Introduction to
Usability Engineering

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Overview

- **Introduction to Usability Engineering/testing**
- **Usability Test Methods**
- **Exercise**

Usability engineering defs.

Usability Engineering

- **User Centered Design**
- **Human Factors Engineering**
- **Ergonomics**

Definitions:

"*Usability Engineering represents not only the techniques, processes, methods and procedures for designing usable products and systems, but just as important, the philosophy that places the user at the center of the process*" (Rubin p.10)

"*... the practise of designing products so that the users can perform required use, operation, service, and supportive tasks with a minimum of stress and maximum of efficiency*" (Rubin p.10)

User-centered Design

Three Principles of UCD

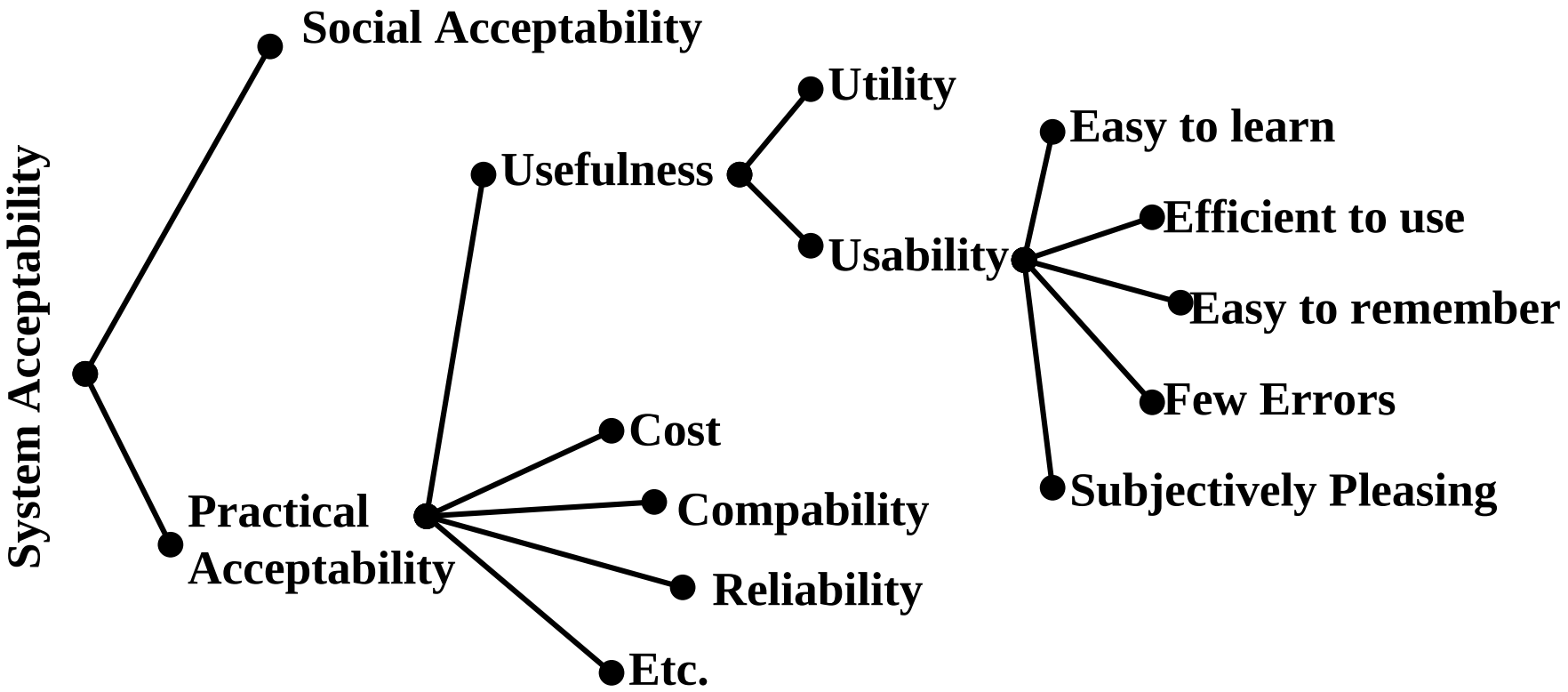
- **Early focus on users and tasks**
- **Empirical measurement of product usage**
- **Iterative design**

Focus is on:

- **Usefulness, Learnability, Effeciency (ease of use), Memorability, Errors, Satisfaction/Likability**

Usability engineering is a philosophy as much as a technique

The Context of Usability



Why Usability Engineering?

