HMI course
Human-Machine Interaction
HMIs Design

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Chapter 4
HMIs Design

Outline

- Examples of HMIs
- Key concepts in IMH design
- HMI design methods

Examples of poor HMI

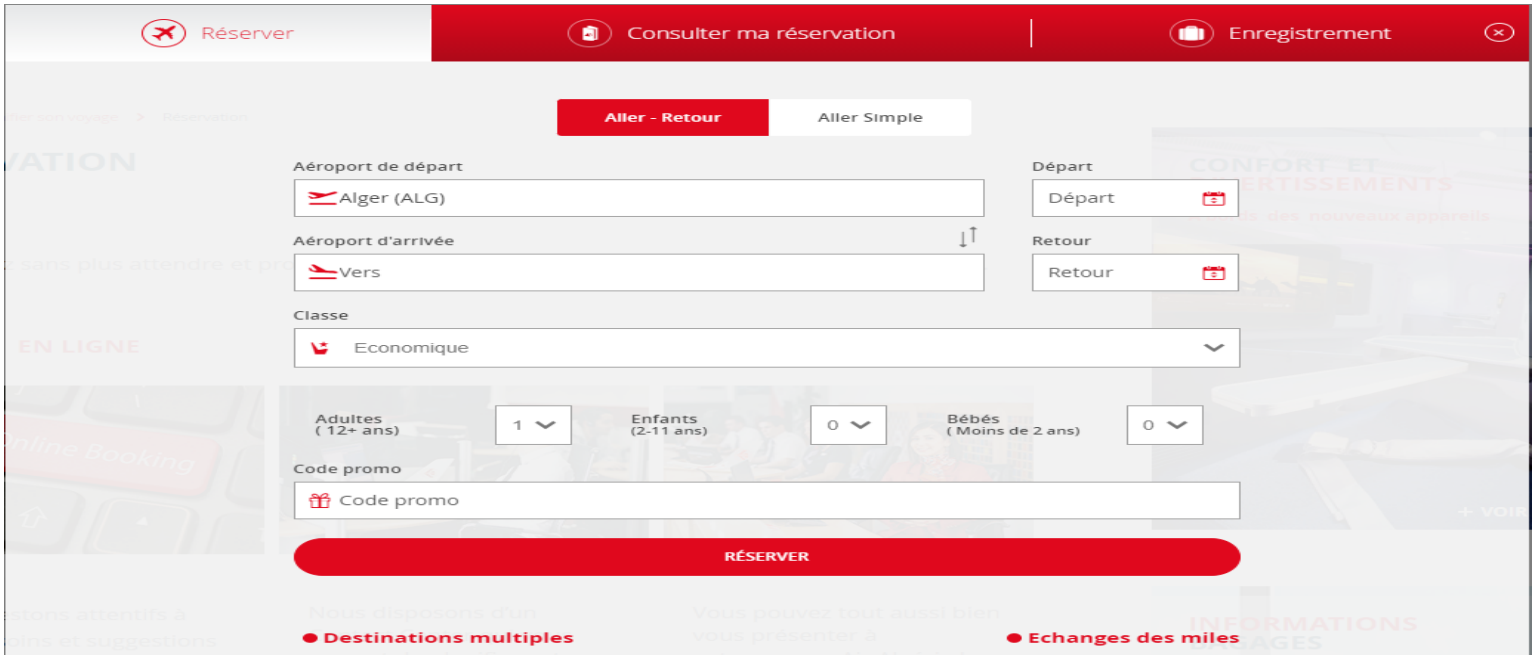
- The Mont St Odile accident:
  - January 20, 1992
  - 87 killed
  - 9 survivors
  - a crash during descent
  - Rulings: "Airbus civil liability for civil fault relating to the design of the A320 cockpit".

