Techniques d'Interaction et multimodalités (TIM)
Cours/TD 1 – intro méthode expérimentale
2017-2018

Marco Winckler, Alain Giboin

Université Nice Sophia (Polytech) | I3S | SPARKS team | bureau 446

winckler@i3s.unice.fr

http://www.i3s.unice.fr/~winckler/

Format de description du projet

- Titre du sujet (nature de l'application visée [jeu, etc.]) ;
- Utilisateurs ciblés;
- Tâche(s) à réaliser avec l'application :
- Techniques d'interaction envisagées pour cette application;
- Scénario(s) décrivant comment les utilisateurs cibles réalisent la tâche avec l'une et l'autre des techniques d'interaction :
- Hypothèse sur laquelle des techniques serait la plus efficace/appréciée/... pour/par les utilisateurs cibles
- Justification de cette hypothèse

Outline of the course

- Definitions about user interface (UI) properties
  - Usability
  - UX
  - Accessibility
- (a panel of) Methods for usability evaluation
- How to build an experimental evolution
  - Hypothesis, variables
  - Materials & methods
  - Analysis

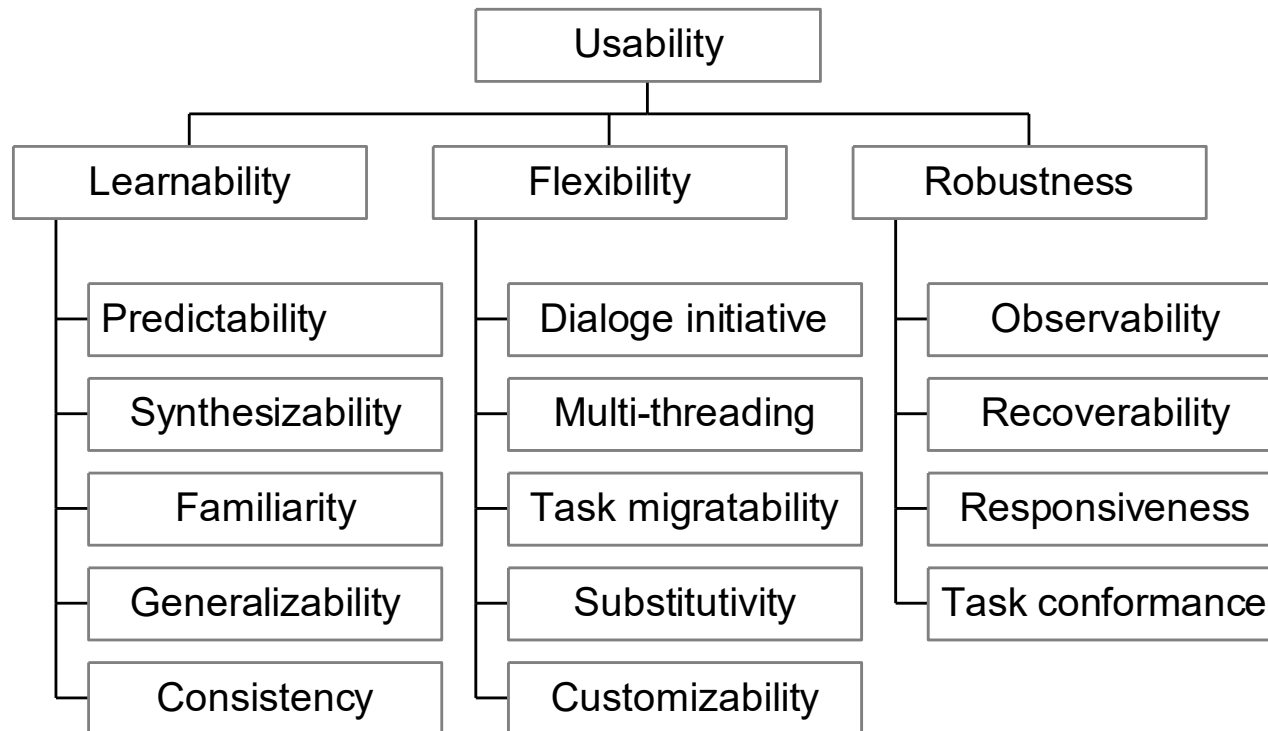# Usability

Definitions of usability

- [Bevan, 1995]
  - Quality of use: efficient usage of interface's resources by users...
- [Nielsen, 1992]
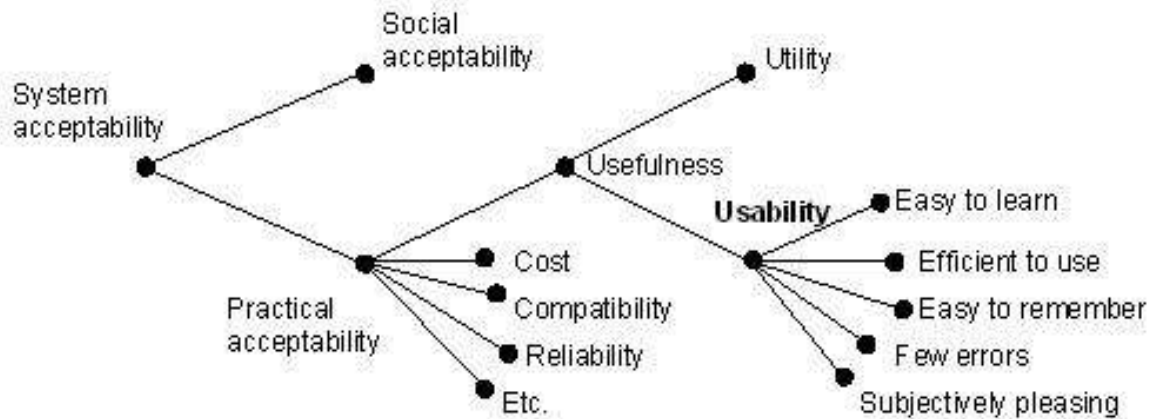
