



Vietnam National University of HCMC
International University
School of Computer Science and Engineering



UI/UX Design & Evaluation

★ What is HCI ★

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<https://vichithanh.github.io>

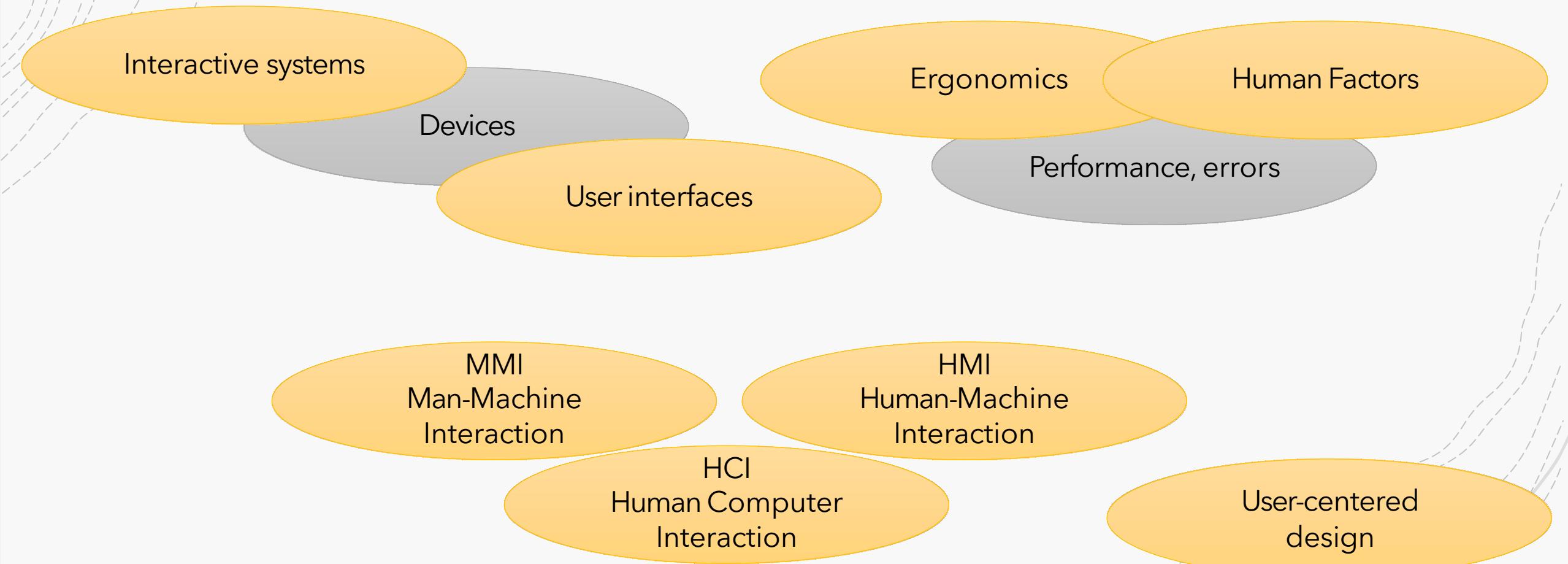


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Goals

- What is HCI?
- What is usability?
- What are the Interaction Design processes, and how does they relate with Software Engineering processes?
- What is meant by User Centered Design?

Interconnected Concepts, and Evolution



BRIEF OVERVIEW OF HCI RESEARCH

What we need?

- Technology, definitely.
- What else?

A promotional still from the movie Minority Report featuring Tom Cruise as John Anderton. He is standing in a futuristic, high-tech environment with glowing blue energy fields around his hands. He is wearing a dark, ribbed, short-sleeved shirt. The background is a blurred, metallic structure with digital displays.

Insights - Minority Report

A scene from the movie Avatar. In the center, Jake Sully, played by Sam Worthington, is shown in his human form, wearing a white t-shirt and blue jeans. He is gesturing with his hands as if he is communicating with someone off-camera. To his left, a female scientist in a white lab coat and a clear plastic headgear is looking at him. To his right, another scientist in similar attire is also looking at him. They are in a futuristic laboratory setting with various screens and equipment in the background.

Insights - Avatar

Insights - Iron Man





Insights - Iron Man



Insights - The Matrix



Insights - Ready Player One

Trend in HCI



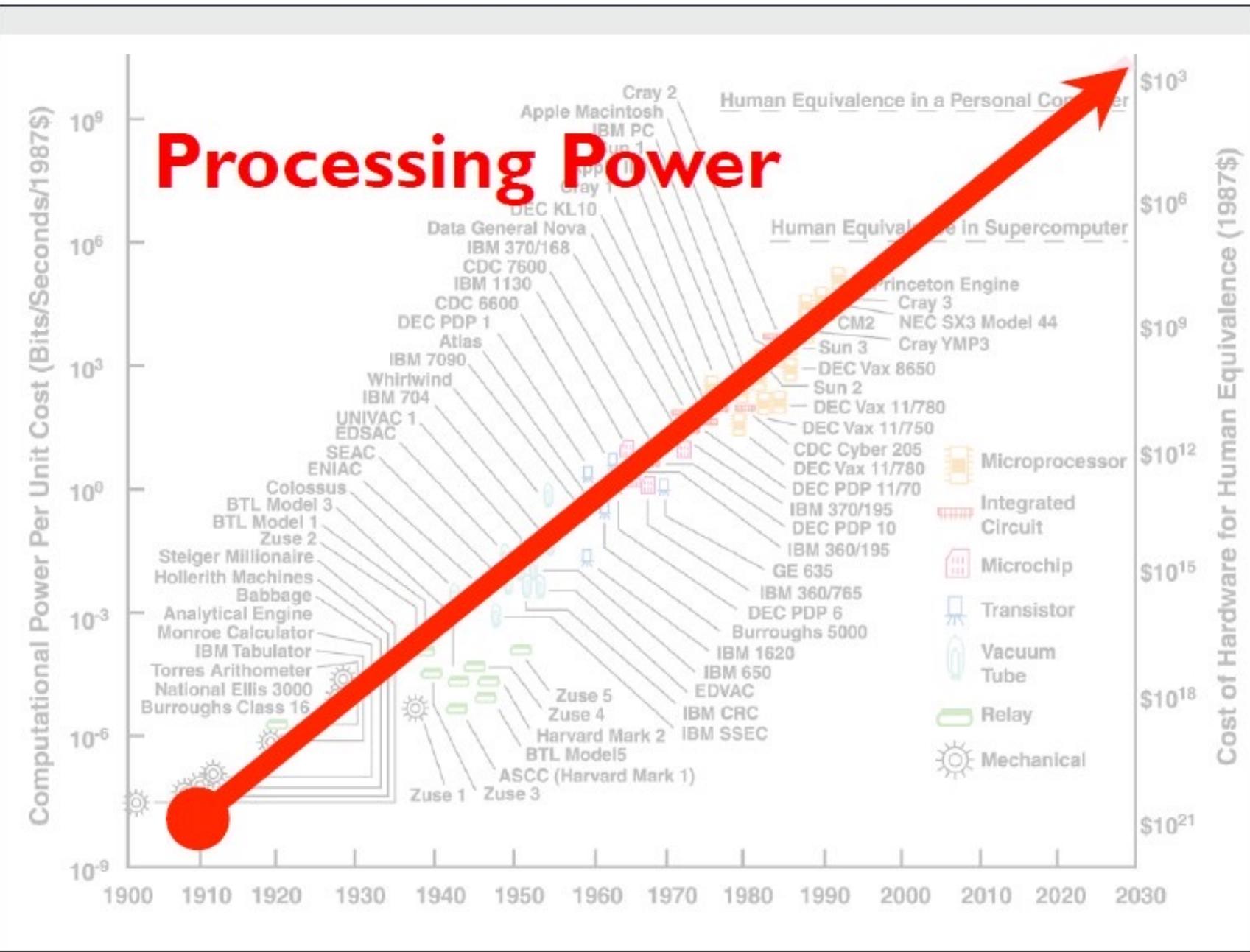
Slides from Dr. M. Billinghurst's lecture note



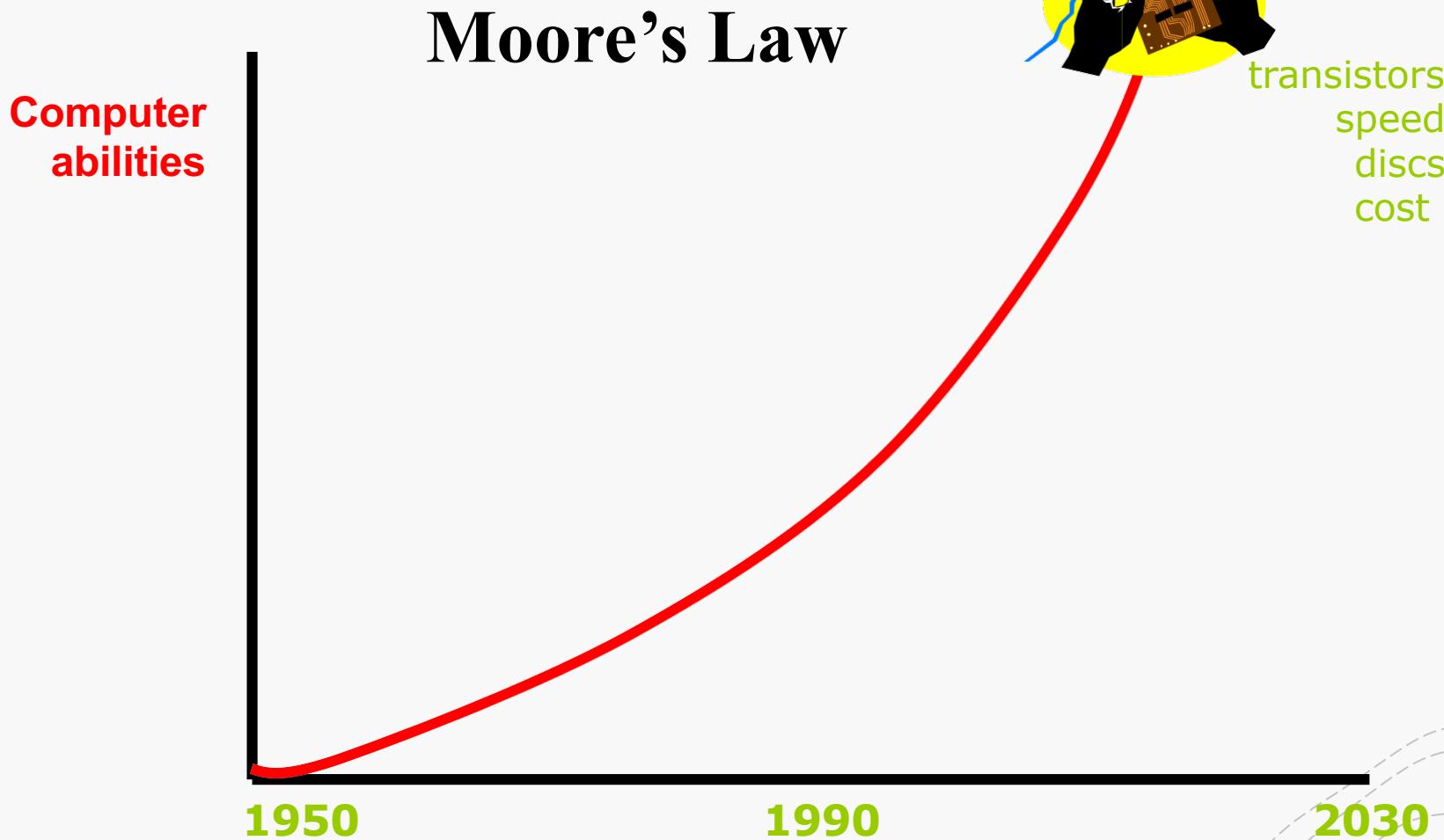
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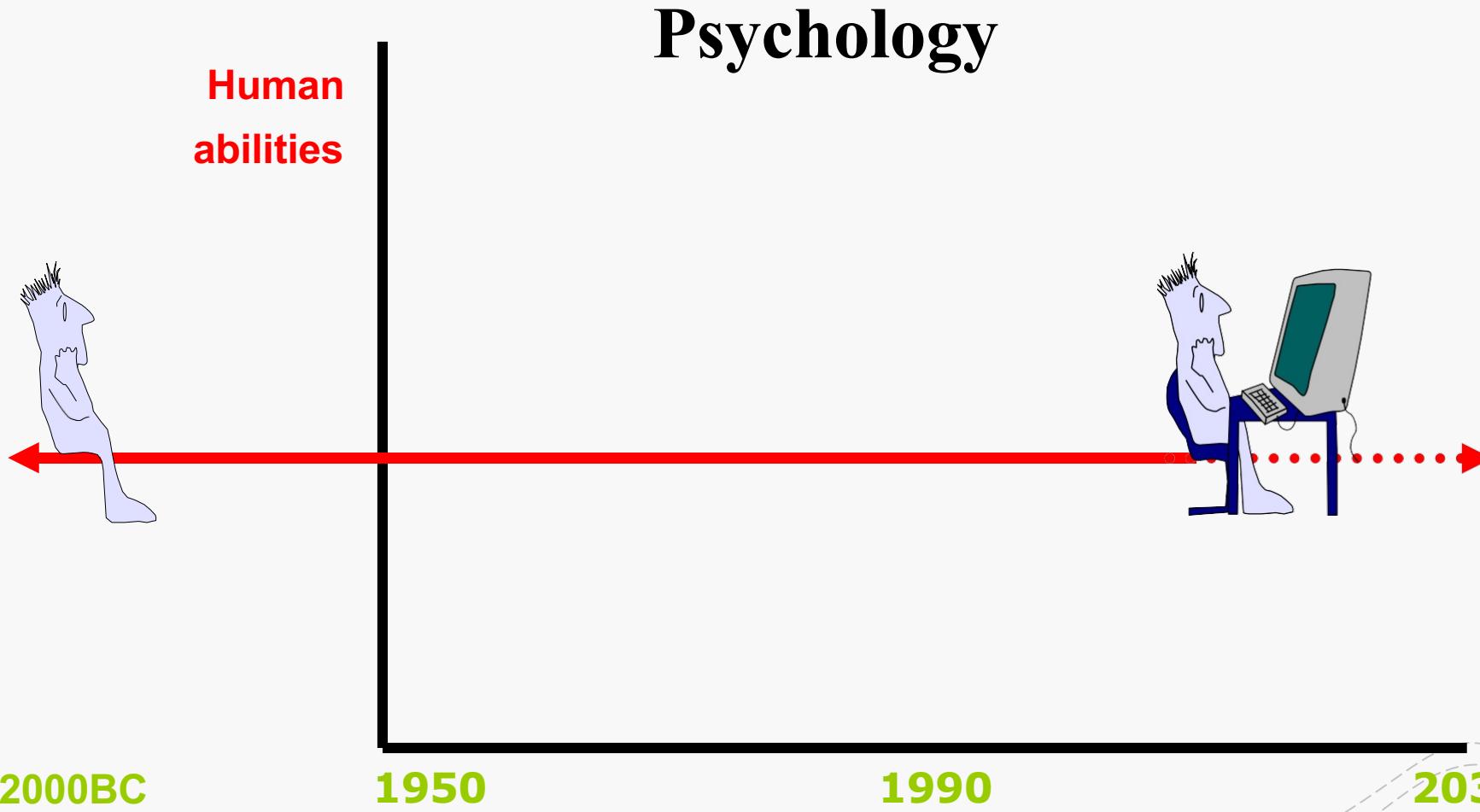




