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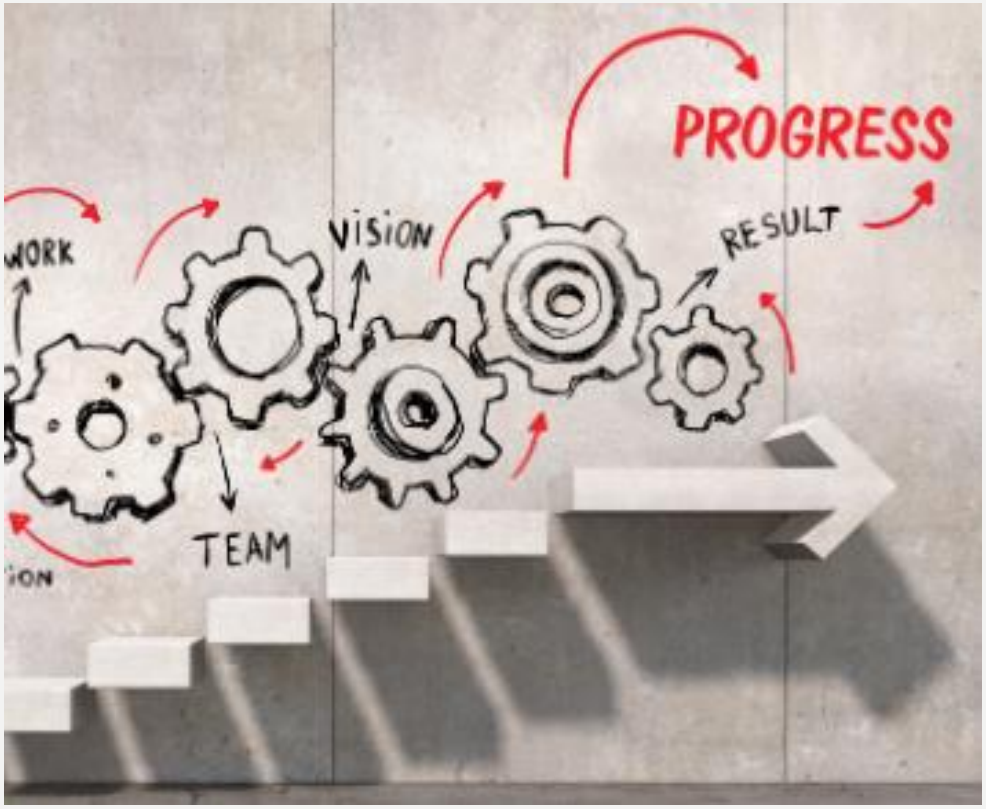


HUMAN – COMPUTER INTERACTION

Chapter 2

Methodology for Building User Interfaces (HCI)

2025- 2026

WHY METHODOLOGY MATTERS

Good UIs enable users to complete tasks

- effectively
- efficiently,
- safely
- with satisfaction
- learning to use the system quickly

HCI choices impact

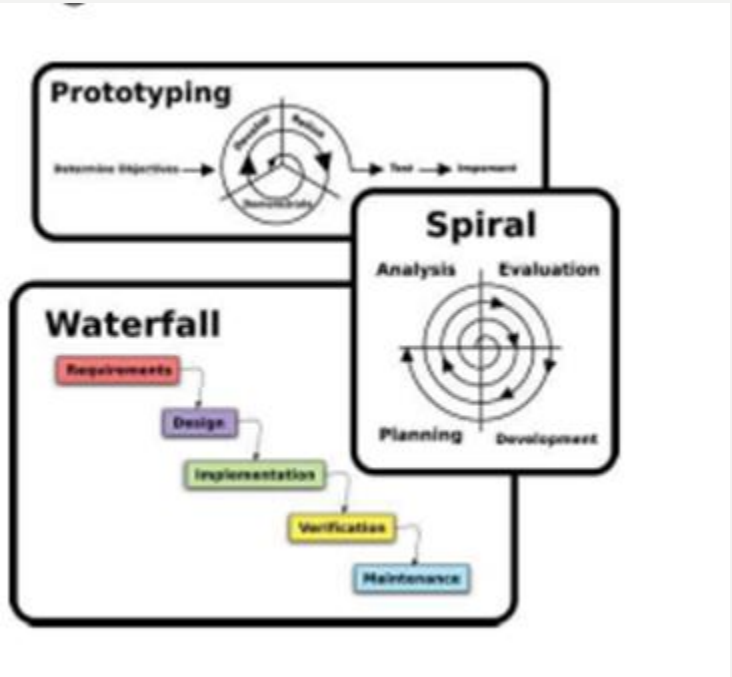
- **productivity**,
- **development & maintenance cost**,
- **training effort**.

Methodology reduces **risk** and supports **evidence-based** decisions.