- **Making everyday life easier for people**
- **Usability is increasingly becoming a competetive factor (vs. functionality)**
- **Cost savings**
  - **Example**

    A study showed that 63% of large software projects significantly overran their estimates.

    The four reasons that were rated as having the highest responsibility were all related to usability engineering:

    - **frequent requests for changes by users**
    - **overlooked tasks**
    - **users' lack of understanding of their own requirements**
    - **insufficient user-analyst communication and understanding**

Usability Slogans (Nielsen pp. 10-21)

Your best guess is not good enough

- **its impossible to design an optimal interface just by giving it your best try**

Usability Slogans

The User is always right

- **The designer must acquire a certain degree of humility and acknowledge the need to modify his design**
- **Example:**

  A company once tested the usability of a manual, and found that users nearly always made a mistake at a certain point. Their solution was to frame the difficult item in a box and add a note saying "*Read these instructions carefully*" (Nielsen p.11)

Usability Slogans

The User is Not Always Right

- **Unfortunately, user interface designs cannot be derived just by asking users what they like.**
  - **Users often do not know what they want**
  - **They might change their minds**
  - **Users often have diverging opinions**
- **Example**
  - **a study showed that the probability of two persons apply the same name to an object is between 7% and 18%. This means it is not feasible to name commands just by asking some user(s)**

Usability Slogans

Users are not Designers

- **The ideal solution to the usability question might be to leave the design to the individual users by providing extended customisation flexibility**
  - **novice users do not customize (experienced do)**
  - **needs good design anyway**
- **Example**
  - **a study compared users own abbreviations with the systems' built-in, and found that users made about twice as many spelling errors when using the customised abbreviations.**

Usability Slogans

Designers are not users

- **Systems designers are different from users in several respects, including their general computer experience, and in their understanding of the underlying concepts of the system at hand**
- **When you have a deep understanding of some system, it is easy to grasp the meaning of any feature. This might distort the designers view on system complexity**
- **You cannot go back from knowing ‘more’ to knowing ‘less’**

Usability Slogans

Less is More

- **Every piece of information (features, etc.) presented to the user (useful or not) adds to the cognitive load of using the system**
- **Example:**

  A study of experienced telephone company directory assistants showed that finding a target in the top quarter of the screen took 5.3 seconds when the screen was half full of information and 6.2 when the screen was full.

  - cutting the 0.9 seconds saved the company 40 mio $ per year

Usability Slogans

Details Matter

- **Usability often depends on (seemingly) minor details**
- **Example**

  An indicator in a microwave oven turned gradually from white to blue to display the state. Tests showed that the phrase “turns blue” was much poorer than “white disappears” in the manual, because users became confused about “how blue is blue”

Usability Slogans

Help Doesn’t

- **It is not always that users are able to find the help they need in e.g. online manuals, or they might misinterpret it**
- **Providing a brilliant help system will not change a user-hostile interface to a user-friendly one**
- **Designers may be tempted to include e.g. online help to cover up for a bad design instead of redesigning the interface**

Usability Test Methods

- **The Different tests during the stages of development**
  - **Exploratory Test**
  - **Heuristic Evaluation**
  - **Assessment Test**
  - **Validation Test**
  - **Comparison Test**

Exercise: Heuristic evaluation of Travel Weather GUI

Usability Testing

- **A process that employs participants who are representative of the target population to evaluate the degree to which a product meets specific criteria**
- **Goals**
  - **to create a history of benchmarks**
  - **minimizing costs**
  - **increasing sales**
  - **competition**
  - **minimizing risks**

