USER EXPERIENCE

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WHY IS USER EXPERIENCE IMPORTANT?

- "Know your users" - the most fundamental principle of design
- **People** are not "standardized" users
- Essence of experience design = people's memory
- Every interaction contains good and bad, but it's the **final impression** that matters
- There is a huge need for UX professionals to consider their audience: not only the user, but clients and businesses
- "**learn to speak the language of business**," including using numbers to sell our ideas

WHY USER EXPERIENCE IS IMPORTANT?

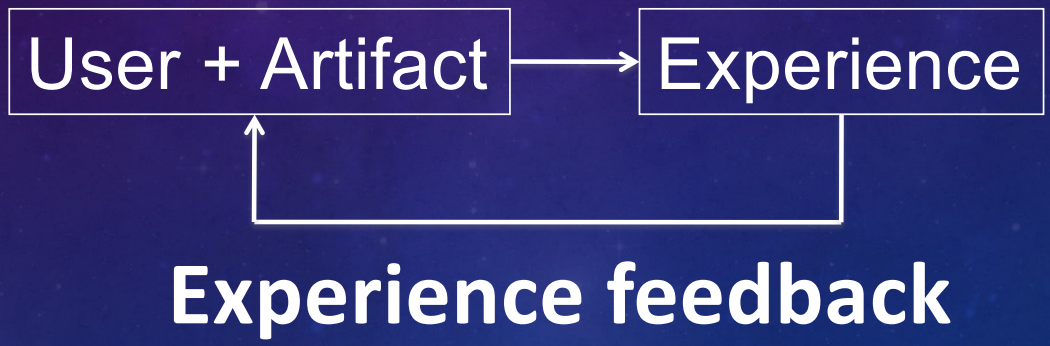
- You just cannot ask people what they want!
  - Most of the time, they do not know
  - And when they think they know, be very skeptical!

So what?

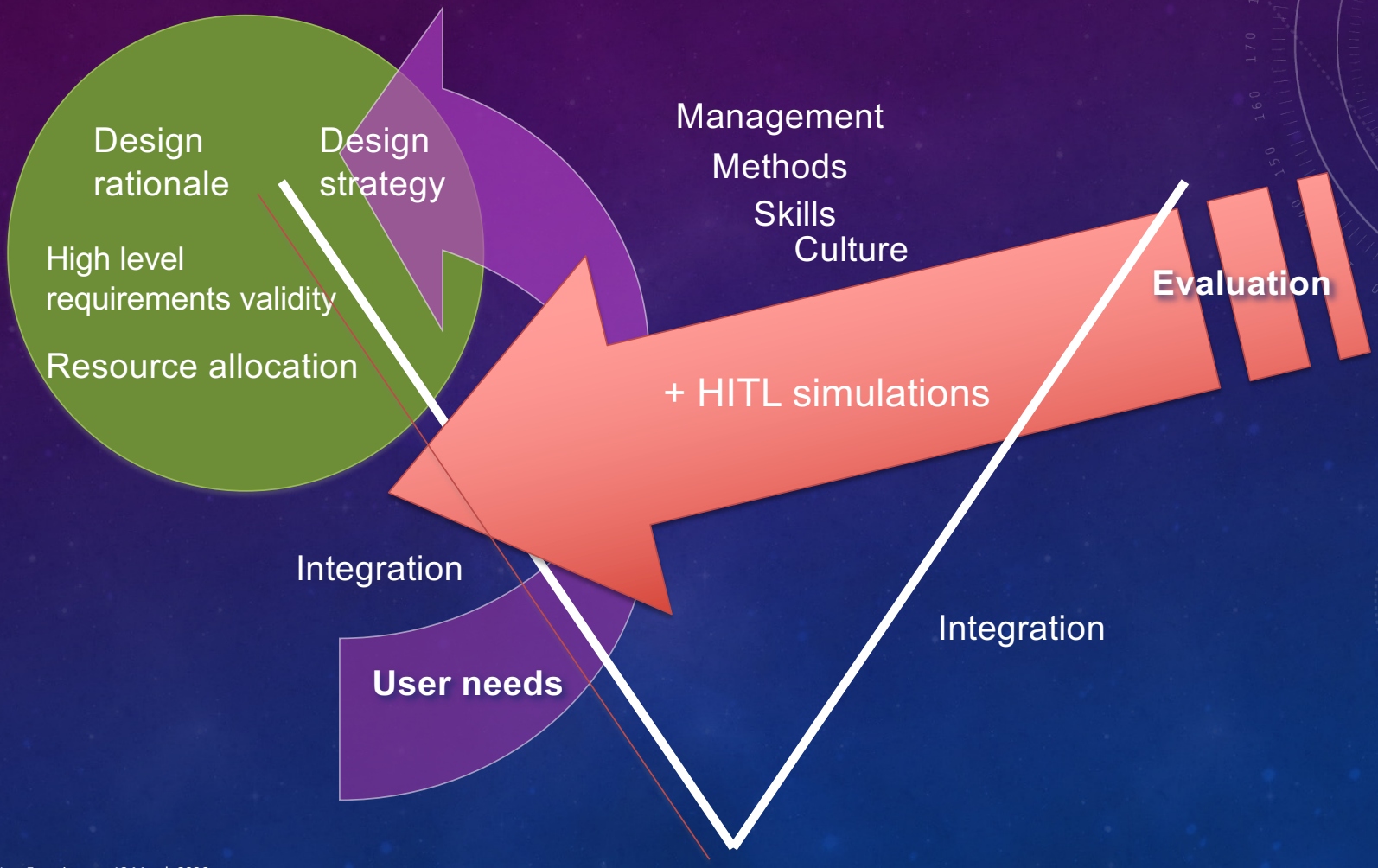
- *They can tell you what they liked or didn't after experiencing it!*

WHY USER EXPERIENCE IS IMPORTANT?

