Biomedical and hospital informatics
Master 1

Human Machine Interface
Interface Homme Machine
GB 722

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Course Program

- Human-machine interaction introduction
- Contributions of cognitive psychology in Human-Machine design (HMI)
- Principles of ergonomics of web software and mobile interfaces
- Design and evaluation of Interfaces

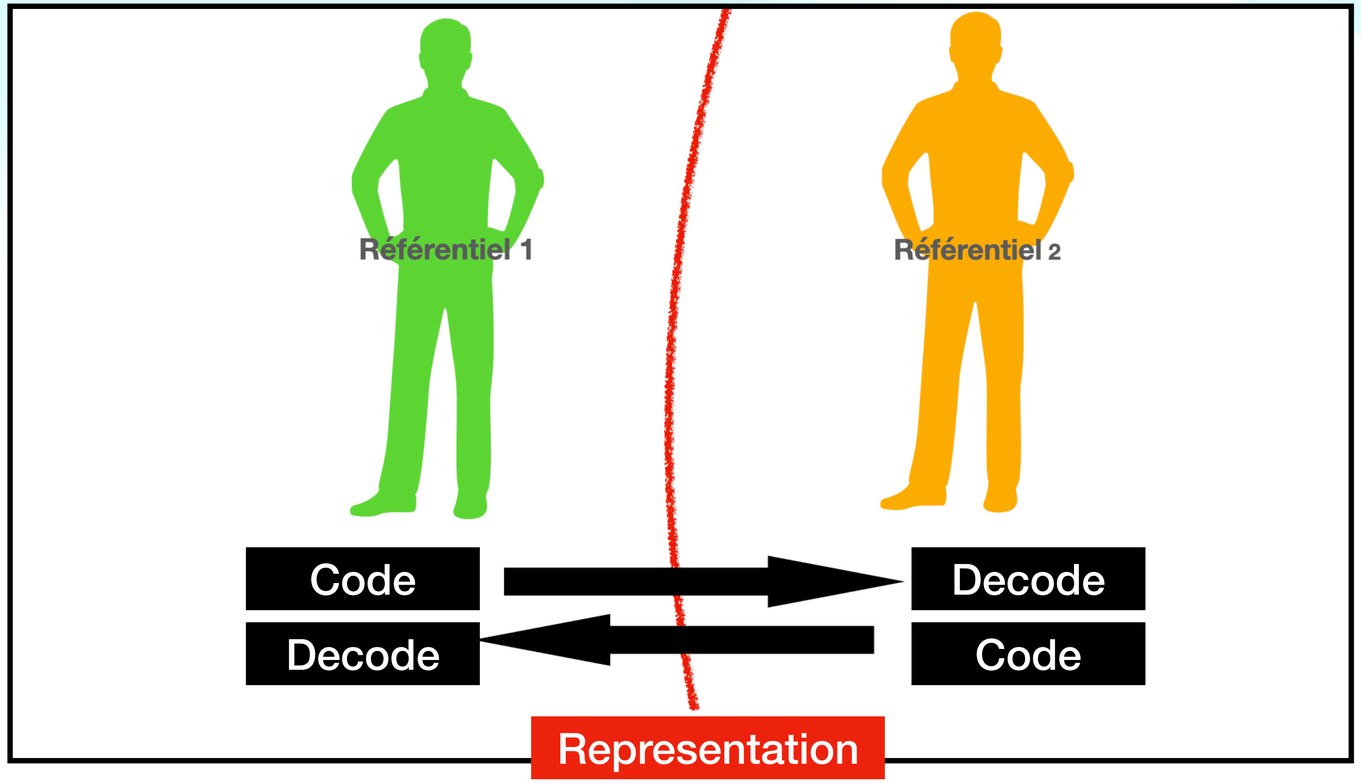
Practical Work Program

- Design a computer application with an ergonomic interface in the biomedical field:
    - Web application, android application, utility software

Chapter 1 Human-machine interaction introduction

1. Introduction

- Any communication between two agents using two different frames of reference must go through a representation in order to cross this border which separates them.



1. Introduction

- This representation mechanism is generalized in the case of human-machine communication which requires the permanent coding and decoding of each incoming or outgoing information.

1. Introduction

- Studying the HMI amounts to studying the means and techniques enabling the discontinuity between the frames of reference of two agents to be crossed.
- HMI can also be considered as the art of designing and producing relevant representations which are likely to be interpreted in a sufficiently similar manner in two given frames of reference.

