



Evaluation and User Support

Syllabus

Evaluation of User Interfaces. Web Browsers - Fonts, Color Palette, Color Depth, Resolution, Layout, Size, Orientation. **Mobile devices issues** – Design, Limitations, What next. **User Support.**

4.1 Introduction

Objective : To design, implement, and evaluate effective and usable Human Computer Interfaces.

Learn a variety of methods for evaluating the quality of a user interface.

Outcome : To evaluate the basic of human and computational abilities and limitations and

To inculcate basic theory, tools and techniques in HCI.

Apply the fundamental aspects of designing and evaluating interfaces.

Important Discussions

- Evaluation plays important role in HCI processes and HCI systems and it acts as verification phase of implementation. HCI system generates User Interfaces (UI) as an outcome as well as to provide interaction with user effectively. Various enhanced technologies and techniques are applicable to develop User Interfaces such as OpenCV, Java Android, and MATLAB etc. Moreover, diversified HCI methodologies are useful such as Pattern recognition, classification, clustering, etc. In this context, appropriate use of operating systems, programming languages, designing techniques, web browsers are required to evaluate the applications.
- The HCI apps developed using web browsers and mobile devices comprise specific characteristics based on technical and user support. HCI deals with Fonts, Color Palette, Color depth, Resolution, Layout, size, Orientation etc. On the other hand, mobile devices deal with issues such as Design, its limitations, user support etc. User support is required during whole HCI process in the form of Design thinking and problem solving ability.
- Execution and evaluation models suggested by Norphans model plays important role in HCI system to develop diversified HCI patterns. Evaluation is applicable to test the learnability, functionality, usability, and accessibility of HCI systems. Evaluation, maybe conducted online or offline, in the lab or in the field along with HCI processes.

- The approaches used to develop expert evaluation model are review based, analytical based, and model based approach. Some of the approaches includes users along with their findings, experimentation, observations, and query method. The importance of evaluation method is enhanced using careful selection of HCI processes, HCI techniques, and interpretation of best suitable outcome.

4.2 Evaluation of User Interface

4.2.1 What is Evaluation ?

Evaluation deals with the correct selection of input, techniques, methodologies based on outcome. Evaluation comprises 3 goals namely; Accessibility, Functionality, Interaction related to specific problem of HCI system. Evaluation is divided in multiple phases of designing of HCI systems.

Design lifecycle along with evaluation lifecycle performs extensive testing of HCI experimentally. Evaluation uses design principles and prototyping techniques ensure about correctness of design phase. Expert opinion of evaluation is received by the direct involvement of users and continuous studies. Evaluation techniques are divided broadly in 2 parts :

1. Expert analysis
2. User participation.

4.2.2 Goals of Evaluation

Evaluation has three main goals, to assess the extent and accessibility of the system's functionality, to assess user's experience of the interaction, and to identify any specific problems with the system.

1. The system's functionality is important in that it must accord with the user's requirements. In other words, the design of the system should enable users to perform their intended tasks more easily. This includes not only making the appropriate functionality available within the system, but making it clearly reachable by the user in terms of the actions that the user needs to take to perform the task.
2. The evaluating system design in terms of its functionality capabilities, it is important to assess the user's experience of the interaction and its impact upon him. This includes considering aspects such as how easy the system is to learn it's usability and the user's satisfaction with it.
3. The final goal of evaluation is to identify specific problems with the design. These may be aspects of the design which, when used in their intended context, cause unexpected results, or confusion amongst users. This is, of course, related to both the functionality and usability of the design.

4.2.3 Evaluation through Expert Analysis

Evaluation based on expert analysis directly deals with system architecture phases because each and every phase of system architecture is evaluated by the experts. If the design has errors and bugs that are cured using user testing phase wise and module wise. It is really difficult to receive accurate evaluation of HCI from incomplete designing and prototyping. In this context, diversified methods have been used to evaluate HCI systems via expert analysis. Expert analysis deals with 4 approaches namely, Cognitive walkthrough, heuristic evaluation, the use of models, and use of previous work (Historical data).