- Understanding UX provides clues to improve the design of an artifact



IMPROVING MATURITY



USER REQUIREMENTS AND TASK ANALYSIS

- Who are the users?
- How to involve users in the design process?
- User requirements are only one part of the problem
- Task analysis complements the requirements acquired from users
- Cost-benefit analysis

WHO ARE THE USERS?

- End-users versus clients
  - Airline pilots versus the airline itself
  - Airline pilots versus test pilots
- Questions
  - Availability
  - Representativity, legacy
  - Efficiency, cost…

HOW TO INVOLVE USERS?

- Users are not designers
- User expertise is not design expertise
- Users should provide operational feedback on the systems being designed & developed
- Showing is better than asking what to do!
- Users are not patented evaluators…
- Evaluation is a discipline by itself
- Very very few people are Leonardo da Vinci !

USER REQUIREMENTS: ONLY A PART OF THE PROBLEM

- User requirements contribute to simplify design
  - They tend to focus on perspectives
- They are constraints
  - Designing is making compromises
  - Economical, physical… constraints
- In addition, task analysis is useful to drive and document design

TASK ANALYSIS COMPLEMENTS USER REQUIREMENTS

- An analytical approach that rationalizes the way work should be done
  - Hierarchical decomposition of tasks (usually)
  - Linearization of work (useful approximation)
  - Enables the calculation of task-load indices (timeline)
- Activity analysis on existing systems (observation)
- Approaches based on scenarios
  - Incomplete, but informative and easy to do…

➢ Provides an envelope for users' activities

FIRST TWO-CREWMEN COCKPIT CERTIFICATION

- Airbus Industrie (beginning of the 1980s)
- Timeline analysis
- MESSAGE modeling and simulation

Dec 11, 1980	First flight of the A300 with a digital autopilot
Oct 06, 1981	First flight with the A300 with FFCC (Forward Facing Crew Cockpit), which enables to reduce the flight crew to two men
Jan 08, 1982	Certification of the A300 FFCC and first delivery to Garuda Indonesia
Mar 11, 1983	The first Airbus aircraft with EFIS (Electronic Flight Instrumental System), an Airbus A310-200, received certification
Mar 11, 1983	Certification of the A310-200 with ECAM (Electronic Centralized Aircraft Monitoring) and first delivered to Swissair and Lufthansa (the same day)
July 08, 1983	First flight - A300-600

FIRST TWO-CREWMEN COCKPIT CERTIFICATION

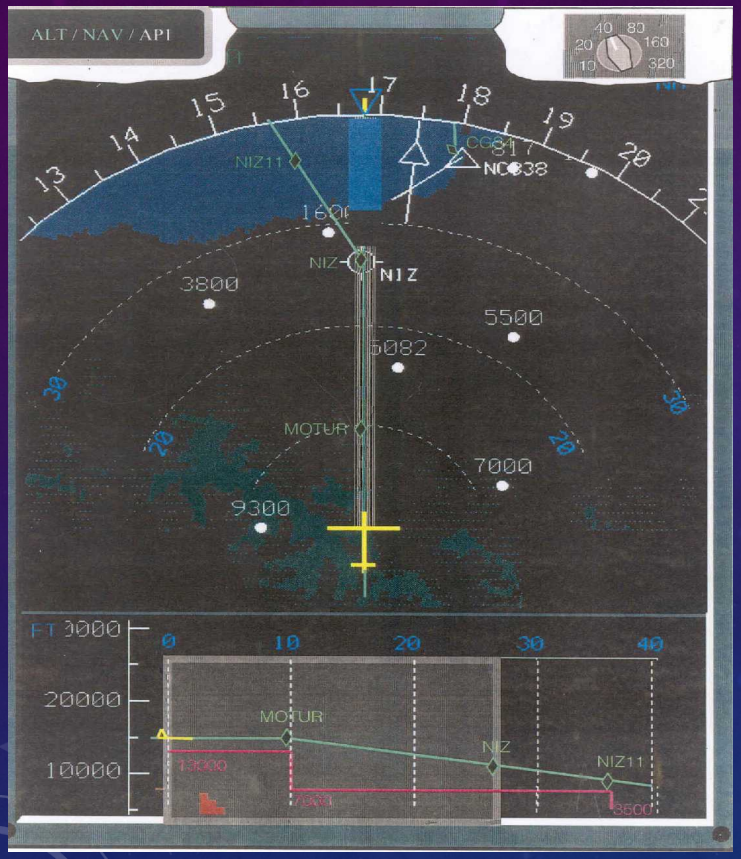
Elapsed Time	CM1	CM2	CM3	Goal	Action(s)	Abnormal Conditions	…

