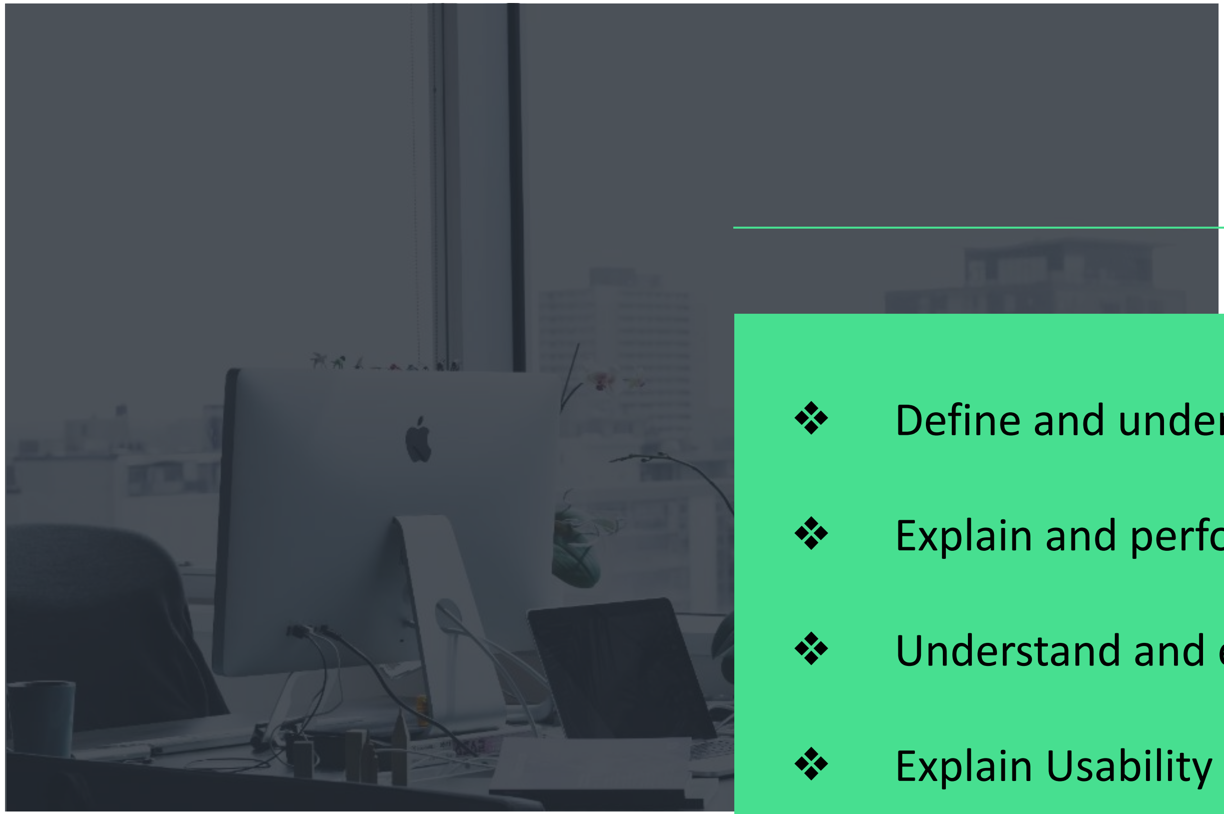
Module 1

Learning Objectives



After reading this chapter, you will be able to:

- ❖ Define and understand Interaction design and user experience
- ❖ Explain and perform steps for interaction design process
- ❖ Understand and execute Design principles on products
- ❖ Explain Usability and user experience goals and wisely choose these goals

Sub-Topics

Learning Objectives

1.1. Introduction

1.2 Good and Poor Design

- 1.2.1 Good Design
- 1.2.2 Bad Design
- 1.2.3. Good Design Versus Bad Design
- 1.2.4. What to Design?

