **fluency** of the entire experience flow (**expectation, use, memory**), compatibly with the users' cognitive, emotional and contextual specificities.

BEFORE USE

Beliefs, emotions, anticipating thought, background, expectations, habits,...

DURING USE

Efficiency, effectiveness and satisfaction pursuing the goal.

AFTER USE

Memories, learnings, and emotional connection that remaining for a while/over time

USABILITY

ISO 9241-11 (1998)



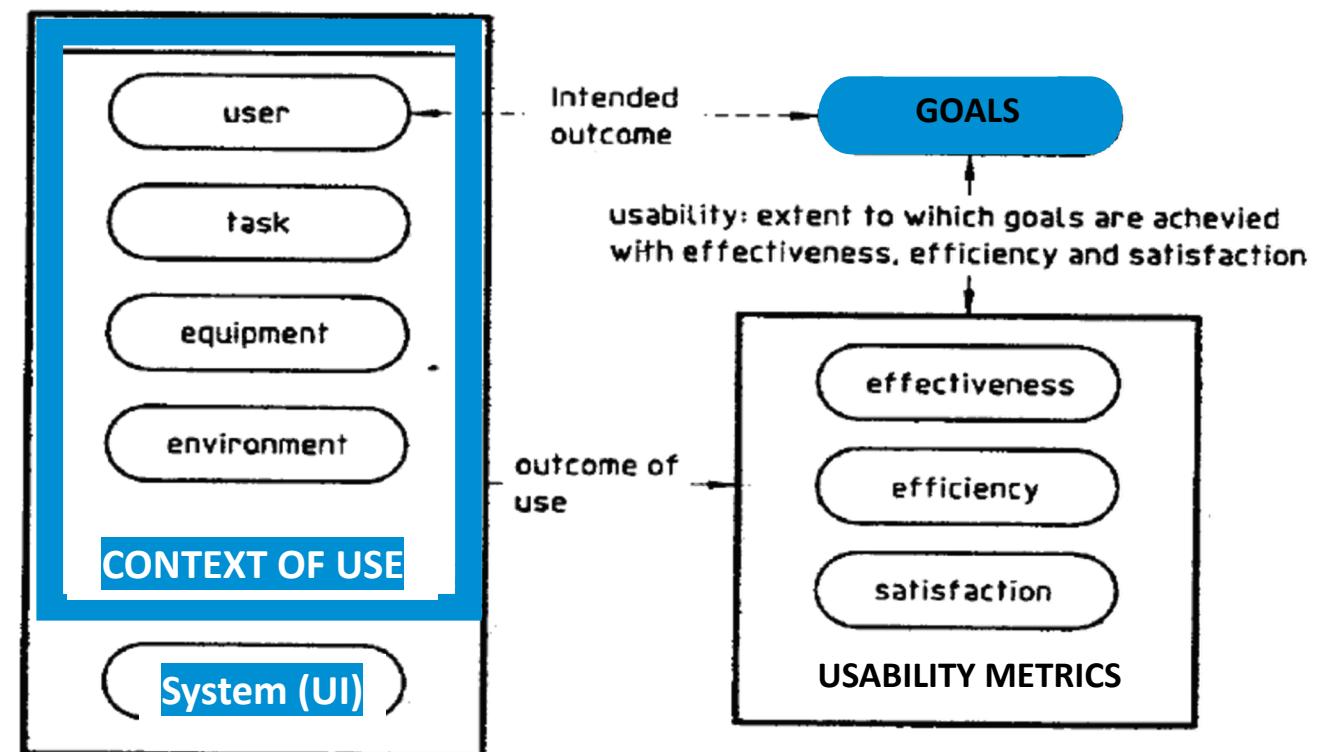
Don Norman: The Term UX



USABILITY

ISO 9241-11 (1998)