Why we need HCI?



Why we need HCI?

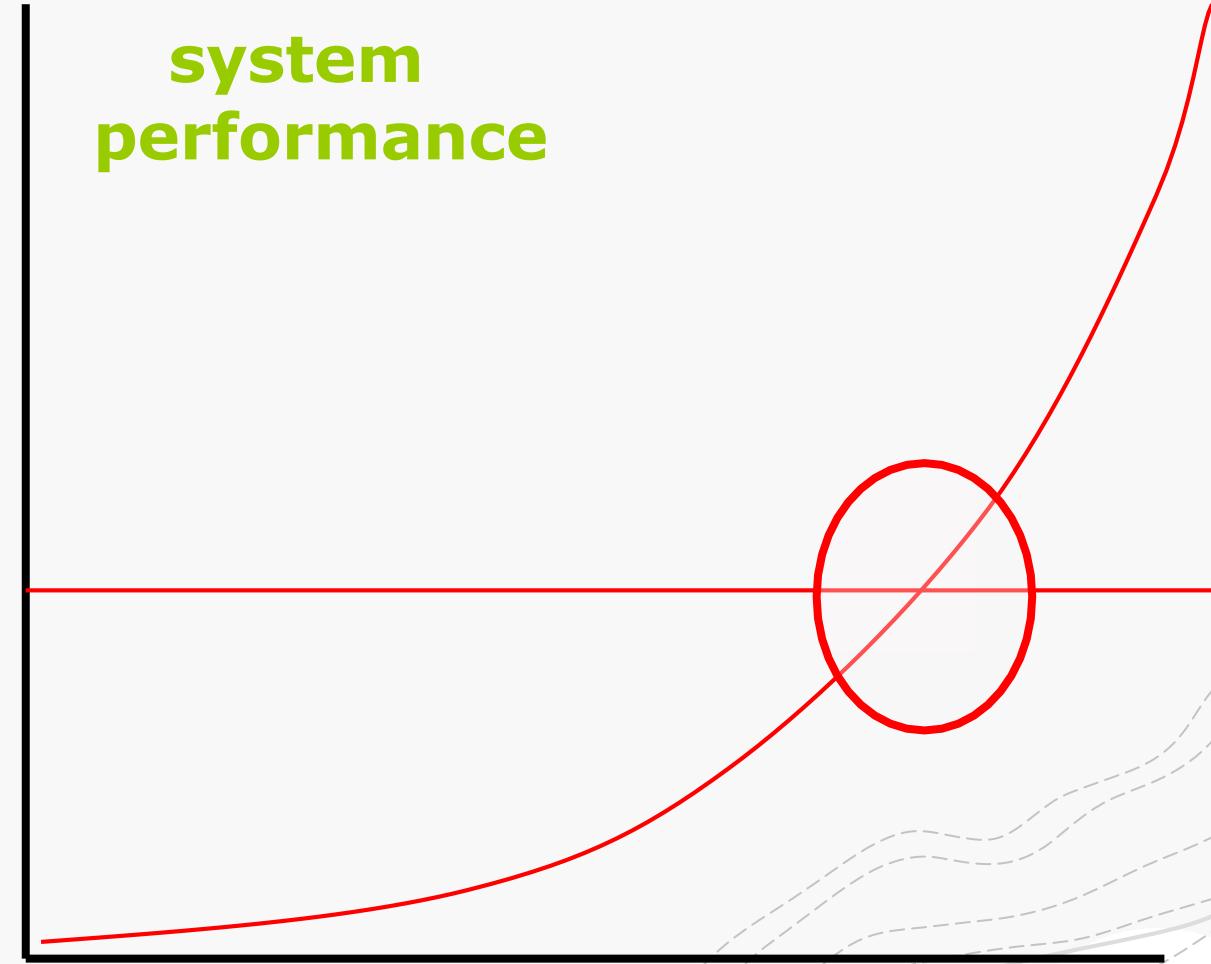


Where is the bottleneck?

**While technology often changes quickly,
people change very slowly**

Medieval helpdesk with English subtitles

**system
performance**



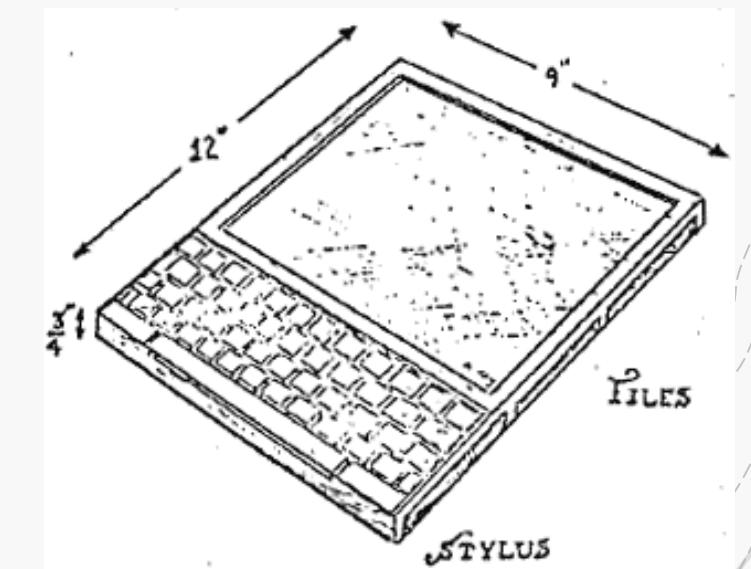
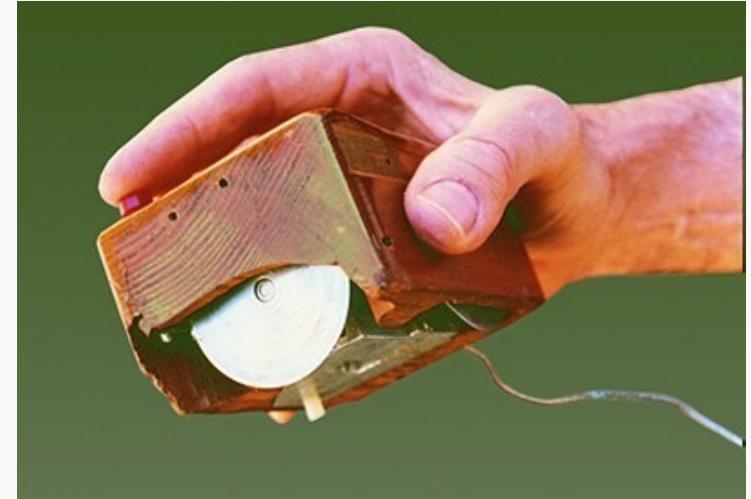
Beyond Performance?

- Use computers for what?



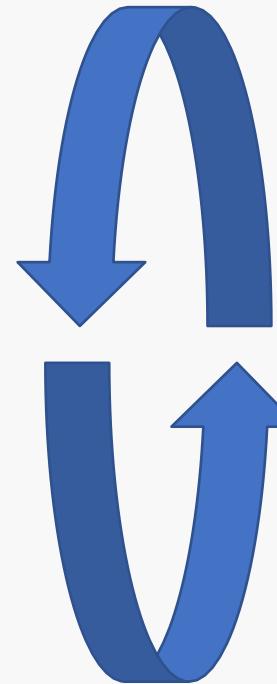
Human-Computer Interaction... In Brief

- A multi-disciplinary field
- Concerned with the **design, evaluation, and implementation** of interactive computing systems for human use
 - and with the study of **major phenomena** surrounding them
- Involves two entities (the human and the computer) that determine each other behavior over time
 - framed in terms of humans' **goals** and related **tasks/pursuits**



HCI Is Multidisciplinary

- Psychology and cognitive science
 - User perceptual, cognitive and problem-solving skills
- Ergonomics
 - User's physical capabilities
- Sociology
 - Understanding the wider context of the interaction
- **Computer Science and Computer Engineering**
 - **Building the necessary artifacts (HW, SW)**
- Business
 - Satisfying market needs
- Graphic design
 - Produce an effective interface presentation
- Technical writing
 - Documentation, manuals, on-screen content
- ...



- To help us in applying expertise from many different fields:
- Design methods and processes
 - Models
 - Heuristics
 - Best practices
 - Conventions
 - Experiments and user studies

The Goal of HCI

Ingredients

- The **User(s)**
- The **Computer(s)**
- The **Task(s)** to be accomplished

Goal

- The system must support the user's **task**, with a focus on its **usability**
 - Useful
 - Usable
 - Used

The Ingredients

The human

- Sensory systems
 - Visual
 - Auditory
 - Haptic
 - Spatial
- Acting systems
 - Hands
 - Voice
 - Head, Body, ...
- Cognitive processes
 - Perception
 - Memory

The computer

- Input peripherals
 - Keyboard, mouse
 - Trackpad, trackball
 - Touch surfaces or screens
 - Microphone
 - Sensors
 - Card readers
 - ...
- Output peripherals
 - Screen
 - Audio (voice, sounds)
 - Haptics
 - VR/AR headsets
 - ...

Models of Interaction

A general framework to understand how User and System interact

What Is “Interaction” (in HCI)?

- Interaction is...