1.3 What is Interaction Design?

- 1.3.1. 5 dimensions of interaction design
- 1.3.2. Key Characteristics of Interaction Design
- 1.3.3 Usability Goals
    1. Effectiveness
    2. Efficiency
    3. Safety

Sub-Topics

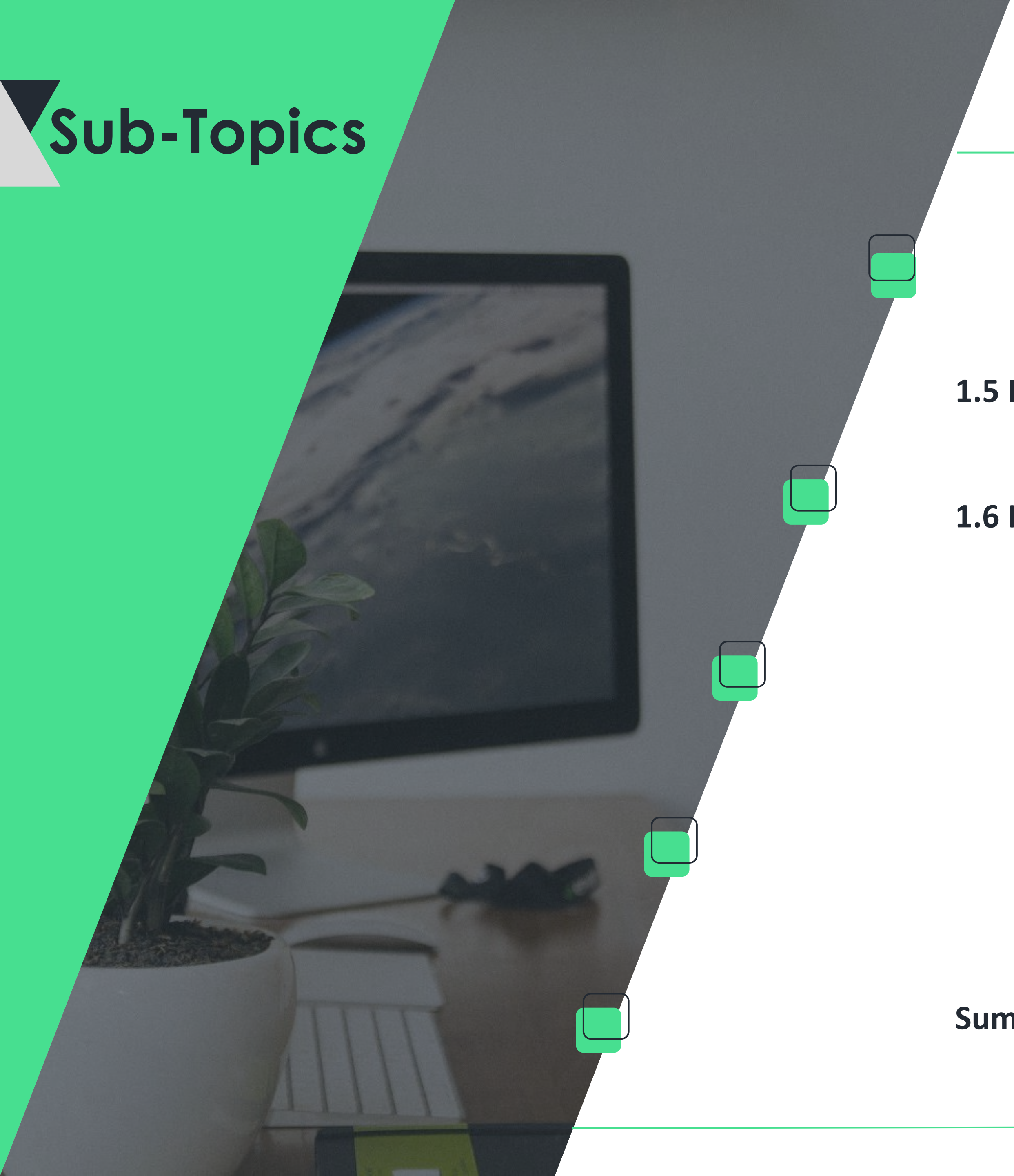
4. Utility
5. Learnability
6. Memorability

