

# Human Computer Interaction

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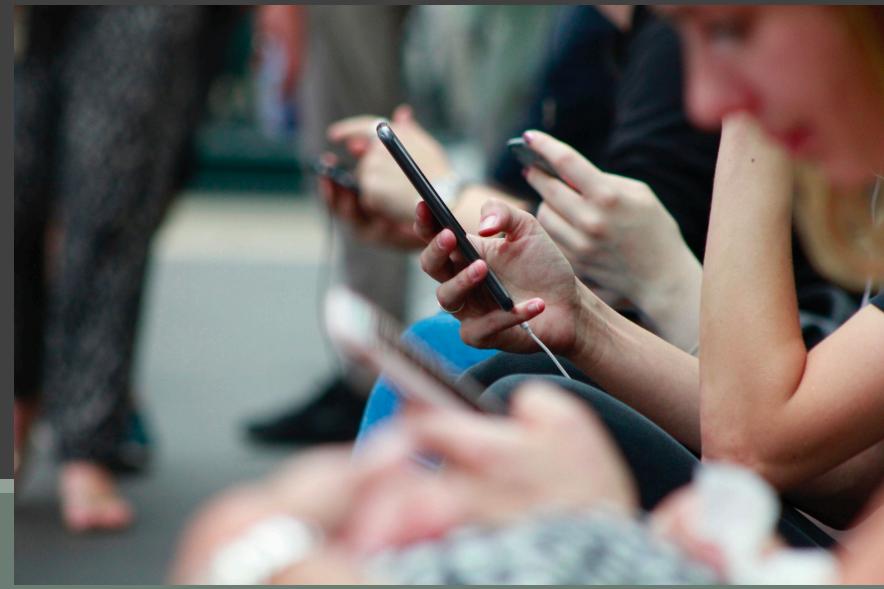
USER INTERFACES

ACADEMIC YEAR 2020/2021

# FOOD FOR THOUGHT

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- Let's think about the devices that we use in everyday life...What is an interactive product?
- How many interactive products are used in everyday life?
- How many of those products are easy, effortless and enjoyable to use?



# FOOD FOR THOUGHT

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- The interactive products used everyday can have different characteristics, scope and dimensions.
- Interactive products have been designed to perform a set of functions, often at the expense of how the system will be used by real people.
  - I want to heat my lunch. At a glance, how can I do it? What do you think about this design?



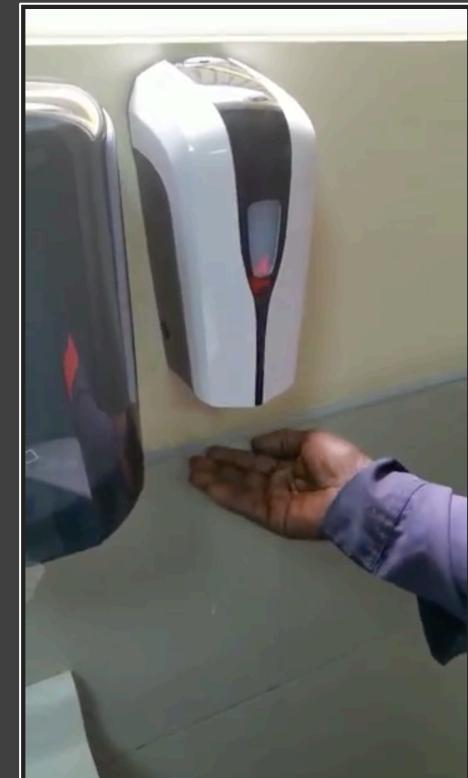
# FOOD FOR THOUGHT

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## THINK ABOUT THE USER!!!

We need to adopt a user-centered design

- What people are good or bad at
  - E.g. A phone system to make an appointment to renew my ID
- Where the product will be used
  - E.g. a public phone box
- Observe and listen (against stereotypes...)



# EVERYDAY EXAMPLES

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The objects of daily life have to solve the problems for which they have been made considering who and how it will use them.

- How to travel comfortable?



# EVERYDAY EXAMPLES

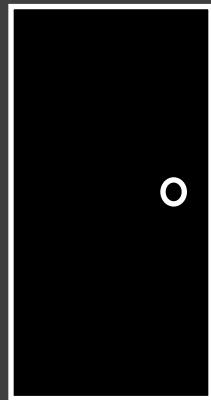
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Objects must be designed so that they can be used taking into account the following factors:

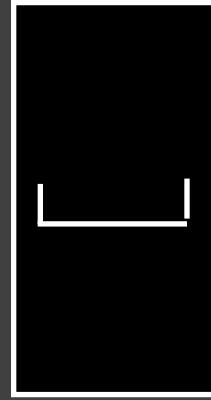
- Visibility
- Causality
- Visible Restrictions
- Mapping with tasks to perform
- Transference effects
- User stereotypes
- Conceptual models
- Individual and cultural differences

# EVERYDAY EXAMPLES

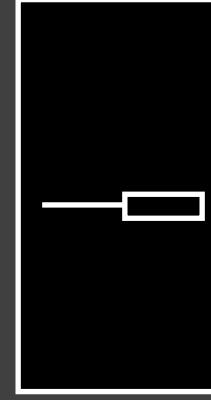
The controls need to be visible (visibility), have a good representation of their effects or results (causality), and their design should suggest their functionality (the mapping between function and result).



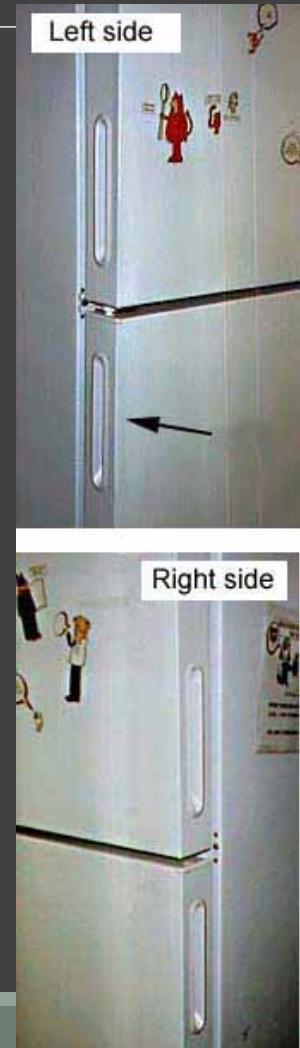
¿push or pull?



¿right, left or center?