4.2.3.1 Cognitive Walkthrough

Cognitive walkthrough has been proposed and then revised by Paulson for introduction of psychological theory into subjective and nontechnical walkthrough techniques. Cognitive Walkthrough approach is used inline with software engineering and software architecture. Also, it requires detailed pipeline operations used in HCI systems. In code walkthrough algorithmic approach provide sequential journey of program code. In the cognitive walkthrough, system architecture provide sequence of phases to provide solution of problems using task analysis. Moreover, step through approach provides checking and evaluation of problems step wise. More specifically research experience, evaluation, execution, and functionality along with documentation are the results of cognitive walkthrough. Its related to 4 things as follows:

- i. A specification or prototype of the system.
- ii. A description of the task the user is to perform on the system.
- iii. A complete, written list of the actions needed to complete the task.
- iv. An indication of who the users are and what kind of experience and knowledge the evaluation/evaluators can assume about them.

4.2.3.2 Heuristic Evaluation

- It deals with usability and decision support system. A heuristic provides guidelines or rules principles while taking decisions during simple and complex design. Heuristic evaluation proposed by Jacob Nielsen and Rolf Molich.
- This evaluation is applicable for structuring HCI systems using a set of rules in a simple and general way of heuristic. It may be performed on a specific design and at an early stage of evaluation. However, heuristic evaluation maybe applied on prototype, functional HCI systems, and complex HCI patterns.

The major advantages are flexibility, low cost approach, use of enriched usability characteristics. The main objective of this evaluation is to provide potential towards solving usability problems. It is a guide line or general principle or rule of thumb that can guide a design decision or be used to critique a decision that has already been made.

It is a method of structuring the critique of a system using a set of relatively simple and general heuristics.

It can be performed on a design specification so it is useful for evaluating early design. But it can also be used on prototypes, storyboards, and fully functioning systems.

The general idea behind heuristic evaluation is that several evaluators independently critique a system to come up with potential usability problems. It is important that there are several of these evaluators and that the evaluations be done independently.

Nielsen's experience indicates that between three and five evaluators is sufficient, with five usually resulting in about 75% of the overall usability problems being discovered.

Each evaluator assesses the system and notes violations of any of these heuristics that would indicate a potential usability problem. The evaluator also assesses the severity of each usability problem, based on four factor ("0 – 4"), these can be combined into an overall severity rating on a scale of 0 – 4 :

0 → I don't agree that is a usability problem at all.

1 → Cosmetic problem only.

2 → Minor usability problem.

3 → Major usability problem.

4 → Usability catastrophe.

Nielsen's Ten heuristics are

1. Visibility of system status
2. Match between system and the real world
3. User control and freedom
4. Consistency and standards
5. Error Prevention
6. Recognition rather than recall
7. Flexibility and efficiency of use
8. Aesthetic and minimalist design
9. Help users recognize, diagnose and recover from errors.
10. Help and documentation.



4.2.3.3 Model Based Evaluation

- Model based evaluation deals with expert based approach. It uses collaboration of designing and cognition models and offers combined design specification along with evaluation. This approach of evaluation deals with cognitive and design models to provide a means of combining design specification and evaluation into the same framework.
- Example: GOMS (Goals, Operators, Methods and Selection) model predicts user performance with a particular interface and can be used to filter particular design options.
- Design methodologies, such as design rationale, also have a role to play in evaluation at the design stage. Design rationale provides a framework in which design options can be evaluated.
- Dialog models can also be used to evaluate dialog sequences for problems, such as unreachable states, circular dialogs and complexity. Models such as state transition networks are useful for evaluating dialog design. Prior to implementation.