2. Definition

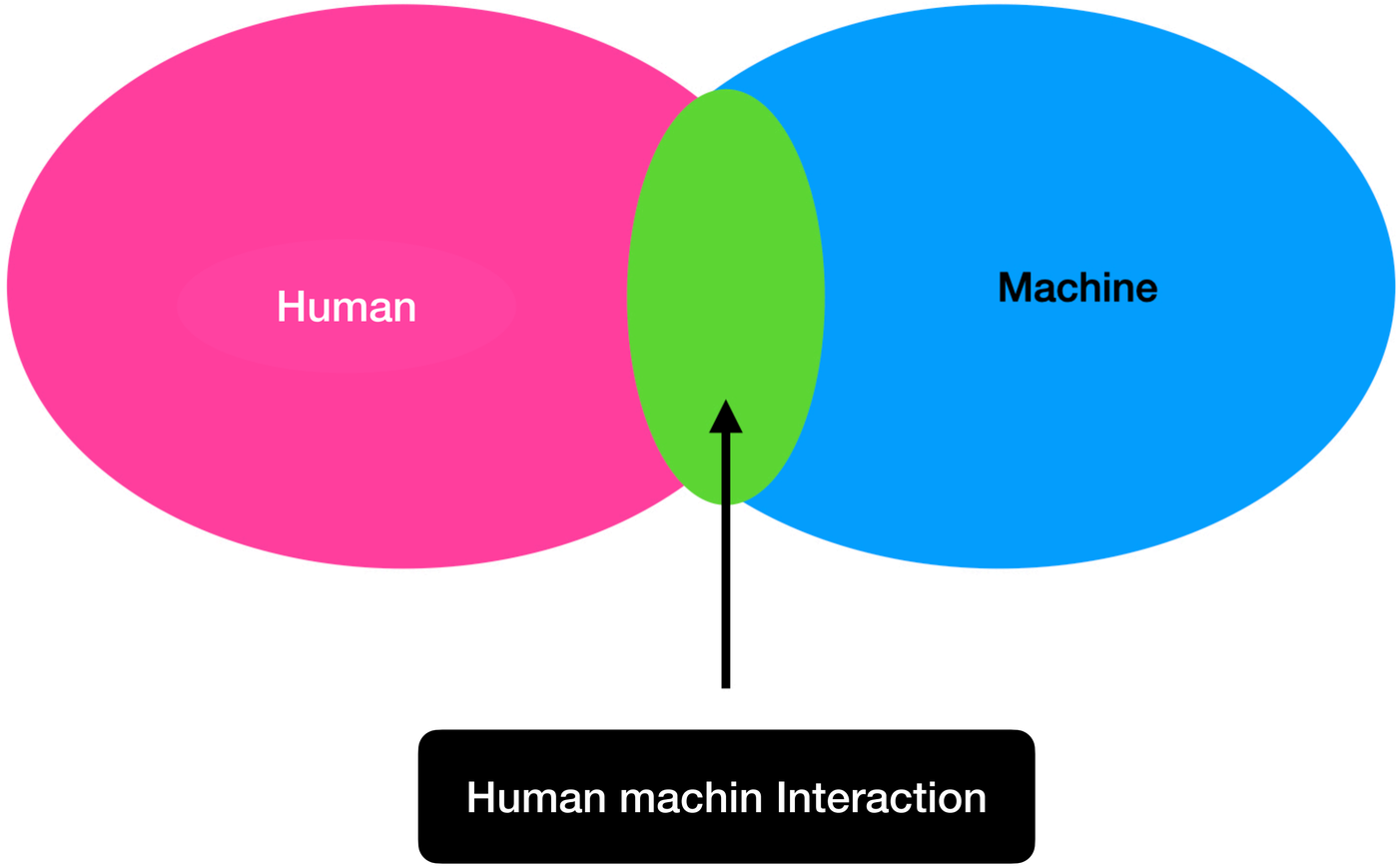
- **Human Machine Interaction HMI, Person-Computer Interaction (PCI), Human Machine Communication (CHM), or even Human Machine Dialogue (DHM),** all these acronyms can be used to define all the means used by man to interact with a machine.

- HMI is the set of hardware and software devices allowing a human to communicate with a computer or any other digital device. These are all aspects of the design, implementation and evaluation of interactive computer systems.

2. Definition

- The 3 participants in the design of human-machine interfaces:
  - **The user**: participates with his choices.
  - **The machine (computer)**: participates with the program.
  - **The designer**: participant who anticipates the user's possible choices and codes them in a program.