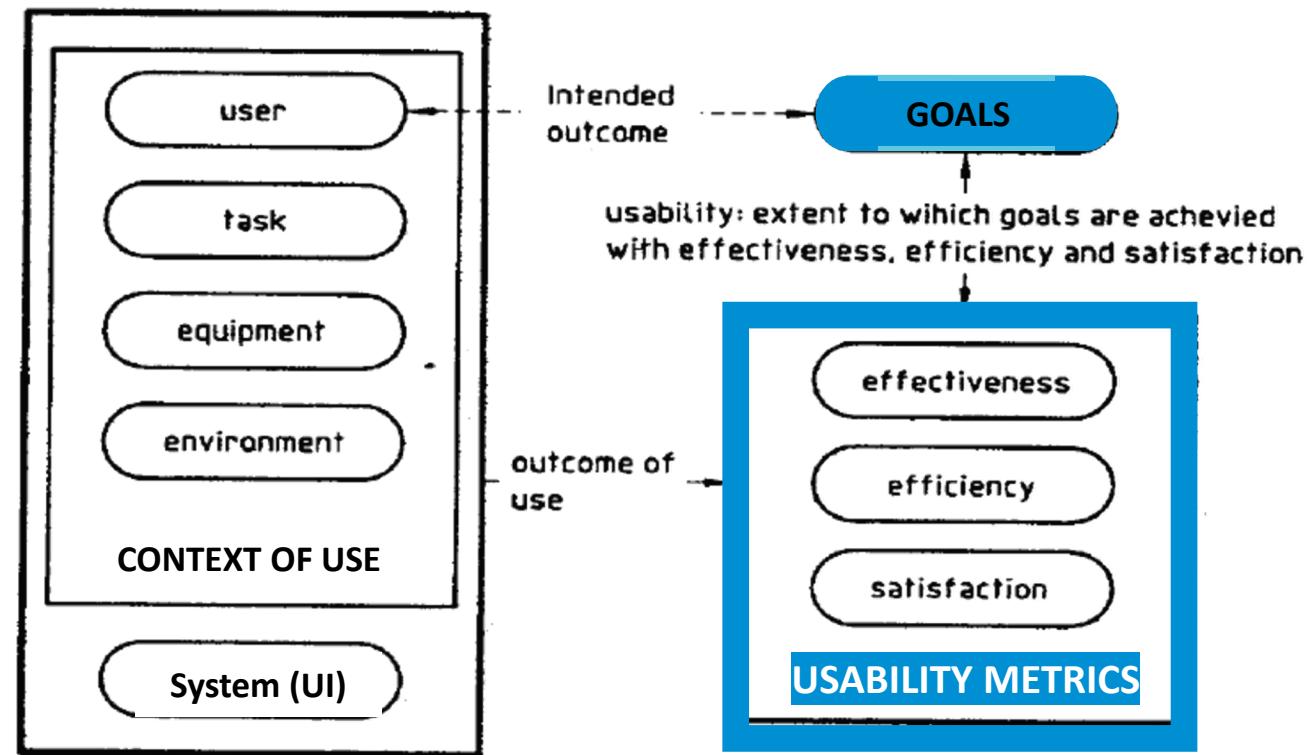
The extent to which a system/product can be used by **specified users** to achieve **specified goals** with **efficacy, efficiency, and satisfaction** in a **specified context of use**.



USABILITY

ISO 9241-11 (1998)

The extent to which a system/product can be used by **specified users** to achieve **specified goals** with **efficacy, efficiency, and satisfaction** in a **specified context of use**.





Efficacy

The extent to which a person correctly and completely achieves the goal through the system.

→ Goals completeness, Accuracy



Efficiency

The amount of resources spent by the person to reach a goal.

→ Execution time, Nr. and types of errors, Nr. of steps, clicks, Repeated tasks



Satisfaction

The degree of comfort/absence of frustrations related to the use of the system. It is also influenced by aspects such as visual style and human-machine dialogue quality.

→ errors, appreciation, lack of frustration,...



They are offered through properties such as:

- Feedback
- Transparency
- Visibility
- Consistency
- Reversibility
- Controllability
- Flexibility

Efficacy

The measure of **accuracy and completeness** of the achieved results.

The system is effective if allows one to carry out the established task **comprehensively and accurately**.

METRICS:

- Total or partial achievement
- % of involvement and use

It's not enough to count downloads or access....



2 examples



Torino: 1.101 strutture trovate

NH Torino Santo Stefano Favoloso 8.7
Centro Storico di Torino, Torino · Mostra sulla mappa · 0,5 km dal centro · 3.154 recensioni · Posizione 9,7

Hotel Alpi Resort Buono 7,9
Centro Storico di Torino, Torino · Mostra sulla mappa · 1 km dal centro · 3.616 recensioni