Timeline analysis spreadsheet template example

TIMELINE OF THE HUDSON RIVER ACCIDENT

US Air Flight 1549
Cockpit
To Ground Audio:
'We're going
to be in the Hudson'

COGNITIVE FUNCTION ANALYSIS TIMELINE



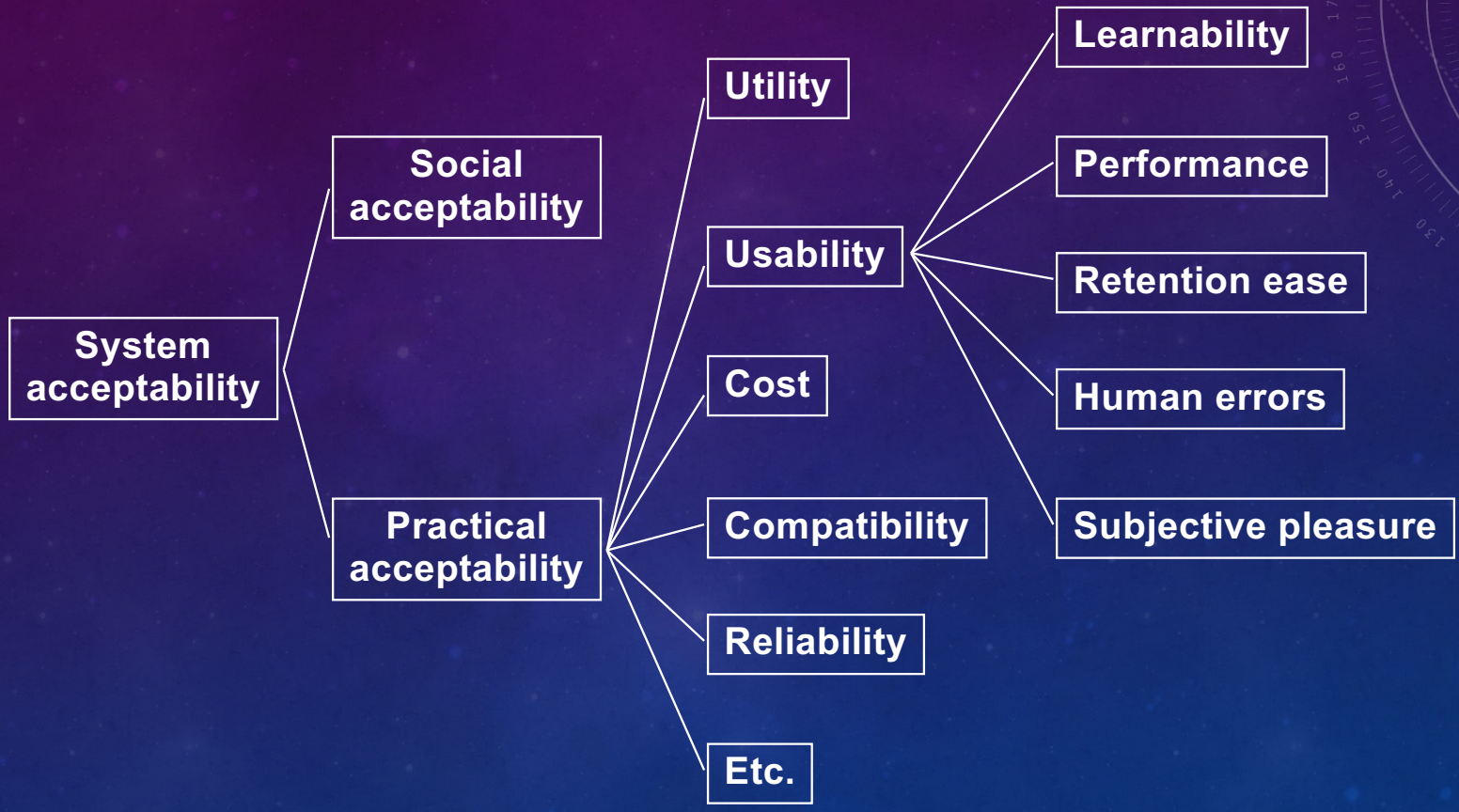
COGNITIVE FUNCTION ANALYSIS TIMELINE

Board	Context	Agent	Goal	Triggering pre-condition	Action	Cognitive Function	Internal resource	External resource
3 à 6	Before MOTUR DES/NAV/ AP1	FMS	Follow MOTUR and Descente on VEVAR 3N	F-PLN FMS	ALT->DES			
	Before MOTUR	ATC	Direct GONTO & descent FL100		ATC msg			
	Before MOTUR DES/NAV/ AP1	PF/PNF		ATC msg	Listen to the msg	Audition of ATC msg	audition	Radio
		PNF	Answer to the msg	ATC msg	Collate the message DIRECT GONTO and descent FL 100	Take the mike and speak	hand voice	mike
		PF/PNF	Msg validation	ATC msg	Msg validation	Interpretation Evaluation x-check	Mental process communication	