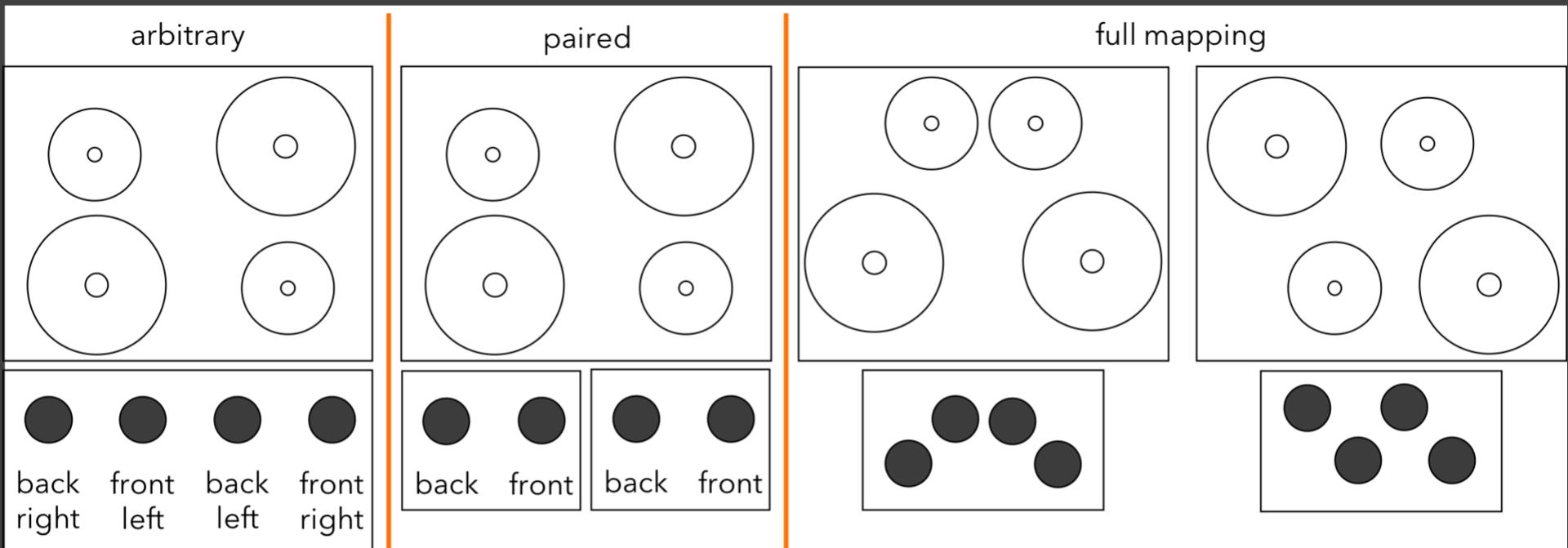
Right!!!



# EVERYDAY EXAMPLES

Mapping: Natural relationship between controls and objects

- E.g., Kitchen hobs



- 24 possibilities
- visible labels
- memory

- 2 possibilities per side
- visible labels
- memory

# EVERYDAY EXAMPLES

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- Transference effects (e.g., computer and typewriter)
- Stereotypes: We all understand them, but they might no longer represent the related concept (e.g., a telephone, the key of a car or a door)



# EVERYDAY EXAMPLES

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- People have mental models of how things work.
- The models might be wrong.
- The models allow people to mentally simulate the operation of the device and to predict how things (should) work.
- It is crucial to find a balance between utility and design.

# THE BIRTH OF HCI

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Interaction takes place everywhere: it occurs both in everyday life and with the use of the computer.

E.g. sending e-mails, playing games, taking money out from bank account...

Firstly, the term Man-Machine Interface was coined

- The interface includes those elements with which the end-user interacts
- User-friendly interface (focus on marketing)

# THE BIRTH OF HCI

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- ❖ Example of good HCI: A steering wheel of a car - only experts are interested in the connection between the engine crankshaft and the wheel hub, but everyone has an opinion on whether it is comfortable and 'nice'.



# THE BIRTH OF HCI

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- ❖ Example of bad HCI: The controls of a video must be visible with a good translation of its effects and must suggest its functionality.



# THE BIRTH OF HCI

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- The birth of HCI (and the term itself) in the mid-1980s to go beyond user-friendly aspects (marketing ploy)
- (1981) "An input language for the user, output for the system and an interaction protocol"
- (ACM SIGCHI, 1987 ) "Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them"
- A Brief History of Human Computer Interaction Technology by Brad A. Myers, 1998

# THE BIRTH OF HCI DIRECT MANIPULATION

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- 1963 - First mouse (research project by Douglas Engelbart, Stanford)
  - [The Demo by Douglas C. Engelbart on December 9, 1968](#)
- 1981 - First commercial device with a mouse (Xerox Star 8010)
- 1984 - First commercial computer with a mouse (Apple Lisa)

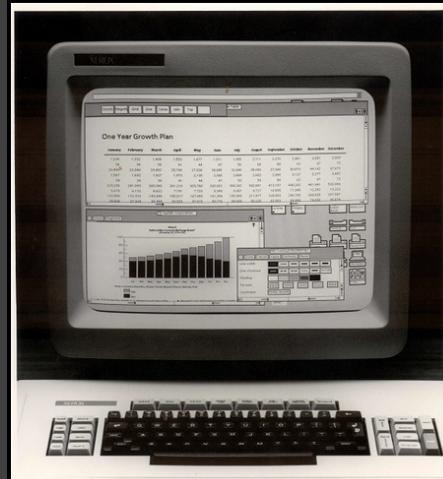


Photo credit: [Joi](#) on [VisualHunt.com](#) / CC BY \*\*\* [pingdom](#) on [Visual hunt](#) / CC BY \*\*\* [kalleboo](#) on [Visual hunt](#) / CC BY