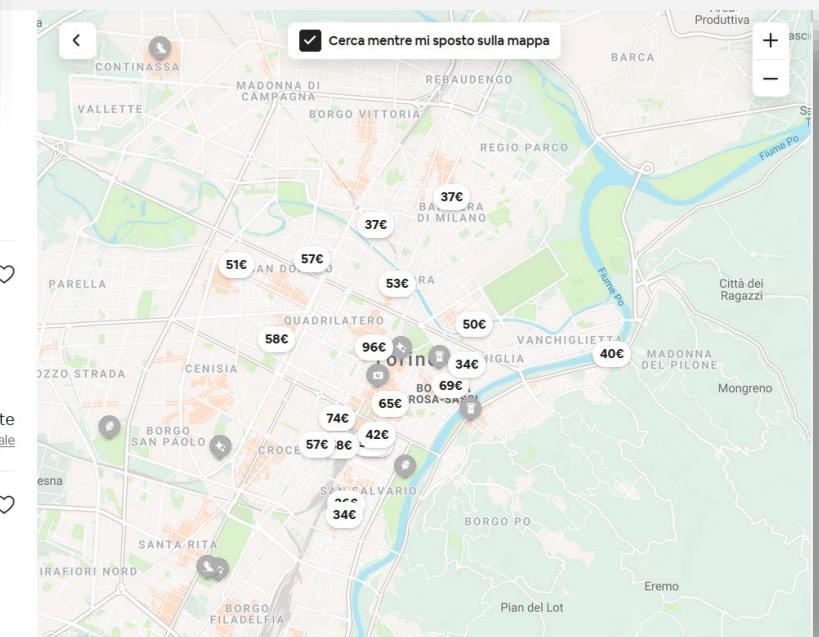
TORINO: alloggi

Cancellazione gratuita · Tipo di alloggio · Prezzo · Prenotazione immediata · Più filtri

Torino: date più richieste. Le ricerche per queste date sono aumentate (144%) rispetto alla media degli ultimi 6 mesi.

SUPERHOST CAVI Incantevole Mansarda nel centro di Torino
Intero alloggio: unità in affitto a Torino
2 ospiti · 1 camera da letto · 1 letto · 1 bagno · Wi-fi · Cucina · Riscaldamento
36€ 34€ / notte 232€ in totale
★ 4,68 (19 recensioni)

SUPERHOST Appartamento indipendente 50mq
Intero alloggio: unità in affitto a Torino
2 ospiti · 1 camera da letto · 1 letto · 1,5 bagni (anche di servizio) · Wi-fi · Cucina · Lavatrice · Riscaldamento



Efficiency

The measure of individual **cognitive resources** employed in achieving the goal.

The more efficient the system, the more it reduces the mental load of the user.

METRICS:

- number of errors the user makes in completing a task
- time spent to reach the goal
(the faster, the more efficient)
- Errors

Efficacy VS Efficiency



2 examples



Satisfaction

It is the most complex dimension to reach and evaluate.
It concerns the LEVEL OF COMFORT and GRATIFICATION
that the user experience offers.

A system can work very well but it is not enough.
IT MUST BE EASY TO USE, PLEASANT AND ENGAGING.

*«Cognition is understanding,
Emotion is interpreting the world»*



Satisfaction layers



Reflective satisfaction:

It orients the user choice according to the memories, the values evoked (e.g., prestige, solidarity, eco-compatibility, ...). Design for reflective satisfaction focuses on the long-term experience (e.g., customization, feedback, follow-up)

Behavioural satisfaction:

It results from the lack of frustration or friction during the use. It derives from the performance of the service and the capability to meet the expected effectiveness.

Visceral satisfaction:

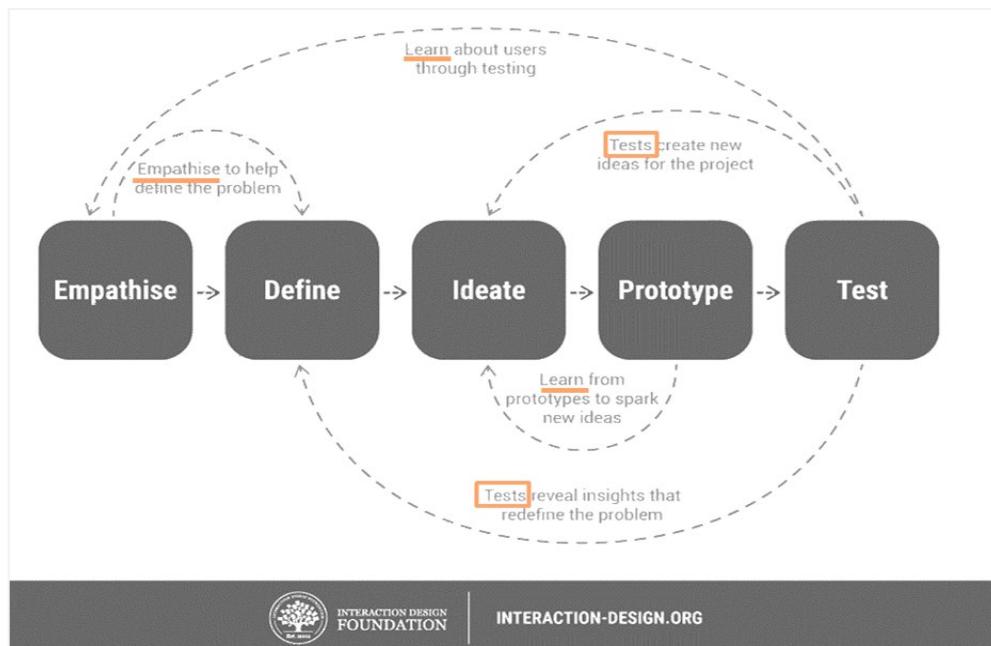
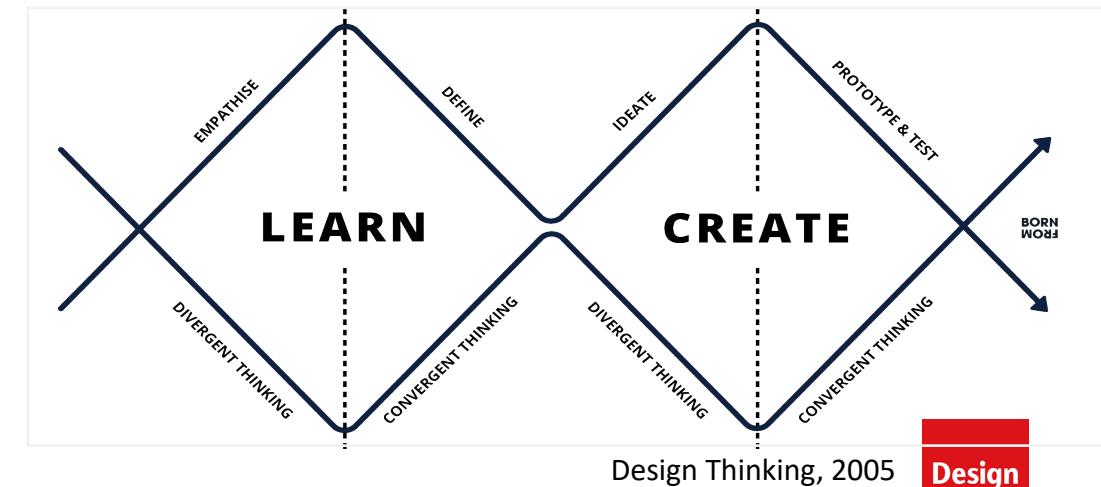
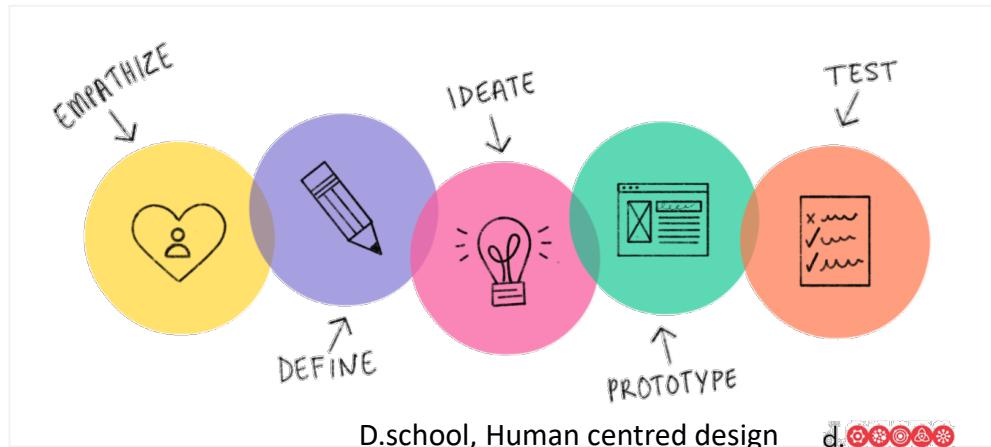
Springs from the first impact and the sensorial signals perceived and processed as pleasant, positive, safe....

<http://www.nathanlucy.com/blog>



HCD | PROCESS and TOOLS

1 approach, many methodologies



HCD | Steps and tools

The macro-process scales up the core process:
in every step, you will learn, ideate and test.



