

The USINACTS usability assessment tutorial

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Abstract

USINACTS is an ACTS (Advanced Communications Technologies and Services, an EC-supported research program) project, within the horizontal domain (ie a support project), and whose main objective is to improve the usability approach of ACTS usage trials, and to promote the best practice in usability. Within this general objective, there is a more particular objective which is to identify, characterise, document and disseminate examples of successful application of usability principles from ACTS usage trials.

In a previous phase of the project, the requirements and needs of support of the participants in the ACTS projects were identified. One of the need most people outlined was methodological support about how to carry out usability tests. As a response to this need, USINACTS is producing a usability assessment tutorial, which presents the different methods based upon real cases, either from ACTS projects or from the industry. One particular advantage of this product is that it is being made in HTML, so that it can be consulted in the USINACTS web (<http://atwww.hhi.de/usinacts.html>), as well as in a CD-ROM, of which a first version is now available.

The USINACTS tutorial provides up-to-date information about the following issues:

- What is usability? Definitions and basic concepts of usability.
- The User-Centred Design Process.
- Guidelines for choosing the appropriate usability testing method as a function of the particular objective.
- Detailed information about the application of each method, including experiments, questionnaires, interviews, heuristic evaluation, observation, performance measures and focus groups.
- Information about data analysis methods, with recommendations about its application in practical settings.

All the information will be supported by cases from ACTS projects or by examples from the literature, and the structure allows different ways to consult the material, either to solve particular problems or to learn about usability testing methods in a thorough way.

1 The USINACTS Project

"The aim of ACTS is to support early deployment and effective use of advanced communications services. A key principle is that ACTS R&D tasks are conducted in the context of trials, especially usage trials with real user communities" (ACTS 96). This is one of the main objectives of the ACTS (Advanced Communications Technologies and Services) Research Program, funded by the European Commission. The aim of USINACTS is to improve the usability approach of ACTS usage trials, and to further best practice in usability.

USINACTS supports these goals by -

- focusing ACTS projects on the key role of usability principles in the deployment of new services
- identifying and characterising specific usability information, as used by ACTS projects
- providing ACTS projects with the usability information they need for improving the quality of their products (content information) and for their trials (methodological information)
- disseminating widely the results of application of usability principles in ACTS usage trials.

The active dissemination of usability results from ACTS, in the form of tutorials and other training materials, contributes directly to the promotion of awareness across a wide spectrum of organisations about the fundamental role of usability principles, methods, guidelines and standards in the product and service life cycle. The material is being tested through pilots, ensuring that the training material readily adapts to the needs of the projects.

In addition, the use of training courses as a means to actively disseminate the results from ACTS will ensure that usability lessons learned in ACTS are fully understood in the move to the Framework 5 R&D environment.

The USINACTS tutorial on usability evaluation is of prime importance to the ACTS Programme objectives in that all projects need to have information about how to test the services under development.

2 The USINACTS Tutorial on Usability Assessment.

2.1 Purpose of this tutorial material

The USINACTS usability evaluation tutorial aims to provide an up-to-date review of the most common methods and tools available for usability assessment of systems and services, mainly in the Information Technology area. It is provided by the USINACTS project as a support information for all ACTS projects and for all researchers in the area. The tutorial is very specific about usability research methodology, but also includes much information about the Human-Centred Design Process (HCD).

The tutorial is a HTML document (HyperText Markup Language, the language of the web pages), so that it can be read both locally and over the Internet, just using a browser (e.g., Netscape Navigator or Microsoft Explorer). The version currently available contains a review of reference material and in the future will incorporate study cases from the ACTS usage trials and elsewhere.

The USINACTS tutorial has been available in Internet since its first version in <http://atwww.hhi.de/USINACTS/tutorial/index.html> and has also been distributed in CD-ROM format.

The introduction page of the tutorial tries to answer to some of the most common questions about the objectives of this tutorial:

Why to concentrate on the methodology of the usability evaluation?