2. Definition



3. Interface design approach

- When creating an HMI, two approaches are possible depending on the two main players in HMIs, which are human and machine:
    - **The techno-centric approach:** which is centered on the machine and its possibilities, it is up to users to adapt to the machine.
    - **The anthropo-centric approach:** which this time focuses on man and his needs, it is the machine now which must adapt to the user

3. Interface design approach

- But whatever the approach used, it is necessary to take into consideration certain characteristics linked to everything that makes up the HMI when designing it, namely: **the man, the machine,** and **the context** of **the HMI application and the task** that the user must perform while interacting with the machine.

3. Interface design approach: User Characteristics

- Physical differences (age, disability, etc.)
- Knowledge and experience:
    - In the field of the task (novice, expert, professional)
    - In computing, on the system (occasional, daily use).
- Psychological characteristics (visual/auditory, logical/intuitive, analytical/synthetic)
- Socio-cultural characteristics
- Direction of writing of old code

3. Interface design approach: Characteristics linked to the context of the application

- General public (offer immediate handling)
- Leisure (make the product attractive)
- Industry (increase productivity)
- Critical systems (ensure zero risk)

3. Interface design approach: Task characteristics

- This involves seeing whether the task is repetitive, regular, occasional, sensitive to changes in the environment, constrained by time, risky...

3. Interface design approach: Technical constraints

- Platform
- Memory size
- Screen, sensors, effectors
- Reuse of old code

5. interfaces Evolution

- The HMI has emerged since the creation of the computer, the question of how to communicate with the machine then arose:
    - How to enter data and programs into this machine?
    - How to visualize the results obtained after treatment?

5. interfaces Evolution

- Among the premises of the field we find: punched cards which were nothing other than papers with holes allowing the machine to read information, magnetic tapes which allowed the recording and reading of analog and digital information, printers, .

5. interfaces Evolution

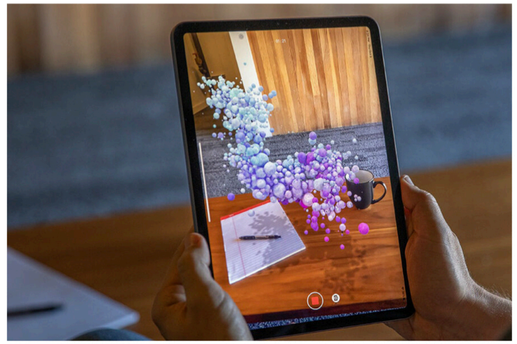
- **1963:** appearance of new, more user-friendly, easy to understand and use input-output devices such as graphic displays and optical pens
- **1968:** appearance of the first mouse
- **1980:** consumer applications contributed to the evolution of HMIs.

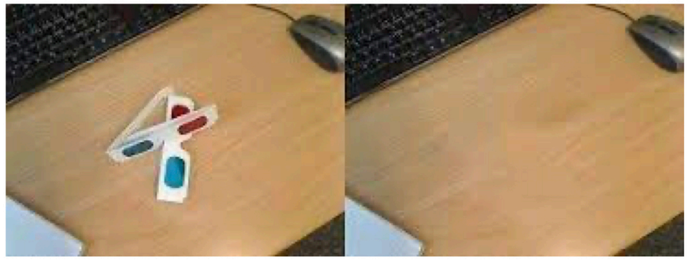
5. interfaces Evolution

- This evolution was subsequently continued by the appearance of graphical interfaces characterized by **direct manipulation via direct actions on objects represented on the screen. Hence the development of WYSIWYGs (What You See Is What You Get)** a category of application equipped with an interface allowing the user to see the result of their work (text, image, website) directly as they are. it will be published.

5. interfaces Evolution: Virtual reality, augmented and diminished, clickable and tangible

- **Virtual reality** appeared in 1990 and continues to be perfected to this day. This evolution of techniques for representing a three-dimensional world is a simulation of an environment in which the subject has the impression of evolving (avatar), using a headset and movement sensors.





5. interfaces Evolution: Virtual reality, augmented and diminished, clickable and tangible

- **Augmented reality** (or AR) is a technology that allows the integration of virtual elements in 3D (in real time) into a real environment. The principle is to combine the virtual and the real and give the illusion of perfect integration to the user.