1.3.4. User experience goals

1.4 The User Experience

1.4.1. Seven factors that influence User Experience

1. Useful
2. Usable
3. Findable
4. Credible
5. Desirable
6. Accessible
7. Valuable



Sub-Topics

1.1 : Introduction

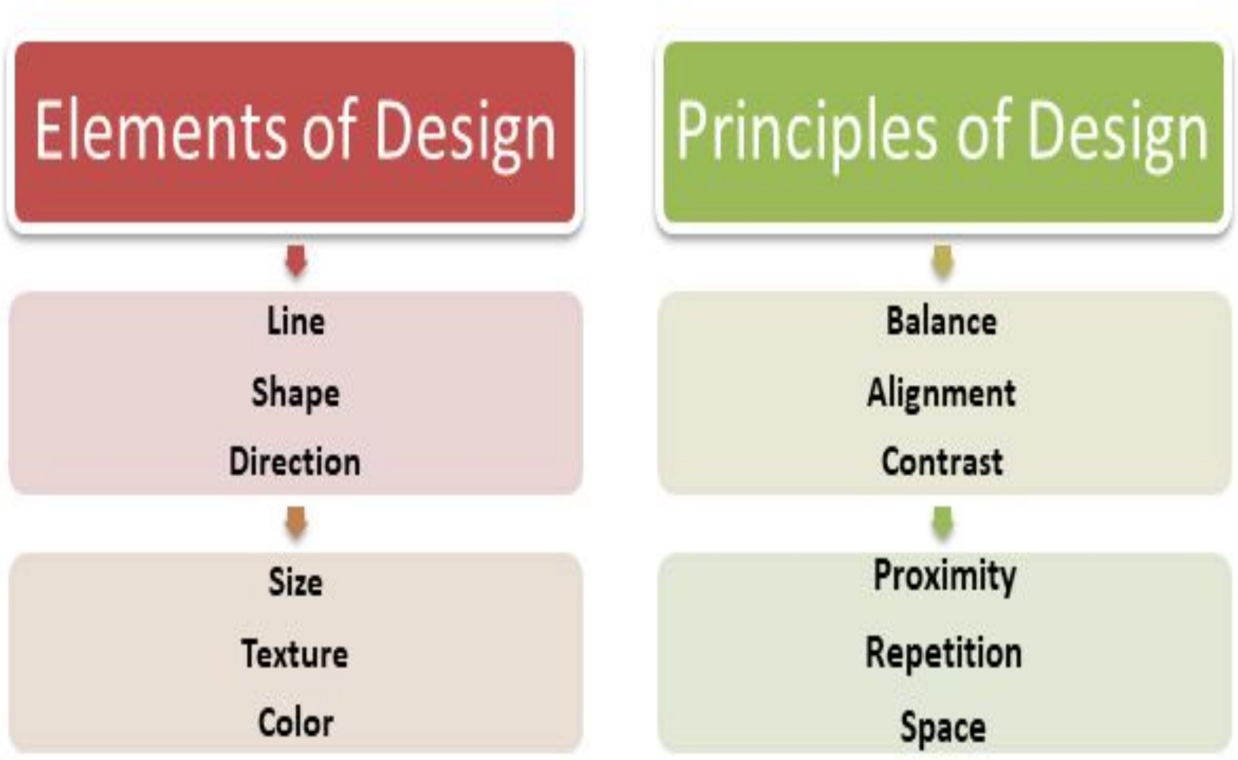
Introduction

In simple words, INTERACTION DESIGN is the interaction between the clients, that are the users, and the items such as applications and websites.

Definition

“Interaction Design (IxD) defines the structure and behavior of interactive systems. Interaction designers strive to create meaningful relationships between people and the products and services that they use, from computers to mobile devices to appliances and beyond. Our practices are evolving with the world.”