EVALUATION METHODS

- Human-centered design is iterative based on base prototypes and formative evaluations
  - Mock-up development
  - Prototype development
  - Product development
  - Iron Bird
  - Aircraft (flight tests)
  - ➢ … V Cycle
- Summative evaluation at the end of the development process
  - Certification

ACCEPTABILITY

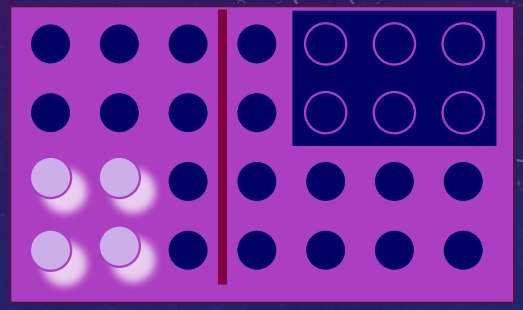


HEURISTICS FOR USABILITY

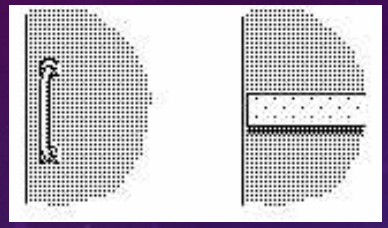
- Design a simple and natural dialog
- Speak user's language
- Minimize user's memory load
- Assure consistency
- Provide information feedback
- Provide clear exits
- Provide good error messages
- Anticipate human errors
- Avoid, or at least secure, modes
- Help and document

SIMPLE AND NATURAL DIALOG

- Graphics and color
  - Perception rules (gestalt)
  - ≤ 5 to 7 colors
  - daltonians (color + sign)
  - color (categorize, differentiate and underline)
- Display necessary information only
  - presenting too many options to the user load him/her
  - difficult choices should be made during design
  - most simple tools are most used



AFFORDANCES…



PULL PUSH

Gibson, J.J. (1979). *The Ecological Approach to Visual Perception*, Houghton Mifflin, Boston. (Currently published by Lawrence Eribaum, Hillsdale, NJ.)
Norman, D. (1988). *The Psychology of Everyday Things*, New York, Basic Books, pp. 87-92.

AUGMENTED REALITY…

SPEAK USER'S LANGUAGE

- Avoid machine language on the user interface
- Address the user directly, "You..."
- Write full names
  - Don't loose meaning
- Synonyms, aliases
- Metaphors

MINIMIZE USER'S MEMORY LOAD

- Recognition versus recall
- Default values
- Generic commands
- Informational objects manipulation

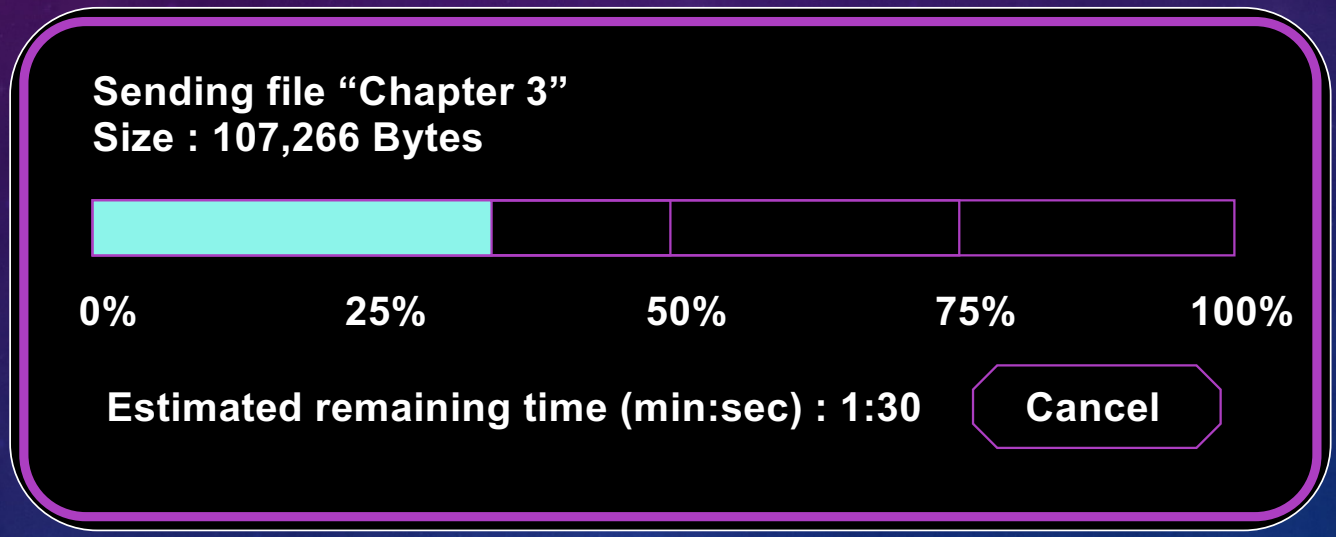
ASSURE CONSISTENCY

- Internal consistency
  - lexical
  - syntactic
  - semantic
  - pragmatic
- External consistency
  - sometimes impossible (socio-technical jump)
  - standardization