SOFTWARE ENGINEERING DESIGN

Many design methods in software engineering:

- Merise
- Waterfall model
- V-model
- Incremental model
- Spiral model
- Agile methods (e.g., Scrum, DSDM)



Question : *Why not use these methods to build user interfaces (UIs)?*

SOFTWARE ENGINEERING DESIGN

- Some methods encourage involving the user during the design phase, but:
  - Limited user involvement (mainly at analysis and evaluation stages)
  - System-centered methods (focus on functional guarantees) at the expense of users
  - Late evaluation

⇨ We need a design method specific to HCI / user interfaces.

WHY HCI-SPECIFIC DESIGN METHODS?

User interfaces must be considered from the very beginning !

- Lower development and maintenance costs for the software
- Reduced project risk
- Productivity gains for users
- Reuse and improvement of core software components
- Lower budget and less training time for the software

CONSIDERING THE USER

One key to designing an ergonomic interface is knowing and understanding its users.

The human must be the central element in the design of a human–machine interface.

User involvement should begin early, from the analysis phase of a software project, and continue through all stages of the development cycle.

HUMAN FACTORS

Perception

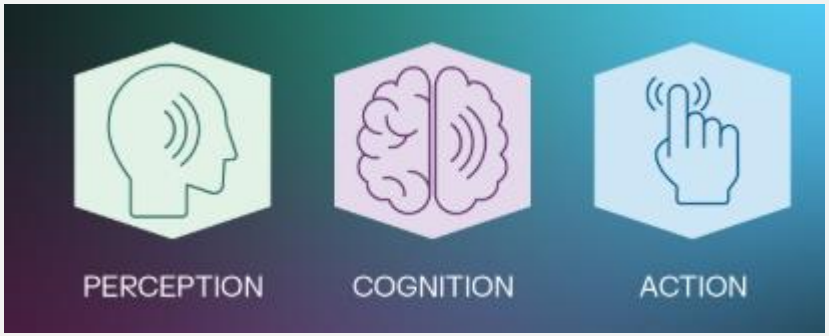
- Vision
- Audition
- Touch

Action

- Motor
- Control
- Speech

Cognition

- Attention
- Memory
- Learning, problem-solving).