Examples of poor HMI

- Three Mile Island nuclear accident in 1979:
  - Lack of consideration of the human dimension in the supervision process

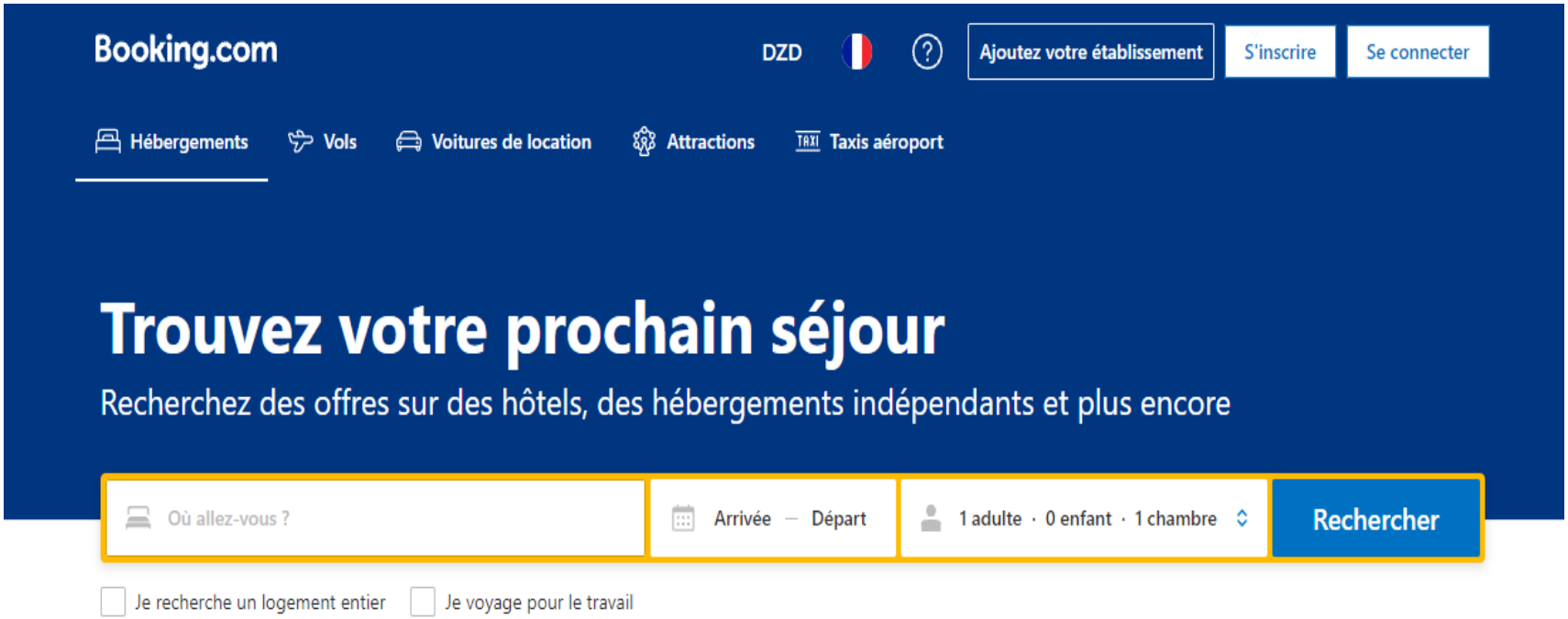
Exemples of good HMI

- Book your flight ticket on the Air Algérie
- website



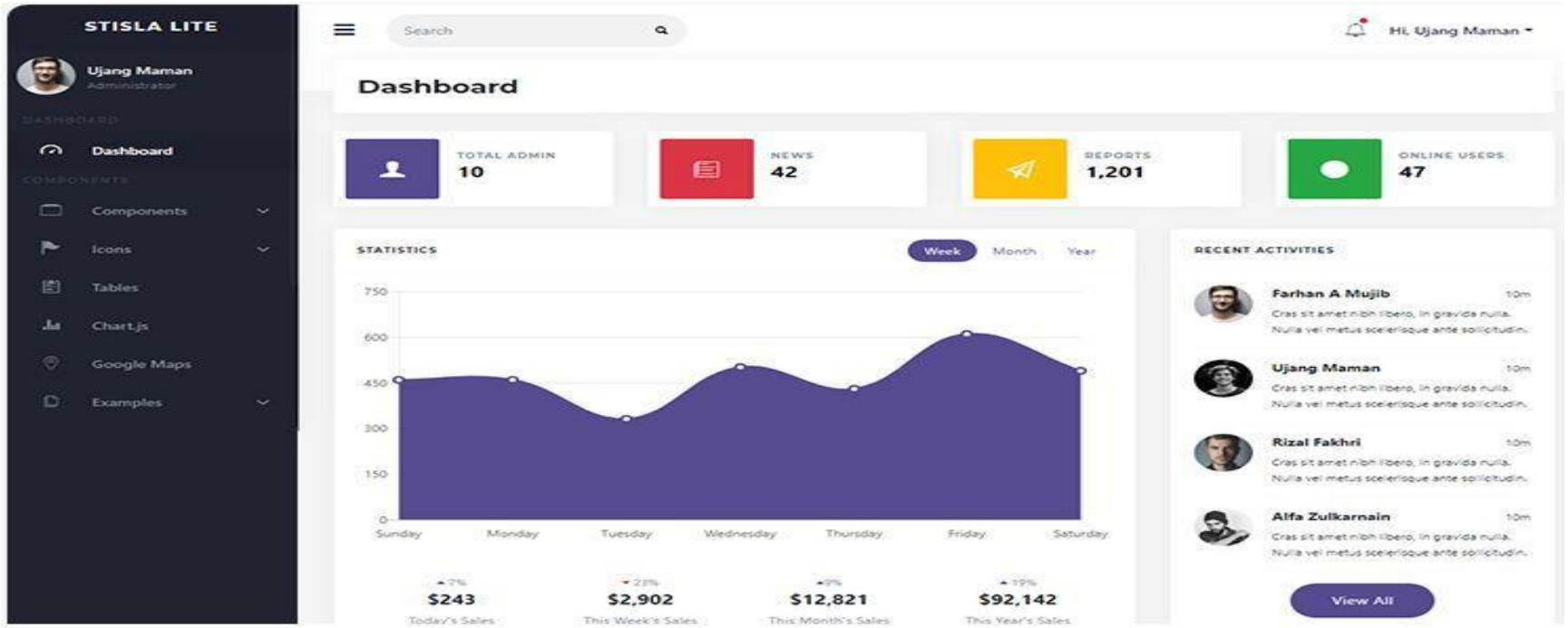
Exemples of good HMI

- Hotel reservation on Booking.com



Exemples of good HMI

- Dashboard

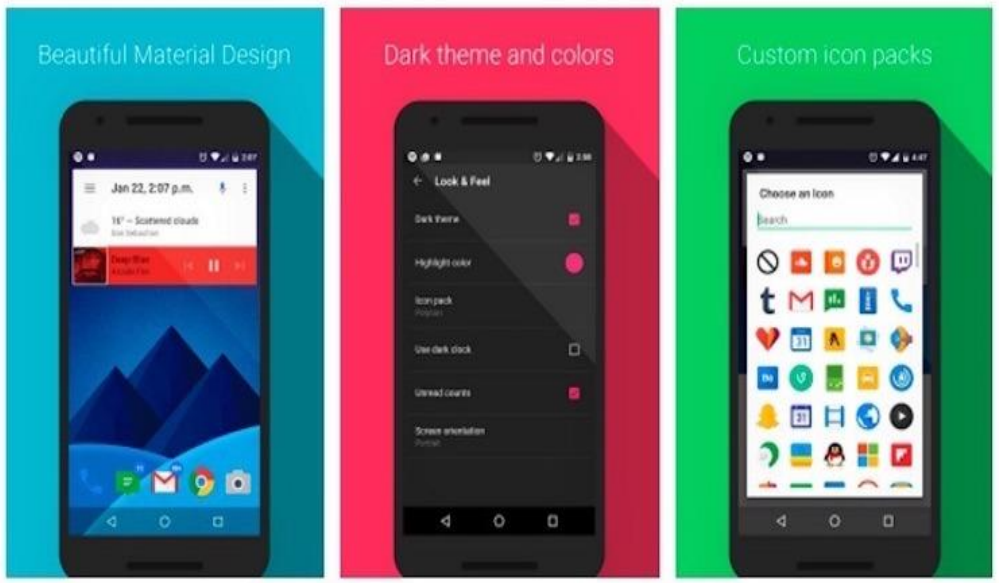


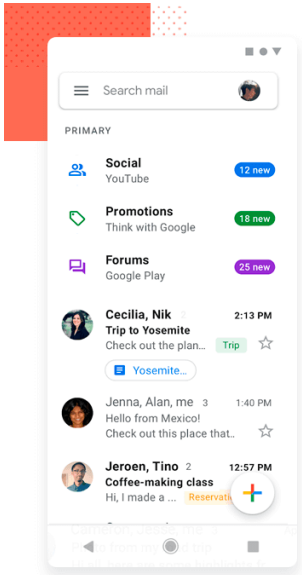
Exemples of good HMI

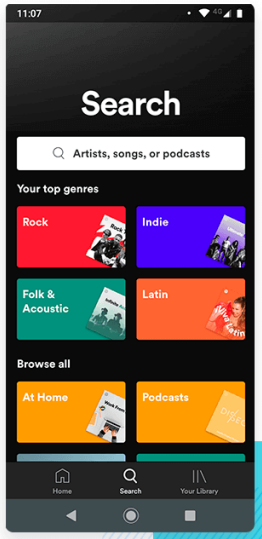
- Aircraft instrument panel

Exemples of good HMI