- According to ISO 9241-11 usability is:
  - **Efficiency** (ex. fulfil a user needs, has a purpose, etc.)
  - **Effectiveness** (ex. reduce errors, improve performance, time for learning, etc.)
  - **Satisfaction** (ex. people like it, less stress, etc.)

Principles related to Usability

- What do we have to take into account to make something usable?

```
                          Usability
         ┌──────────────────┼──────────────────┐
    Learnability         Flexibility         Robustness
         │                   │                   │
  Predictability      Dialogue initiative     Observability

  Synthesizability    Multi-threading         Recoverability

  Familiarity         Task migratability      Responsiveness

  Generalizability    Substitutivity          Task conformance

  Consistency         Customizability
```

Criteria for identifying usability problems

- Matching interface with user's needs (ex. task analysis)
- User performance:
    - Task execution (successful, unsuccessful, partial execution)
    - Time to complete a task
    - Error occurrence
- User satisfaction, stress, etc.
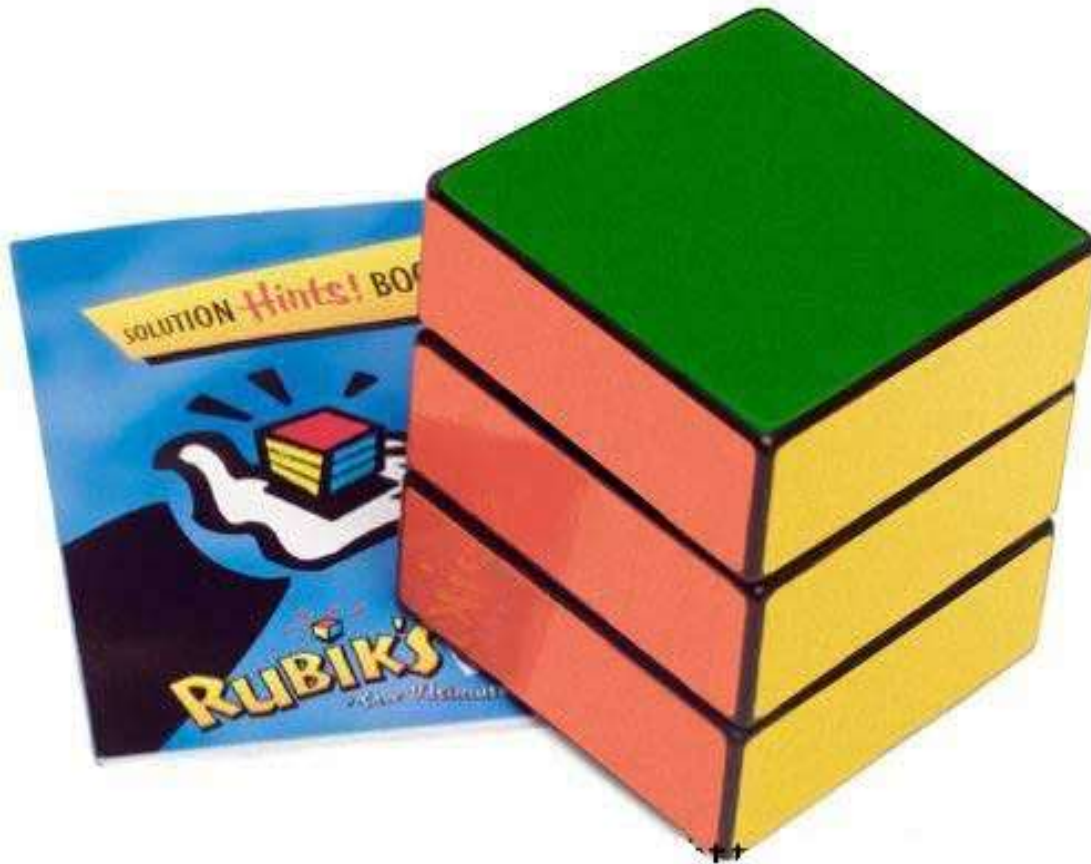- Conformance with ergonomic rules, guidelines, recommendations, etc.