PROVIDE INFORMATION FEEDBACK

- Present the “What” and the “How”
- Information feedback relevance
- Response time
  - 0,1 second instantaneous response
  - 1 second perception of a delay
  - 10 second information feedback mandatory
- e.g., information on a system failure

PROVIDE INFORMATION FEEDBACK



PROVIDE CLEAR EXITS

- The user is in charge (he/she controls)
- *Cancel, escape, undo*

PROVIDE GOOD ERROR MESSAGES

- What should be presented?
  - The situation + Recovery means
- Shneiderman's rules:
  - Clear and understandable language (no code)
  - Be precise
    - « Impossible to open this document »
    - « Impossible to open 'Chapter 3" because the application is not on the disk »
  - Problem-solving aid
  - Be polite, never blame the user
- Messages at several levels (hypertext)

EXAMPLE OF A BAD ERROR MESSAGE

System: Type user's name

User: Descartes

System: Error, type user's name

User: René

System: Error, type user's name

User: René Descartes

System: Error, type user's name

User: [illegible]

ANTICIPATE HUMAN ERRORS

- Avoid asking the user to type words when it is not necessary (menus are better)
- Determine consequences of human errors (risk assessment)
- Ask for a confirmation
  - *Do you really want to do this?*

AVOID, OR AT LEAST SECURE, MODES

- Example of the old text-processing systems
  - *edit* mode ..... commands
  - *insert* mode ..... text
- Air/ground modes (Airbus)
- Robustness of mode errors
- Augment information feedback to help distinguish modes and keep situation awareness

HELP AND DOCUMENT

- Most users don’t use documentation
- Context-sensitive online help (hypertext)
- Example: EURISCO study on flight-deck procedures
- Minimal manual (Carroll et al., 1987)

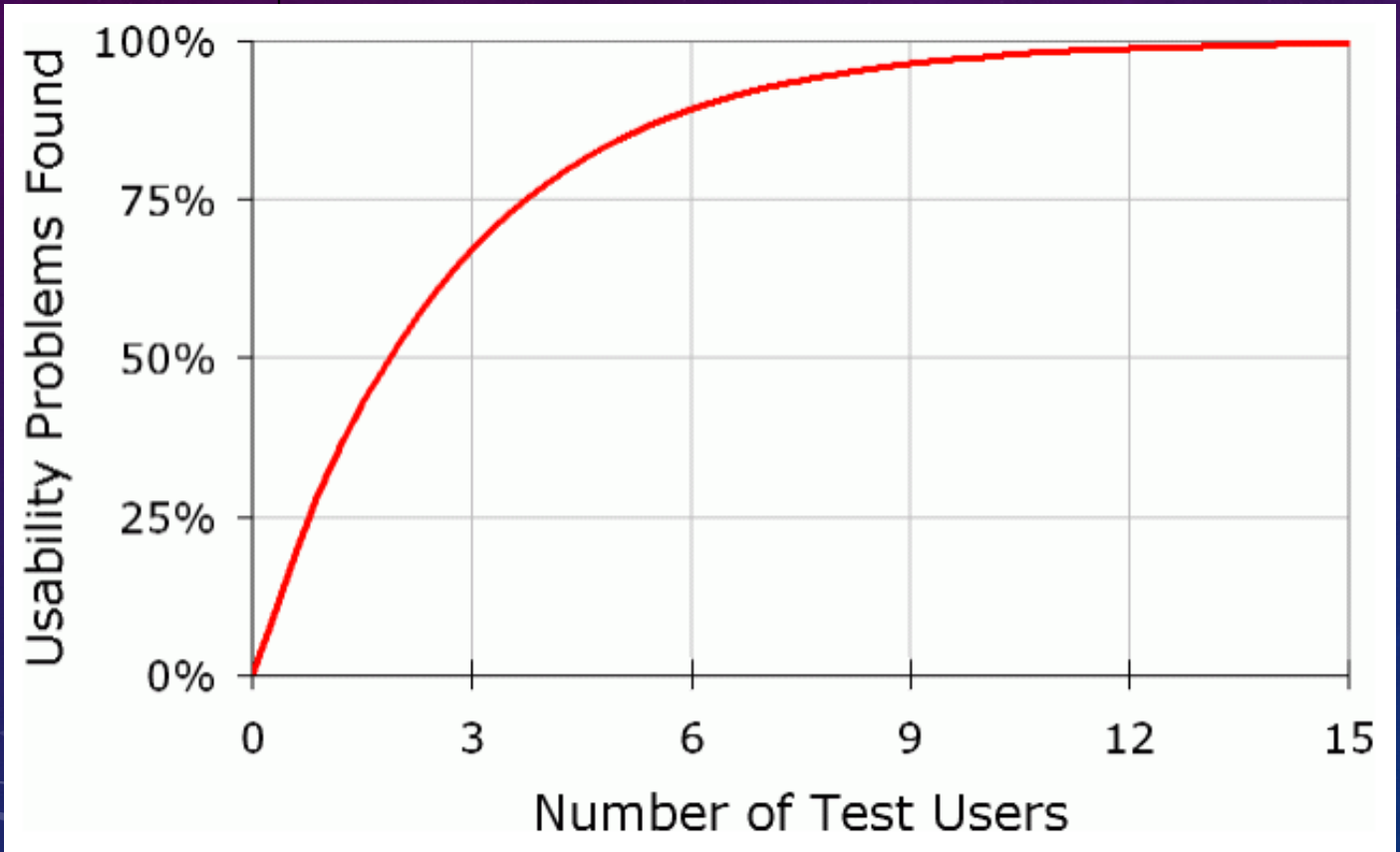
ONLY 5 TEST USERS

- Tom Landauer and Jakob Nielsen showed that the number of usability problems found in a usability test with *n users is:*