H

HEAR: Study, Visit, Listen, Observe, Ask

- Define the problem
- Map the context
- Know user characteristics and needs



C

CREATE, compare, draw

- Design big vision and details before starting to develop
- Design the interaction
- Test alternatives



D

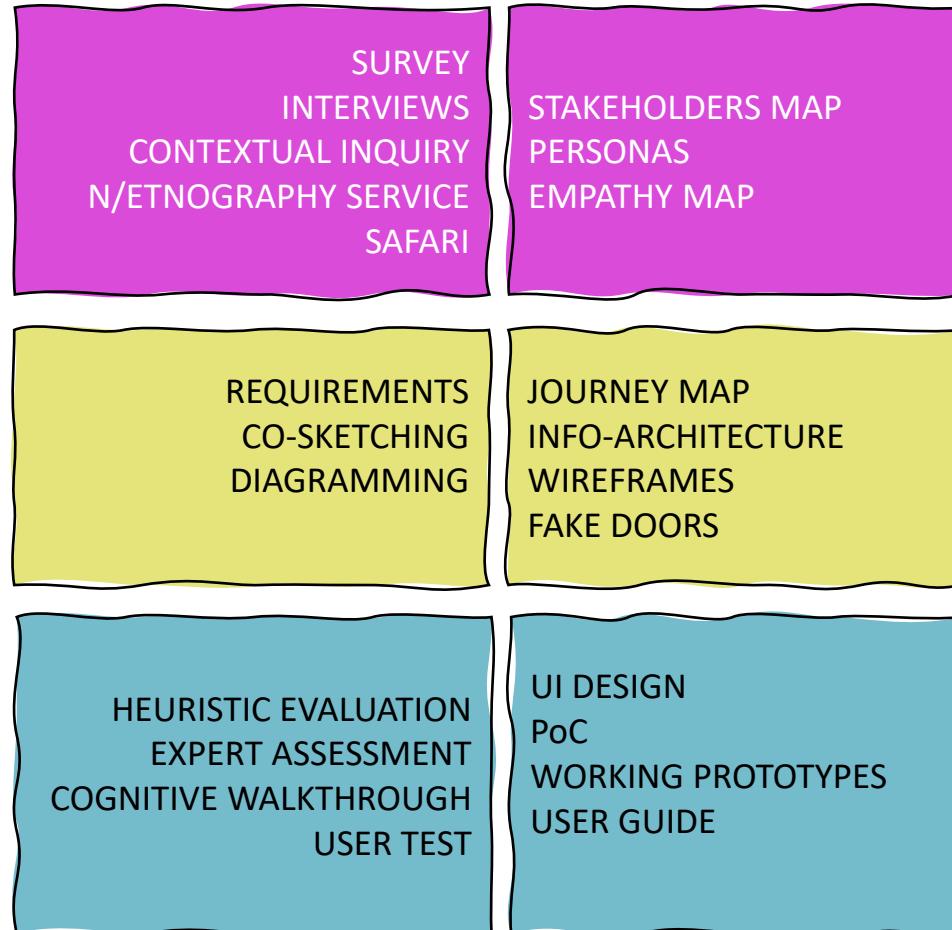
DEVELOP, Test, Refine, test, Describe, Evolve