Research in any area, either scientific or in applied settings, requires the use of a commonly accepted and proven methodology. Furthermore, it comprises both a "philosophy", or a standard process, and the use of common methods and procedures. Using a standard research methodology across different projects allows for comparisons and the possibility of obtaining conclusions which would be impossible if different methods are used.

Different techniques and procedures are more appropriate depending which purpose and which moment in the development process. The aim of this tutorial is to provide guidance to make the best choice of the method, and to provide all the necessary information to carry it out in the practice.

Which issues does it address and which issues does it not?

The tutorial, in its present version, presents a summary of the role of usability evaluation in the human-centred design process. But it is only a summary, and does not provide a full description of this process. The tutorial is especially focused on usability testing methods, and, although some of them are common with other stages in the development process, it is not addressed to phases like user requirements analysis. The tutorial presents the most common methods in this sector. Some other methods are or have been used, like GOMS, or longitudinal methods, but they are not covered.

To whom is this tutorial addressed?

The target populations of this tutorial are:

- Usability experts who have to conduct usability evaluations and want to consult about methods to carry them out.
- Designers who want to know basic principles of usability evaluation, and perhaps want to choose between the most commonly used methods.

How can the reader consult the material?

The tutorial can be consulted in different ways:

- If the reader has a particular question for which he or she wants a quick answer, it is possible to go directly to the part of the index containing that information.
- If the reader wants to read it as a book, we recommend him or her to use the index clockwise, and follow the links.

2.2. Detailed index of the tutorial

Below you can find a detailed index of the reference materials collated for this version of this material. The order of presentation is that recommended in the case of reading the material as a book.

What is usability?

- Definitions of usability
- Social and economic impact

The Human-Centred Design Process

- The Human-Centred design approach
- The usability evaluation process
 - Definition of usability goals
 - Identification of user's population, task and environmental characteristics.
 - Specification of usability criteria
 - Scenario building.
 - Usability testing.

Choosing the evaluation method

- Testing and evaluation methods
 - Experiments
 - Interviews
 - Observation
 - Heuristic evaluation
 - Focus groups
 - Input logging
 - Surveys (User feedback)
- Data collection and measurement techniques
 - Questionnaires
 - Performance measures
 - Thinking aloud
 - Audio-video recording

Assessment techniques in Detail

- Testing and evaluation methods
 - Experiments
 - Interviews
 - Observation
 - Heuristic evaluation
 - Focus groups
 - Input logging
 - Surveys (User feedback)
- Data collection and measurement techniques
 - Questionnaires
 - Performance measures
 - Thinking aloud
 - Audio-video recording

Data analysis

Measurement issues

Statistical data analysis

Experimental data analysis. Testing for comparative hypotheses

Comparing two means: Student's t-tests

Comparing more than two means: ANOVA models.

Repeated measures ANOVA.

Descriptive statistics. Exploratory data analysis

What is exploratory data analysis

Plots.

Data analysis models for subjective data

Introduction to Linear Models

A table of multivariate analysis models

Glossary

References

2.3. Navigation and graphic design in the USINACTS tutorial.

The USINACTS tutorial has followed a iterative development cycle, in which we have incorporated different navigation tools.

Figure 1 shows the home-page for the current version of the tutorial with the first level in the hierarchy of contents.