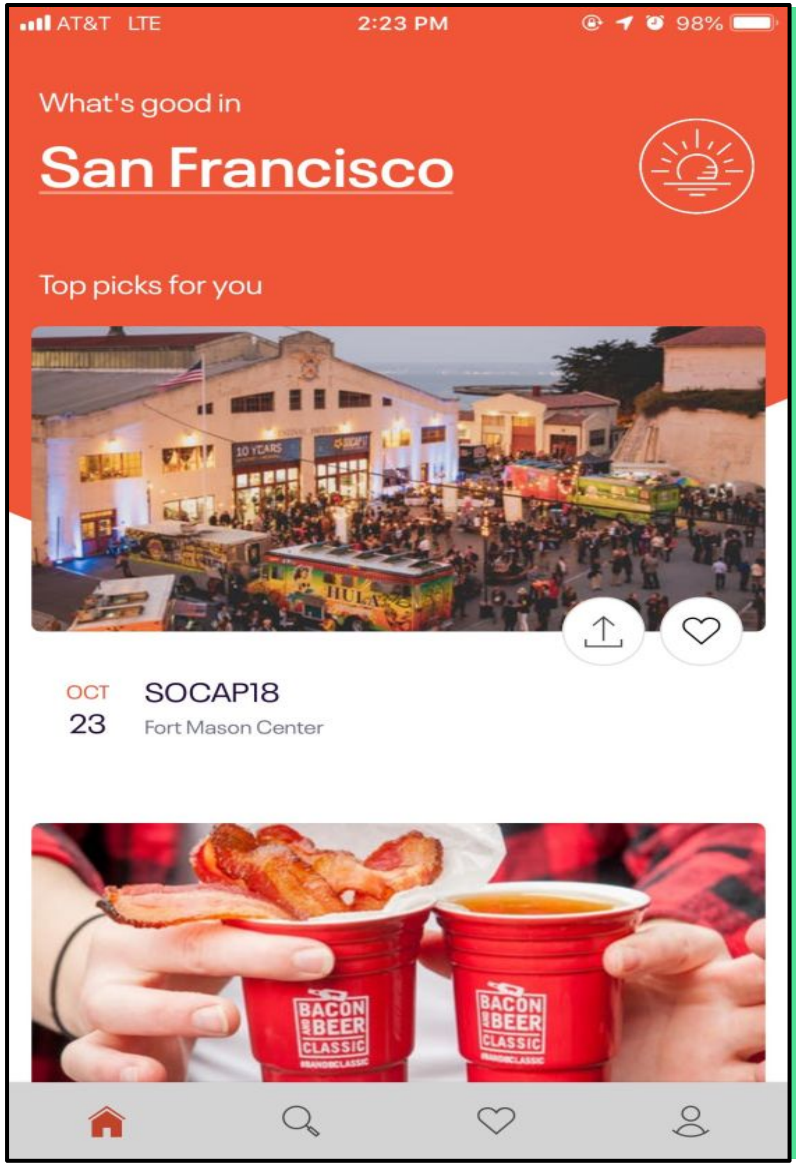
1.2: Good And Poor Design



- Elements and Principles of design are important to turn a basic design into a good design which automatically provides a good interaction design.
- Ignorance of any one characteristic can reduce your design to a disaster eventually reducing your chances of a good interaction design and user experience.

1.2.1: Good Design

01



Good Design ✓

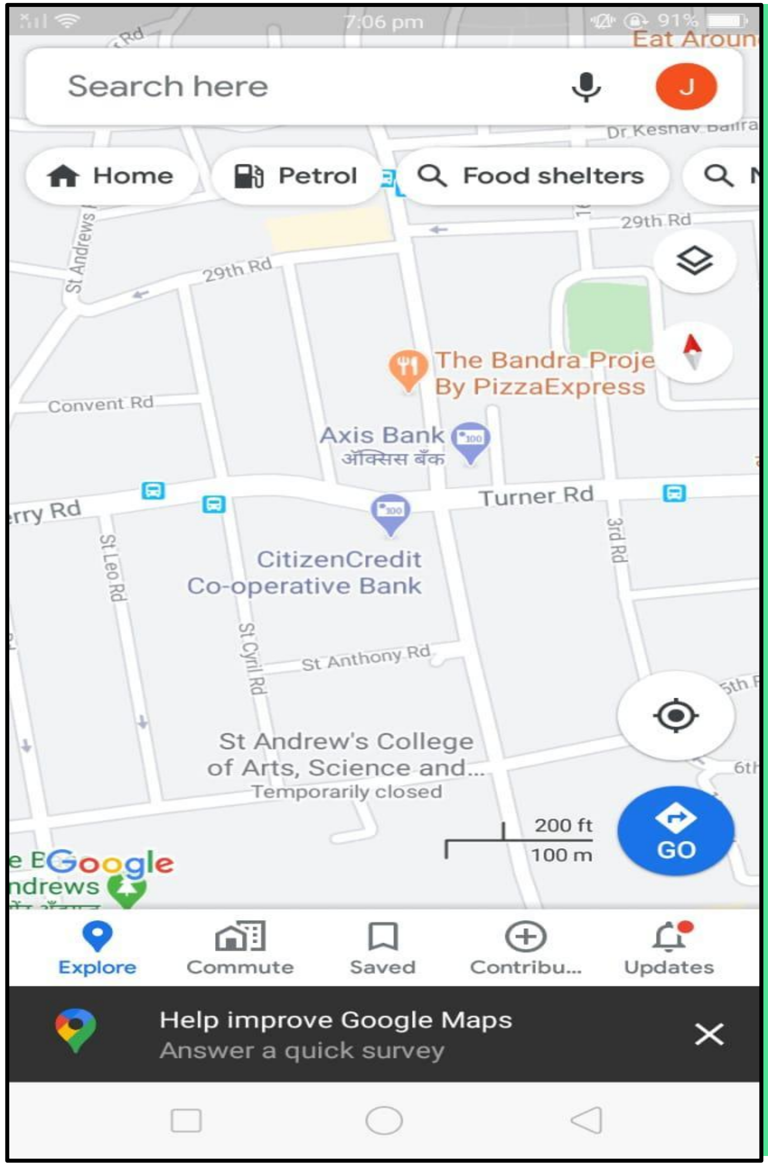
1. Design is simple and easy. For good designs, Less is always more.