User eXperience (UX)
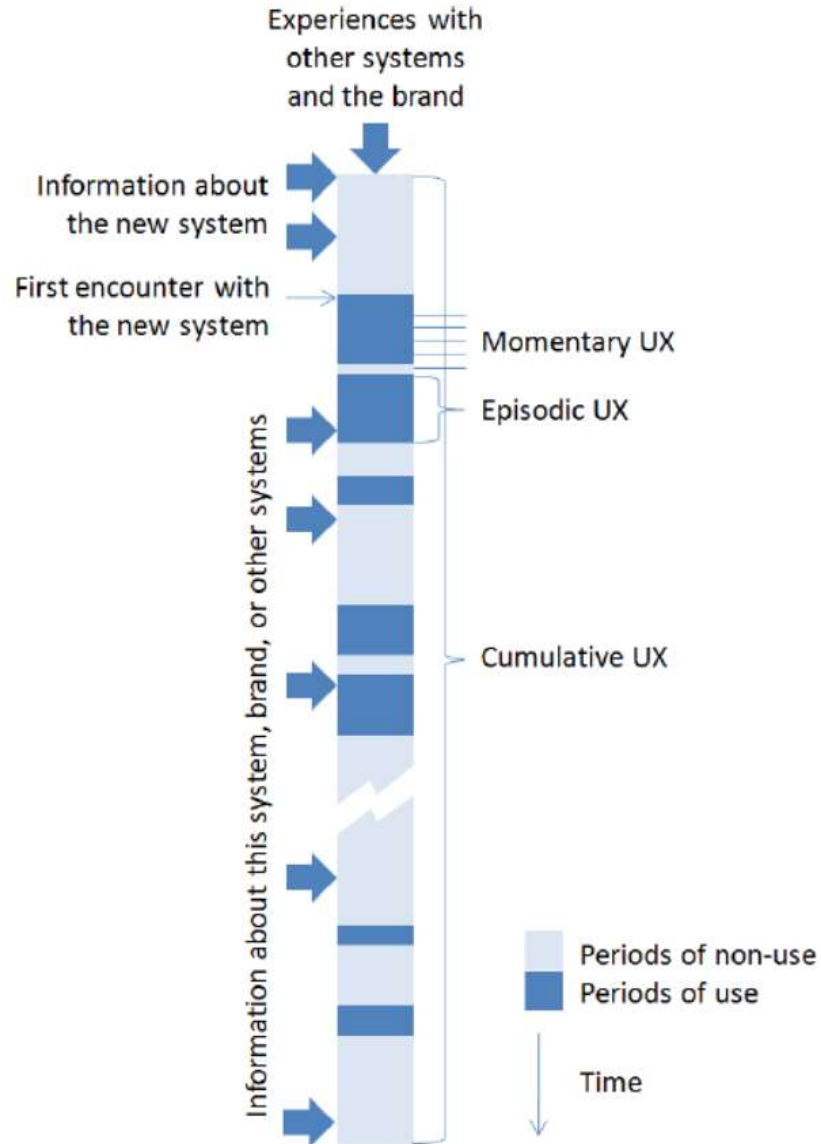
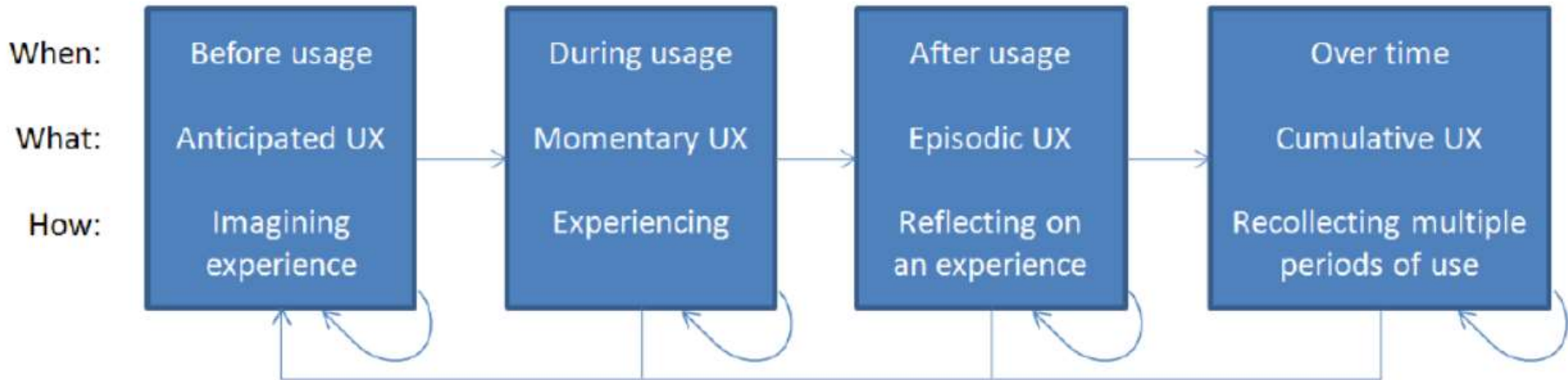# Learning curves and usability