Limitations to Usability Tests

- **Testing is always an artificial situation**
- **Test results do not prove that a product works**
- **Participants are rarely fully representative of the target population**
- **Testing is not always the best/only technique to use**

Test Methodology for Scientific Experiments

A usability test is formally a controlled scientific experiment. This signifies that:

- **a specific hypothesis must be fornulated.**
- **Participants must be randomly chosen**
- **The experiment must be tightly controlled (including the role of the experimenter)**
- **A control group must be employed to validate the results**
- **The number of test users must be of sufficient size to ensure statistically valid results**

Real-life test situations

A formal scientific experiment will often be impossible to carry out in a real-life situation, e.g. due to time pressures, costs, recruitement of test users, etc. This is in particular true for the case of a student project.

- **To achieve statistically significant results, 10-15 test users per condition/variable must be employed**
- **The classical scientific theory is aimed at providing proof for a hypothesis. In usability engineering our goal might often be a more qualitative evaluation**

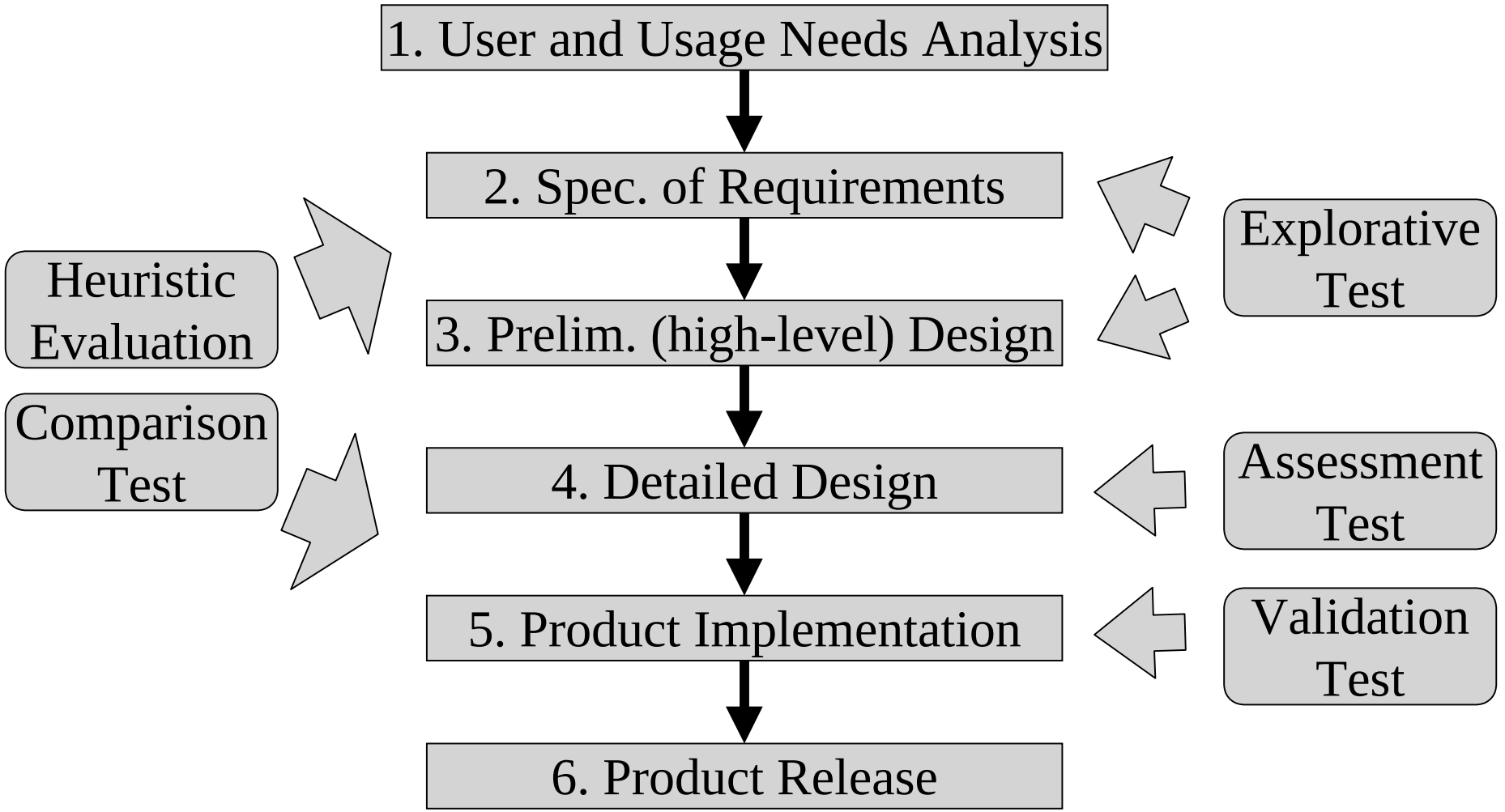
As an alternative to the classical approach, a series of quick, pointed experiments can be employed.