- Android applications







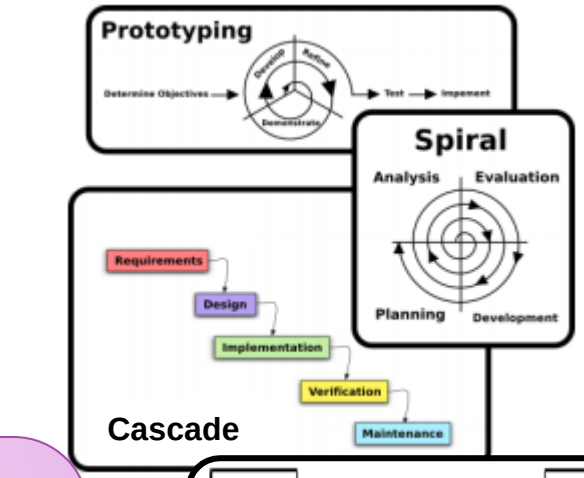
Introduction

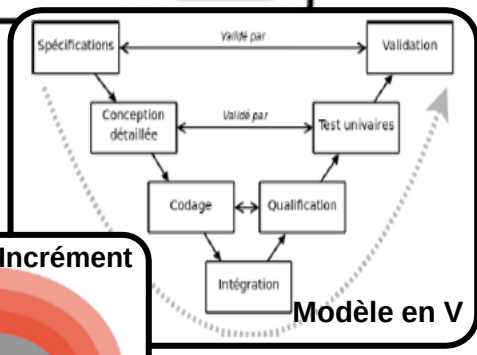
Poor design of the HMI's design can be the source of ***usability problems***. Indeed:

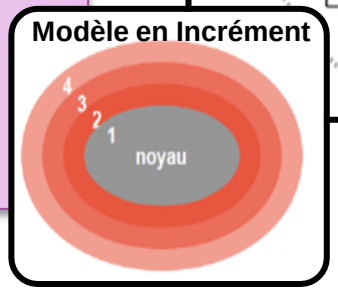
- The interface is the application's showcase, serving as a means for the human (user) to interact with the kernel that brings together the various processes;
- A third of questions during initial contacts with users concern the appearance of HMIs (what will the final product look like? What does it look like?).
- A study has shown that in the maintenance phase: 33% of debugging is caused by poor HMI design, and 67% of HMI (i.e. interface) change requests are made by users.
- Better HMI design thinking helps to secure critical systems and avoid
- disasters

Design in Software engineering

- Numerous software engineering design methods
  - Merise
  - V-shaped cascade model
  - Spiral model
  - Agile methods (e.g., Scrum, DSDM)…







Disadvantages

- System-centric methods
- Principle of independence between functional core and user interface
  - Interface and interaction are only defined after
- Limited user involvement

HMIs specified Methods

Why HMI design methods?