Concept	View of interaction	Key phenomena and constructs	Good interaction	Example support for evaluation and design
Dialogue	a cyclic process of communication acts and their interpretations	mappings between UI and intentions; feedback from the UI; turn taking	understandable; simple, natural; direct	methods/concepts for guessability, feedback, mapping; walkthroughs
Transmission	a sender sending a message over a noisy channel	messages (bits); sender and receiver; noisy channels	maximum throughput of information	metrics and models of user performance
Tool use	a human that uses tools to manipulate and act in the world	mediation by tools; directness of acting in the world; activity as a unit of analysis	useful and transparent tools; amplification of human capabilities	compatibility in instrumental interaction; break down analysis
Optimal behavior	adapting behavior to goals, task, UI, and capabilities	rationality; constraints; preferences; utility; strategies	improves or reaches maximum or satisfactory utility	models of choice, foraging, and adaptation
Embodiment	acting and being in situations of a material and social world	intentionality; context; coupling	provides resources for and supports fluent participation in the world	studies in the wild; thick description
Experience	an ongoing stream of expectations, feelings, memories	non-utilitarian quality; expectations; emotion	satisfies psychological needs; motivating	metrics of user experience; experience design methods
Control	interactive minimization of error against some reference	feedforward; feedback; reference; system; dynamics	rapid and stable convergence to target state	executable simulations of interactive control tasks

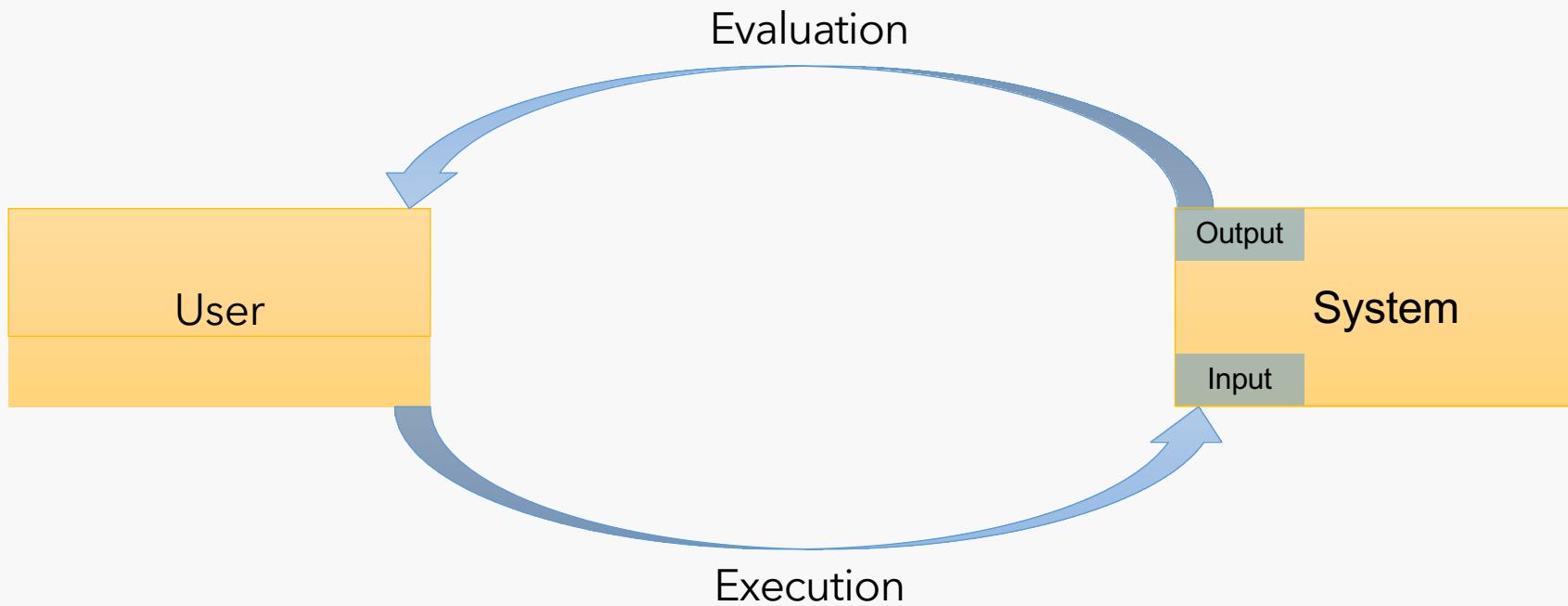
What Is Interaction (in HCI)?

- Interaction...
 - **is not** the idea promoted and repeated in folk notions that a computer and a human are engaged
 - it concerns two entities - humans and computers - that determine each other's behavior over time
 - Their mutual determination can be of many types, including statistical, mechanical, and structural
- **Users**, with their **goals** and **pursuits**, are the ultimate metric of interaction

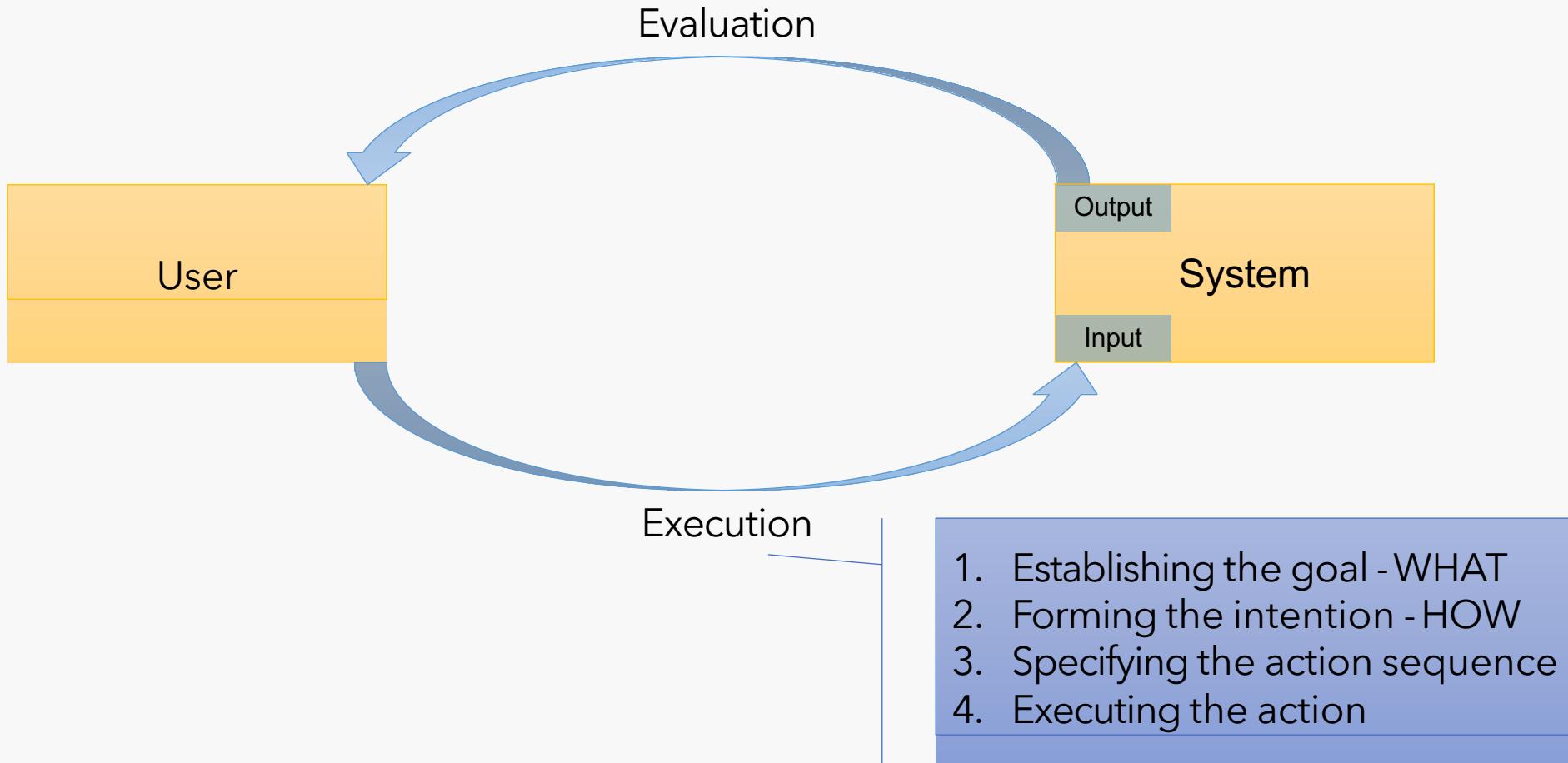
Assumptions

- The **user** wants to accomplish some **goals**, in a specific application domain
 - Each domain has a specific jargon, set of possible processes and goals, artifacts and building blocks, ...
- **Tasks** are operations to manipulate the concepts of a domain
 - The goal is attained by performing one or more tasks
- Interaction studies the relation between User and System
 - The system possesses a **state** and “speaks” a **core language**
 - The user possesses a **state**, that includes an **understanding** of the system’s state, some **intention** to perform a task, and “speaks” the **task language**