4.2.4 Evaluation through User Participation

User participation in evaluation tends to occur in the later stages of development when there is at least a working prototype of the system in place. This may range from a simulation of the system's interactive capabilities, without its underlying functionality.

4.2.4.1 Styles of Evaluation

a. Laboratory Studies

Users are taken out of their normal work environment to take part in controlled tests, often in a specialist usability laboratory.

b. Field Studies

The second type of evaluation, takes the designer or evaluator out into the user's work environment in order to observe the system in action.

4.2.4.2 Empirical Methods: Experimental Evaluation

- One of the most powerful methods of evaluating a design or an aspect of a design is to use a controlled experiment. This provides empirical evidence to support a particular claim or hypothesis. It can be used to study wide range of different issues at different levels of details.
- Any experiment has the same basic form. The evaluator chooses a hypothesis to test, which can be determined by measuring some attribute of participant behaviour. A number of experimental conditions are considered which differ only in the values of certain controlled variables.

- Empirical methods are :

- | | |
|--------------------------|--------------------------------|
| (1) Participants | (2) Variables |
| (3) Hypotheses | (4) Experimental design |
| (5) Statistical measures | (6) Studies of groups of users |

4.2.4.3 Observational Techniques

A popular way to gather information about actual use of a system is to observe users interacting with it. Usually they are asked to complete a set of predetermined tasks, although, if observation is being carried out in their place of work, they may be observed going about their normal duties.

Simple observation is seldom sufficient to determine how well the system meets the user's requirements since it does not always give insight into their decision processes or attitude.

Techniques

1. Think aloud and cooperative evaluation

- The process is less constrained.
- The user is encouraged to criticize the system.
- The evaluator can clarify points of confusion.

2. Protocol Analysis

- Paper and pencil
- Audio and video recording
- Computer logging
- User notebooks

3. Automatic protocol analysis tools

- Analyzing protocol, whether video, audio or system logs, is time consuming and tedious by hand.
- Example : EVAC : Experimental Video Annotator

4. Past task walkthrough.

4.2.4.4 Query Techniques

- It can be useful in eliciting detail of the user's view of a system.
- There are two main types of query techniques :

1. Interviews

Interviewing users about their experience with an interactive system provides a direct, structured way of gathering information.

2. Questionnaires

- An alternative method of querying the user is to administer a questionnaire

- It includes :

- (a) General

- (b) Open ended

- (c) Scalar

4.2.5 Choosing an Evaluation Method

We have seen, the range of techniques is available for evaluating an interactive system at different stages in the design process.

4.2.5.1 Factors Distinguishing Evaluation Techniques

We can identify at least eight factors that distinguish different evaluation techniques and therefore help us to make an appropriate choice. These are :

1. The stage in the cycle at which the evaluation is carried out.
2. The style or evaluation.
3. The level of subjectivity or objectivity of the technique.
4. The type of measures provided
5. The information provided
6. The immediacy of the response.
7. The level of interface / interference implied.
8. The resources required.

Choosing evaluation method also depends on :

- Design vs. implementation.
- Laboratory vs. field studies.
- Subjective vs. objective.
- Qualitative vs. quantitative measures.

3 Web Browsers

It is commonly referred as browser. It is a software application for accessing information on the worldwide web. Each individual web page, image and video is identified by a distinct uniform resource locator (URL), enabling browsers to retrieve these resources from a web server and display them on user's device.

3.1 Fonts

Font properties define the font family, boldness, size and the style of a text.

There are two types of font families :

Generic family : A group of font families with a similar look.

Example : serif

Font family : A specific font family.

Example : Times New Roman

3.2 Color Palette

Palette can refer to a range of colors. A platform used for moving things is a pallet, and your preference of flavours in food is your palate.

The meaning of word palette has extended beyond actual color to include figurative colors.

3.3 Color Depth

It is also known as a bit depth is either the number of bits used to indicate the color of a single pixel, in a bit mapped image or video frame buffer, or the number of bits used for each color component of a single pixel.