$$N(1-(1-L)^n)$$

  - *where N is the total number of usability problems in the design and L is the proportion of usability problems discovered while testing a single user*
  - *The typical value of L is 31%, averaged across a large number of projects we studied. Plotting the curve for L=31% gives the following result…*

ONLY 5 TEST USERS



ITERATIVE DESIGN

- 15 users to discover all the usability problems
- Better to distribute your budget for user testing across many small tests
  - Spend this budget on three tests with 5 users each!
  - After the first study with 5 users has found 85% of the usability problems, you will want to fix these problems in a redesign

HEURISTIC EVALUATION

- Evaluations using a scenario written from a preliminary task analysis
- Each evaluator inspects the interface and interprets the user's actions by themselves
- Evaluator meeting
- An observer can aid evaluators and write a report
- Results: list of usability problems
- These problems are usually solved online
- Importance of usability expertise

MOCK-UP EVALUATION

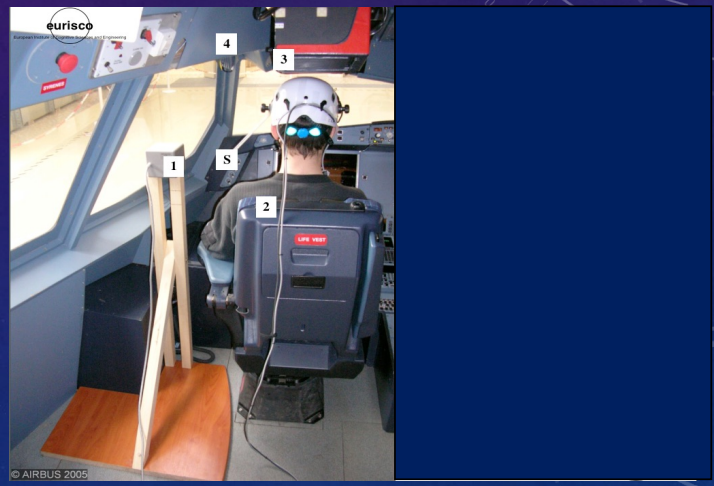
- PowerPoint is still a great tool!
- A rapid prototyping tool is strongly recommended (it must be fully mastered)
- The more you are close to (apparent) reality, the more you can be sure that test-users will provide appropriate feedback

« A good mock-up is better than a long explanation! »