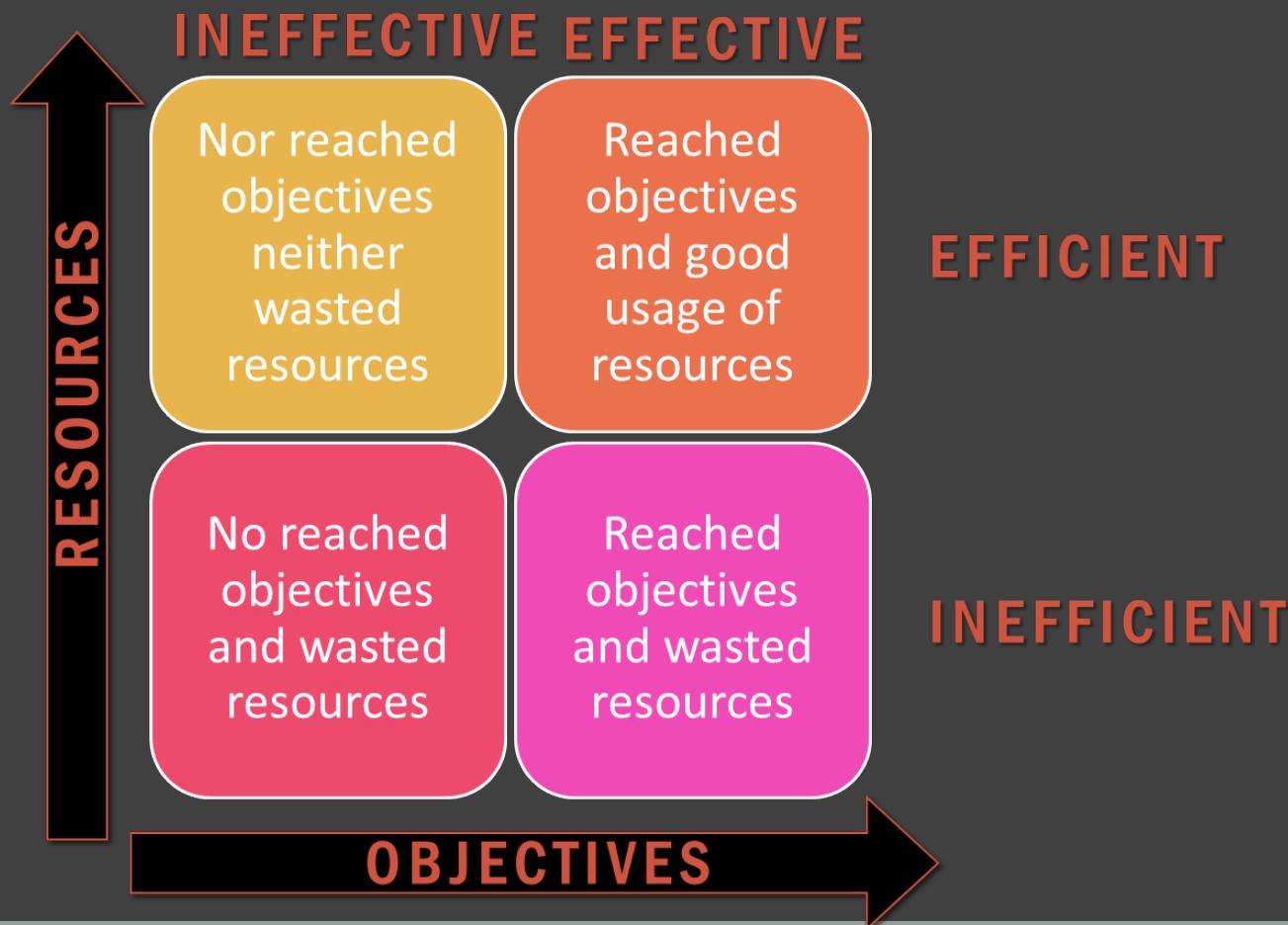
# OBJECTIVES OF HCI

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- To develop and/or improve:
  - Security – e.g., at work
  - Usefulness – what can the system do?
  - Effectiveness – e.g., put together the exit and delete buttons
  - Efficiency – e.g., the most used button must be the closest one
  - Usability – easy to use, easy to learn and error free
- Example: [www.edreams.es](http://www.edreams.es)



# OBJECTIVES OF HCI



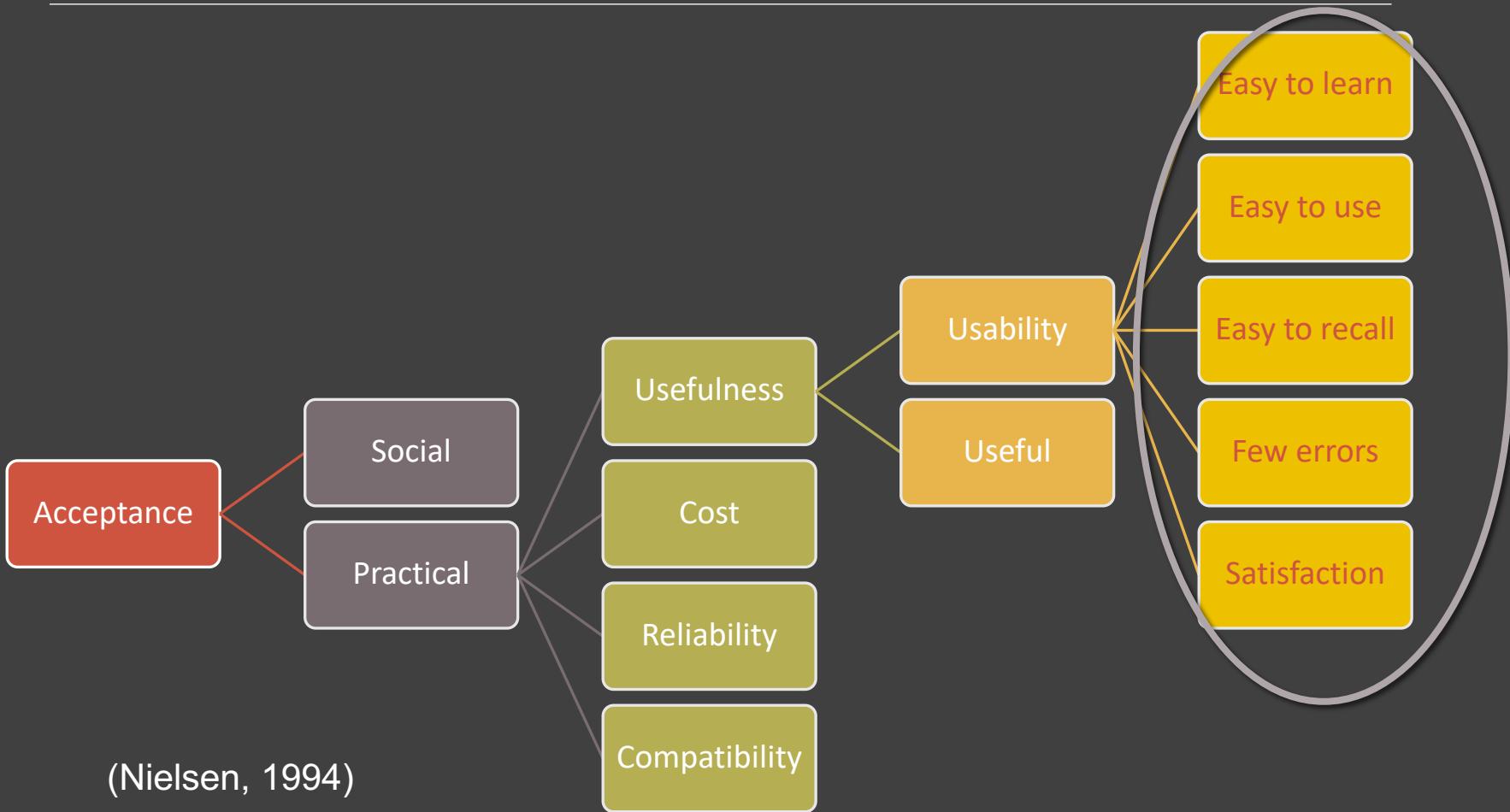
# OBJECTIVES OF HCI

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In order to achieve a good usability, we need to:

- understand the factors which determine how people work with computers;
- develop tools and techniques which help interaction designers to create systems which end-users can effectively use;
- achieve an efficient, effective and secure interaction.