→ shape interactions to match users' capacities and limits

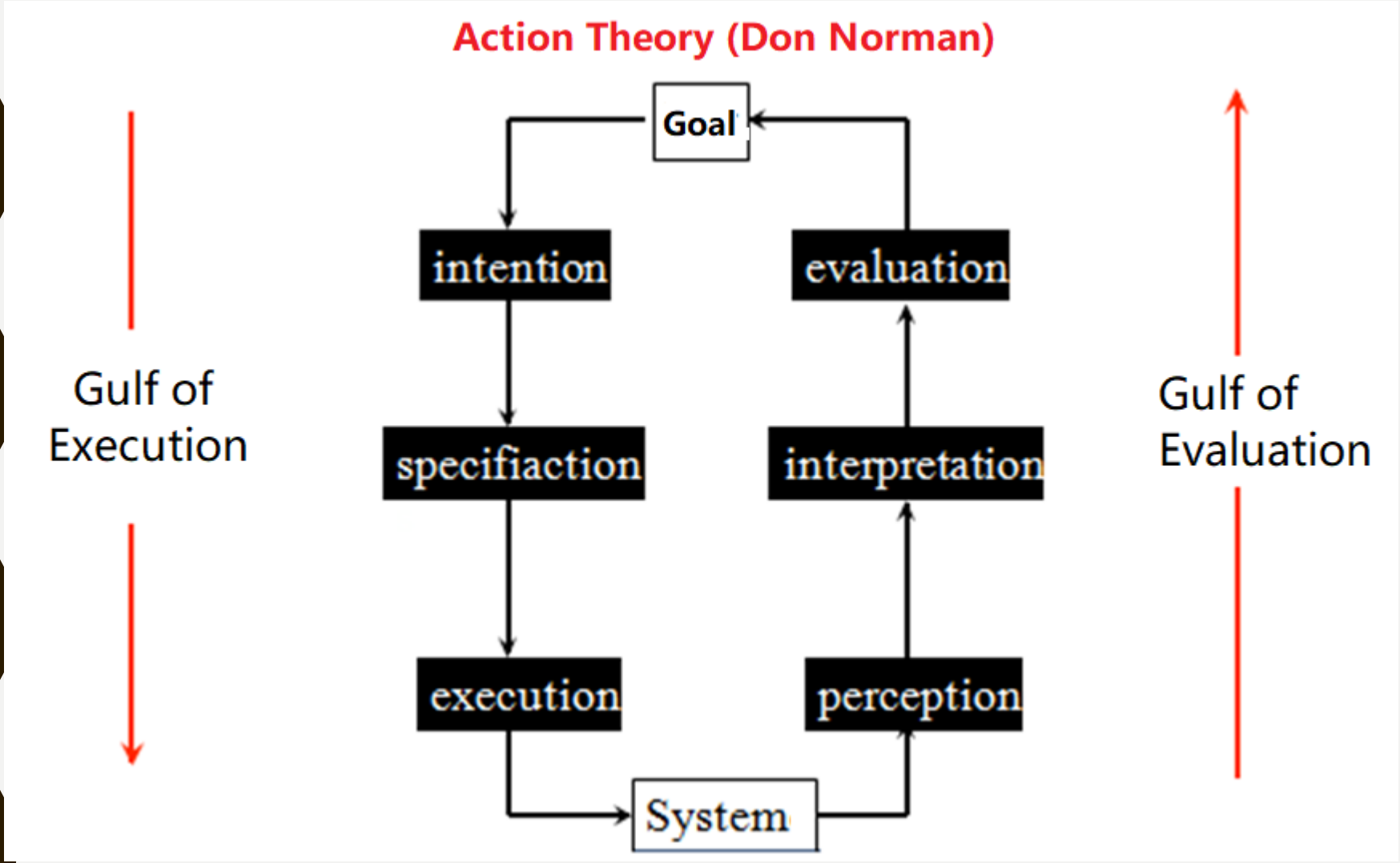
PROBLEM SOLVING

"Problem solving" often suggests intense intellectual work; in psychology it refers to any activity aimed at reaching a goal starting from a current situation.

Examples:

- Looking for where you left your watch
- Deciding what to eat tonight.
- Proving a theorem.
- ……