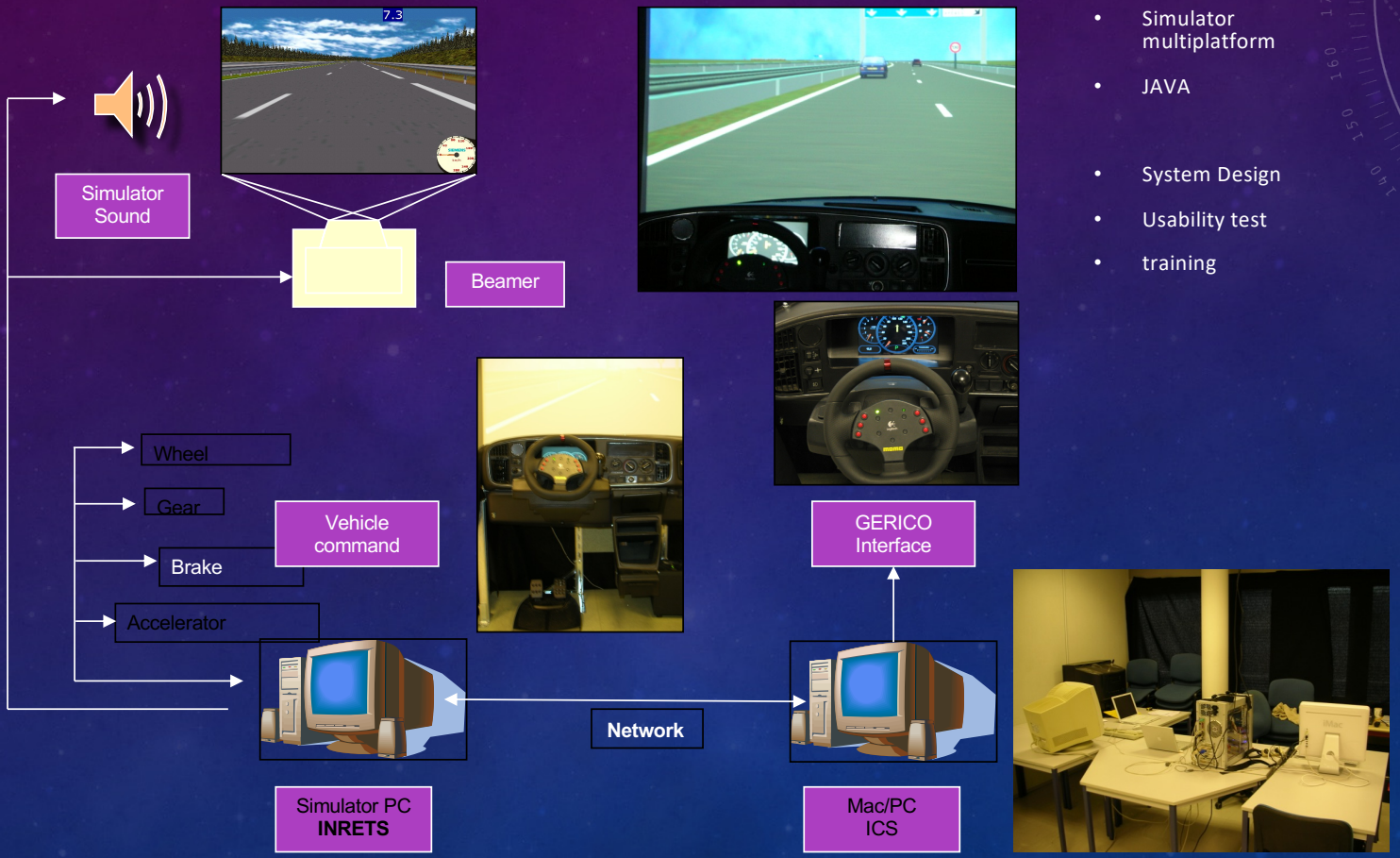
HORIZONTAL AND VERTICAL PROTOTYPES

- Horizontal Prototype
  - Represents the whole shallow interface
- Vertical Prototype
  - Represents the deeper interface of a function (part-task prototype)

- Research simulators



LIGHT SIMULATOR FOR HCD



- Simulator multiplatform
- JAVA

- System Design
- Usability test
- training

TESTS IN A SIMULATOR

FLIGHT TESTS

USABILITY TESTS

- Goals and plan for the tests
- Find test users
- Choose experimenters
- Ethical aspects of the tests with respect to people
- Tasks for the tests
- Steps of tests
- Performance measures
- Verbal protocols

TEST PLAN

- Goal of the test: What are we looking for?
- Where and when the test will be held?
- How long should each session be?
- What experimental means will be needed for the test (information technology in particular) ?
- Which software should be available for the test?
- What should the system state be before the test?
- What response time should be acceptable?
- Who should evaluate?

TEST PLAN (CONT.)

- Which test users? How will they be managed?
- How many test users are needed?
- What tasks will these users perform?
- What criteria will be used to evaluate task performance?
- What assistance will be provided to users (manuals,help, etc.)?
- To which extent the evaluator should help users during the tests?
- What data will be collected? How will they be analyzed?
- What criteria will be used to determine the success of the interface?

BUDGET OF THE TEST

- Usability specialists who will plan, conduct and analyze tests
- Administrative assistant who will create users' schedules, enter data, etc.
- Users' time
- Hardware and software that will be used
- In some cases, usability lab
- Videos and other consumables products

NO USABILITY TEST
BEFORE TESTING THE TEST PROCEDURE
ON FEW APPROPRIATE PEOPLE

FIND TEST USERS

- Representativity
  - The salesmen problem
  - Real users (or potentially real users)
- Novice vs. Expert users
- Categories
  - age
  - gender
  - training

CHOOSE EXPERIMENTERS

- Level of expertise
- Application domain knowledge
- Do not take people who developed the system being tested

ETHICAL ASPECTS

- Users are also human beings!
- Users may feel that they are being tested themselves
- Carry out tests without interruption
- Tests must remain confidential
- The experimenter should enable test-users to discover solutions by themselves

ETHICAL GUIDANCE

- Checklist before tests
  - Having everything ready before user(s) arrive
  - Say that the system is being tested, not users
  - Recognize that system is new and may induce problems
  - Say that user(s) can stop at any time
  - Explain the exprimental setup
  - Say that results will stay confidential
  - Assure that you answer all user’s questions before starting

ETHICAL GUIDANCE

- Checklist before tests
- Checklist during tests
  - Try providing a positive user experience to test users
  - Present tasks one after the other
  - Keep a relaxed atmosphere in the test location, serve coffee or tea, break…
  - Avoid useless interruptions: sign on closed door, unplug phone
  - Never mention that user(s) commit errors or are too slow
  - Minimize the number of observers during tests
  - Do not allow hierarchy to observe user performance during tests
  - If necessary, the experimenter can stop tests when they are too boring

ETHICAL GUIDANCE

- Checklist before tests
- Checklist during tests
- Checklist after tests
  - Finish by saying that user helped you improve product
  - Never report results where test users may be recognized
  - Only show video recordings outside the usability group with approval

TASKS

- Representativity
- System coverage
- Derived from a task analysis
- Short to be terminated in time
- Not too short not to be trivial
- Task goal must be clear
- Tasks should be given to users one by one