4

x   y
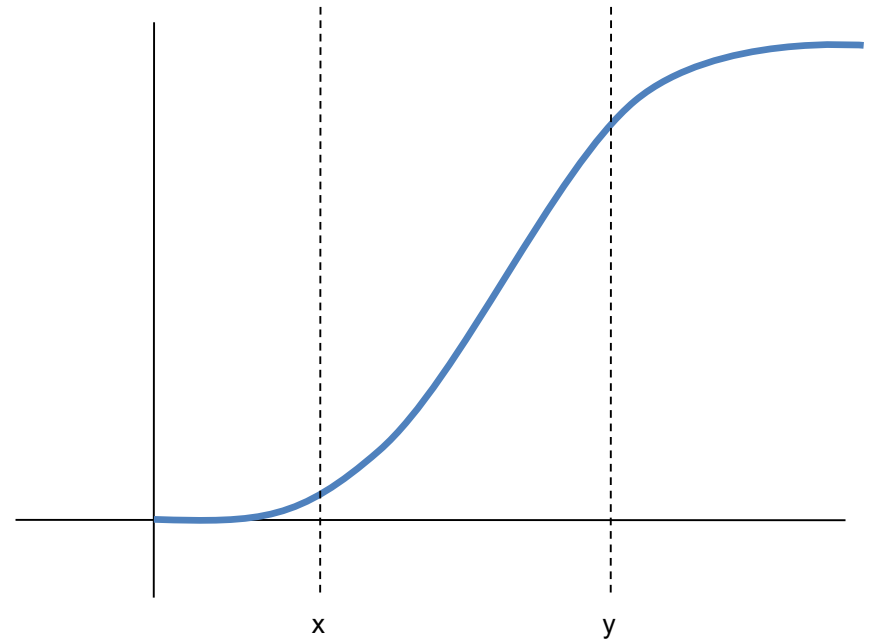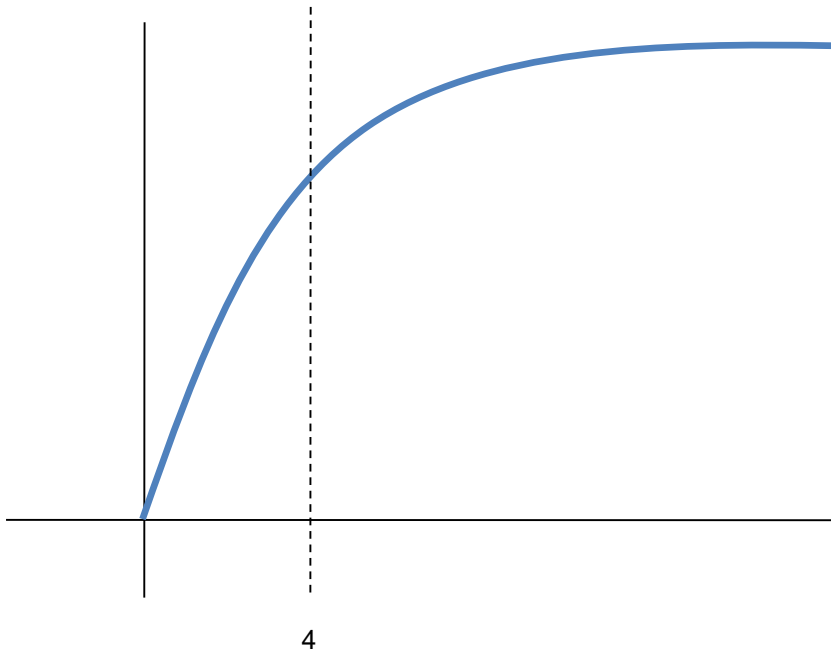
User eXperience