# THE OBJECTIVES OF HCI



# FACTORS WITH A ROLE IN HCI

ORGANISATION training, how work is done, who uses what	ENVIRONMENTAL noise, heat, lighting, ventilation
HEALTH / SECURITY stress, headaches, body disorders	USER motivation, satisfaction, enjoyment, experience
USER INTERFACE	
I/O devices, colour, icons, commands, graphics 3-D, graphics, natural language, multimedia	
TASKS	
Easy/difficult, complexity, sharing of tasks, monitoring, skills, components	
RESTRICTIONS	
Costs, timing, budget, teams, building, staff	
SYSTEM	
Hardware, software, applications	
PRODUCTIVITY	
more quality, minimize costs, reduce time, increase productivity, more creativity and innovation	

(Preece et al, 1994)

# HCI IS MULTIDISCIPLINARY

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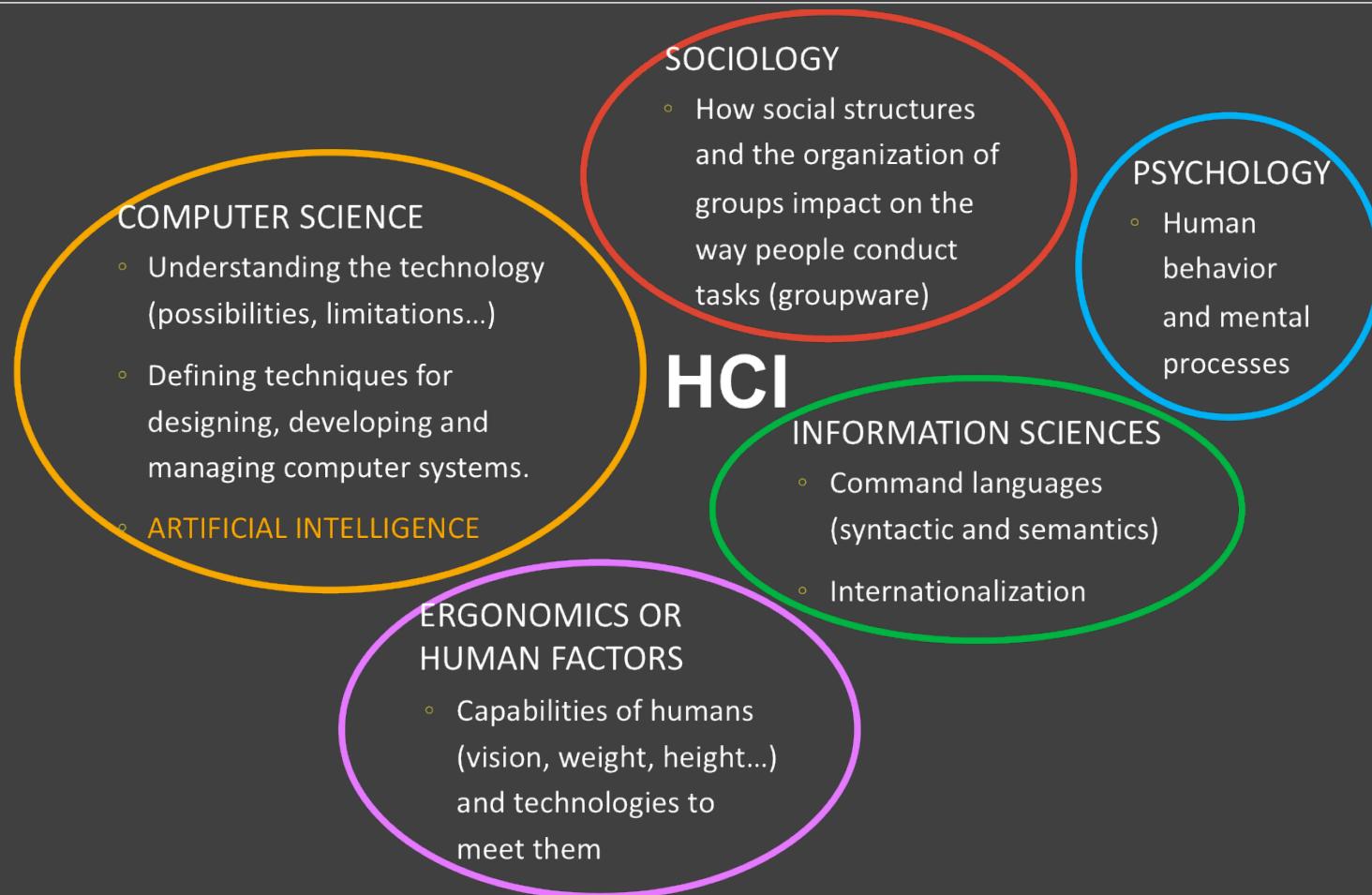
HCI is a discipline related to:

- the design, evaluation and implementation of interactive systems for human use; and
- the study of the great phenomena around these systems.

(ACM, 1987)

# HCI IS MULTIDISCIPLINARY

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# HCI IS MULTIDISCIPLINARY

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## Computer Science

- Understanding the technology (possibilities, limitations...)
- Defining techniques for designing, developing and managing computer systems.
- Artificial intelligence

## Psychology

- Human behavior and mental processes

## Sociology

- How social structures and the organization of groups impact on the way people conduct tasks (groupware)

# HCI IS MULTIDISCIPLINARY

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## Ergonomics or human factors

- Capabilities of humans (vision, weight, height...) and technologies to meet them

## Information Sciences

- Command languages (syntactic and semantics)
- Internationalisation

# THE CONCEPT OF INTERACTION

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The **communication process** between the user and the system

- The system as an element which conducts, simplifies or supports the execution of tasks

The **user interface** is where this communication process takes place

- Therefore, it has to be designed to facilitate this interaction

# INTERACTION MODELS

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An interaction **model** is an abstract representations of a complex reality that is used to facilitate its understanding and the study of its behaviour

- E.g., Social or economic models

The use of interaction models can help us to

- ❖ Understand what is going on in the interaction process, and the different interaction styles
- ❖ Identify the root of problems that may occur during this process, and their solutions

# INTERACTION MODELS

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## Interaction models

- **Domain:** A domain defines an area of expertise and knowledge in some real-world activity.
- **Goal:** A goal is the desired output from a performed task.
- **Task:** Tasks are the activities required or carried out to achieve a goal using a particular device.
- **Action:** This is a task that does not involve resolution of problems or control structures (e.g. hit a button).
- **Plan:** Set of tasks to achieve a goal.

# INTERACTION MODELS

An example of interaction model

- **Domain:** Public administration



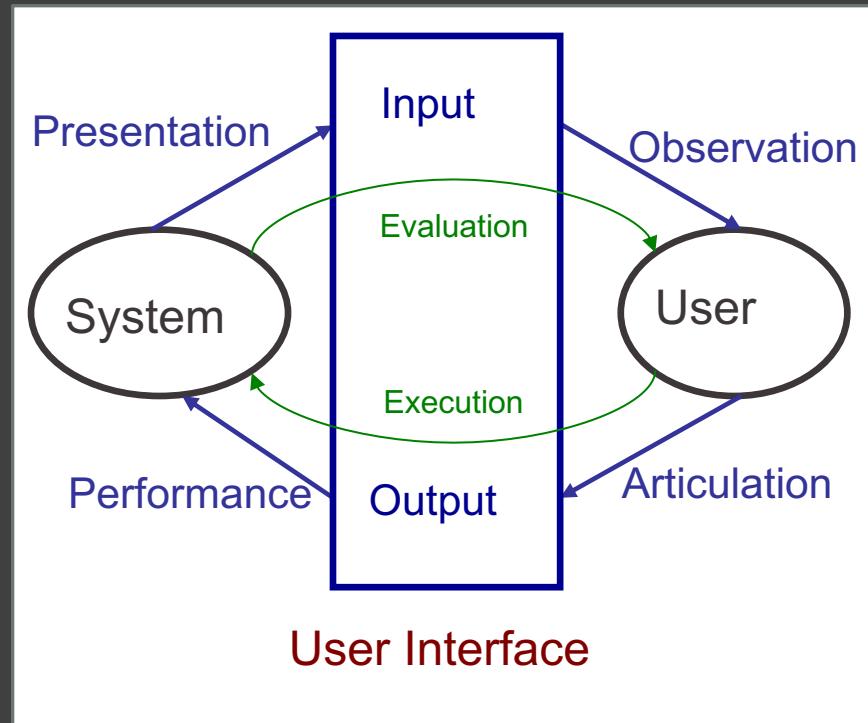
# THE CONCEPT OF INTERACTION

Norman, in *The design of Everyday Things* (1988), talks about:

## User Centered Design

### Norman's Model

- The user formulates a plan of action, which is then executed at the computer interface.
- When the plan, or part of the plan, has been executed, the user observes the computer interface to evaluate the result of the executed plan, and to determine further actions.
- Execution / evaluation model



# Norman's model

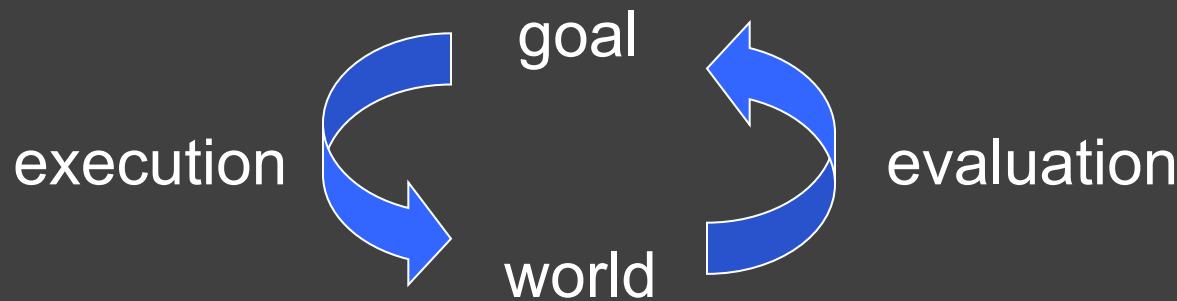
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## Two languages

- ❖ **System language** → The core (system) language describes computational attributes of the domain relevant to the system state.
- ❖ **User language** → The user language describes psychological attributes of the domain relevant to the user state (task language).

# Norman's model

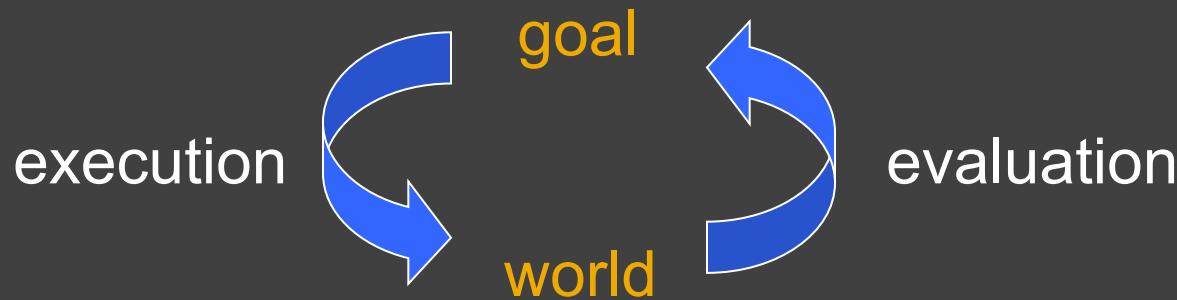
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1. user establishes the goal
2. formulates intention
3. specifies actions at interface
4. executes action
5. perceives world state
6. interprets world state
7. evaluates world state with respect to goal

# Norman's model

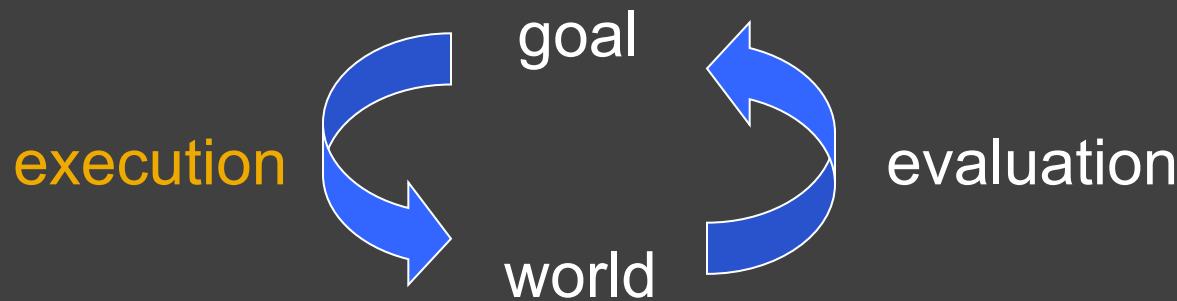
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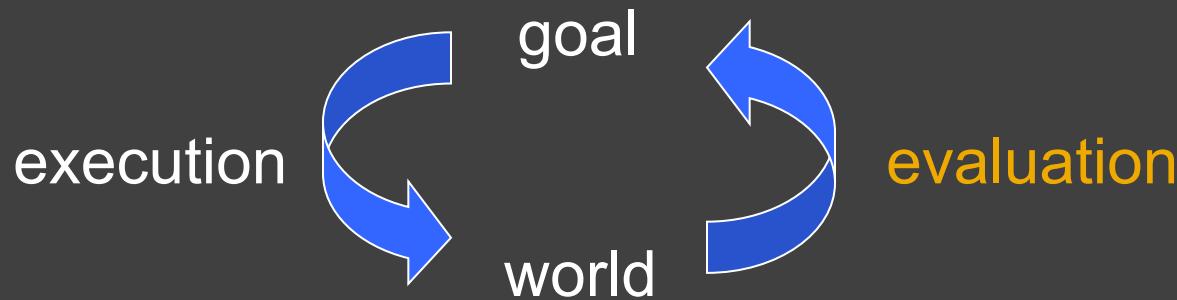
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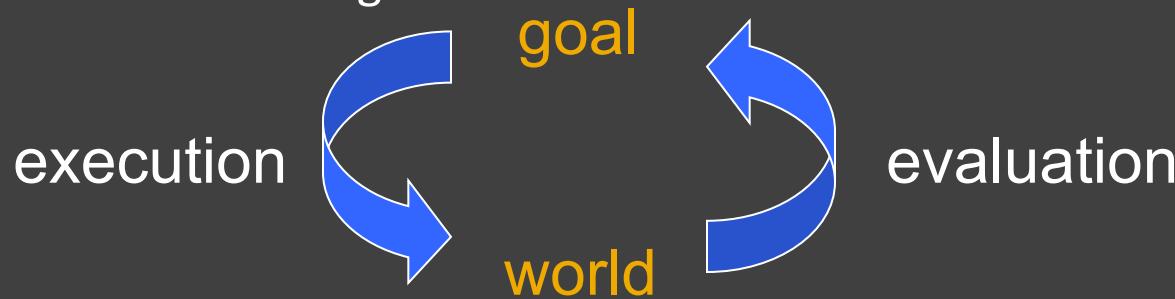


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# Norman's model - Example

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The user establishes the goal