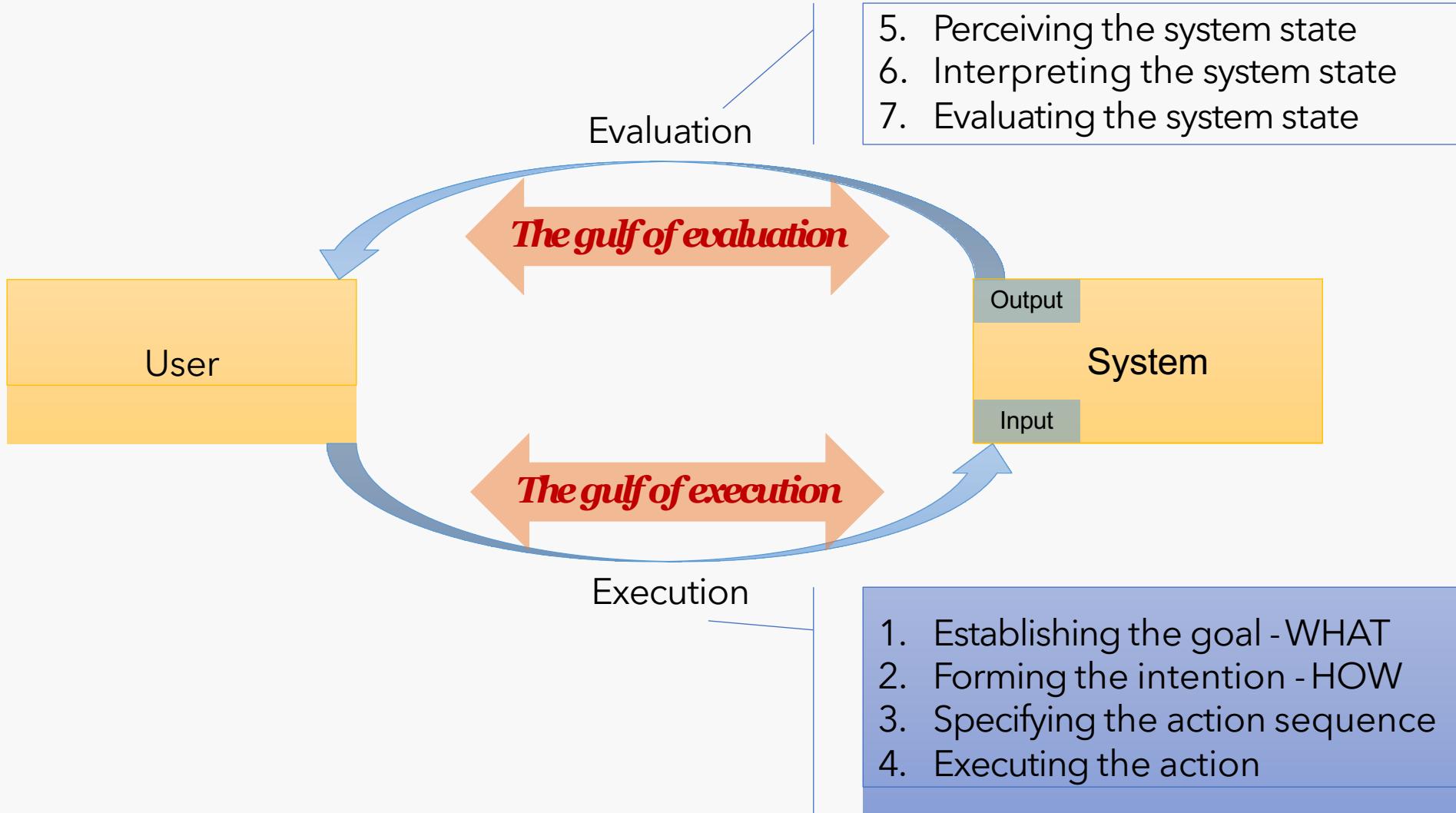
Norman's Model of Interaction



Norman's Model of Interaction

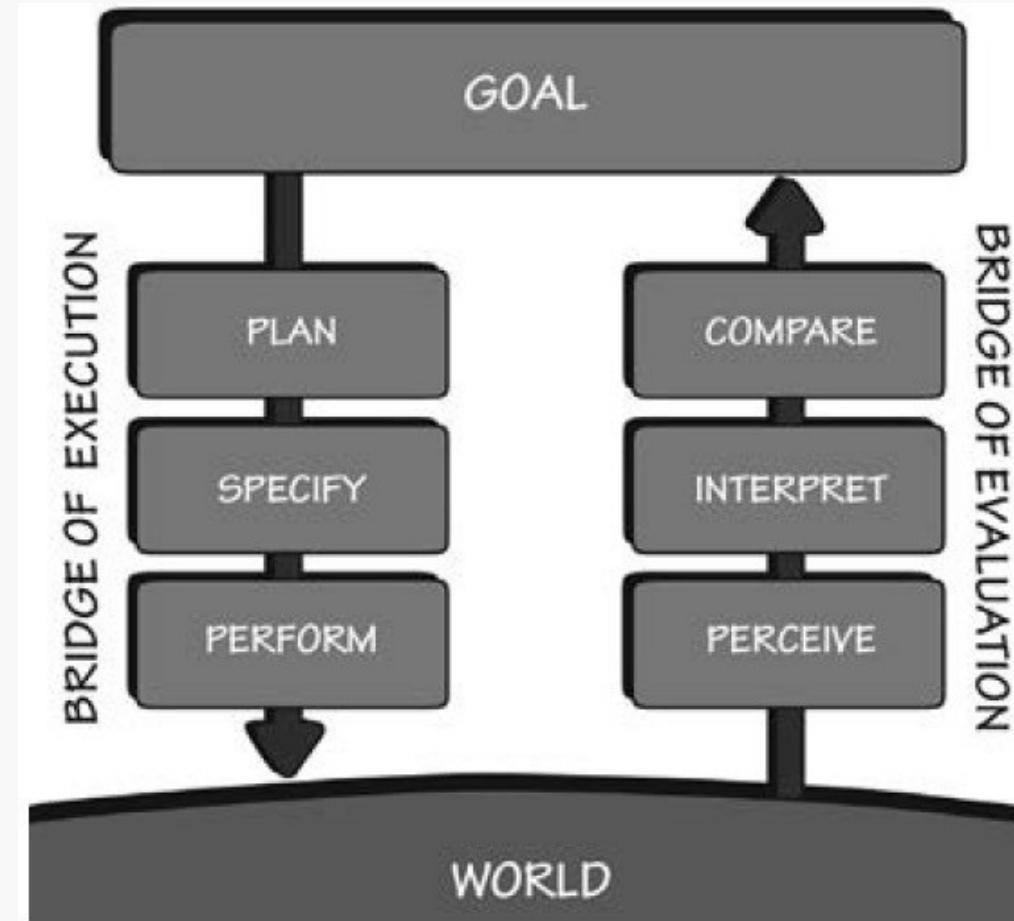
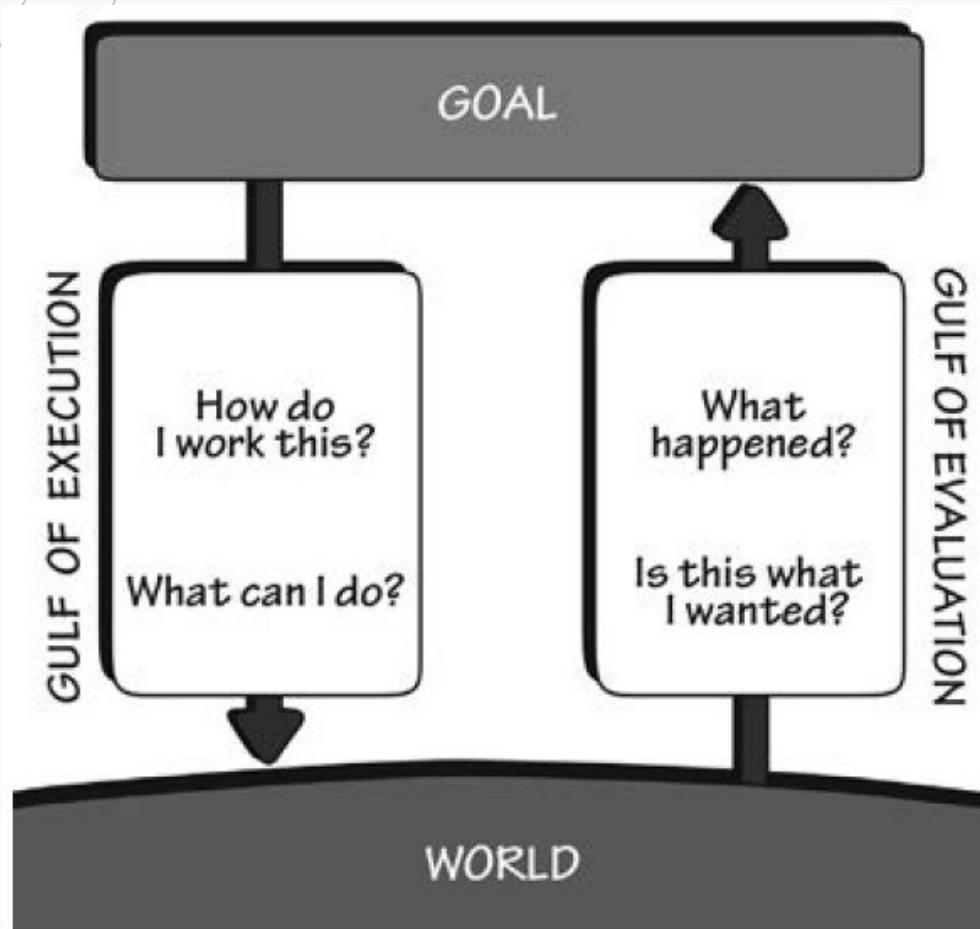


Norman's Model of Interaction

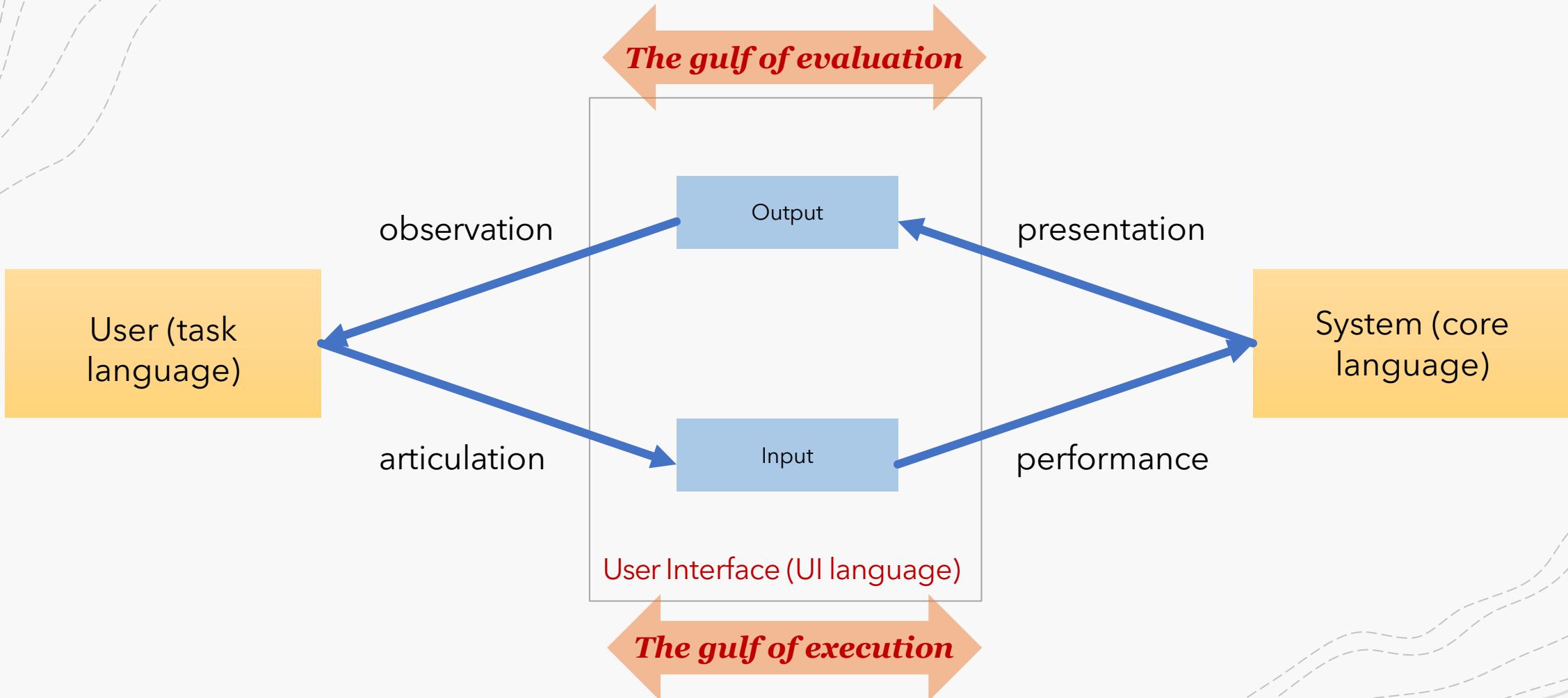


Norman's Diagrams

1. **Goal** (form the goal)
2. **Plan** (the action)
3. **Specify** (an action sequence)
4. **Perform** (the action sequence)
5. **Perceive** (the state of the world)
6. **Interpret** (the perception)
7. **Compare** (the outcome with the goal)



Abowd and Beale Model, with Explicit UI



Human Errors* in the gulf of execution

Slip

- You have formulated the right action, but fail to execute that action correctly
 - E.g., click the wrong icon, or double-click too slow, ...
- May be corrected by a better interface (spacing, layout, highlights, ...)

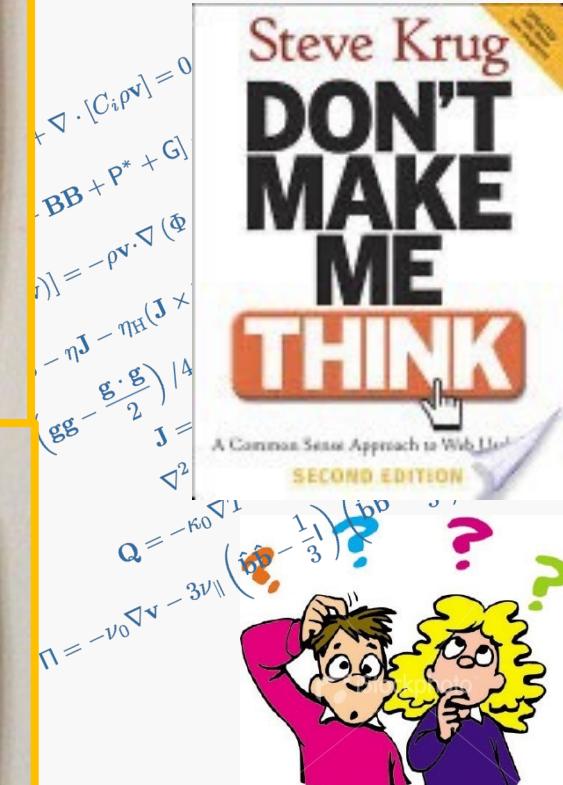
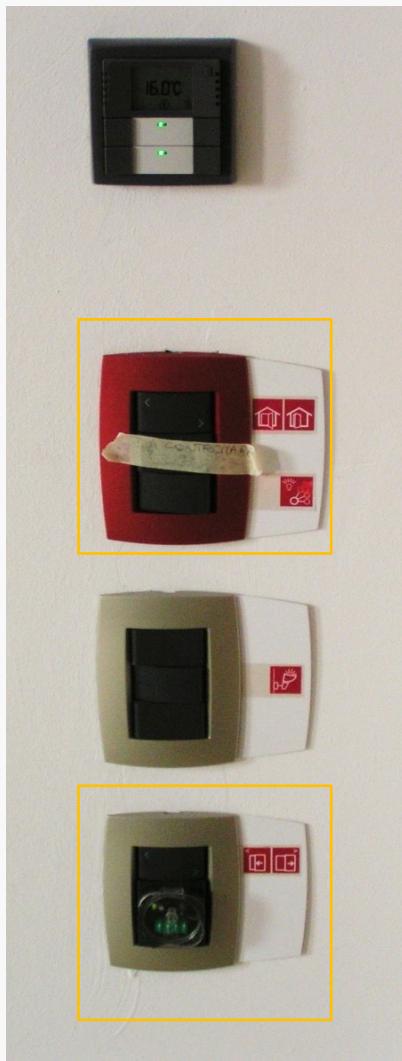
Mistake

- You don't know the system well and you may not formulate the right goal
 - E.g., click  for Zoom, but it means Search
- The user's mental model of the system's state is not correct
- Requires more radical redesign, or additional training