"UX is person's perceptions and responses that result from the use or anticipated use of a product, system or service." **ISO 9241-210 (2009)**

User eXperience over time

Time spans of UX

When:	Before usage	During usage	After usage	Over time
What:	Anticipated UX	Momentary UX	Episodic UX	Cumulative UX
How:	Imagining experience	Experiencing	Reflecting on an experience	Recollecting multiple periods of use

Definitions: User Experience

Visual/aesthetic experience refers to the pleasure that people gain from sensory perceptions, how beautiful something is perceived

Emotion, the emotional experience is one of the three main factors contributing to product experience, including feelings and emotions elicited

Stimulation as a hedonic attribute of a product, which can lead to new impressions, opportunities and insights

Identification dimension addresses the human need to express one's self through objects

Meaning and Value is referring to "Ideo pleasure" indicating values the product can satisfy.
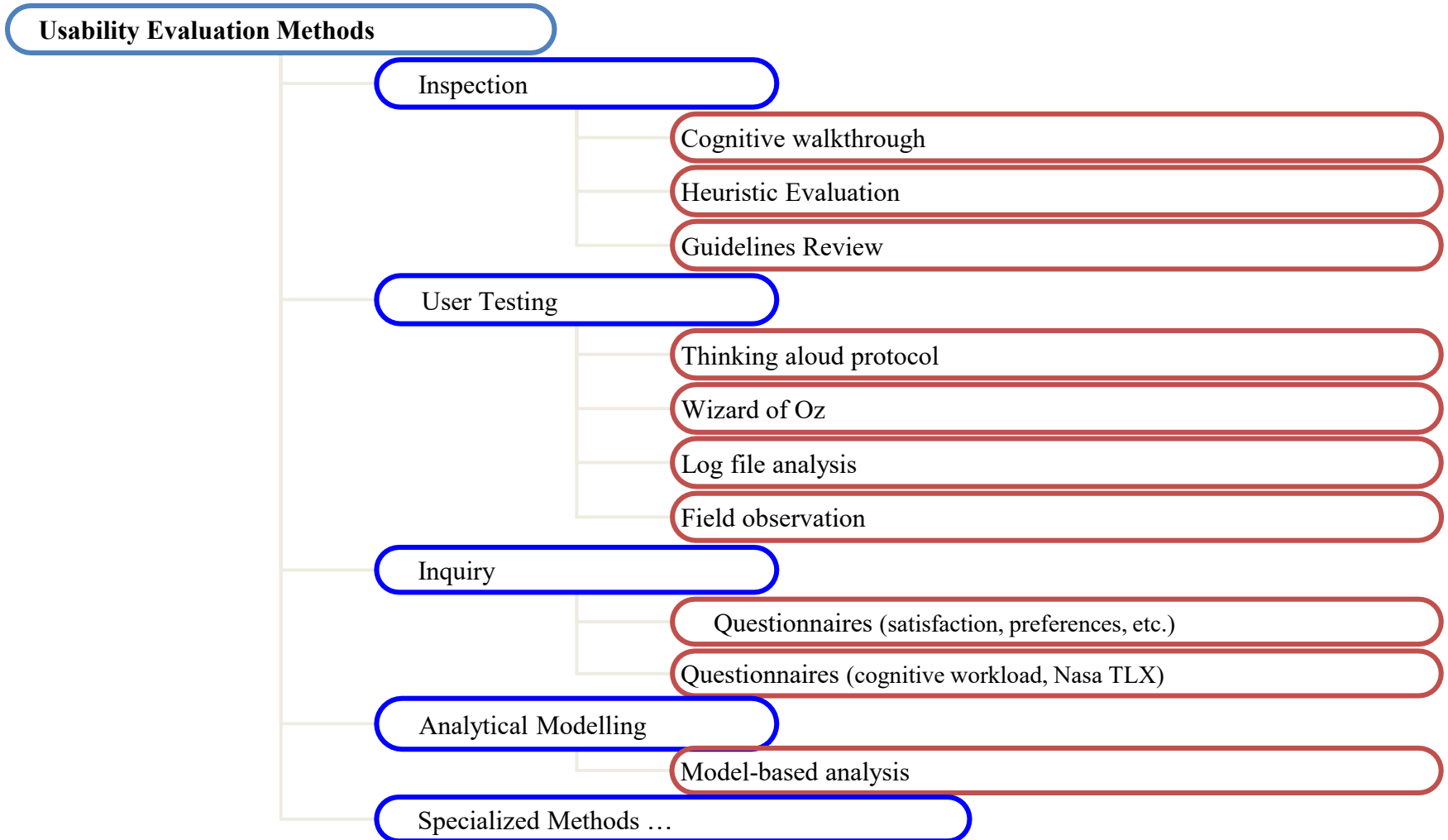
Relatedness (***social relatedness/co-experience***), products that facilitate communication as well as those that serve as conversation pieces contribute to socio pleasure.