STEPS

- Preparation
- Introduction
- The test itself
- Debriefing

PERFORMANCE MEASURES

Goal:
Usability

Component:
Ease of learning

Quantification:
Average time needed to perform five specific tasks

Component:
Efficiency of use

Method:
User performs tasks without help

Data acquisition technique:
Chronometer
(specific rules)

TYPICAL QUANTIFIABLES USABILITY MEASURES

- Time taken by users to perform a specific task
- Number of tasks to perform in a given time
- Ratio between positive interactions and errors
- Time spent to recover from errors
- Number of user errors
- Number of erroneous actions that immediately follow
- Number of controls and other entities that were used
- Number of controls and other entities that were not used
- Number of entities that users can remeber after the tests
- Frequency of use of manuals and/or onlime help systems, and time spent to use them
- How many times manuals and/or onlime help systems helped users soving problems

TYPICAL QUANTIFIABLES USABILITY MEASURES

- Ratio between users' positive expressions during the test and critiques against the system
- Number of times that users expressed clear pleasures (or frustrations)
- Number of users who said that they preferred to use the system instead of the given alternative systems
- Number of times that users needed to go around unsolvable problems
- Ratio between users using efficient strategies and users using inefficient strategies (when several ways of accomplishing a task)
- Commulative dead time when users do not interact with the system (system response time and thinking time)
- Number of times that users l'utilisateur go around assigned main task

VERBAL PROTOCOLS

- Record verbal protocols (Thinking aloud) and derive interpretations
- Method from cognitive psychology
- Practical evaluation of a user interface
- Crosscheck with notes taken by the experimenter

USABILITY METHODS

- Observation & video recording
  - Task analysis; follow-up studies
  - 3 users or more
  - Ecological validity; reveals tasks really performed by users (activity); suggests functions and entities
  - No experimenter control

USABILITY METHODS

- Observation & Video Recording
- Questionnaires
  - Task analysis; follow-up studies
  - At least 30 users
  - Find users' subjective preferences; easy to reproduce
  - Prepare (test of the questionnaire) to avoid ambiguities and misunderstandings

USABILITY METHODS

- Observation & Video Recording
- Questionnaires
- Interviews
  - Task analysis
  - 5 users
  - Flexible; in-depth assessment of attitudes and experience
  - Costly in time; difficult to analyze and compare

USABILITY METHODS

- Observation & Video Recording
- Questionnaires
- Interviews
- Performance measures
  - Competitive analysis; final test
  - At least 10 users
  - Numerical results easy to compare
  - Do not find individual usability problems related to tasks

USABILITY METHODS

- Observation & Video Recording
- Questionnaires
- Interviews
- Performance Measures
- Heuristic evaluation (analytical)
  - Pre-study; preliminary design phase
  - No user needed
    - Do not identify surprises related to users' needs
  - Finds individual usability problems related to tasks

USABILITY METHODS

- Observation & Video Recording
- Questionnaires
- Interviews
- Performance Measures
- Heuristic evaluation (analytical)
- Verbal protocols
  - Iterative design
  - 3 to 5 users
  - Identifies bad interpretations of users; could be high-cost tests
  - Not natural for users, verbal protocols difficult for expert users

USABILITY METHODS

- Observation & Video Recording
- Questionnaires
- Interviews
- Performance Measures
- Heuristic evaluation (analytical)
- Verbalisation
- Expert Groups (brainstorming)
  - Task analysis; user involvement
  - 6 to 9 users per group
  - Spontaneous reactions and group dynamics
  - Difficult to analyze; validity could be discussed

USABILITY METHODS

- Observation & Video Recording
- Questionnaires
- Interviews
- Performance Measures
- Heuristic evaluation (analytique)
- Verbalisation
- Expert Groups (brainstorming)
- Group Elicitation Method (GEM)
  - Task analysis; user involvement
  - 7 users per group (maximum 10)
  - Analytical (brainwriting) and group dynamics
  - Normalized analytical method; decision aid

USABILITY METHODS

- Observation & Video Recording
- Questionnaires
- Interviews
- Performance Measures
- Heuristic evaluation (analytique)
- Verbalisation
- Expert Groups (brainstorming)
- Group Elicitation Method (GEM)
- Experience feedback
  - Follow-up studies
  - Hundreds of users
  - Change management and user practices
  - Requires an organisation to manage users's experience feedback

STANDARDS

- Consistency advantages of standards
  - For users
    - Training, productivity, expectations, confidence
    - User assistance and procedures
  - For designers
    - Internal consistency in design
    - Gain of time (consensus)
    - Could leave more time to develop esthétics
- Dangers of standards
  - Development costs of standards
  - Resistance to innovation (flexibility issue)
  - Likely to decrease motivation

STANDARDS

- International standards
  - ISO (International Standard Organization)
  - ANSI (American National Standard Institute)
  - Interoperability
- Internal standards
  - Corporate culture; comfort and habits
  - Internal consistency

YOUR PROJECT

- Define measurable usability attributes
- Add these to your Design Rationale QOC
- Evaluate…

METHODOLOGY

- Develop use cases (at least 2)
- Define all agents (humans and machines)
- Define workflows
- Define an architecture for the system
- Evaluate the architecture with potential users
- Implement the architecture
- Validate the implementation