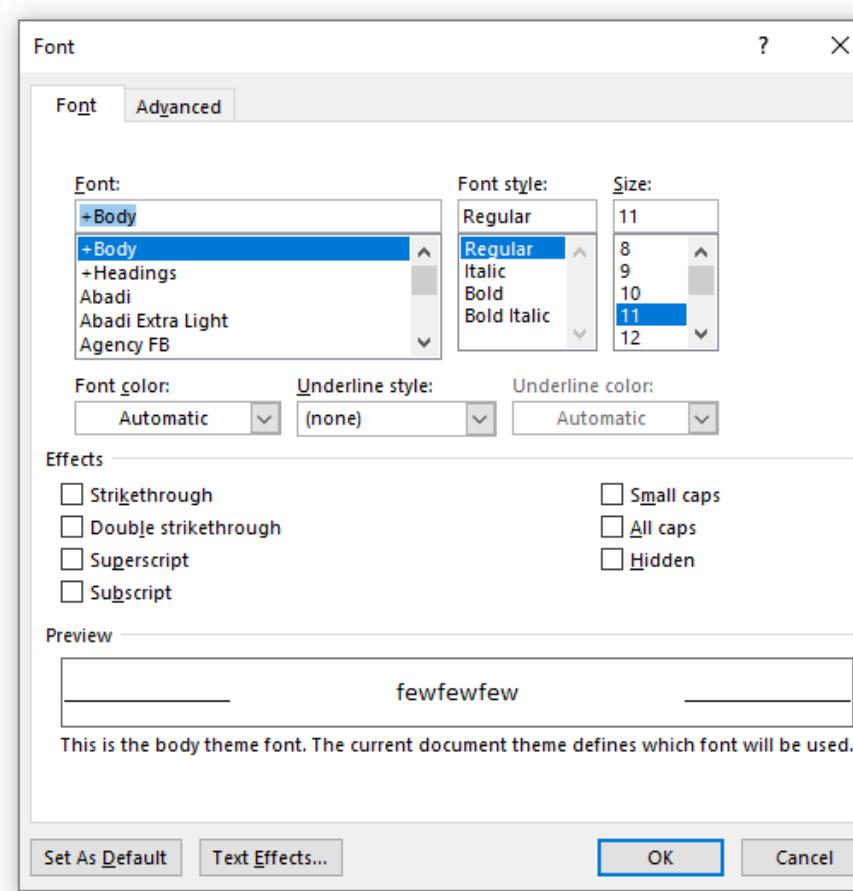
* About Human Errors

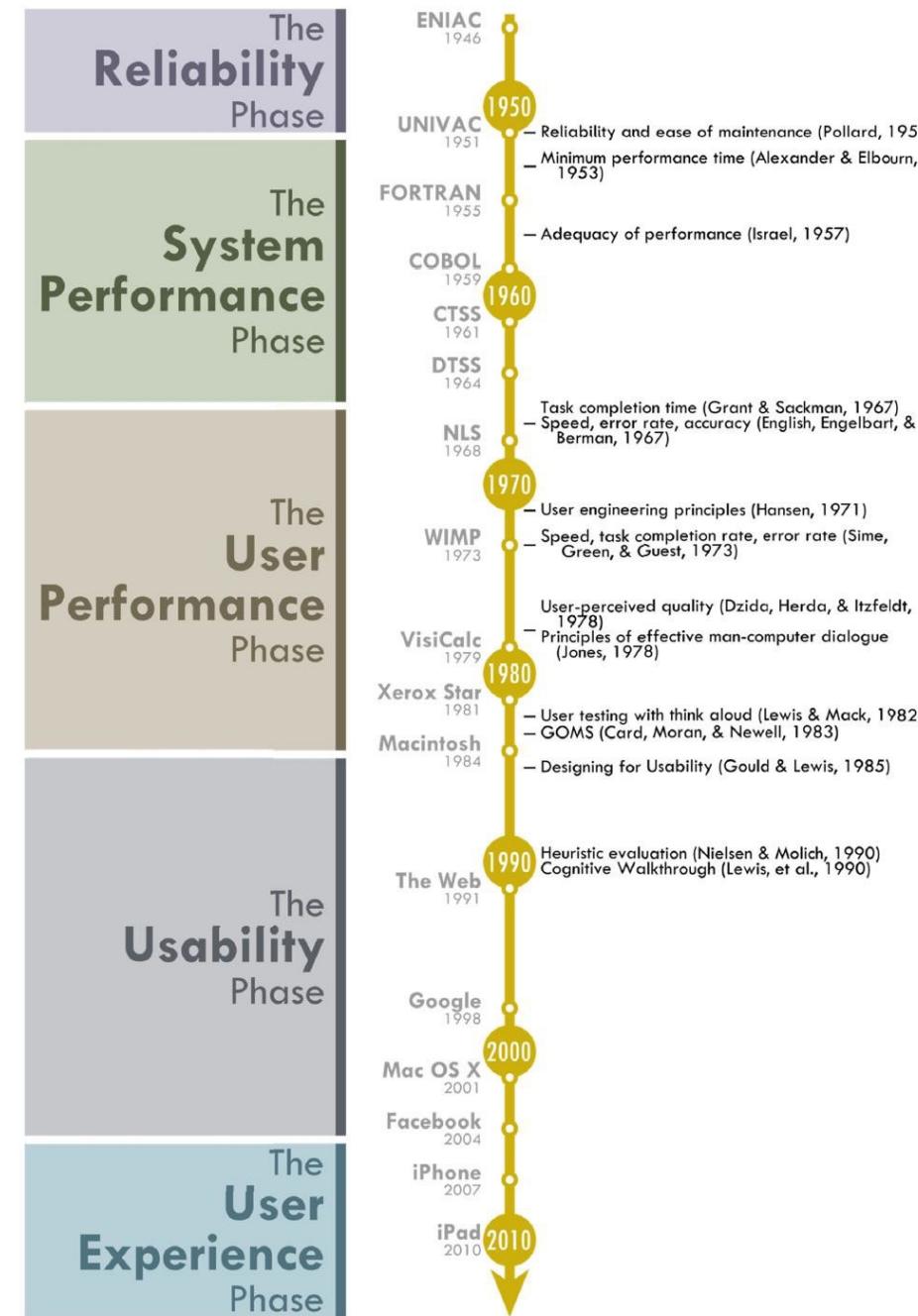
- Human errors should **never** be considered as faults of the user
- Rather, «they are usually a result of bad design» (Norman)
- Humans tend to be imprecise, distracted, not-omniscient
- System design should anticipate this human behavior
- Minimize the chance of inappropriate actions (evaluation)
- Maximize the possibility of discovering and repairing an inappropriate action (execution)
- Enable users to understand the state of the system and build an appropriate model

Example (articulation): find the right switch



Example (presentation): Which are the allowed combinations?



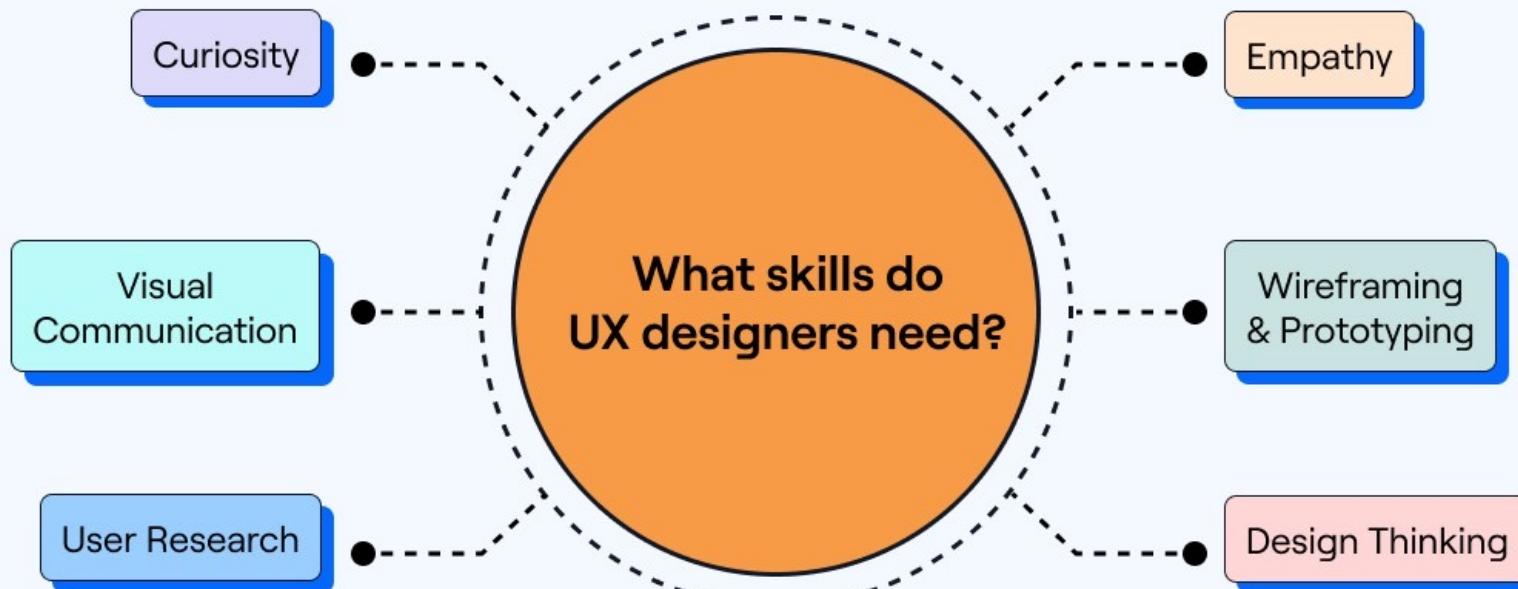


What is User Experience Design?



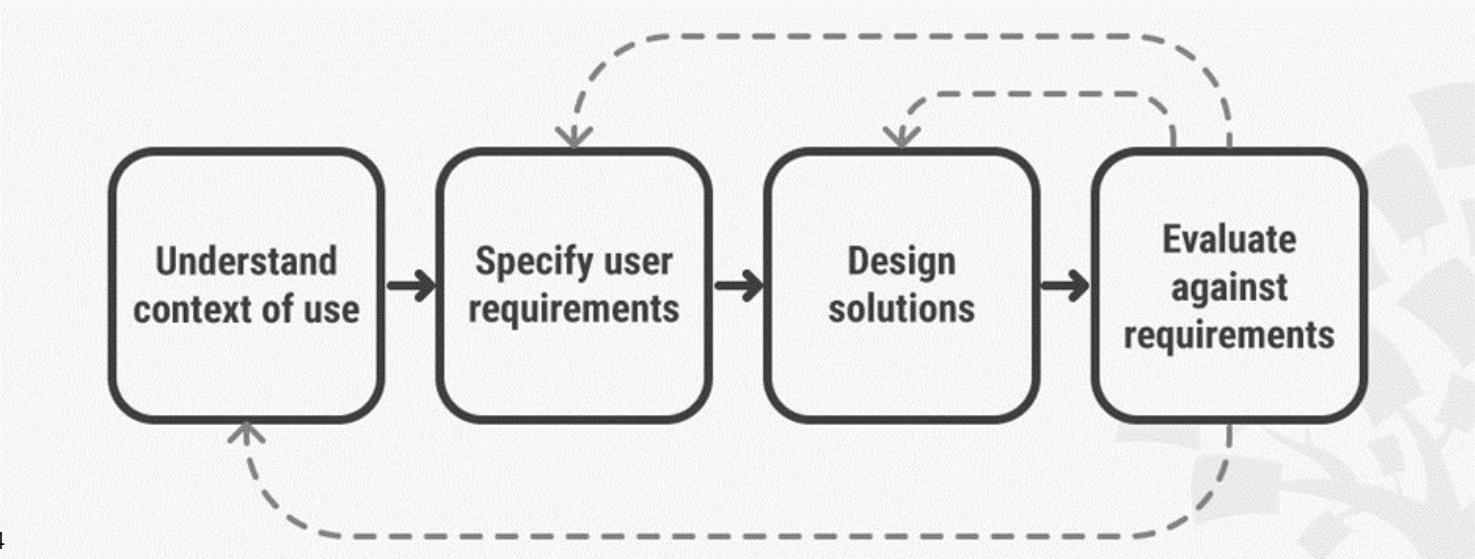
What is User Experience Design?

- User Experience (UX) Design is the process of **supporting user behaviour** through **usability**, **usefulness**, and **desirability** provided in the interaction with a product or system.



What is User Experience Design?

- UX Design draws from knowledge in different areas such as Human- Computer Interaction (HCI), User-Centred Design, Psychology and Cognitive Science.
- UX Design shares elements from similar disciplines such as Visual Design, Information Architecture, User Research, and many others.