3.4 Resolution

Screens are made up of thousands of tiny dots all bunched together called pixels, each one has the ability to change color and when you zoom out all the dots joined together make up an image.

Screen resolution is measure of the number of pixels a screen can display. This would be measured by width x height

Example : 1024 x 768

3.5 Layout

Fixed Layout

In web, fixed layouts are those that use a specific unit of measurement to define web page.



2. Relative Layout

If refers to a layout that defines webpage width using some relative unit of measurement. In this case, the content in the page will resize according to the size of browser window.

4.3.6 Size

For input element the size attribute specifies the visible width, in characters of an <input> element.

Example: Email <input type = "text" name = "email" size = "35">

4.3.7 Orientation

- Adjusting layout based on orientation.
- Screen orientation is handled by CSS and java script.

4.4 Mobile Device Issues

- Mobile devices can be defined in different ways when they are looked at from different perspective.
- They can be defined in terms of the services they offer or based on the level or functionality connected with the devices.

Challenges in HCI design for mobile devices

(A) Hardware Challenges

1. Limited input facility

(i) Keyboard

- Space for key installation.
- Small keyboard increase error rate effort to learn new typing method.

(ii) The style and touch screen

Screen size is small.

(iii) The scroll wheel

- Navigate mobile device is one direction.
- Use as push button to do specific function.

2. Limited output facility

(i) Screen

- Screen acts as interface between user and computer.
- Screen is the vitalization and the presentation part of HCI system.

(ii) Audio

- Audio processing deals with speech processing of outcome of HCI system.
- It is helpful in providing text to speech as easiest way for understanding.
- Good output facility for feedback message for user.
- Can be used in conjunction with graphic and text message.

3. Design for mobility

(i) Power facility for mobile device

- Display, RF unit, keyboard, memory.
- Power management unit which collects information in hardware so that the performance of the system to not degraded.

(B) Software Challenges

1. Hierarchical Menus
2. Navigate and Browsing
3. Image and Icon

4.5 User Support

4.5.1 Introduction

There is often an implicit assumption that if an interactive system is properly designed it will be completely intuitive to use and the user will require little or no help or training.

A more helpful approach is to assume that the user will require assistance at various times and design this help into the system.

The type of assistance users require varies and is dependent on many factors. There are four main types of assistance that users require:

1. Quick reference
2. Task-specific help

3. Full – exp

4. Tutorial

4.5.2 Requirements

If we were to answer, but we can system will have all we design.

Requirements of us

1. Availability
2. Accuracy and c
3. Consistency
4. Robustness
5. Flexibility
6. Unobtrusivene

4.5.3 Approac

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Approaches are

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3. Content – sen
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 - Example
4. Online Tutor
 - It allows the
 - can progres

3. Full – explanation
4. Tutorial

4.5.2 Requirements of User Support

If we were to design the ideal help system, what would it look like ? This is a difficult question to answer, but we can point to some features that we might like our help system to have. Not every help system will have all of these features, sometimes for marks against which we can test the support tools we design.

Requirements of user supports :

1. Availability
2. Accuracy and completeness
3. Consistency
4. Robustness
5. Flexibility
6. Unobtrusiveness

4.5.3 Approaches to User Support

There are a number of different approaches to providing help, each of which meets a particular need. These vary from simple captions to full adaptive help and tutoring systems.

Approaches are

1. **Command assistance**
 - The user requests help on a particular command and is presented with a help screen or manual page describing it.
 - **Example :** In UNIX “man”, in DOS “help”
2. **Command prompts**

In command line interfaces, command prompts provide help when the user encounters an error, usually in the form of correct usage prompts.
3. **Content – sensitive help**
 - Some help systems are context sensitive. This range from those that have specific knowledge of the particular user.
 - **Example :** Menu based system to provide help on menu options.
4. **Online Tutorials**

It allows the user to work through the basics of an application within a test environment. The user can progress at his own speed and can repeat parts of the tutorial if needed.