Evaluation Methods

What is Evaluation?

- Methods and processes used during the whole product development life cycle.

- **The earlier – the better**: Changes at early stages in the development are „cheaper" compared to changes late in the development.

- Evaluation can focus on various aspects: evaluation of the design; evaluation of the usage of the product.

- **Many methods** can be used **together** or in isolation along the life cycle.

- **Important**: user centered design ≠ participatory design

Classification of Usability Evaluation Methods

Usability Evaluation Methods

- Inspection
  - Cognitive walkthrough
  - Heuristic Evaluation
  - Guidelines Review
- User Testing
  - Thinking aloud protocol
  - Wizard of Oz
  - Log file analysis
  - Field observation
- Inquiry
  - Questionnaires (satisfaction, preferences, etc.)
  - Questionnaires (cognitive workload, Nasa TLX)
- Analytical Modelling
  - Model-based analysis
- Specialized Methods …

Evaluation settings

	Lab	Field
Design	Analytical, review or model based methods; usability inspection methods (performed by experts)	Evaluation using prototypes (Card sorting, usability studies using paper prototypes)
Implementation	Experimental methods, observation, interviews (experts or users)	Experimental Methods, observation, interviews (users)

Evaluating Design (early phases)

- Usability Inspection Methods (Conducted by experts, are based on experts opinion)
  - Cognitive Walkthrough, Pluralistic Walkthrough
  - Heuristic Evaluation
  - Guideline Review: evaluation of the design following guidelines
  - Standard Inspections: evaluation following norms (ISO)
- Model-based Evaluations (design phases)

Evaluation of the Implementation (late phases)

- Experimental Evaluation:
  - Experiments, Usability Testing
- Observation during usability testing
  - Thinking aloud
  - Protocol analysis
- Questionnaire related
  - Interview
  - Questionnaires

User oriented methods

- User oriented methods are **conducted with real users**
- Do include most of the time an experimental question (hypothesis)
- Focuses on the typical dimensions for usability:
  - effectiveness
  - efficiency
  - (user) satisfaction.
- There is a general agreement on what kind of metrics (measurable factors) represent these dimensions:
  - Number of successful completions of a task (effectiveness)
  - Time needed to conduct a task (efficiency)
  - Standardized satisfaction questionnaires (SUMI, SUS, …) (satisfaction)

Evaluation with Experiments
X
Experimental Evaluation

- Experimental Evaluation / controlled (psychologically oriented) experiment
- Experiment is a standard adopted across all experimental science disciplines to determine objective truth that is independent of any prejudices, biased or belief structure.
- Experimental Process:
  - Conducted by: End-users
  - Equipment: Interactive prototype
  - Result: quantitative and scientifically rigorous
  - Where: usually laboratory based.

How to build and experimental evaluation

When we evaluate Usability, we have to know what usability is about ...

- Usability can be described using
- Principles
- Guidelines
- Usability goals:
  - „A novice user can learn to enter a new patient in the hospital administration software within 3 minutes".
  - „A doctor does not need more time to fill out the receipt for medicaments compared to the old system".

Material and methods…

- Identify the UI to compare
  - Should support similar tasks
- What is the required condition of test
  - Ex. mobile (in the move) X desktop (fixed position)
- Build hypothesis based on properties and measurements
  - Ex. An hypothesis based on performance should take into account the time of task execution whilst

Consider the diversity of users…

Users have differences according where they came from, needs, objectives, culture, etc.

- Who the user are?

- How to get user feedback?
  - Methods such as Thinking aloud protocol, questionnaires, observation of user behavior, etc.

Selecting participants

- Selection of participants conducting the usability test is based on user and task analysis of the product/system

- Usability Test consists of several steps:
  - Demographic Information and pre-interview (to understand the „back-ground" of the participant)
  - Introduction to the topic and learning phase
  - Tasks to be accomplished
  - Final Interview and Debriefing

Recruiting participants

- Demographic information:
  - Age, Job, Family
  - Habits and Interests: Money spent on entertainment products, hobbies, interests, …
- Selection of participants based on demographic data – according to the user groups analysis
- How many user to use?
  - Virzi, RA (1992) Refining the Test Phase of Usability Evaluation: How Many Subjects Is Enough? Human Factors: The Journal of the Human Factors and Ergonomics Society 34: 457-468.
  - Nielsen, J. (2000) Why you only need to test with five users.