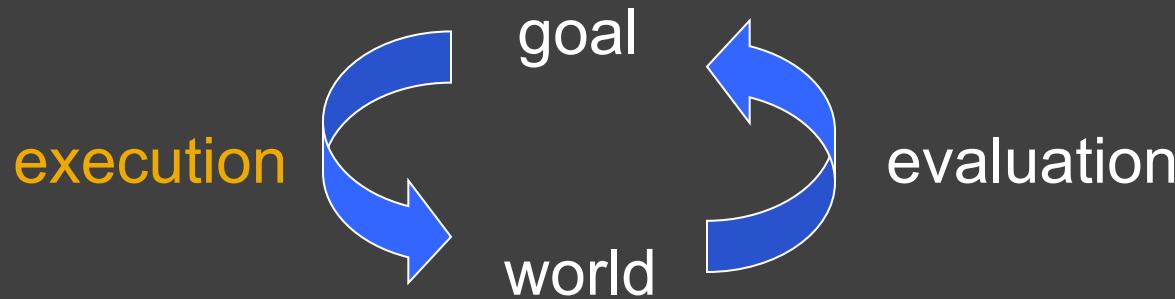


- Imagine you are sitting reading as evening falls.
- You decide you need more light
- **Goal:** getting more light

# Norman's model - Example

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The user formulates intention

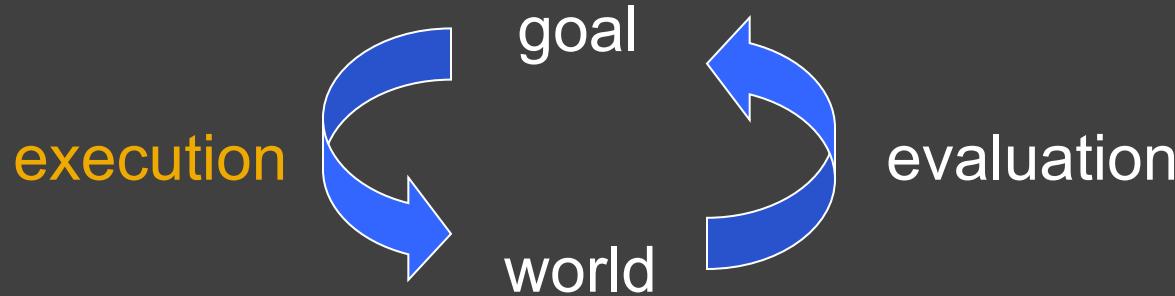


- From the established goal, you form an intention
- **Intention:** switching on the desk lamp

# Norman's model - Example

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The user specifies actions at interface

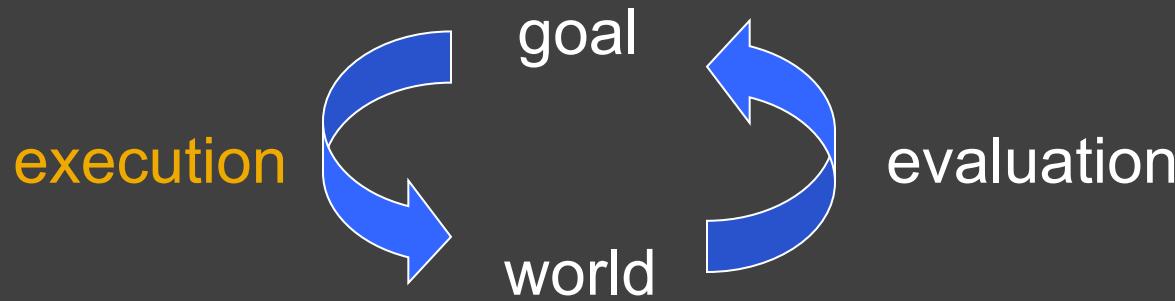


- From the intention, you specify **the actions to execute**: to reach over and press the lamp switch.
- If someone else is closer the intention may be different – you may ask them to switch on the light for you. Your goal is the same but the intention and actions are different.

# Norman's model - Example

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The user executes the action

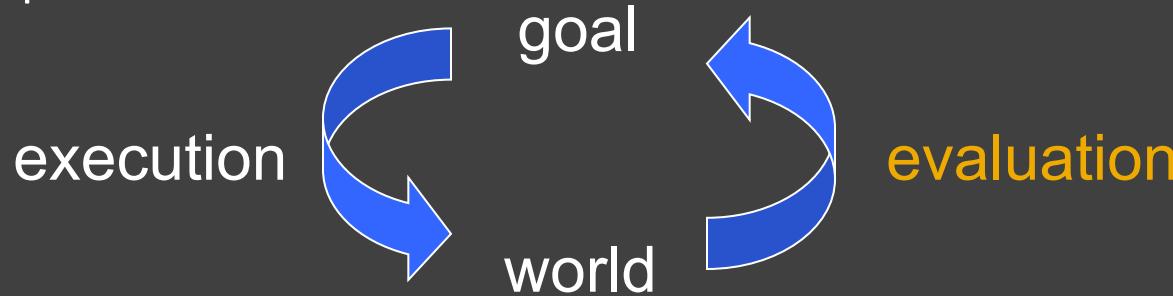


- Execution: press the lamp switch

# Norman's model - Example

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The user perceives the world state

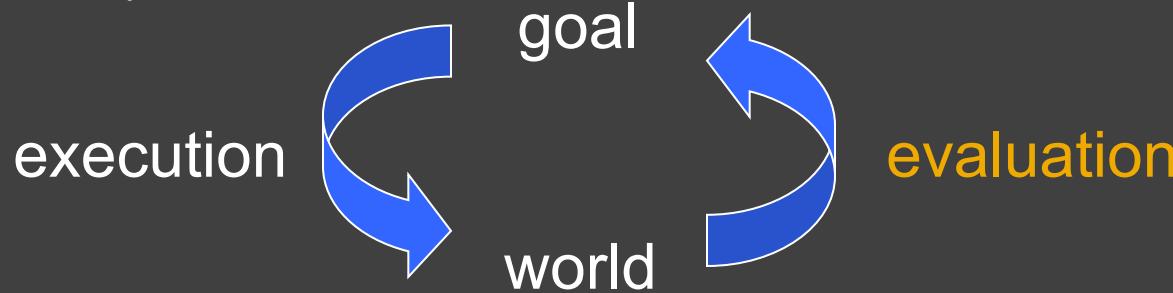


- When you have executed the action you perceive the result
- **World state:** the light is on or it isn't

# Norman's model - Example

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The user interprets the world state

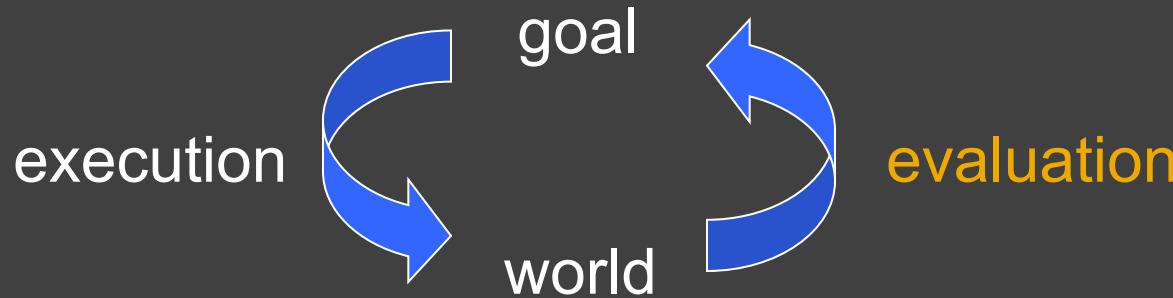


- If the light does not come on, **interpretation**: the bulb has blown or the lamp is not plugged into the mains. Consequently, you will formulate new goals (cycle).