User involvement + regular GUI evaluation :

- Reduced risks and maintenance costs
- Reduced budget / training time
- Attractive application, productivity gains
- Reuse and improvement of basic components

Key concepts in HMI design

THE HMI is based on the understanding and the good conception of 4 important concepts:

- The user
- The task
- Background
- The phases

Key concepts in HMI design

1) **User**
   - User profiles and characteristics are varied

2) **Task**

Represents the user's objective (e.g. to find a book)

- Repetitive, regular, occasional, sensitive to environmental changes, time-constrained, risky, etc.

Key concepts in HMI design

3) Background

Represents the environment and constraints of use:

- General public (offer immediate control), leisure (make the product attractive), industry (increase productivity), critical systems (ensure zero risk), in mobility, etc.

- Technical (exp: platform, memory size, screen, sensors, reuse of old code).

Key concepts in HMI design

4) Phases

An HMI design method is (generally) divided into three phases:

- **Analysis** = specify user expectations and needs, know their tasks and the context

- **Development** = realizing all or part of an interface (in a more or less finished form)

- **Evaluation** = measure/assess the usability of the developed interface, user satisfaction with tasks performed with this interface, identify areas for improvement for the next version, etc.

HMI design methods

There are different methods for designing HMIs:

- Iterative and incremental design;
- Design by prototyping;
- User-centered design;
- Persona and scenario design.

HMI design methods

Features - Iterative

Methodology based on a succession of cycles consisting of three phases (analysis, development, evaluation):

- Work on the entire interface
- Progressive refinement of product specifications
- Evaluations of selected solutions
- Cycles repeated until obtaining a satisfying interface
- New objectives taken into account
- Taking into account t h e opinions of users that may change

HMI design methods

Features - Incremental

Methodology based on producing a first part, then a second, etc.

- Work on a single zone of the interface up to satisfaction
- Development of partial and intermediate solutions
- New objectives taken into account
- Take into account the opinions of users, that might change

HMI design methods

Features - Prototyping

- **Prototyping** consists of designing intermediate (sketch, mock-up) and therefore incomplete (prototype) versions of a software program or website, designed to test usability before the actual computer programming phase. As part of an ergonomic intervention, the prototyping phase enables us to test the use and usability of a product with users (user testing).

- Prototyping allows designers/users to make choices on several levels:
  - high level (exp: available features)
  - intermediate level (e.g. screen sequence)
  - low-level (e.g. icon ideas)

HMI design methods

Features - Prototyping

Prototyping types

- Informal prototype:
  - Paper, post-its
- Formal prototype:
  - Transparencies, video (e.g. Libre Offi Impress)
- Prototype using IT tools:
  - Mock-up software:
    - high reliability, exp: with interactions (exp: Quant-UX, Alva, Invision, Maqetta, Zeplin)
    - low fidelity, exp: only links between screens (exp: draw.io, Mocking Bird, Pencil, Basalmiq, Adobe XD, PenPot, Akira, Sketch)
  - Development software (exp: web frameworks, Netbeans, Visual Studio)