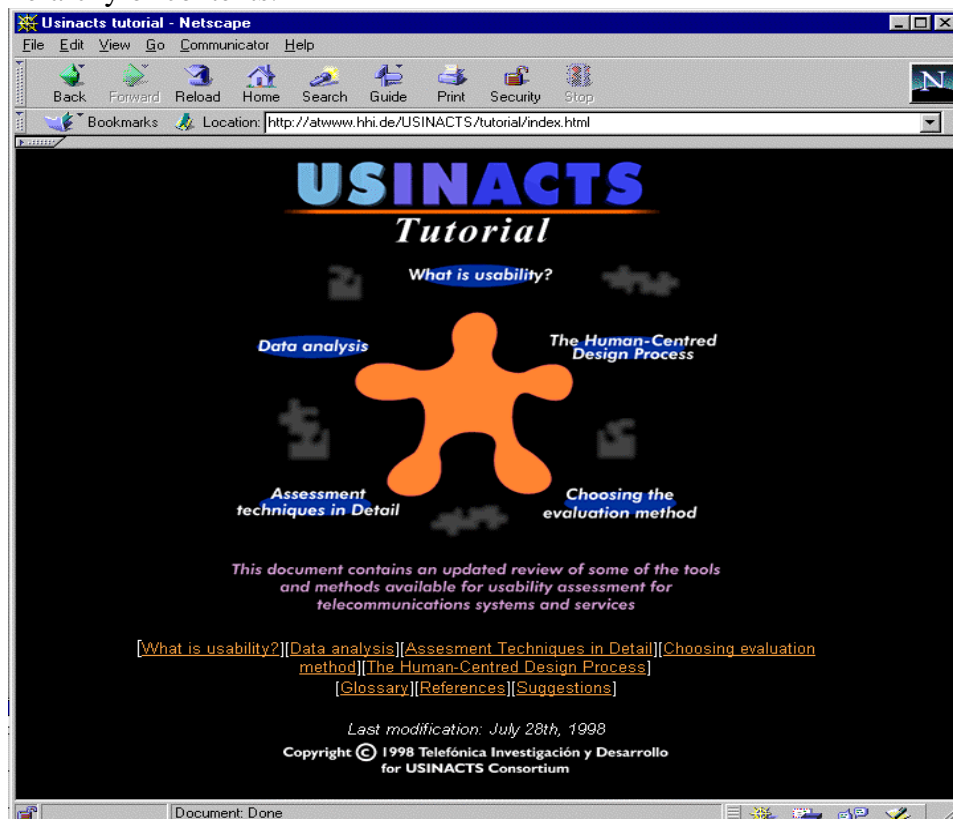


Figure 1: Home page for the current version of the USINACTS tutorial

The tutorial, all over its contents, provides a navigation bar with instant access, by means of links, to:

- Any other point in the first level of the hierarchy.
- The USINACTS Home
- The TUTORIAL Index.

These navigation bars are shown in Figure 2 below in one page of the tutorial.