2. The application has important functionalities such as Like, Share which helps me to do the task in one click.

3. The schematic design is grabbing my attention in the right places. Hence the text, color, size everything is in the right proportion making the interface attractive yet subtle.

1.2.1: Good Design

02



Good Design ✓

1. Balance of its elements is perfect. Two buttons are present and yet it does not hide or overcrowd the map.

2. Alignment is correct. The most important is the search bar and that is present on the top of the screen.

3. Contrast in color for different elements is making the map easier to read.

1.2.2: Bad Design

01

Bad Design

1. No visual order. One cannot decide where to look. There is a lot of going on that is diverting and indistinct. There are excesses of overwhelming components.
2. No appeal. This is the ideal case of a structure that is both unappealing and not practical. The foundation is too loud and detracts from the usefulness and the objective of the site which is to guide customers to its product.
3. No Balance, Alignment and Pattern. Everything is missing. All the information is dumped haphazardly making it difficult to understand.

1.2.2: Bad Design

02

Bad Design ✗

1. The image is an example of how if even one element is not proper can cause our design to fall apart.

2. Color Scheme. The colors overlap each other in the worst scene making it almost impossible to read. Other than the color scheme if you observe, unlike the above design it has a grid, is not much crowded and also has navigation links. But due to the wrong choice of color scheme, it looks shabby.

3.

1.2.4: What to Design?

1. Designing of a product depends on who is going to use the product, how the product is going to be used, where it is going to be used and what kind of users are going to use the product.
2. Hence a designer has to do something different when he is designing,in the picture the designer has invented a biking jacket with inbuilt signal mechanism. But he has a lot of options to choose from making it a difficult and complicated task for the designer.
3. To overcome this difficult user has 2 options: assume or understand. By assuming the choices of the user, the designer can only hope for the best.
4. But by understanding the user, which will guarantee better results, design will have to:

a. Understand what users are comfortable with
b. Think of ways that will help the users do their regular jobs more easily.
c. Using the product should make the user feel satisfied i.e. quality user experience.
d. Involving the user in this process and asking for their feedback.
e. Making use of successful designing techniques.

1.3.1: 5 Dimensions of Interaction Design

1D : Words

Words envelop content. Easy to understand Words should be used in interaction for button labels,etc.

2D: Visual Representation

Customers interact with images and different illustrations which are known as Visual Representations. Ex, ‘?’ means help desk

3D: Physical Object or Space

In order to make use of products we need physical objects through which we can access the products and services of our choice. Like, a mouse to click.

1.3.1: 5 Dimensions of Interaction Design

To understand the changes taking place in the product, that can be a website or application, time is an important factor.

4D: Time

5D: Behaviour

Action and reaction together make up the behaviour of the system. It helps us understand the functioning of the product by showing us the interaction of the product with the user.

1.3.2: Key Characteristics of Interaction Design

User Involvement

User involvement is extremely important and takes place at every step of the interaction design process