Pre-interview

- Opinions, habits and demographic information related to the tested subject
  - E.g.: are you using an electronic programming guide, do you know any kind of automatic recommendations system you are using in your daily life?

Planning tasks

- Learning or Warm-up tasks (typically not reported in the results)
- Conduction of selected tasks. Tasks are selected according to the hypothesis and to the general usability principles efficiency, effectiveness
- Each task is typically judged by the user: e.g.: Based on a scale from 1 to 5, where 1 means very easy and 5 means very difficult, how would you rate the task you have been performing.
- After each task, users are asked to make suggestions of how to improve the task/system.

Usability parameter	Task	Variable	Baseline value	Worst acceptable value	Target value	Best	Observed value
Initial performance	Book an appointement	Number of errors	-	3 Errors	2 errors	0 error	
Initial performance	Find an appointement	Time to find an appointment	2 minutes (?)	30 seconds	20 seconds	15 seconds	
Initial performance	Remove an appointement	Time to remove an appointment	2 minutes (?)	20 seconds	12 seconds	8 seconds	
Performance after training	Book an appointement	Time to book an appointment	15 seconds	15 seconds	12 seconds	8 seconds	
User eXperience	User reactions	Positive/negative user comments	/	10 negatives / 2 positives comments	5 negatives / 5 positives comments	2 negatives / 10 positives comments	

Steps

- Measuring subjective satisfaction:
  - Standardized questionnaires (SUS, SUMI)
- Final interview:
  - Questions intended to gather qualitative data for possible improvements of the system
  - Typical questions: Can you name 3 items/things of the system you would not change at all?
  - Can you tell me 3 things of the system that you think must be changed before delivering the system?
  - Would you recommend the system to a friend?

What User Testing is about

- Principle: observe users doing tasks according to a specific protocol

- Special equipment and an usability laboratory is required to record the test sessions

- In general the test is focused on predefined tasks which users have to accomplish during the testing

- *Thinking aloud protocol* is used to cause user comments

Thinking out loud protocol

- Used to get user comments and other subjective information about the interface
- Consist in asking users to verbalize their thoughts...
- Evaluator shouldn't give answers, express opinions about interface, etc
- Please: do not scare users!!!!!
- It is not natural for user speak their thoughts...
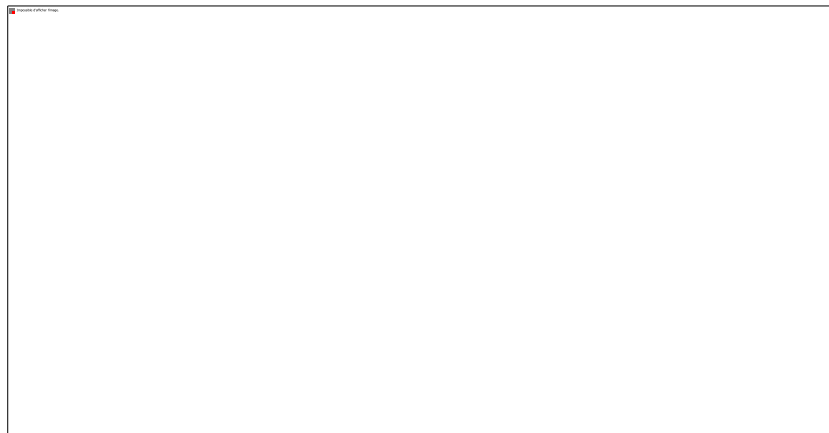- Some training is required to successful employ this technique

Usability lab (1/2)