- Test the development
- Test with users
- Also design the support



Tools to:
Know, Design, Share, Refine

DATA COLLECTION + **DATA DISPLAY**

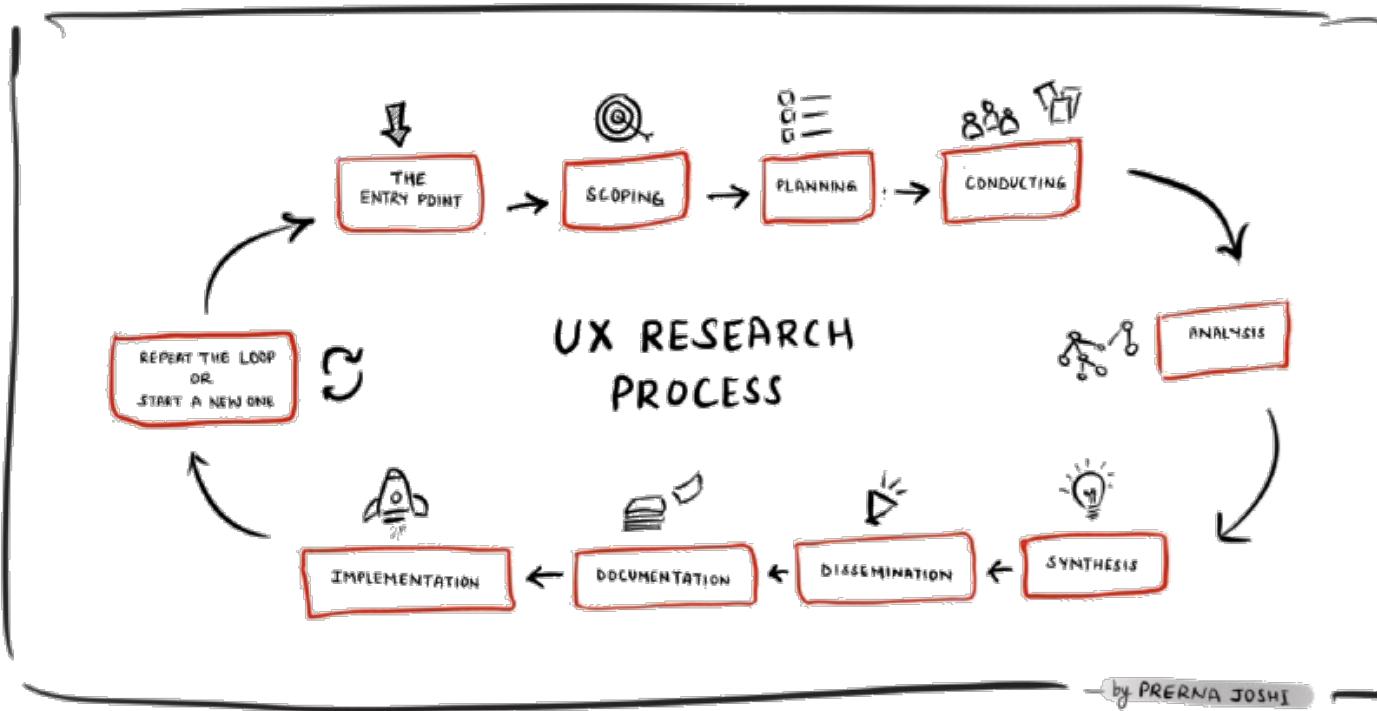


User Research | Reasons why



User Research activities begin very early and last throughout the whole design and development process. to:

- To gather useful information to bring **real benefits** to people
- Know the contents of existing **mental models** associated with specific tasks (needs & wants)
- Detect and **mitigate distortions** in data collection and processing
- Identifying cultural links
- To **set up the project** correctly and do not stop delving into it and check



User Research | Common complaints



«We already know our users»

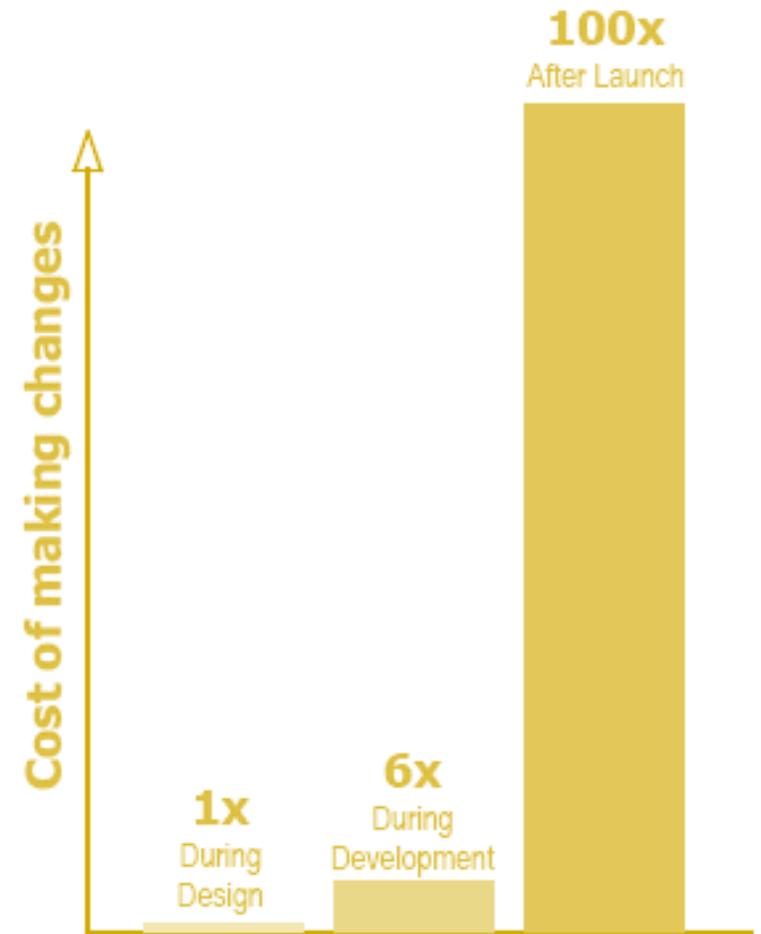
Any one of us has **preconceptions and cognitive biases**. Investigating real users' perspectives allows us to identify solutions better replying to different target needs. We don't have enough experience and knowledge to deal with the variability of human factors.