Experience design

“The product is no longer the basis of value. The experience is.”

Venkat Ramaswamy
The Future of Competition

Commodity	Good	Service	Experience
<p>Prevailing prices for various coffee offerings</p> 			
\$.01-\$02 Per Cup	\$.05-\$25 Per Cup	\$.75-\$1.50 Per Cup	\$ 2.00-\$5.00 Per Cup

Graphic: BusinessWeek, 2005

Source: Pine and Gilmore, The Experience Economy, 1999

Defining the user experience

- How users perceive a product, such as whether a smartwatch is seen as sleek or chunky, and their emotional reaction to it, such as whether people have a positive experience when using it.

(Hornbæk and Hertzum, 2017)

- Hassenzahl's (2010) model of the user experience
 - Pragmatic: how simple, practical, and obvious it is for the user to achieve their goals
 - Hedonic: how evocative and stimulating the interaction is to users
- Hassenzahl et al (2021) reflection on the way the user experience has evolved over the last 20 years
 - growing interest in designing for hedonic aspects in relation to wellbeing

Why was the iPod user experience such a success?



Figure 1.6 The iPod Nano Touch

Source: ©Press Association, reproduced with permission.

- Quality user experience from the start
- Simple, elegant, distinct brand, pleasurable, must have fashion item, catchy names, cool...

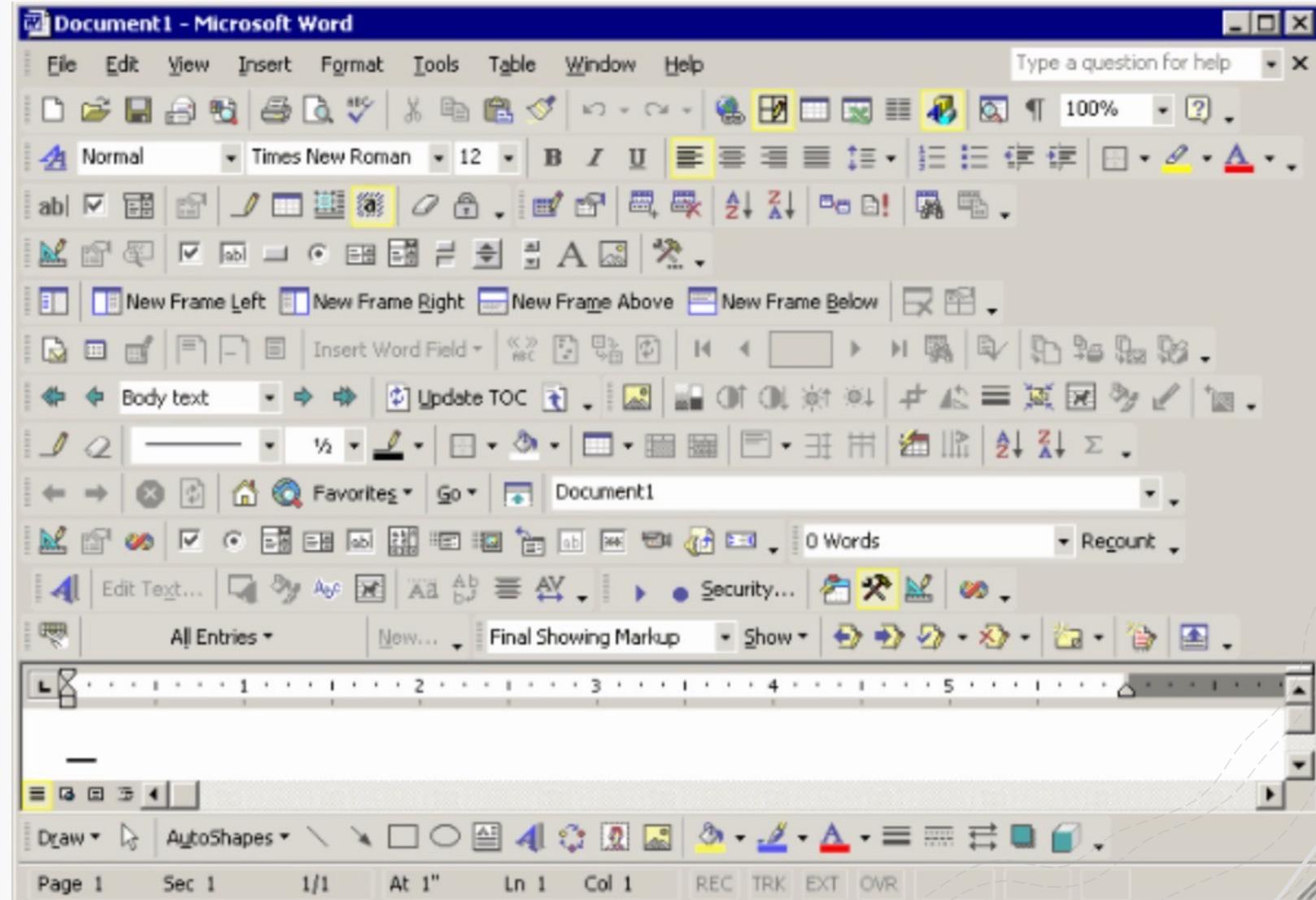
Core characteristics of interaction design

- Users should be involved throughout the development of the project
- Specific usability and user experience goals need to be identified, clearly documented, and agreed to at the beginning of the project
- Iteration is needed through the core activities

What do UX designers do?

- UX designers consider the **Who**, **Why**, **What** and **How** of product use:
- **Who**: The *Who* refers to the individuals or groups of people (target users) who will most likely use the product.
- **Why**: The *Why* involves the users' motivations for adopting a product, whether they relate to a task they wish to perform with it or to values that users associate with the ownership and use of the product.
- **What**: The *What* addresses the things people can do with a product - its functionality and features.
- **How**: The *How* relates to the design of functionality in an easy, accessible and pleasant way. That is, how the product will look like and behave.

Is this a good UX design example?

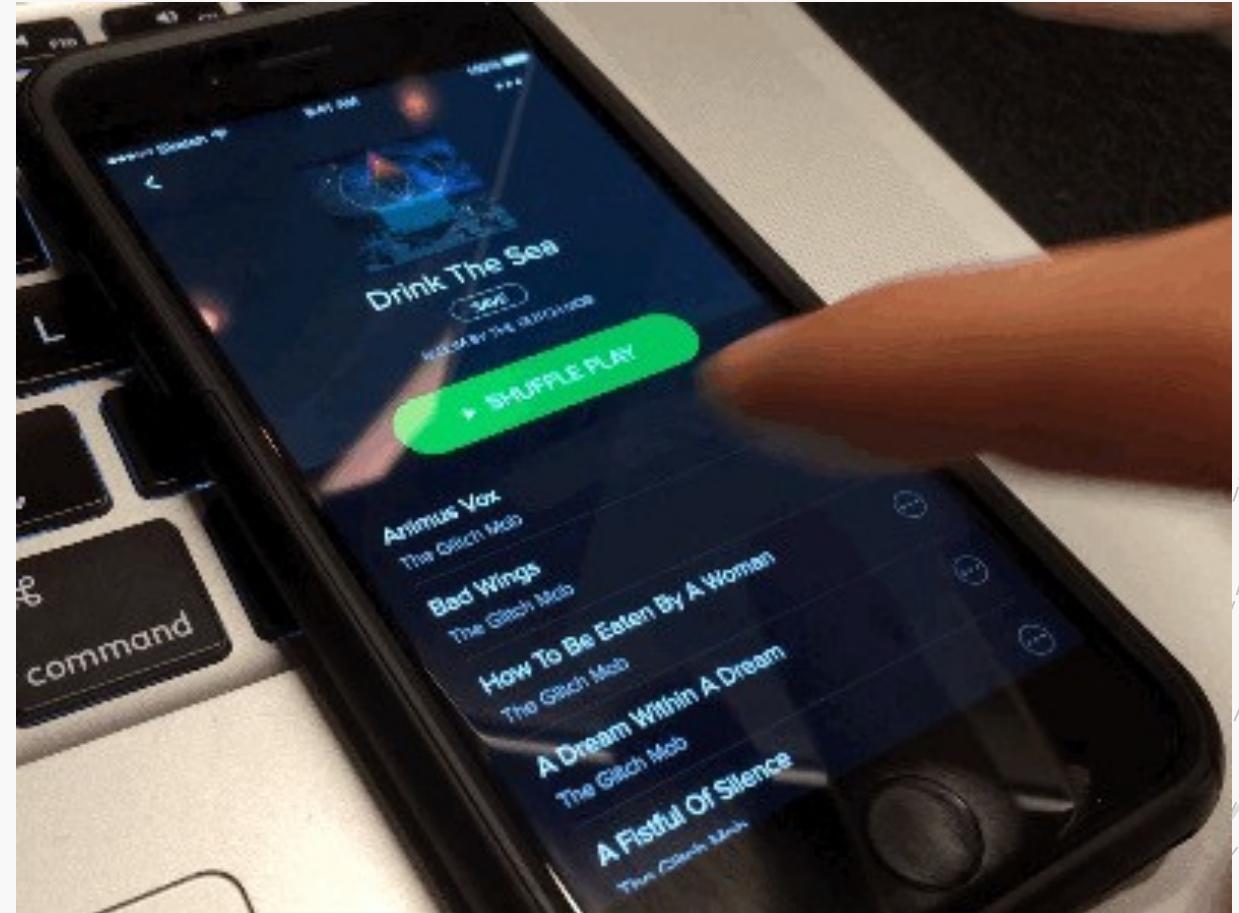


What
about this
website
design?

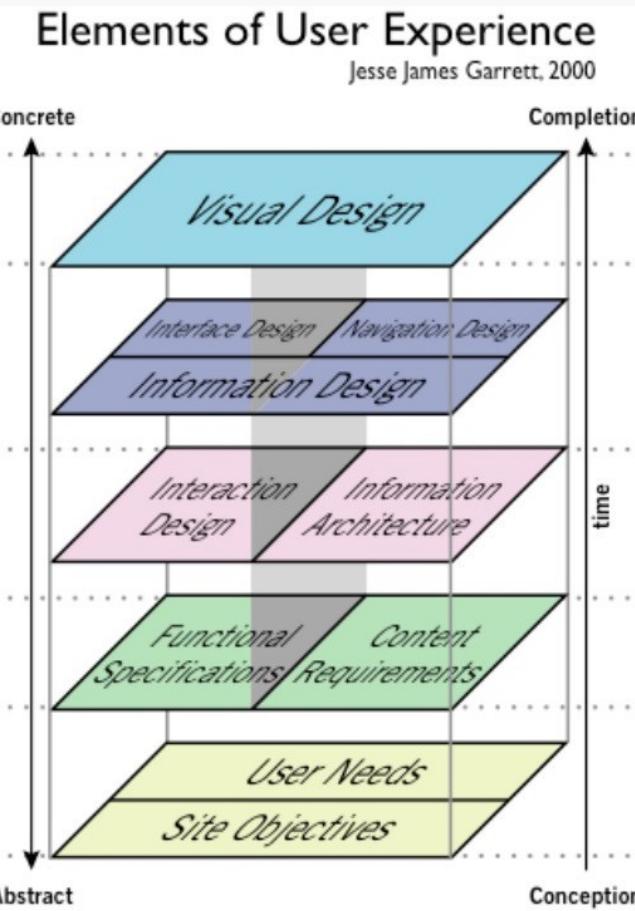
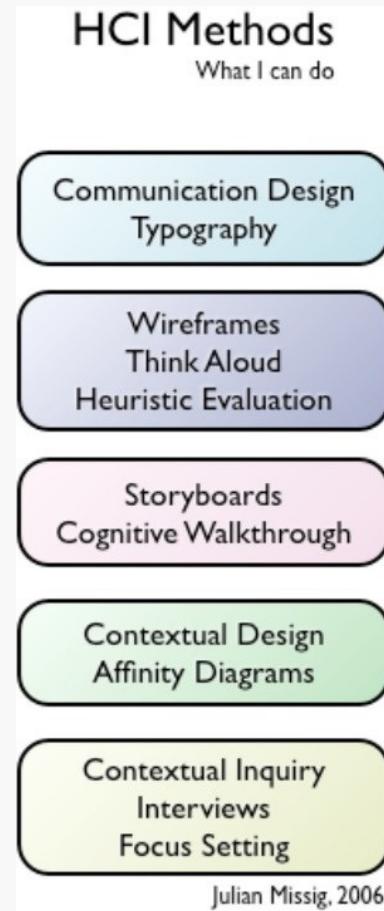
The image shows a website with a red background. At the top right is a yellow cartoon rubber duck. To its right, the words "BUY STOCKS" are written in large, bold, yellow, outlined letters. Below that, "WITH US.COM" is written in a similar style. In the center, there is a block of yellow text: "BUY STOCKS WITH US. WE'VE BEEN IN BUSINESS FOR OVER 100 YEARS, HELPING MILLIONS OF PEOPLE WITH THEIR EVERY FINANCIAL NEED. LET US HELP YOU WITH...". Below this text, in a smaller font, is a list of services: "Large cap, Mutual funds, Retirement, Online Accounts, and Research.". At the bottom left, there is a phone number "(716)555-1234" and an email address "or buystockswithus.com". At the very bottom, there is a digital-style display showing the number "18493". On the left side of the red area, there is a vertical sidebar with a yellow header and footer, and a white middle section containing several blue hyperlinks: "MY FAVORITE LINKS", "RECENT LEGAL LOSSES", "FEES", "BANKRUPTCY", "OUR SOFTBALL TEAM", "SITEMAP", "MAILING LIST", "CLIENTS", and an email address "info@buystockswithus.com".