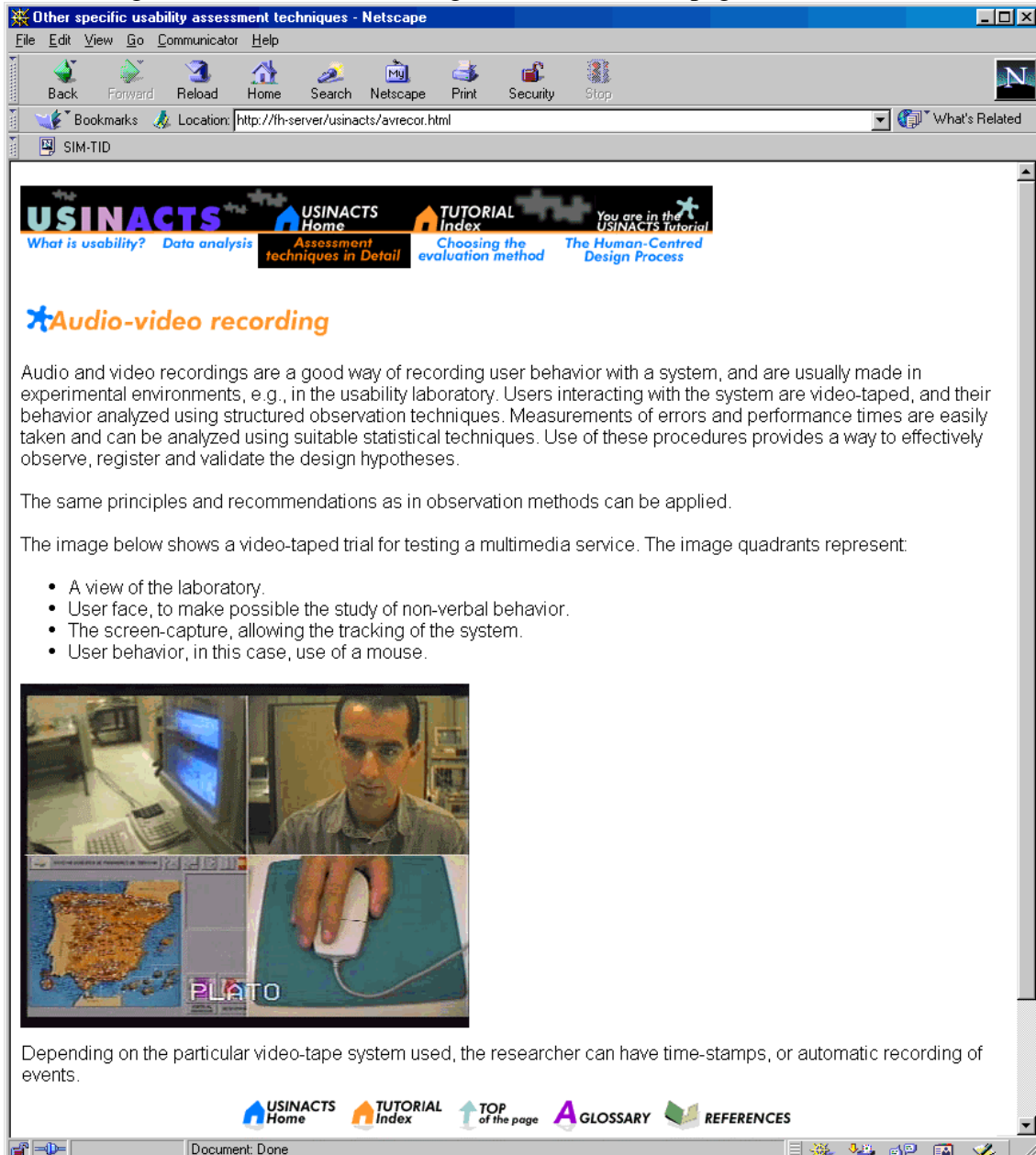


Figure 2: Example of a page of the tutorial, with the top navigation bar.

At the same time, the bottom of every page (see Figure 2 above) provides another navigation bar with links to:

- The USINACTS Home
- The TUTORIAL Index.
- The top of the current page.
- The glossary.
- The references.

The glossary and references pages are organized with a virtual keyboard, as shown, respectively, in figure 3. These make possible that the user goes directly to the page with the concepts (glossary) or references beginning with the chosen letter.

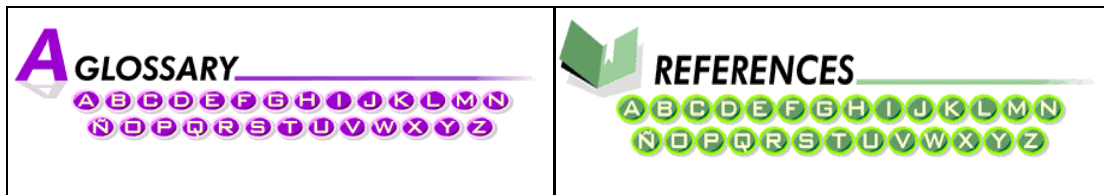


Figure 3: Virtual keyboards for the glossary and for the references in the tutorial

2.4. Strongest points in the USINACTS tutorial.

The strongest points in the USINACTS tutorial are, apart from the multiple possibilities of navigating through its contents, the way the information is classified. Tables present at a quick glance the different techniques available, and provide basic information for using them. This way, both the usability specialist and the newcomer can quickly know which techniques are useful for a particular usability evaluation problem. Links are provided in these tables to the pages with more detailed information.

The most interesting table of these is that of choosing the evaluation method. The table is divided into two parts: one is dedicated to testing and evaluation methods, and the other one to data collection and measurement techniques. This is because you can use a particular testing method with several data collection methods (e.g., you can make an experiment and use both objective –performance- and subjective –by means of a questionnaire- measures). This table is graphically depicted in figures 4 & 5.