«We already search with users»

User research for design purposes is often confused with market research: they are both focused on knowing consumers and share many tools, such as interviews, focus groups and surveys, but have different goals. Data collected from market research is useful, but needs to be **complemented by information about users' objectives, needs, tools, habits and context**. Individual needs and expectations cannot be standardized: depending on the context and situation, each type of user has different needs, even for the same service.

«It's too expensive and time-consuming»

Basing the project on data and continuing to test it brings proven economic benefits, savings for the recovery of design errors, and gains related to valuable experiences.

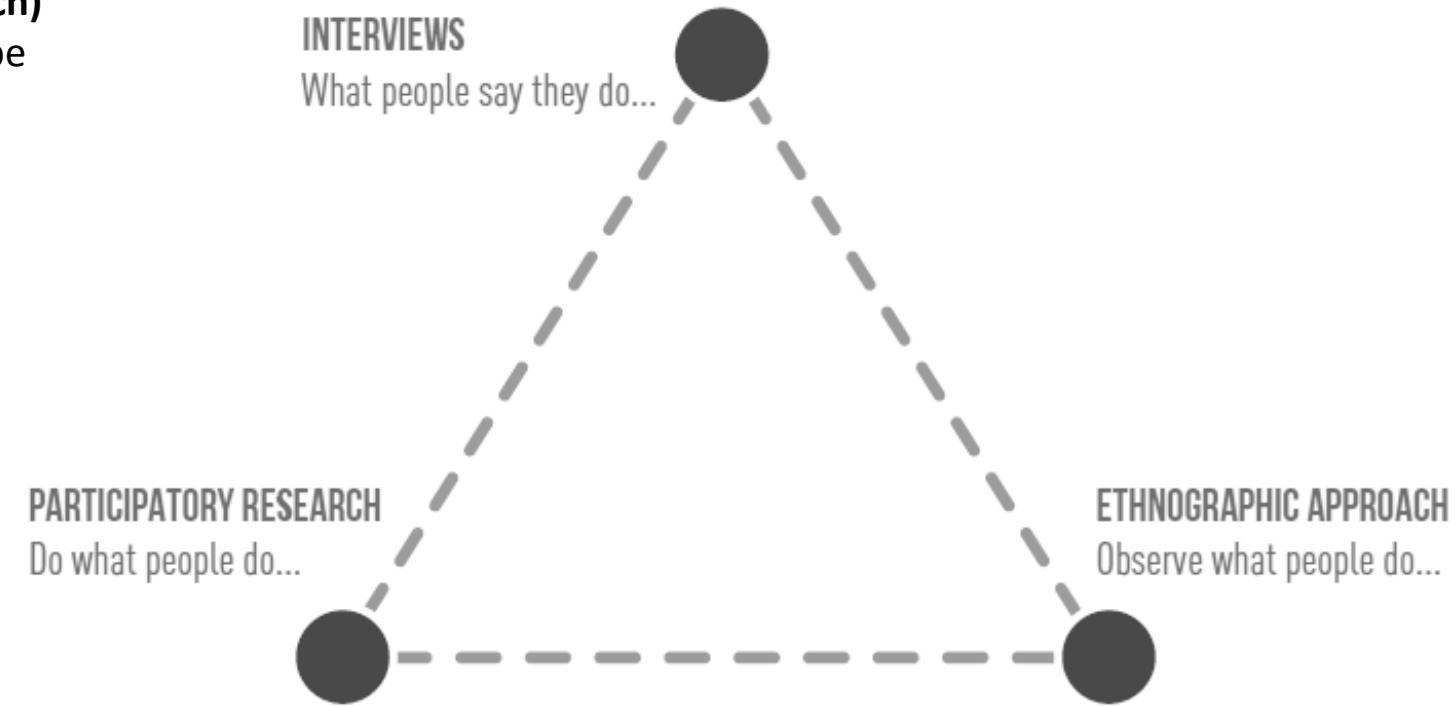


Data collection and triangulation



User research generates an in-depth understanding of the real needs of people and all the actors involved in the system.

To get a good enough understanding of the problem, ideally, **Big data (quantitative research)** and **Small data (qualitative research)** should be combined.



What information do we need?