Adopted Test Methodology

Instead of the formal scientific approach, the following methodology can be employed:

- **Formulate problem statements or test objectives instead of a formal hypothesis**
- **Use a representative sample of end users (not necessarily random)**
- **Representation of the work environment**
- **Observe end users, who either use or review a representation of the product. Extensive interviews of the test users.**
- **Collect quantitative and qualitative measurements**
- **Recommendation of improvements**

Overview


1. User and Usage Needs Analysis
2. Spec. of Requirements
3. Prelim. (high-level) Design
4. Detailed Design
5. Product Implementation
6. Product Release
Heuristic Evaluation
Comparison Test
Explorative Test
Assessment Test
Validation Test

Exploratory test

When

- **early in the development cycle**

Objectives

- **to evaluate/explore/investigate the effectsiveness of preliminary design concepts**
- **gain knowledge of the intended end users (expertise, expectations, goals, etc.)**

Methodology

- **Close interaction between the test users and the experimentor**

Exploratory Test

Methodology:

- **Use prototype, simulation or mockup of the intended system**
  - **Informal test**
  - **Paper drawings**
  - **“shell” GUI**
  - **Concentrate only on the functionality needed for the experiment (e.g. described in a test scenario)**
  - **“Walk through”**
  - **Essential uncover the users reactions and thoughts about the interaction**
  - **Focus on why instead of how**
  - **Often comparative test**

Heuristic Evaluation

When

- **Most often early in the development, i.e. an exploratory test**

Objective

- **Discount Usability Engineering**
- **Obtain a list of usability problems (it does note produce a list of suggested “bug fixes”**

Methodology

- **non-systematic approach**
- **Close interaction with experimentor**
- **debriefing/interview test users/evaluators**

Assessment Test

When

- **Either early or midway during the development process, after the high-level design has been established**

Objective

- **To continue the process from the explorative test with more details of lower-level functions.**
- **The assessment test is essentially a test of the implementation of the intended design**

Methodology

- **The user actually performs the tasks**
- **Less intervention -action from the experimentor**
- **Quantitative measures are collected**

Validation Test

When

- **Late in the development**

Objective

- **To validate the usability, against some predefined performance criteria or benchmark, competing products, etc.**
- **Integrated test**
- **Insurance against overlooked flaws/problems**

Methodology

- **Formulate criteria (what and how well)**
- **Very little or no interaction with the experimentor**
- **Focus on quantitative data**
- **Rigorous/tightly controlled test conditions**

Comparison Test

When

- **No specific point in the development cycle**

Objective

- **combined with the other tests. The goal is to compare two or more designs**

Methodology

- **Often as a classical scientific test**
- **Forces designers (and test users) to contemplate why one design is preferred over another**