Good UX design is

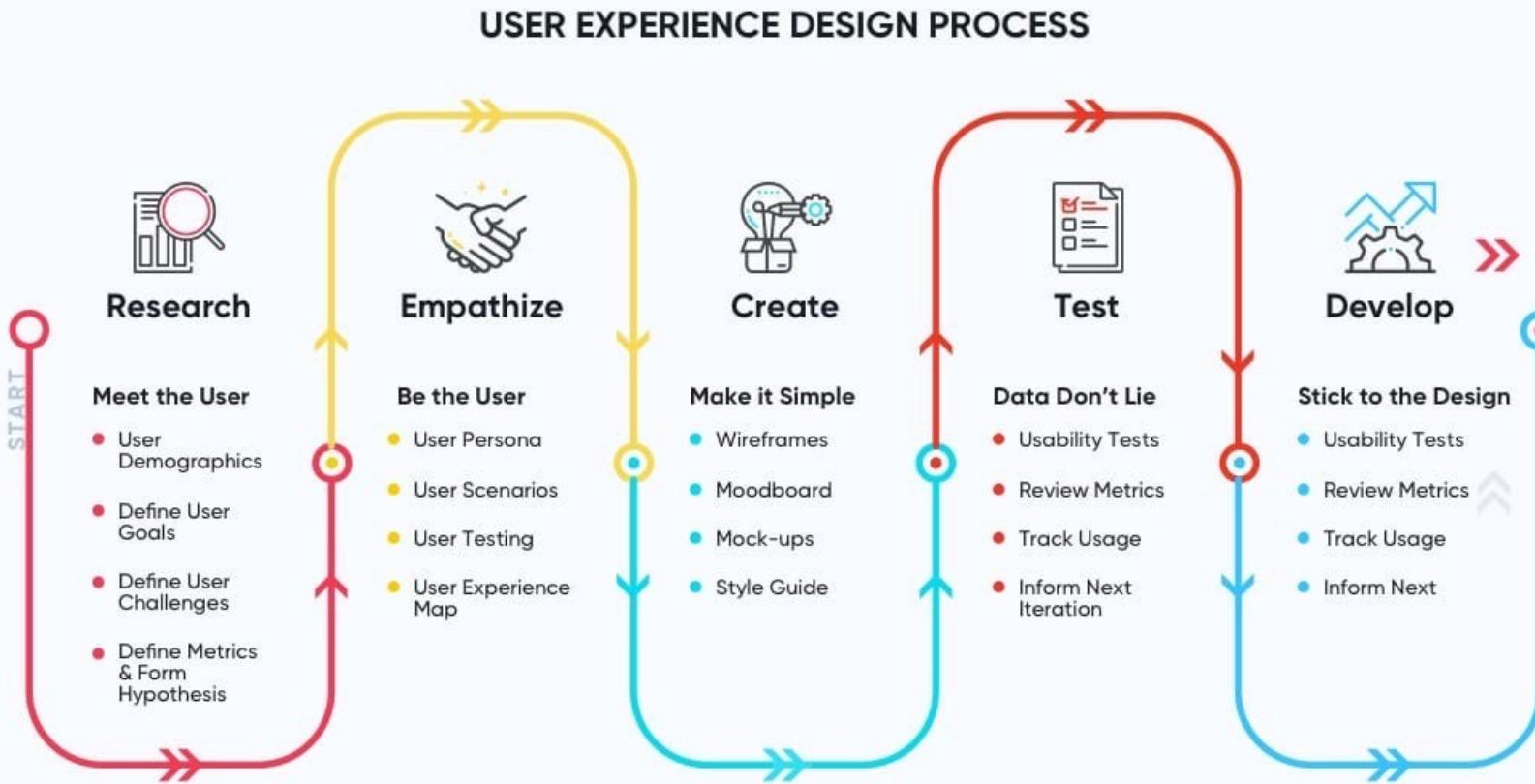
- Useful
- Enjoyable
- Usable (easy to use)
- To achieve these goals, you need to know your **users** and their **needs!**



The Elements of User Experience



The UX Design Process



People-centered design

- Involves understanding how people feel about a product and their pleasure and satisfaction when using it, looking at it, holding it, and opening or closing it.
- Their overall impression of how good it is to use
- The quality of the experience
- *“It is not enough that we build products that function, that are understandable and usable, we also need to build joy and excitement, pleasure and fun, and yes, beauty to people's lives.”*

Don Norman (2004)

Experience and fun

- World's Deepest Rubbish Bin:

<https://www.youtube.com/watch?v=tcrhp-IWK2w>

- Musical Stairs: <https://www.youtube.com/watch?v=2lXh2n0aPyw>

User experience goals

Desirable aspects

- Satisfying
 - Helpful
 - Fun
 - Enjoyable
 - Motivating
 - Provocative
 - Engaging
 - Challenging
 - Surprising
- Pleasurable
 - Enhancing sociability
 - Rewarding
 - Exciting
 - Supporting creativity
 - Emotionally fulfilling
 - Entertaining
 - Cognitively stimulating
 - Experiencing flow

Undesirable aspects

- Boring
 - Unpleasant
 - Creepy
 - Frustrating
 - Patronizing
 - Intrusive
 - Making one feel guilty
- Makes one feel stupid
 - Deceptive
 - Annoying
 - Cutesy
 - Childish
 - Gimmicky

Affordances: to give a clue

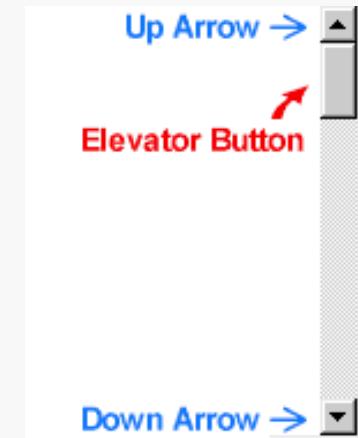
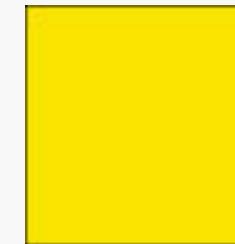
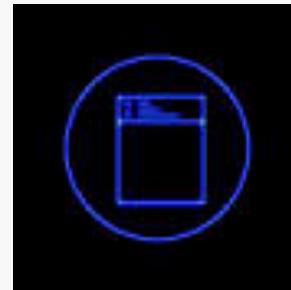
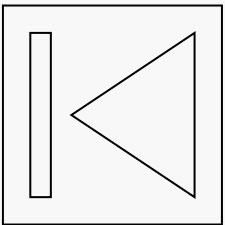
- Refers to an attribute of an object that allows people to know how to use it. (For example, a mouse button invites pushing, a door handle affords pulling)
- Norman (1988) used the term to discuss the design of everyday objects
- Has since been popularized in interaction design to discuss how to design interface objects (for example, scrollbars to enable moving up and down; icons to click on)

What does “affordance” have to offer interaction design?

- Interfaces are virtual and do not have affordances like physical objects
- Norman argues that it does not make sense to talk about interfaces in terms of ‘real’ affordances
- Instead, interfaces are better conceptualized as ‘perceived’ affordances:
 - Learned conventions of arbitrary mappings between action and effect at the interface
 - Some mappings are better than others

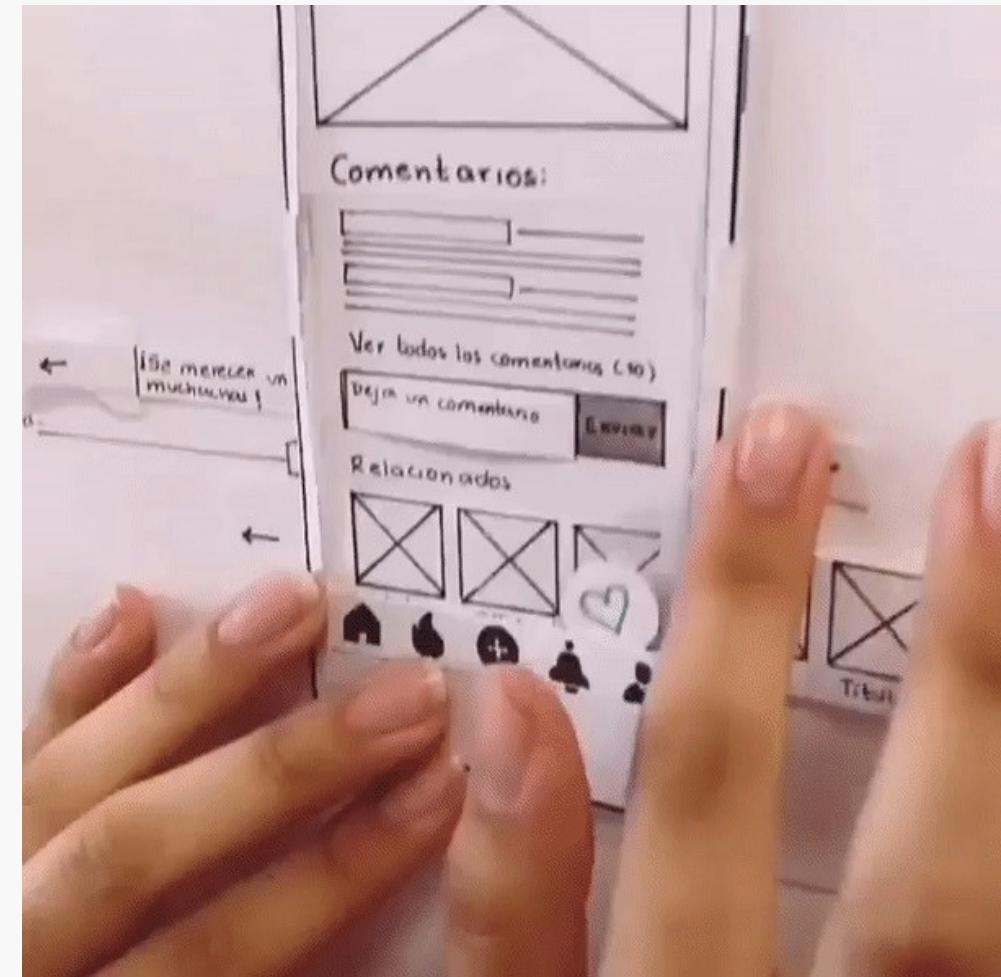
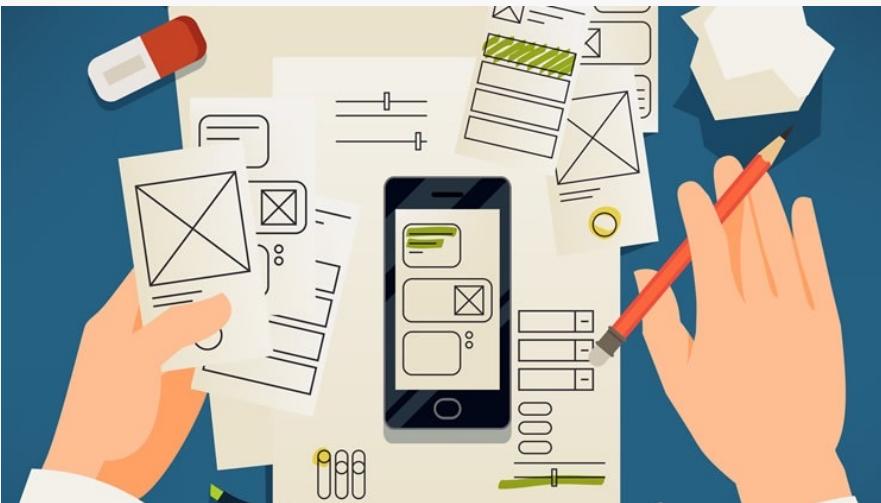
Activity

- Virtual affordances
- How do these screen objects afford?
- What if you were a novice user?
- Would you know what to do with them?