Understand and Specify the context of use

- Characteristics of people that will use the system
- Tasks that people can do (operations, actions, activities in relation to objectives)
- Ambient or instrumental conditions (hw and sw)
- Needs and wants

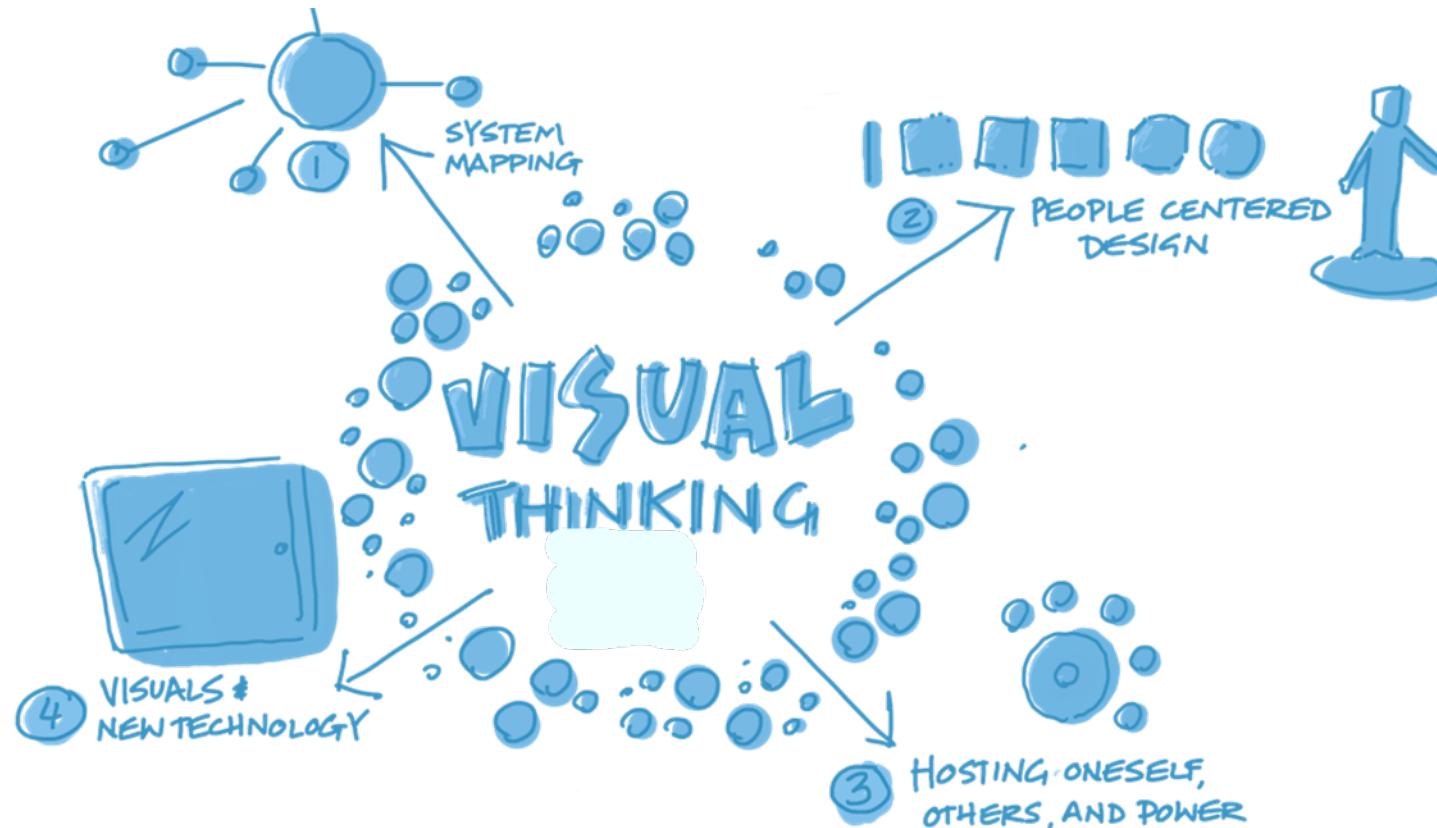
What information
do we need?

Users	Tasks	Equipment
User types Primary Secondary and indirect users Skills and knowledge Product skill/knowledge System skill/knowledge Task experience Organizational experience Level of training Input device skills Qualifications Language skills General knowledge Personal attributes Age Gender Physical capabilities Physical limitations and disabilities Intellectual ability Attitude Motivation	Task breakdown Task name Task frequency of use Task duration Frequency of events Task flexibility Physical and mental demands Task dependencies Task output Risk resulting from error Safety critical demands	Basic description Product identification Product description Main application areas Major functions Specification Hardware Software Materials Services Other Items

Visual thinking

It is a process in which thought, communication and coordination is stimulated and facilitated by visual representations: schemas, images.

DATA DISPLAY TECHNIQUES



STAKEHOLDERS MAP

PERSONAS

USER JOURNEY

Miro Board

We'll use **Miro Board** to work.

- Create your free account and take a tour.

www.miro.com

- Enter our board: <https://miro.com/welcomeonboard/>
- Complete the team portrait
- Add your interests in projects





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