- Audio and Video recording

- room with one-way mirror

- recording of user interaction on a log file

http://www.labiutil.inf.ufsc.br/

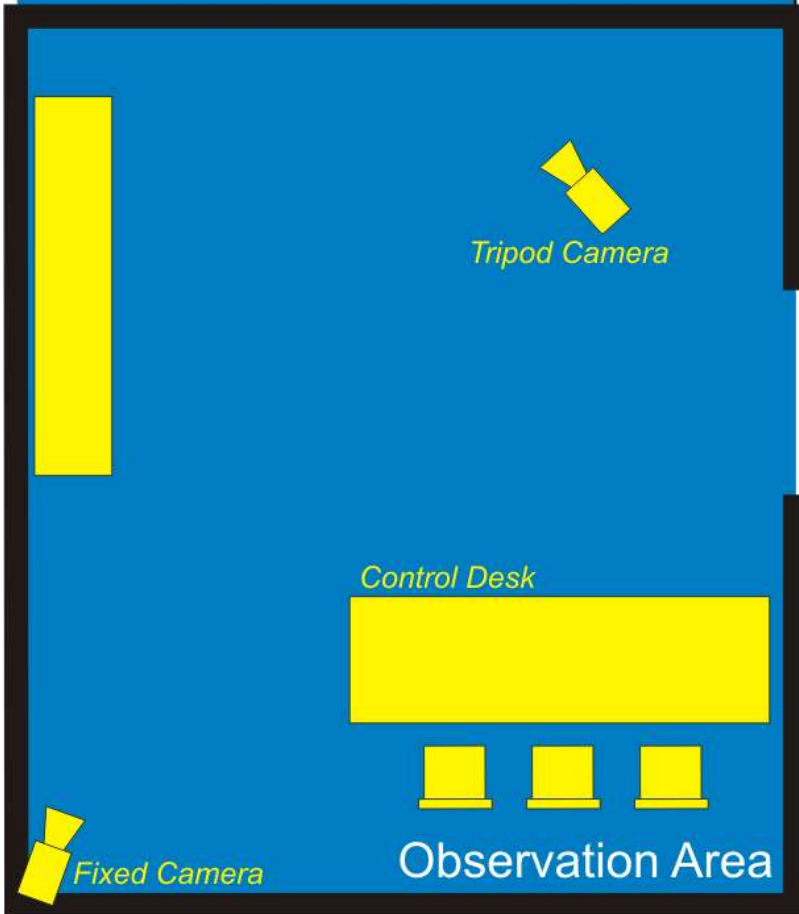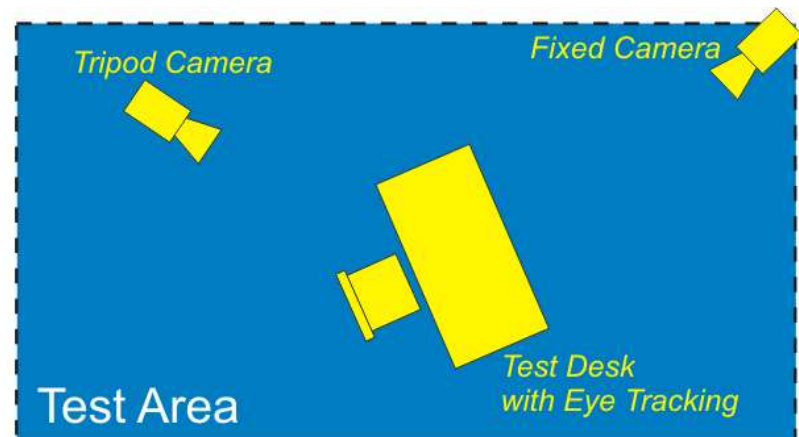http://www.microsoft.com/usability/tour.htm

Usability lab (2/2)

Example Usability Test: iTV Services

- 10 People
- 6 Tasks
  - Read the last news in the Salzburg News (Top Story)
  - Read the news entry for the formula 1 results and tell us who made the third place.
  - Display the video of the weather forecast from Salzburg Today
  - Read an E-mail
  - Write a SMS

  - Order 2 tickets for an event

Test Area

- Tripod Camera
- Fixed Camera
- Test Desk with Eye Tracking

Observation Area

- Tripod Camera
- Control Desk
- Fixed Camera

Example for Usability Test Results: Testing the iTV solution

- 55 % of the exercises were solved
- 6 Exercises
  - Read Top Story, 9/10
  - Read News on Formula 1, 9/10
  - Weather Information – Video on Demand, 5/10
  - Read E-Mail, 2/10
  - Write SMS, 2/10
  - Order Tickets, 7/10

Example for Usability Test Results: Testing the iTV solution

- Experience with other Medias (like frequent SMS usage is supportive)

- Users solving the E-mail and SMS task were frequently using other Media (20 SMS/Week on the cell phone).

- Experience with Computer/Internet supports the ease of use for the navigation. (Wizzards)

When People have to wait ….

- 5 use itv
- 2 read newspaper
- 3 something else

Expert user …

When user struggle …

Conducting a testing

- First of all: planning the testing!!!!!
- Choose real users for testing
- Keep usability lab ready when user arrive
- Explain the purpose of evaluation
- Apply a pre-questionnaire
- Provide to users a list of task
- Use thinking out loud protocol
- Apply a pos-questionnaire after the test
- Thank and pay users for participation

TD

- Small groups 2-3
- Make a plan for a usability evaluation
  - Define hypothesis
  - Identify variables
  - Identify the target audience
  - Choose the most suitable methods