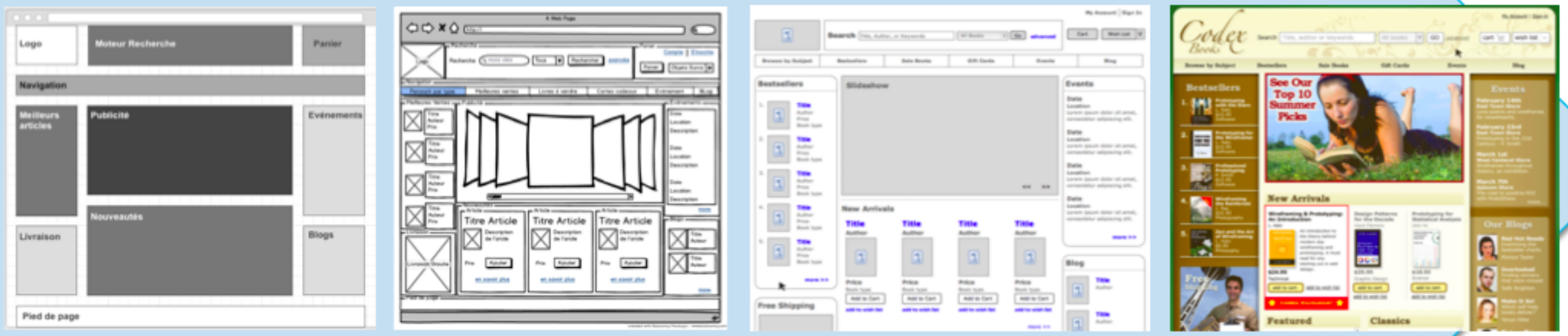
HMI design methods

Zoning

Wireframe

Medium-Fidelity Prototype

High-Fidelity Prototype



HMI design methods

Features- User-centered

User-centered design is based on three models:

User model: identify relevant user features

- General data
  - height, age, gender, disabilities
  - level of education, habits cultural (e.g: format of dates, writing direction)
  - psychological (e.g. visual/auditory, logical/intuitive, analytical/ synthetic)
- Application data: domain expertise, skills in computer science and the
  - novice, expert, professional
  - usage occasional, daily

HMI design methods

Features- User-centered

Task model: identify the sequence of processes in a task

- Building the system task hierarchy
- Specify each task, think about exceptions
- Evaluating decomposition with the user

In this model :

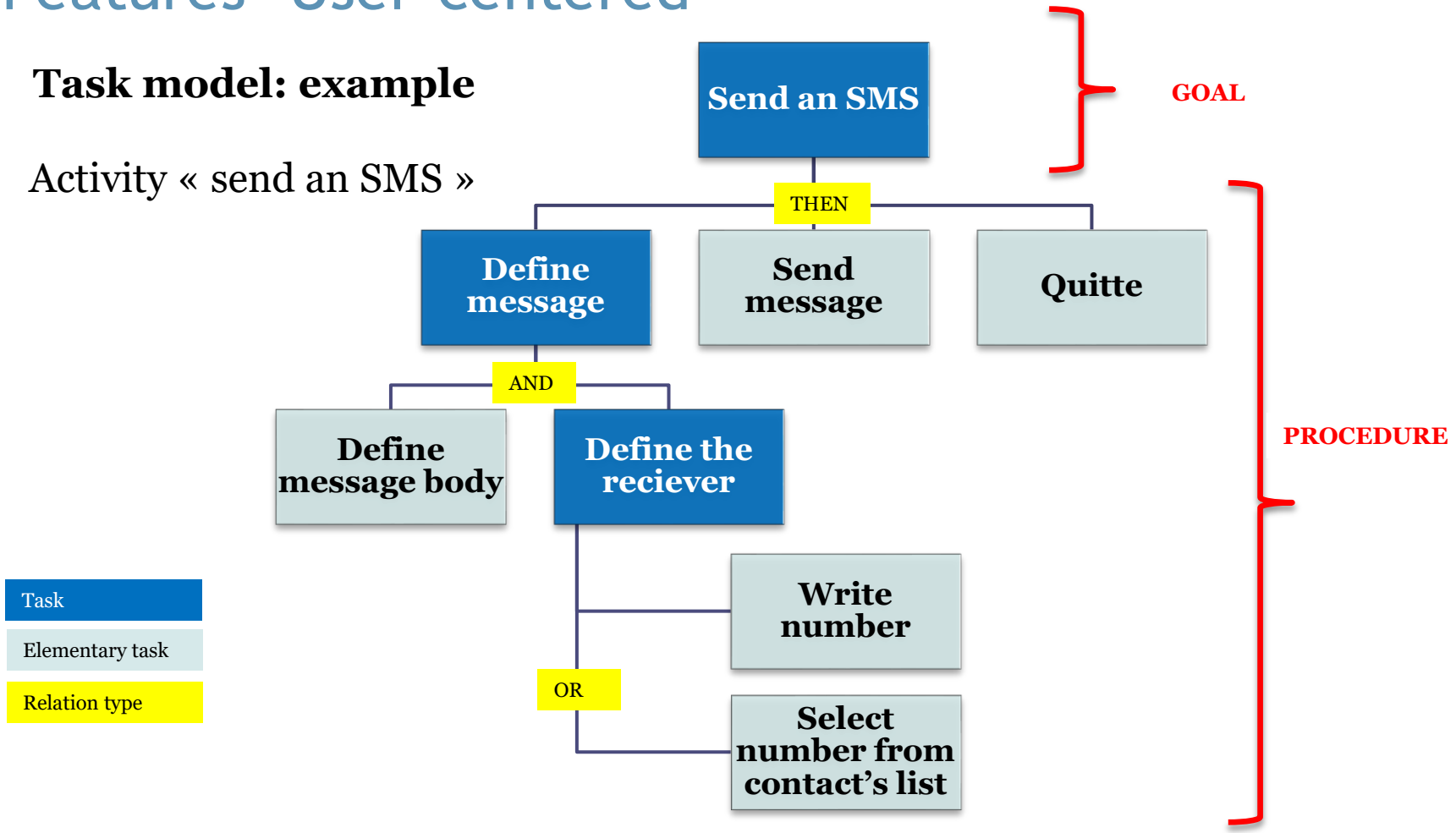
- A task consists of :
  - goal = what needs to be done
  - procedure = a set of subtasks linked by compositional or temporal relationships.
- An elementary task is a task that can only be broken down into physical actions I/O operations