PROBLEM SOLVING: ACTION THEORY

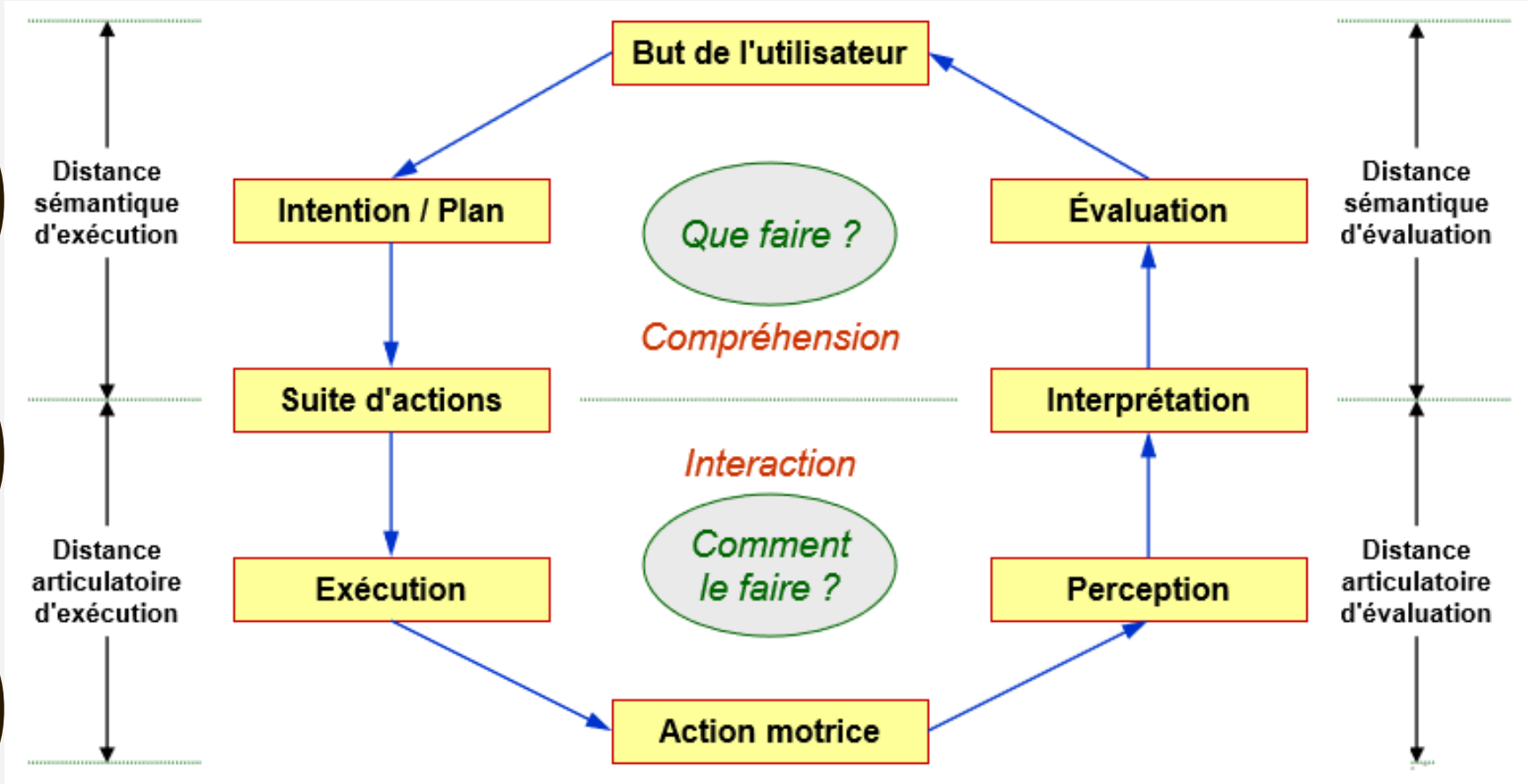


ACTION THEORY

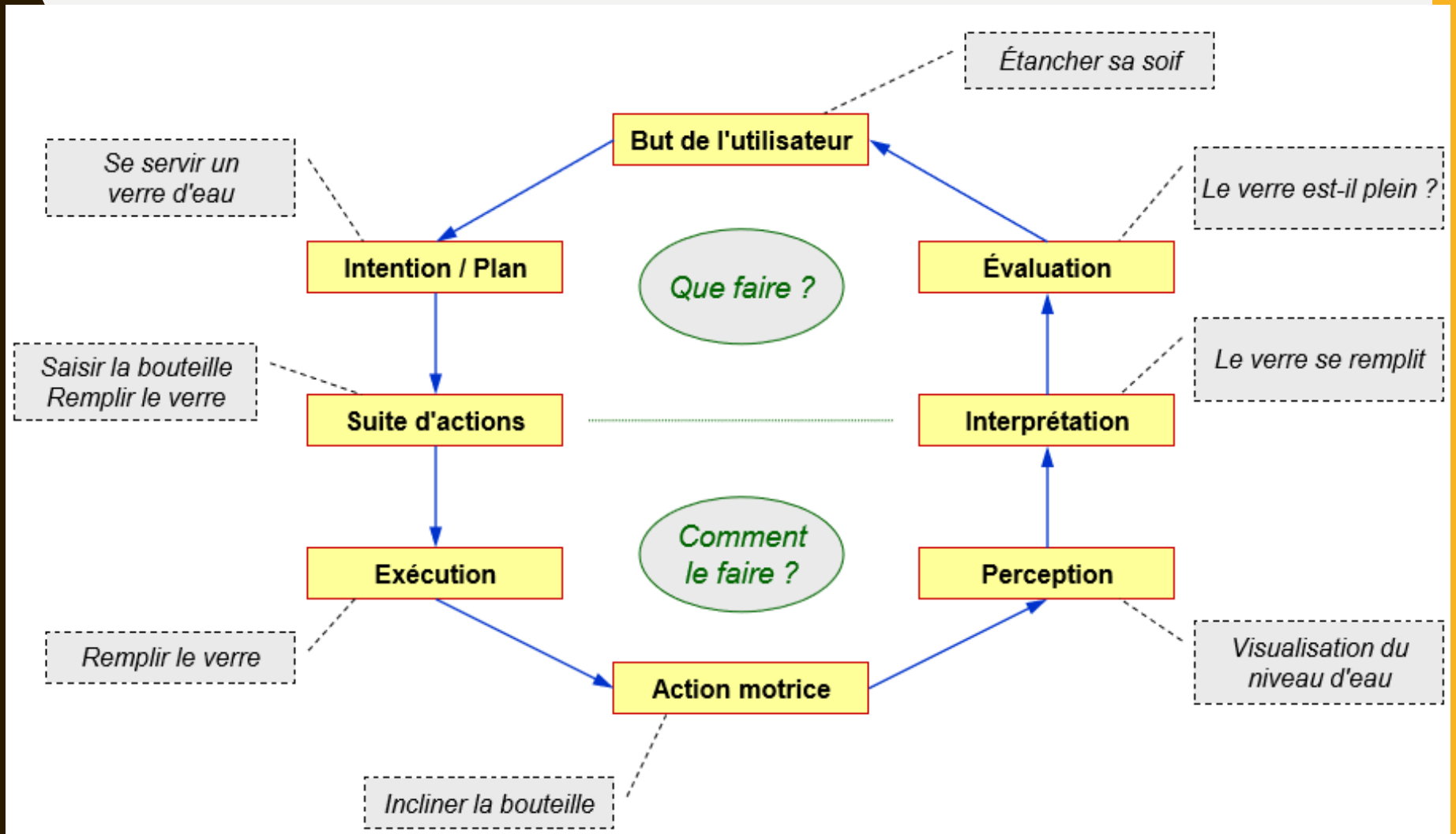
We distinguish two layers in the action cycle:

Understanding the system (planning and evaluating the result)

Interacting with the system (executing the action and perceiving the outcome)



EXAMPLE OF AN ACTION-EVALUATION CYCLE



DESIGN APPROACHES

Tech-centered approach

- Development focused on the machine and its technical possibilities
- The user must adapt to the machine
- A common temptation for developers:

Impose the technologies they like

Prioritize systems that are technically efficient

Human-centered approach

- Focused on people and their uses
- The machine must adapt to users' activities
- Requires developers to understand user needs, the context of use, etc.