The data analysis page also includes a detailed review of the techniques available to the usability expert. As with the material for choosing among techniques, the information is organized in such a way that it can be viewed at a glance, and with links to more detailed information. Figure 6 shows the table with recommendations for graphical display of data.

Data collection and measurement techniques			
Technique	Method in which it is used	Main Advantage	Main Disadvantage
Questionnaires	Surveys. Experiments. Structured interviews.	Finds subjective user preferences. Easy and cheap to repeat once a validated instrument is developed.	Pilot work needed to validate the instrument.
Performance measures	Input logging Experiments	Objective measures. Results easy to compare.	Does not find subjective constructs (opinion, attitudes, satisfaction).
Thinking aloud	Experiments. Interviews.	Points out cognitive processes implied in the use of the system.	Unnatural for users. Hard for expert users to verbalize. Information is difficult to analyze.
Audio-video recording	Observation Experiments	Records all behaviors and can be kept for analysis in the future	Behavior has to be categorized. Very costly.

Figure 4: Table of choosing the data collection and measurement techniques.

Testing and evaluation methods				
Method Name	Lifecycle Stage	Users Needed	Main Advantage	Main Disadvantage
Experiments	Components (hardware or software) design. Establishing generic principles fro system design.	Depends on complexity. At least 10 for design cell.	It allows to test design hypotheses or alternatives in an optimal way.	Complex techniques involved, which requires expert knowledge for maximum benefit. Usually made in the usability laboratory, and not in the real use environment.
Interviews	User requirements. Task analysis	5	Flexible, in-depth attitude and experience probing.	Time consuming. Hard to analyze and compare.
Observation	Final testing. Task analysis.	3 or more	It is made in real use enviroment.	Very costly. Difficult to analyze, and to know the reasons for behavior.
Heuristic evaluation	Early design, "inner cycle" of iterative design	None (it is made by experts)	Finds out individual usability problems. Can address expert user issues.	Does not involve real users, so does not find "surprises" relating to their needs.
Focus groups	Task analysis, user requirements	6-9 per group	Spontaneous reactions and group dynamics. Allows to find out opinions or factors to be incorporated in other methods (e.g., surveys)	Hard to analyze. Low validity.
Input logging	Final testing, follow-up studies	At least 20	Finds highly used (or unused) features. Can run continuously.	Analysis programs needed for huge mass of data. Violation of users' privacy.

Figure 5: Table of choosing the testing and evaluation method

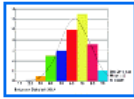
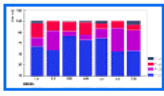
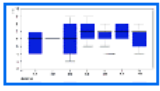
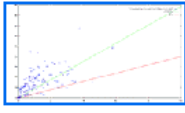
Graphical Technique	Example	Description
Bar charts and histograms		Bar charts plot the frequency or percentage of different objects or events. These are considered to be not quantitative, but discrete events. Histograms are a variation of bar charts used when the x axis is scaled as a function of a continuous variable, which can be time or the range of values for a continuous variable. These are useful for testing distributional assumptions (but there are formal statistical techniques for this) by plotting the normal curve on it. The following plot shows the distribution of the global evaluation for a prototype system.
Stacked Bar Charts		These are a variation of bar charts, and are useful to show the distribution (frequency) of different alternatives or variables as a function of another variable (e.g., group). Care should be taken not to present too many variables, groups, or, in general, making a too complicated plot, since then it is less useful.
Box and whisker plots		Box and whisker plots show the mean, the confidence interval of the mean, and maximum and minimum values of one variable in several groups. They are very useful for detecting the presence of outliers.
Scatterplots		These show the joint distribution of two variables. They are useful for finding out relationships (linear or non-linear) between two variables (at a minimum of interval level of measurement). This example has lines indicating two alternative hypotheses about the relationship between two variables.

Figure 6: Part of the table of types of plots for displaying usability data.

3. References

ACTS (1996): Advanced Communications, Technologies and Services. Overview. Brussels: European Commission.