# Norman's model - Example

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The user evaluates the world state



- If the light comes on, **evaluation**: is there now enough light?
- If so, the cycle is complete. If not, you may formulate a new intention to switch on the main ceiling light as well.

# Norman's model

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Exercise for students

Apply the evaluation-execution model on the objective:

"I want to book an accommodation for spending the holidays in Rome"

# Norman's model

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## Exercise for students

1. The goal of the user is "I want to book an accommodation for spending the holidays in Rome"
2. Intention: Using the web Airbnb
3. Actions: Open the browser, Look for the Airbnb website, Write Rome as destination in the search box, switch to the map view, choose one of the accommodation based on the price/location, click on the book button, follow the booking process, get the reservation email
4. Executes the actions specified in the previous point
5. Observe the interface and the message you get from the website
6. Read the message in the website: "Great. You already have your accommodation booked"
7. The user gets the accommodation

# Norman's model

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# Norman's model

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Why do some interfaces cause problems?

## Execution gulf

- ❖ The gulf of execution is the difference between the user's formulation of the actions to reach the goal and the actions allowed by the system
- ❖ If the actions allowed by the system correspond to those intended by the user, the interaction will be effective. The interface should therefore aim to reduce this gulf.
- ❖ Example: To record a film you are watching now
  - ❖ User's language: click on 'record'
  - ❖ System's language: press the record button, select the channel, select the recording time, press ok

# Norman's model

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Why do some interfaces cause problems?

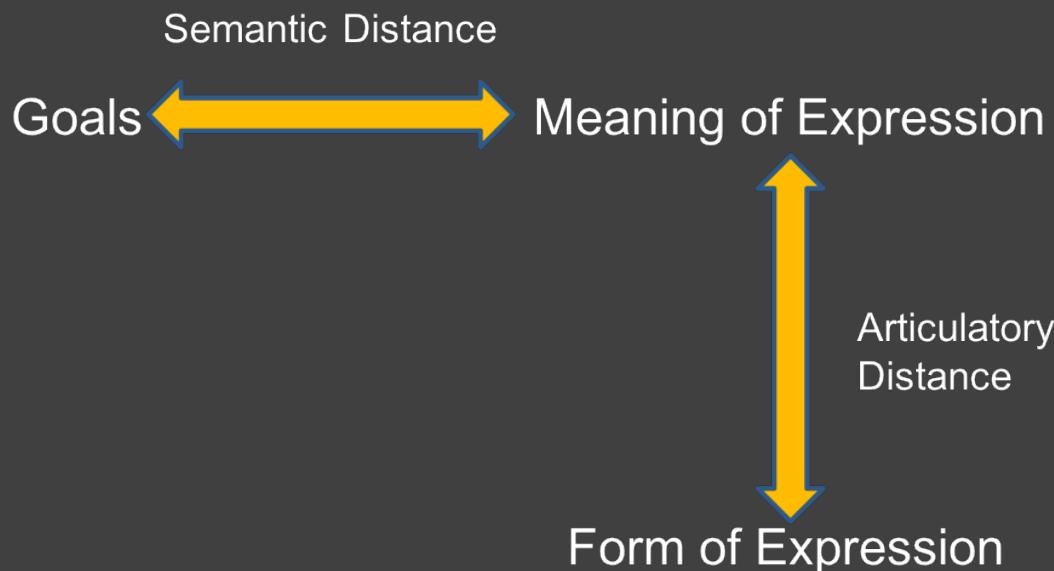
## Evaluation gulf

- ❖ The distance between the physical presentation of the system state and the expectation of the user. If the user can readily evaluate the presentation in terms of his goal, the gulf of evaluation is small.
- ❖ The more effort that is required on the part of the user to interpret the presentation, the less effective the interaction.
- ❖ Example: You follow all the steps, but there is no feedback (e.g., A red light informing you about the fact that the system is actually recording the film).

# Norman's model

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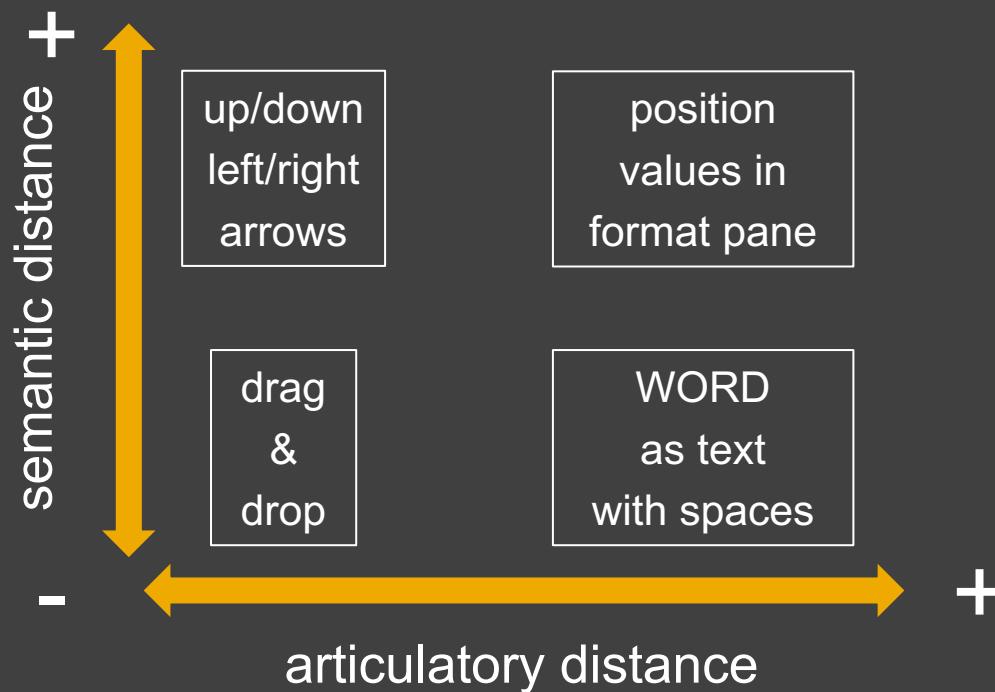
- The **semantic distance** is the relation between the meaning of the elements in the interface and the aim that the user wants to achieve.
- The **articulatory distance** is the relation between the meaning of the elements in the interface and their physical representations.