ERGONOMICS & USABILITY

Ergonomics: the science of work and human activity.

From Greek **ergon** (work) and **nomos** (rules).

Focus on human factors.

Its aim is to understand human–system interactions and to optimize both people's well-being and overall system performance so that systems are:

- Effective
- Reliable and safe
- Supportive of users' health
- Supportive of the development of users' skills

OBJECTIVES OF ERGONOMICS

People-centred objectives

- Health
- Safety
- Comfort, ease of use, satisfaction, pleasure

→ How to design systems that support the development of users' skills?

Performance-centred objectives

- Effectiveness
- productivity
- reliability
- quality

ERGONOMICS : EXAMPLE

Ergonomics =adapting an object/tool to its user

Screen-magnification software for people with visual impairments

HCI DESIGN METHODS

- Iterative design
- Incremental design
- Prototyping-based design
- User-centered design
- Participatory design
- Informative design (data-/evidence-informed)
- Design using personas and scenarios

ITERATIVE DESIGN

In each cycle, the design must be developed, refined, and tested. The test results from cycle n–1 feed into the design of cycle n.

The construction process is iterative:

- Suited to problems that are hard to specify upfront
- Design is neither strictly top-down nor bottom-up
- Development of partial/intermediate solutions
- New goals may emerge during development
- User feedback is taken into account—and can change over time!

INCREMENTAL DESIGN

Methodology based on delivering a first part, then a second, and so on.

- Work on one area of the interface until it is satisfactory
- Develop partial/intermediate solutions
- Take into account new goals that may appear
- Consider user feedback, which can change over time

Prototyping-based design

Definition

Wireframing / prototyping consists in creating preliminary and intermediate versions of the interface before freezing specifications for the final product.

Mockups vs. prototypes.

Mockups are often throwaway versions used to explore layout and flow.

Prototypes are usually interactive and sometimes built on the same technical stack as the final product.

In UI practice, the two terms are often used interchangeably.

Fidelity. The fidelity of a mockup/prototype is its degree of resemblance to the final interface in visual design and interactivity.

- **Low-fidelity:** simple sketches, paper models
- **Mid-fidelity:** wireframes or mockups (layout only)
- **High-fidelity:** interactive, near-final versions

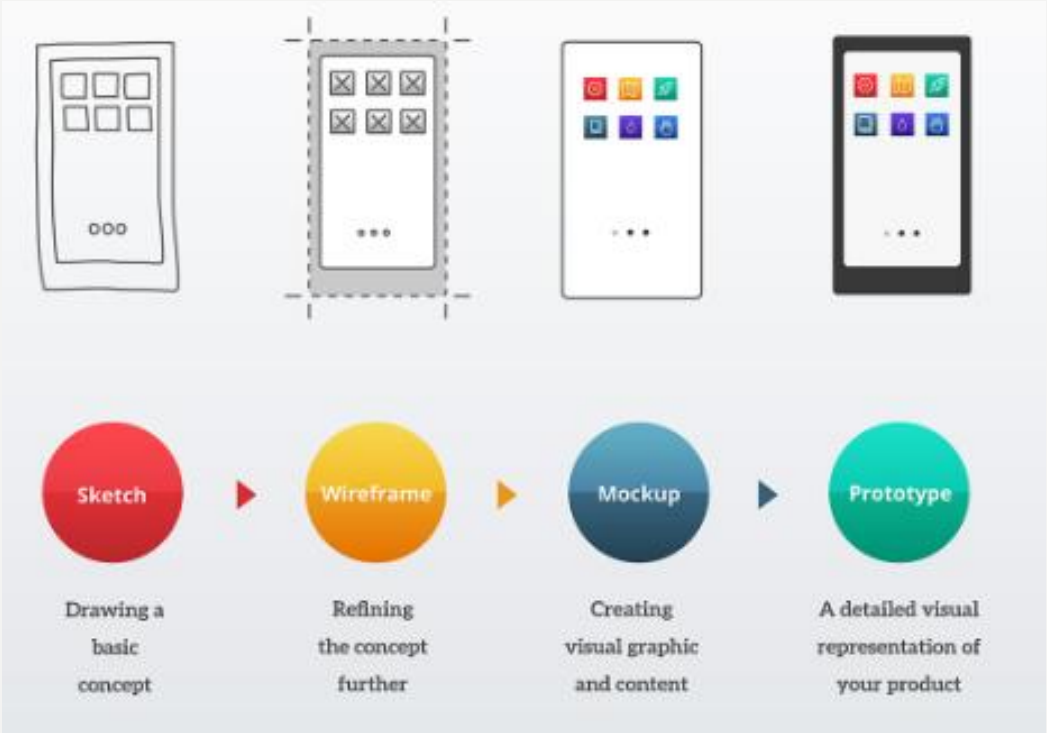
SKETCH ? WIREFRAME? MOCK-UP? PROTOTYPE

Getting to a final interface goes through several stages:

Sketch (croquis) = overall view of the interface (general idea)

Mockup / Wireframe (maquette) = detailed interface (no interaction)

Prototype = incomplete version of an interface (with interactions)



Types of prototypes

1) **Informal / paper prototypes**

Sketch screens on paper or with simple drawing tools.