Online documentation

This effectively makes the existing paper documentation available on computer. This makes the material available continually in the same medium as the user's work and potentially to a large number of users concurrency.

(A) Pre

Wizards and Assistants

- Wizards is task - specific tool that leads the user through the task, step by step, using information supplied by the user in response to questions along the way.
- Assistant are software tools that monitor user behaviour and offer suggestions or hints when they recognize familiar sequences.

(B) Imp

5.4 Adaptive Help System

In any large or complex computer system, users will be familiar with a subset of the available functionality, demonstrating expertise in some applications and having no experience with others, even to the point of being unaware of their existence.

In addition, different user will have different needs and levels of understanding. Adaptive help systems attempt to address these problems by adapting the help that they provide to the individual user who is making the request and by actively suggesting alternative courses of action of which the user may not be aware.

This is special case of a general class of interactive system, known as intelligent system. These include domain specific expert system intelligent tutoring systems and general adaptive interfaces.

Adaptive help systems operate by monitoring the activity of the user and constructing a model of him. This may include a model of his experience, preferences, mistakes or a combination of some or all of these.

Adaptive help system includes :

1. Knowledge representation : User modeling

- Quantification
- Stereotypes
- Overlay models

Q. 1

2. Knowledge representation : Domain and task modeling**3. Knowledge representation : Modeling advisory strategy.****4. Techniques for knowledge representation**

- Rule - based
- Frame - based
- Network - based

Q. 2

4.5.5 Designing User Support Systems

(A) Presentation Issues

- How is help requested ?
- How is help displayed ?
- Effective presentation of help.

(B) Implementation Issues

- Implementation is the important phase in software engineering processes and software architecture phases.
- Successful implementation is totally dependent on analysis, design, and detailed design phase.
- Once the system architecture and workflow of HCI system is correctly received from design phase, implementation phase work is started in pipeline.
- Algorithmic approach gives guidelines to implementation phase.
- Designing of HCI system using various components is shown in Fig. 4.5.1.

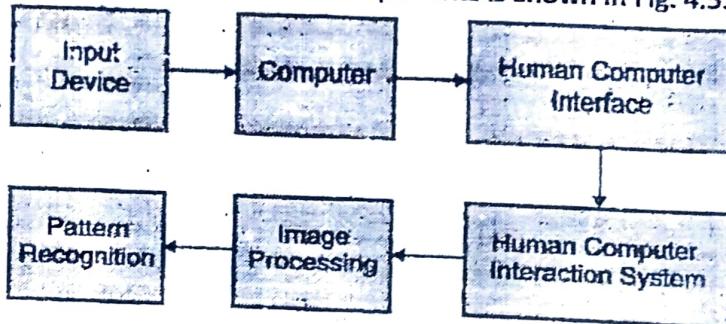


Fig. 4.5.1 : Designing the HCI system using various components

Review Questions

Q. 1 Discuss about evaluation of user interfaces such as

- Human and Computer
- Human and Mobile

Q. 2 Explain web browsers by considering following terms:

- Fonts
- Color Pallet



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(c) Color Depth

(d) Resolution

(e) Layout

(f) Size

(g) Orientation

Q. 3 Write down various issues arises in design, evaluation, and implementation of mobile devices.

Q. 4 Why Java is used with Android Studio.

Q. 5 Explain working of Human Robot Interface.

Q. 6 What is role of HCI in Brain Computer Interaction (BCI).

Q. 7 Which are necessary phases applied in hand gesture recognition, character recognition, and emotion recognition.

Q. 8 What is impact of design process on implementation process of HCI.

Q. 9 Explain mobile App using Gesture Control.

Q. 10 Which are the mobile device issues arrived while designing HCI applications.

Q. 11 What are the differences between software engineering and software architecture.

Q. 12 List down all the design patterns used in HCI.

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