# Norman's model

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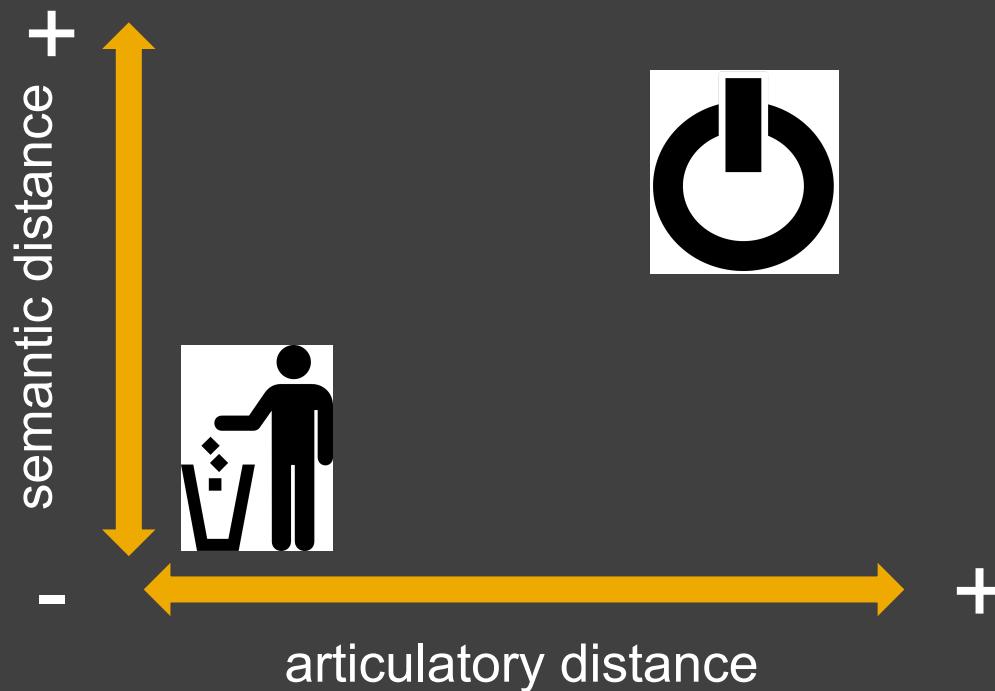
- Let's image that we have inserted an image in PowerPoint and we want to move it. We have at least 4 options.



# Norman's model

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- An interesting example is about how the icons are designed.



# Norman's model

Exam January 2014

Explain what the Norman implementation and evaluation chasms are and indicate where you think they can be produced in the displayed mobile application (2 pts). Instagram lets you personalize your photos with different filters and share them. In a first screen (a)) icons are displayed to explore the photos of the community, take or modify my photos, view my favourite users or see my profile. Once the photo is obtained you can customize it (b)). Pressing the > button would move to the third screen to share the photo (c)).



# Abowd & Beale's model

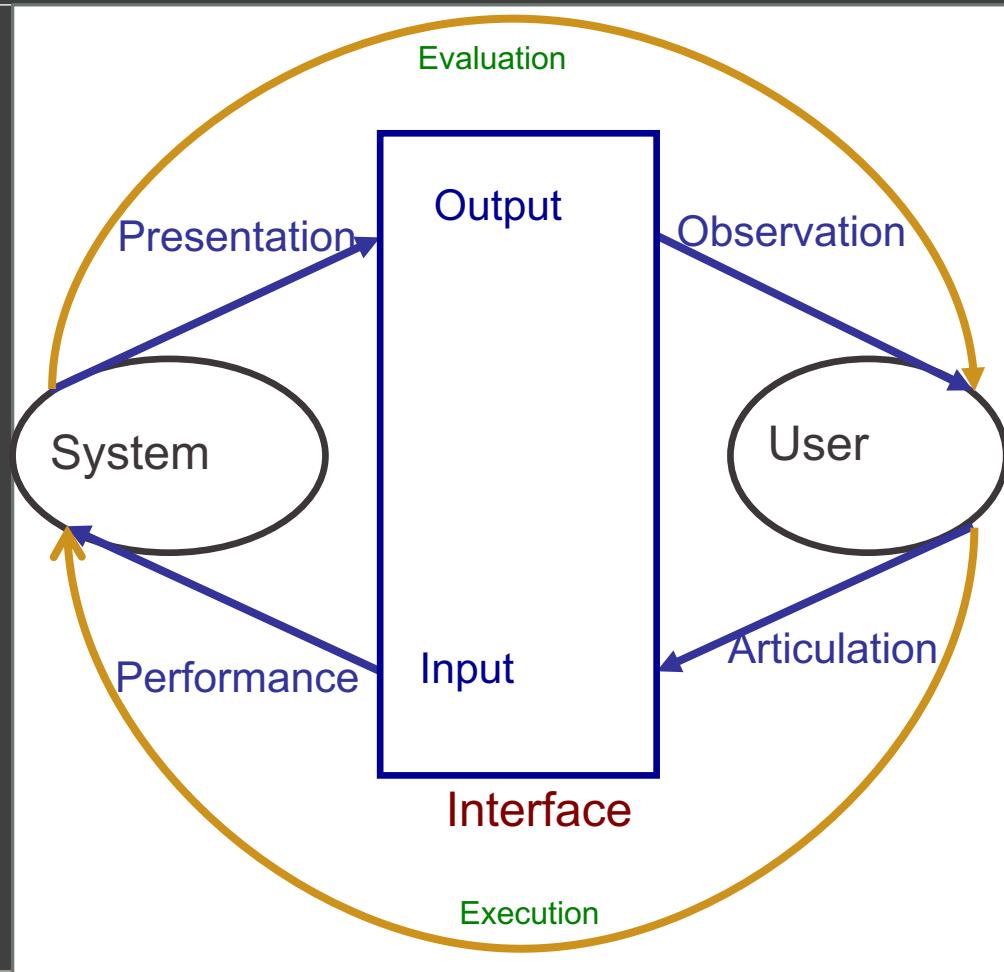
Norman focuses on the user's point of view of the interaction

- The system's communication through the interface is missing

Another Interaction Model:

Abowd & Beale

- It includes the system explicitly.
- The system will perform the translation between user language and system language and vice versa.



# WHAT IS THE USER INTERFACE?

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- The user interface is where the communication between the user and the computer takes place.
- The user interface is:
  - Logical (Usefulness and Usability) - systems and applications
  - Physical (Ergonomics) - devices

# WHAT IS THE USER INTERFACE?

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- The interaction is a dialogue to carry out a task.
- The user interface should be designed to help the user to conduct this task in an efficient and satisfactory way.
- Most of the technological innovations depend on good user interfaces to transform the complexity of a product into something useful, easy to use and attractive to its users.

# TYPES OF USER INTERFACES

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## Types of user interfaces

- Text
- Graphics
- Multimedia
- Multimodal
- Conversational

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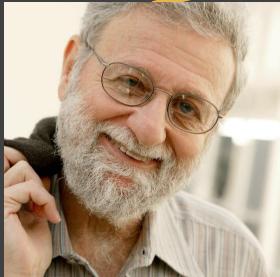
# HCI HEROES

Who said what?

Design is not just what it looks like and feels like. Design is how it works

It's not enough that we build products that work, that are understandable and usable, we also need to build products that bring joy and excitement, pleasure and fun, and yes, beauty to people's lives

A picture is worth a thousand words. An interface is worth a thousand pictures



Don Norman



Ben Shneiderman



Steve Jobs