Play through a scenario and try variants for design choices:

High level: decide which features are available.

Mid level: draw a sequence of screens/flows.

Low level: explore icon and micro-interaction ideas.

2) Video prototypes

Create a short video that shows how the interface would be used.

Simulate features not yet implemented and key interactions.

3) Software prototypes (with tools)

Build clickable or code-based prototypes.

Examples: Figma / Adobe XD / Sketch (UI click-through), Axure (logic), or code in React / Flutter / SwiftUI (direct access to the interface).

PARTICIPATORY DESIGN

Participatory design is characterized by the active involvement of users in the design work. It is a user-centered approach that emphasizes users' active role in shaping the solution.

It relies on:

Observation and interviews

Scenario creation

Users as full design partners who can be a source of innovation and take part in final design decisions.

INFORMATIVE DESIGN

Taking users into account:

- Not only as testers,
- but without considering them full design partners.
- Originally proposed for designing with children.

Designer–user relationship:

- The user is part of the design team,
- but does not take part in final design decisions.

USER-CENTERED DESIGN (UCD)

- **Goal:** iterative design based on user experience analysis.
- **Three main phases:**

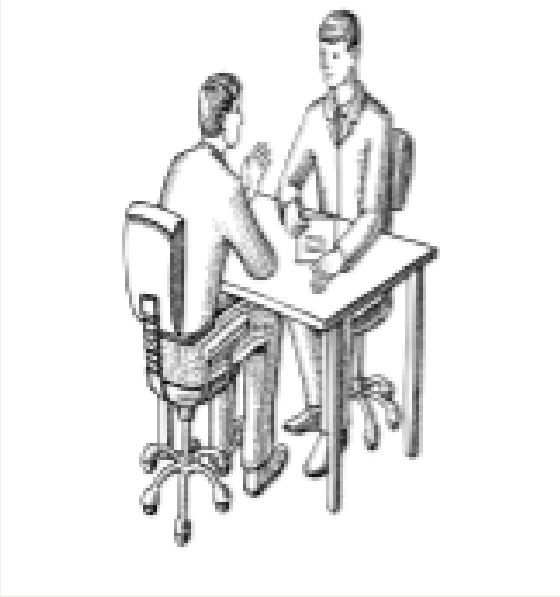
1. **Analysis:** understand users, context, and needs
2. **Design:** create mockups and prototypes
3. **Evaluation:** test usability and refine

PHASE 1 – ANALYSIS

- **Purpose:** define user needs and context.
- **Techniques:**
- **Interviews:** with representative users; qualitative data collection
- **Focus Groups:** group discussions (≤7 participants) to explore expectations
- **Task Analysis:** study how users perform real tasks
- **Context Analysis:** observe users in their environment (lighting, noise, tools, frequency of use)

INTERVIEW TIPS

- Use clear objectives and open questions
- Choose a representative sample
- Record observations accurately
- Gather subjective opinions and experiences



FOCUS GROUPS

- The focus group is a creativity tool that encourages idea generation and group reflection.

Steps:

- Introduction – explain purpose
- Discussion – collect opinions
- Summary – identify key insights

- Goal: reveal motivations, attitudes, and expectations.

TASK ANALYSIS

- Goal: understand how users accomplish activities.

Steps:

- Interviews to outline tasks
- Observation in real context

Results:

- Identify goals, actions, exceptions
- Structure interface: windows, menus, tabs, etc.
- Define displayed information and navigation logic.

CONTEXT (SITUATION) ANALYSIS

- Generally proceed through observation, interviews, or questionnaires conducted in the actual context of use (at the workplace).
- The information collected helps to adapt the software to the target user population. Identify user characteristics:
  - Computer literacy
  - Knowledge of the domain
  - Environmental factors (light, noise, gloves, etc.)
  - Frequency and duration of use
  - Planned training or support

→ Adjust the design to fit the target environment.

PHASE 2 – DESIGN TECHNIQUES

- Personas – represent user archetypes
- Card Sorting – organize information architecture
- Prototyping – iterative construction of interfaces
- Keep in mind: users are diverse → designs must adapt to all.

PHASE 3 – EVALUATION

- Purpose: measure interface usability.

Techniques:

  - Heuristic Evaluation / Ergonomic Audit: check design against known principles
  - User Testing: observe real users completing tasks
  - Perception Tests: assess comprehension and interaction comfort

- Goal: detect problems, collect feedback, and improve next version.