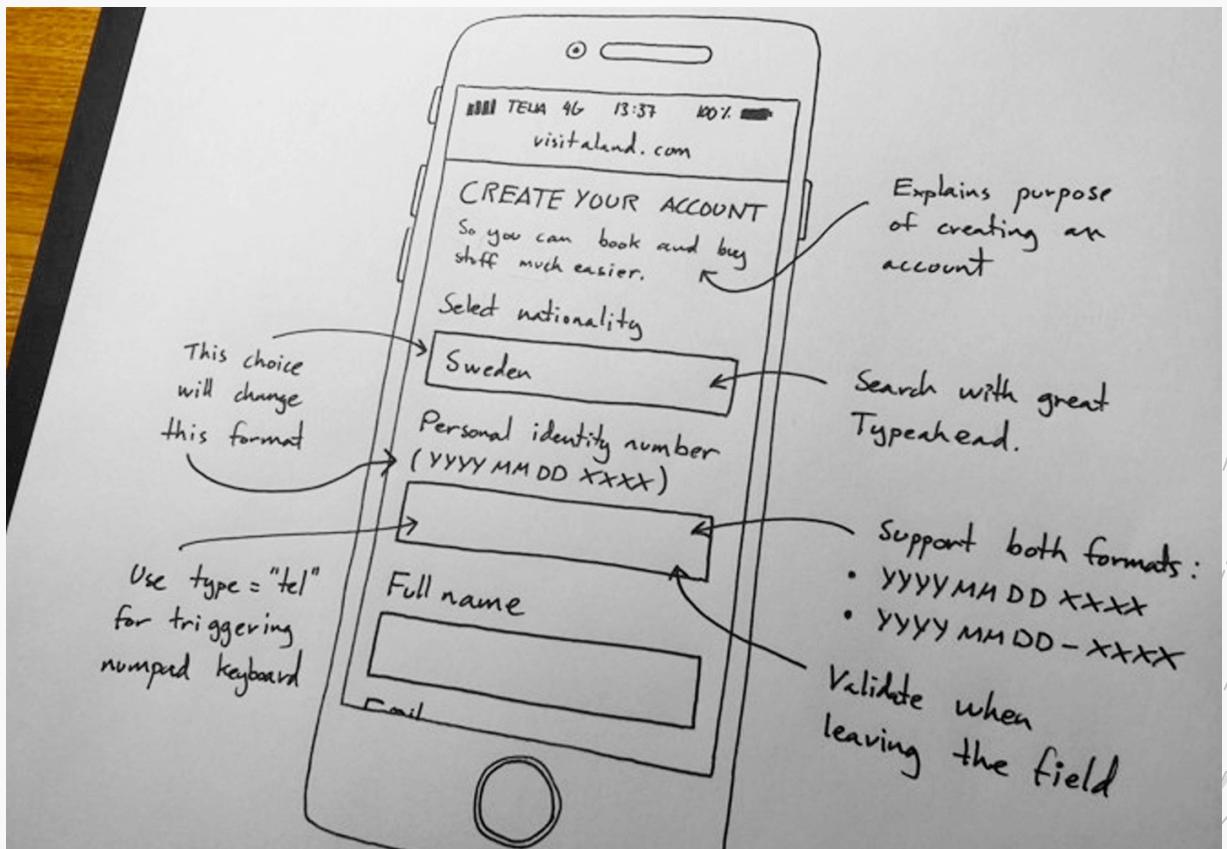
Prototyping

- A prototype is an early working model of a design.
- Prototyping is used to gain feedback and rapidly experiment with ideas and solutions.



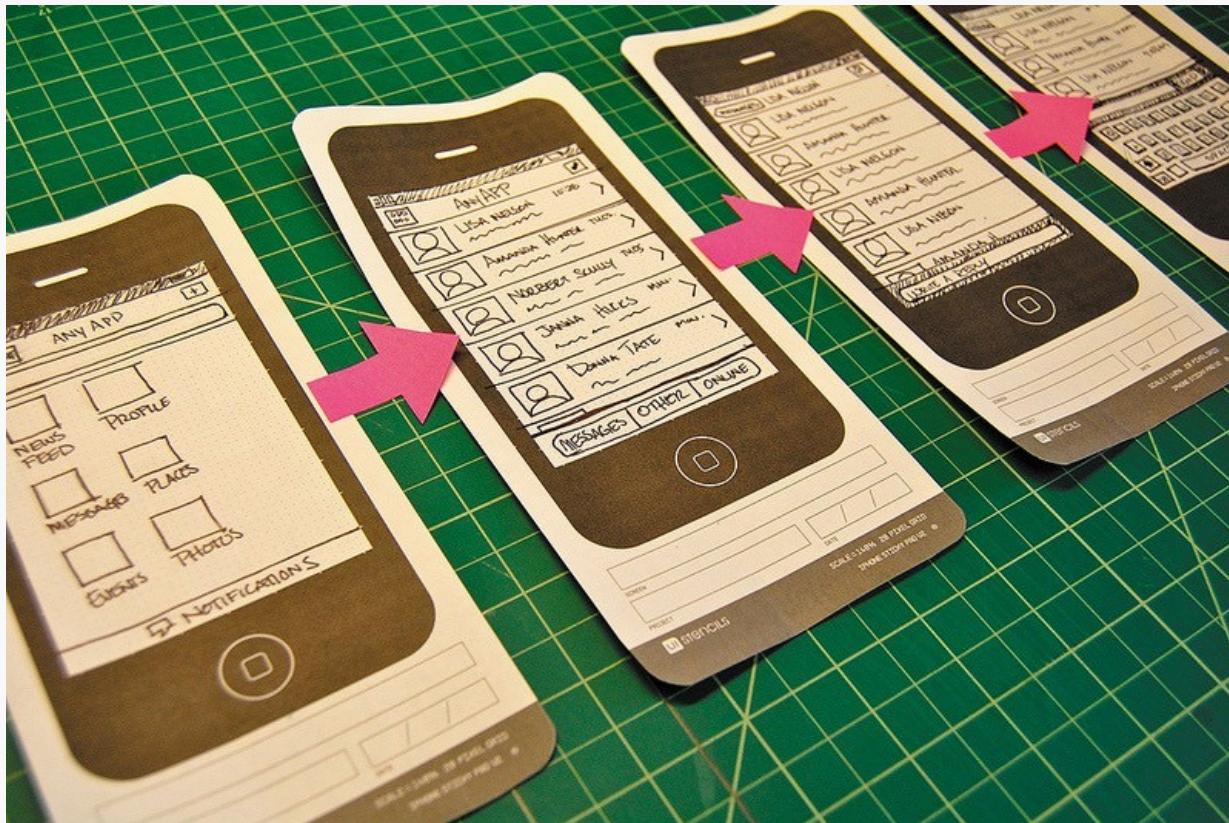
Benefits of prototyping

1. Prototyping helps us get rid of bad ideas **quickly** and move on to good solutions.
2. Reduces process costs.
3. It gives insights into the usability of your product.



Benefits of prototyping

1. It gives an overview into the project phases to different teams.
2. It helps evaluating the structure of individual pages/screens in your project.
3. It helps understanding and visualising how related pages/screens work together.



Prototyping

Prototypes are created through a combination of:

1. Sketches

2. Wireframes

3. Mockups

The fidelity of the prototype depends on the design stage:

Low fidelity

Medium fidelity

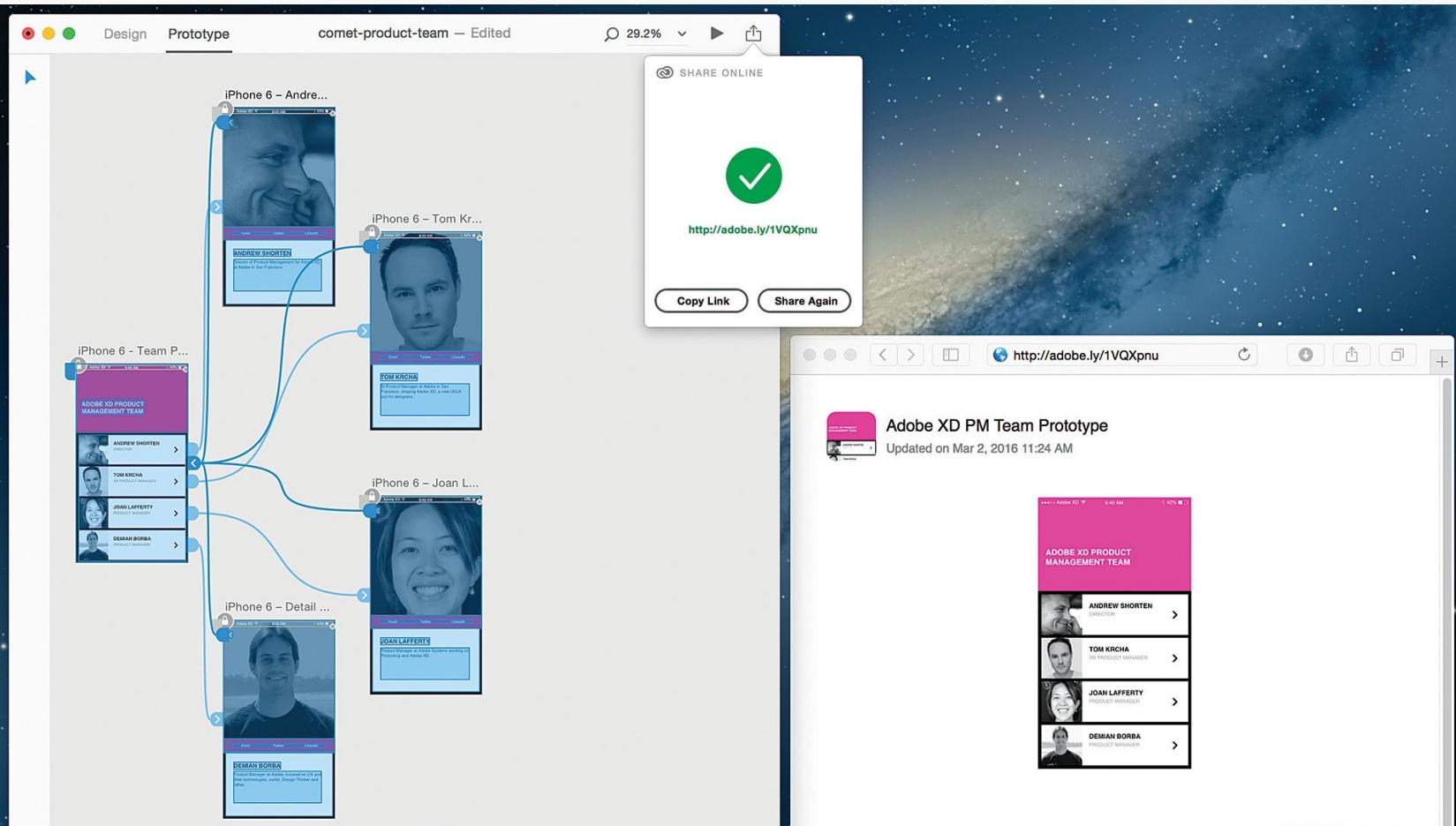
High fidelity

Tools for prototyping

The screenshot shows the Figma interface with a mobile application prototype for a plant store. The prototype includes four screens: Home, Detail, Login Prompt, and Added to Cart Modal. The Home screen displays a grid of plants with '+' icons. The Detail screen shows a single plant named 'Lil Bud' with a price of \$25. The Login Prompt screen is a modal for saving a cart, featuring fields for 'username' and 'password'. The Added to Cart Modal shows a confirmation message: 'Lil Bud Plant added to cart' with a 'View Cart (1)' button. On the right side of the interface, there is a sidebar with tabs for 'Design', 'Prototype', and 'Code'. The 'Design' tab is selected. The sidebar also contains sections for 'Background' (set to D9E1F1), 'Local Styles' (Text Styles, Ag Mobile - Header, Ag Mobile - Small Text, Ag Mobile - Body, Ag Mobile - Body Links), and 'Color Styles' (Lil Green). A large blue text overlay on the right reads: 'Using FIGMA for UX Design'.

[Figma.com](https://figma.com)

Tools for prototyping



Adobe XD

Learning outcomes

- Design and create an interactive prototype through applying user-centred design principles.
- Critically appraise techniques utilised within a user-centred design methodology.
- Evaluate a digital prototype to assess the usability of an interactive application.
- Propose and implement updates to interface designs based on analysis of usability data collected.



Vietnam National University of HCMC
International University
School of Computer Science and Engineering



THANK YOU

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<https://vichithanh.github.io>



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