Exercise - Usability Heuristics

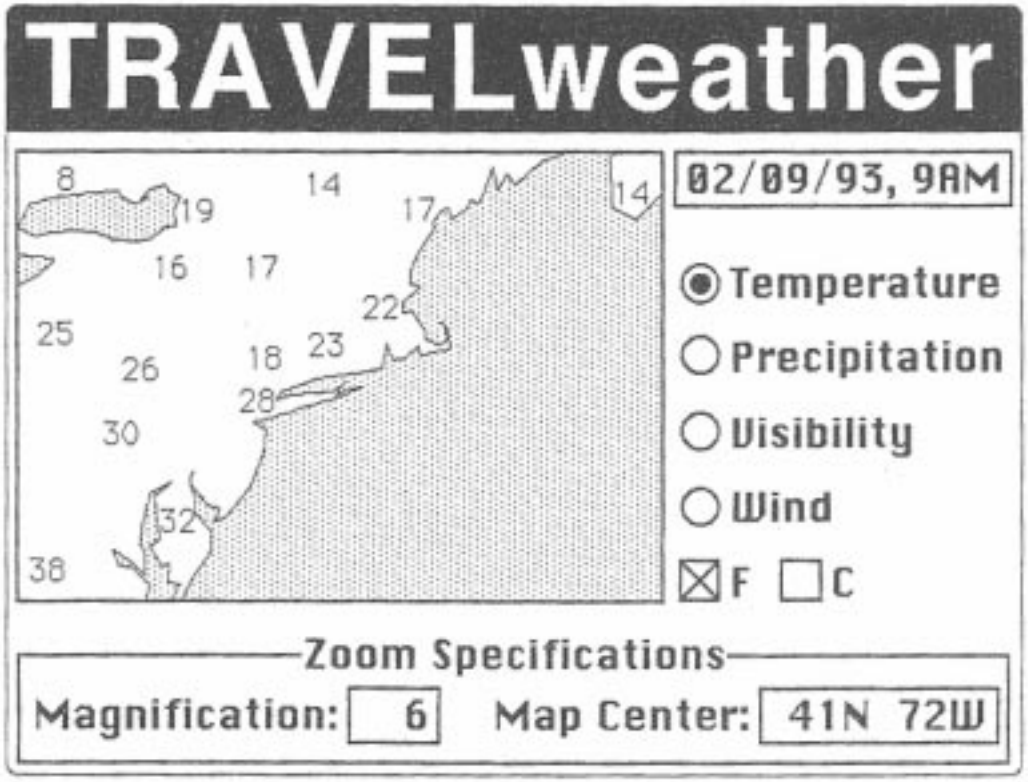
Consider the basic heuristics:

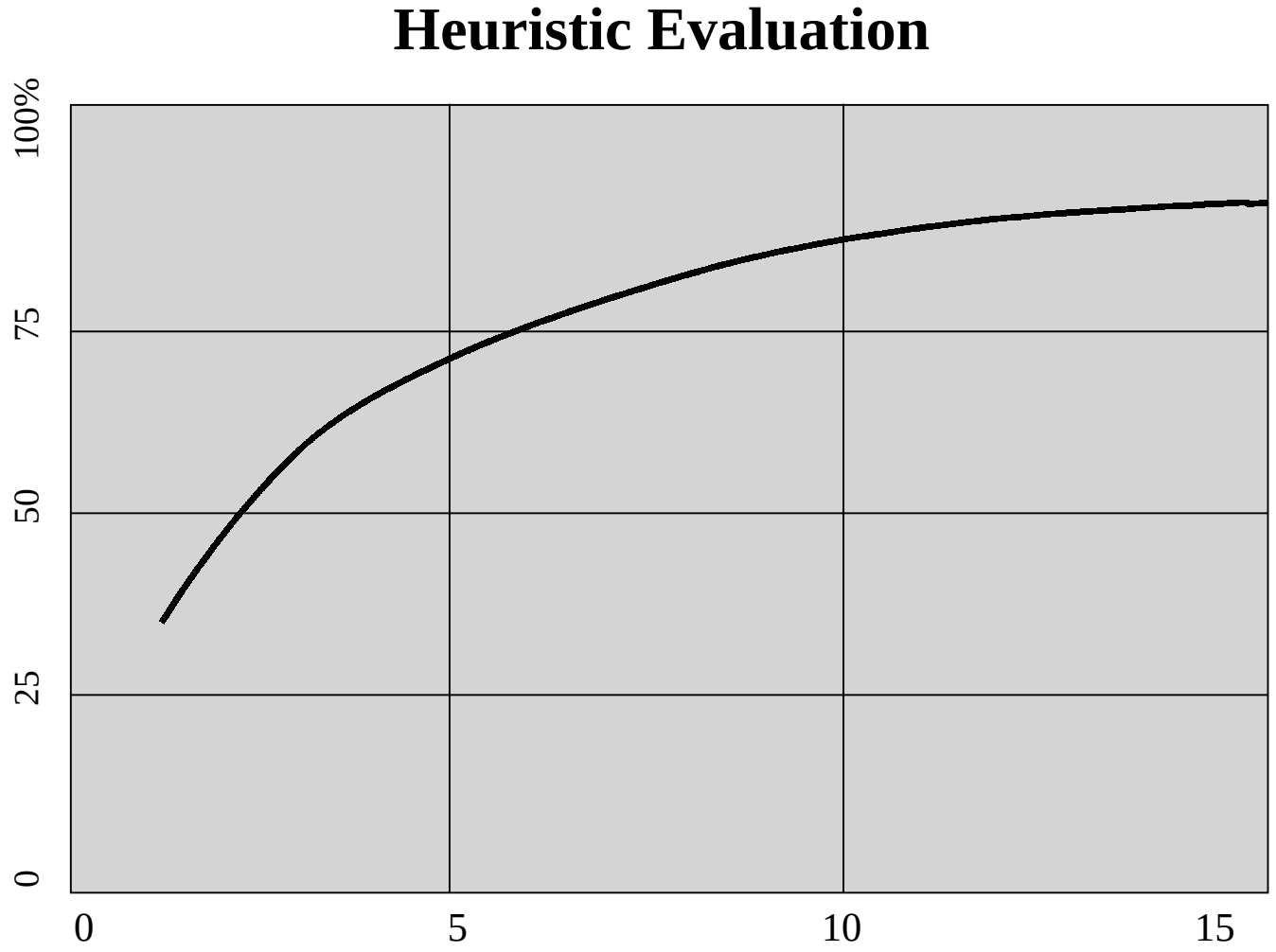
- **Simple and Natural Dialogue**
- **Speak the User's Language**
- **Minimize User Memory Load**
- **Consistency**
- **Feedback**
- **Clearly Marked Exits**
- **Shortcuts**
- **Good Error Messages**
- **Prevent Errors**
- **Help and Documentation**

Perform a heuristic evaluation of the Travel Weather UI.

Excercise

Perform a heuristic evaluation of the user interface shown here



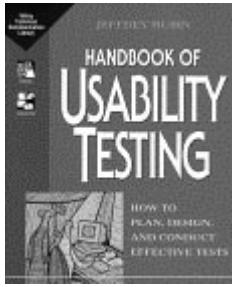


Proportion of found usability problems vs. number of evaluators

Literature

Jeffrey Rubin: "Handbook of Usability Testing - how to plan, design and conduct effective tests"

- **Wiley Technical Communication Library, 1994, USA. ISBN 0-471-59403-2. 330 pages.**
- **Price: Amazon, £ 24.5, (Centerboghandelen 620 DKK)**



Jakob Nielsen: "Usability Engineering"

- **Academic Press Inc. Paperback - 362 pages (October 1994) AP Professional; ISBN: 0125184069**

  Price: Amazon: £17.44, (Centerboghandelen 360 DKK (1996))

Link to S9-IMM fall Usability Engineerng course:

http://www.cpk.auc.dk/~lbl/IMM/S9_99/usability.html