PERSONAS & SCENARIOS METHOD

- **Goal:** Understand how personas and scenarios help design effective interfaces
- One of the most powerful **HCI design methods**
- Combines **user research** and **storytelling**
- Helps designers create **empathy** and **realistic use cases**
- Supports design decisions focused on **user goals**

WHAT IS A PERSONA?

- **fictional but realistic character** representing a **group of users**
- Built from **research** (interviews, observations, surveys)
- Summarizes key **traits, goals, and frustrations**
- **A persona includes:**
  - Name, age, background
  - Goals and motivations
  - Skills and experience level
  - Frustrations or needs
  - Preferred devices or contexts of use

EXAMPLE PERSONA

- **“Sara” – Student Persona**
- Age: 21 – University student
- Goal: Keep track of book due dates easily
- Behavior: Uses smartphone daily, prefers simple apps
- Frustration: Forgets library deadlines
- Need: Quick notifications and renewal features

EXAMPLE PERSONA

Marie

23 ans

Célibataire

Paris (20eme)

Etudiante aux Arts Déco

Marie est une étudiante qui a prévu de fêter son anniversaire à son a
possédant ni CD, ni chaîne Hifi elle prévoit de gérer l'ambiance music

Equipements :

- PC portable, Windows XP Familial, Firefox 3.6
- Ecran 17 pources, résolution 1024x768 pixels

Habitudes :

Marie passe environ six heures par jour sur internet. Elle effectue principalement des reche
études et utilise le chat de FaceBook pour communiquer avec ses amis.

Relation à Grooveshark :

Marie connait l'application depuis peu. Elle utilisait auparavant Deezer mais à la dernière s
chez ses voisins, la programmation musicale avait été gérée par Grooveshark.

Scénarios types :

1. Rechercher par titre, par auteur ou par album des musiques pour la soirée.
2. Rechercher des musiques auquelles elle ne pense pas tout de suite dans le même gen
3. Constituer une playlist qu'elle lancera en début de soirée et laissera tourner ensuite.
4. Modifier la playlist en cours de la soirée pour y ajouter des musiques réclamées par ses

Lectrice

Allia : la prof

65 ans, Divorcée 3 enfants
Retraitée, ancienne professeur de Français, Boulogne

« La littérature française aurait bien besoin d'un petit remontant»

Sites clefs

- LeMonde.fr
- Picasa
- Projet Gutenberg (soutien pas utilisation)

N'aime pas

- Les fautes d'orthographes
- Les gens malpolis
- San Antonio

Biographie

Alia a été professeur de Français au lycée de Thiers pendant 40 ans. Plutôt découragée par le niveau d'orthographe et le faible vocabulaire de ses élèves, elle a tout de même continué à transmettre sa passion.. Avec un certain succès puisque plusieurs de ses élèves sont devenus des écrivains à succès. Aujourd'hui à la retraite, elle dévore des livres à longueur de journée. Elle est souvent déçue mais parfois un auteur ravive sa flamme.

Pratique informatique

- Dialogue avec Skype depuis que son fils lui a installé
- Evite les réseaux sociaux, trop souvent bourrés de fautes et de stupidité

Attente

- Aider de jeunes auteurs à s'améliorer
- Satisfaire sa boulimie livresque
- Dialoguer avec des gens civilisés et cultivés

En conclusion

Alia sera exigeante sur le contenu et la forme du site mais pourra beaucoup s'investir et faire avancer les auteurs.

WHAT IS A SCENARIO?

- A **short story** describing how a persona interacts with the system
- Shows the **context of use**, **goals**, and **expected results**
- Helps visualize **user flow** through the interface
- **Typical scenario elements:**
    1. The situation or context
    2. The user's goal
    3. The interaction steps
    4. The result (success or problem)

EXAMPLE SCENARIO

- Scenario for Sara:

- Sara opens the library app to renew a borrowed book.
- The app reminds her that the due date is tomorrow.
- She taps “Renew,” and a confirmation message appears instantly.

WHY USE PERSONAS AND SCENARIOS?

Advantages:

- Keep the design **focused on users**
- Encourage **empathy** and **realistic decisions**
- Guide **feature prioritization**
- Facilitate **team communication** (shared user vision)
- Improve **usability testing** (test with real-world use cases)

HOW TO CREATE PERSONAS AND SCENARIOS

- **Step 1:** Collect user data (interviews, observation, surveys)

  Step 2: Identify patterns and group similar behaviors

  Step 3: Build personas (profiles with names, goals, frustrations)

  Step 4: Write scenarios (short realistic stories)