HMI design methods

Features- User-centered

Task model: example

Activity « send an SMS »



HMI design methods

Features- User-centered

Interaction model: establish a correspondence intuitive and natural (metaphor) between :

- Manipulated conceptual objects (e.g. a file)
- Presentation and interaction :
  - object representations on screen (e.g. open, locked file)
  - operations on the object (e.g. opening, modifying)
- Inspired by the real world (e.g. space, technology)

HMI design methods

Features- Personas & Scenarios

A **persona** is not a real user, but an abstraction of several (e.g. the most common characteristics).

- Better understanding of users and their objectives
- Shared user vision

A **Persona**: can include:

- General data (first name, photo, currency, etc.)
- Objectives, constraints, working environment
- What will trigger his actions
- What can influence it
- What can slow it down or scare it away?

HMI design methods

Features- Personas & Scenarios

A scenario : is a kind of story and imagination with :

- A persona
- An environment (sites)
- A goal (which the persona must achieve)
- Obstacles shared by personas

The execution of a scenario implies an orientation for the choice of functionalities, interactions, interfaces (and later evaluation of the realized interface). Example scenario: Connect to the Grooveshark site, search for music by title, author or album, add it to the playlist interface and then extend it with other music in the same genre.

HMI design methods

Features- Personas & Scenarios

« Pour prendre une décision, je dois pouvoir maîtriser tous les aspects... »

Gérard

Informations personnelles	
Age	43 ans
Éducation	Formation secondaire et école d'architecture avec obtention d'une maîtrise en architecture
Occupation	Il travaille dans un petit atelier d'architecture de 5 personnes en Haute-Savoie. Apprécié de son patron et de ses collègues pour sa patience et son humeur égale.
Situation familiale	Gérard est marié depuis 9 ans. Le couple a 2 enfants. Sa femme travaille à mi-temps comme secrétaire médicale.
Hobbies	Il apprécie les excursions en famille le week-end. Amateur de bandes dessinées et des livres sur le design industriel et l'architecture.
Équipement	Avec un PC au travail avec une connexion ADSL en réseau, Gérard a néanmoins opté pour un iBook à la maison pour ne pas avoir à se préoccuper des virus.

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»

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.

Sites clefs

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

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

N'aime pas

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

En conclusion

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

HMI design methods

Summary

An HMI design method requires collecting information about users, their tasks or interface evaluations ⇒ information collecting techniques

Questions?