- **Diminished reality** is a type of computer-assisted reality that allows you, through technology, to remove, hide, or eliminate real-life objects from your environment

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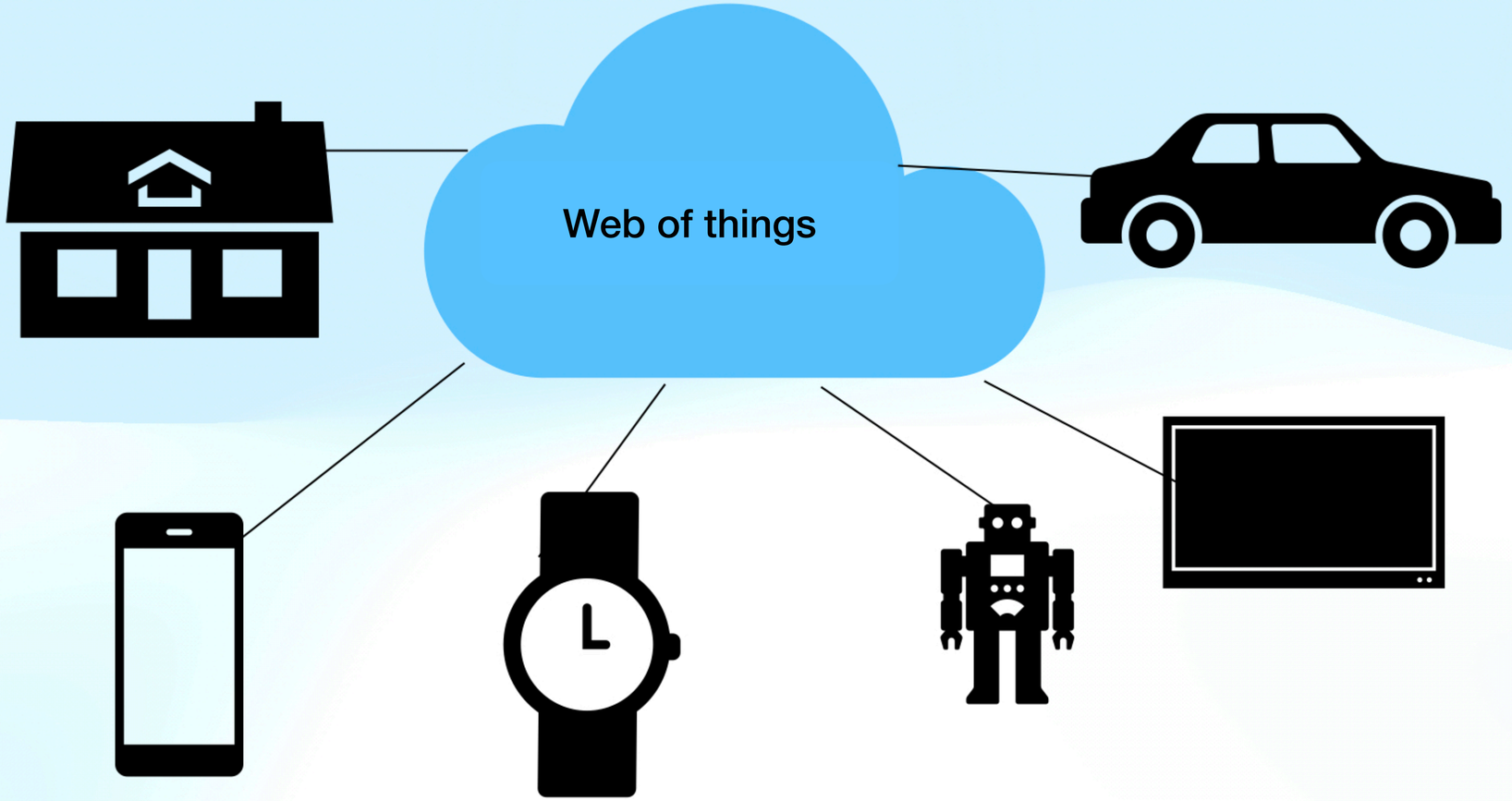
5. interfaces Evolution:Web of Things and Wearable Computing

- **The Internet of Things (IoT**) is a network of networks that allows, via standardized and wireless electronic identification systems, to identify and communicate digitally with physical objects in order to be able to measure and exchange data between the physical and virtual worlds. Computing is then embedded in objects (smart house, car and household appliances, etc.) or in clothing (smart shoe) as well as accessories (smart watch).

5. interfaces Evolution: Pervasive environment, ubiquitous

- This is an environment where communicating objects automatically recognize and locate each other autonomously. The latter interact with each other without any particular action from the user .

5. interfaces Evolution:Web of Things and Pervasive environment



Environnement pervasif

5. interfaces Evolution: Interactive systems

- An interactive system is a computer application which takes into account, during its execution, information communicated by the user(s) of the system, and which produces, during its execution, a perceptible representation of its internal state.

- Typically, the inputs provided by the user depend on the outputs produced by the system and vice versa. Today, interactive systems constitute a growing part of computer applications.