  Step 5: Validate with the design team or users

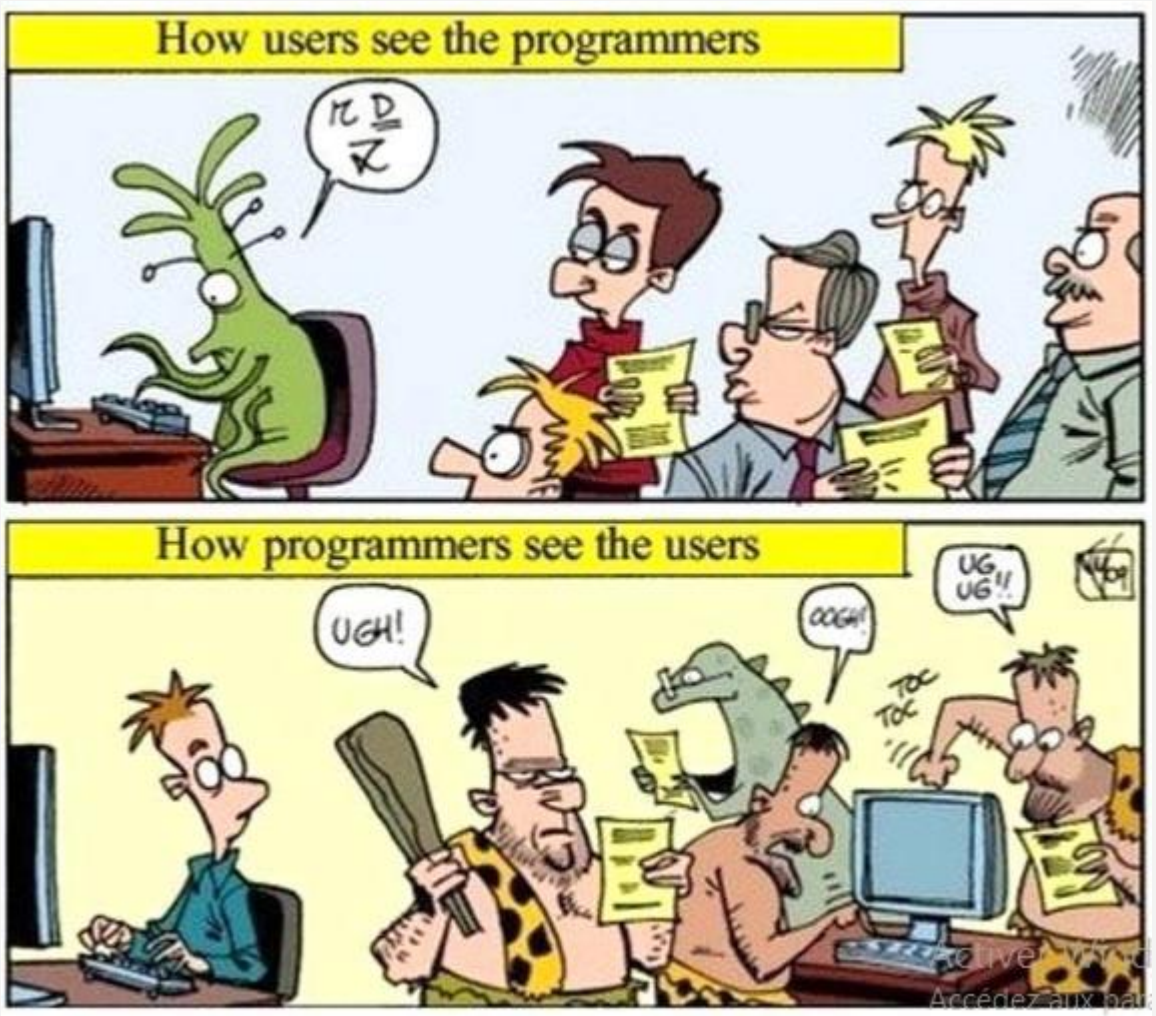
THE MAIN HCI DESIGN METHODS

Design Method	Main Idea	Key Features	User Involvement
Iterative Design	Design, test, and refine repeatedly	Each cycle improves the previous version	Users test prototypes each iteration
Incremental Design	Build the system step by step	Develop partial solutions, integrate gradually	Users give feedback per module
Prototyping-Based Design	Create early versions to explore ideas	Low-, mid-, or high-fidelity models	Users test and comment on prototypes
Participatory Design	Users co-design the product	Users join workshops, ideation, and decision stages	Very high — users are active collaborators
Informative Design	Users are consulted for feedback	Based on observation and interviews	Moderate — users inform but don't decide
Personas & Scenarios	Model users and use cases	Create fictional users and realistic stories	Indirect — user data used to guide design

DEVELOPER ≠ USER

Developers and users often have different perspectives.

- Misunderstandings create usability problems.
- Avoid assumptions — test with real users.
- "Each must take a step toward the other."



BEST METHOD?

- There is no single "best" method — they complement each other.
- Start with Personas & Scenarios to understand users.
- Use Prototyping and Iterative design to explore and refine ideas.
- Apply Participatory or Informative design to engage real users.
- Combine methods for a balanced, effective HCI process.

THANK YOU