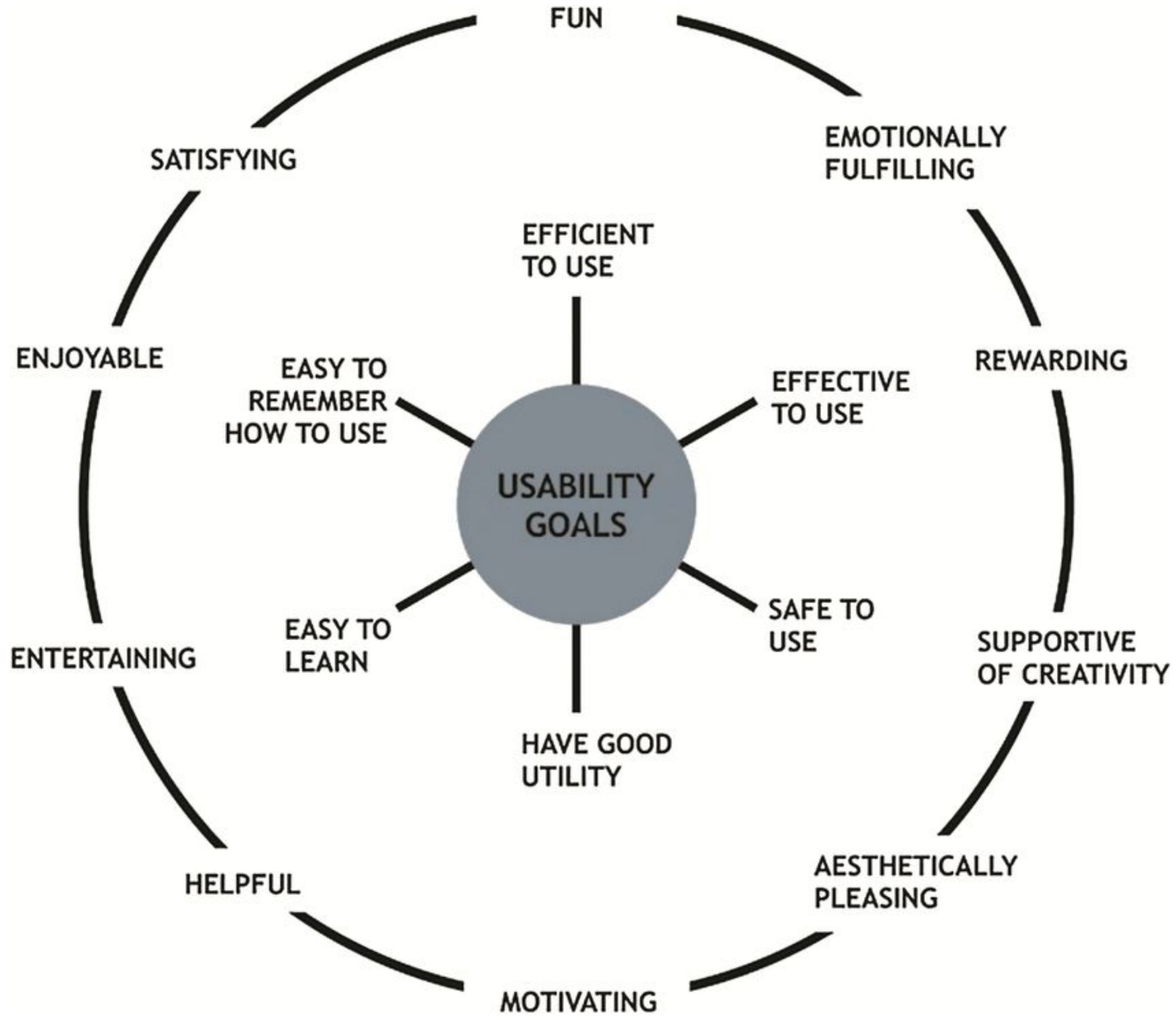
Usability Goals and User Experience Goals

- Usability goals and user experience goals should be discussed and agreed upon at first.
- It should be documented at the starting of the process so that no confusion arises in the end.

Iteration

- Iteration through the four activities is inevitable
- Interaction design is an ITERATIVE PROCESS.

1.3.3: Usability Goals and User Experience Goals



1.3.3.1: Usability Goals

- Usability alludes to guaranteeing that interactive products should not be difficult to learn, successful to utilize, and fun from the client's point of view.
- Users should be able to complete their work or activities at school, office by advancing the interaction between users and products.
- Usability aims are formed by asking questions.

01 Effectiveness

02 Efficiency

03 Safety

04 Utility

05 Learnability

06 Memorability

1.3.3.1: Usability Goals

Effectiveness

It is a common aim of an interactive product and it relates to how good the product performs its tasks

Efficiency

It refers to how good performance the product has. It means that the product is performing its task in the right way and giving the desired output.

Safety

It includes avoiding risky situations or dangerous situations with respect to the client.

1.3.3.1: Usability Goals

Utility

It refers to the extent at which users are being able to perform their task correctly because the system is working perfectly with respect to functionalities.

Learnability

It refers to use of the system, whether it is easy or difficult.

Memorability

It means once the users have learned the steps of how to use the system, the ability to recollect the same steps, if the user has not used the system for a long time.

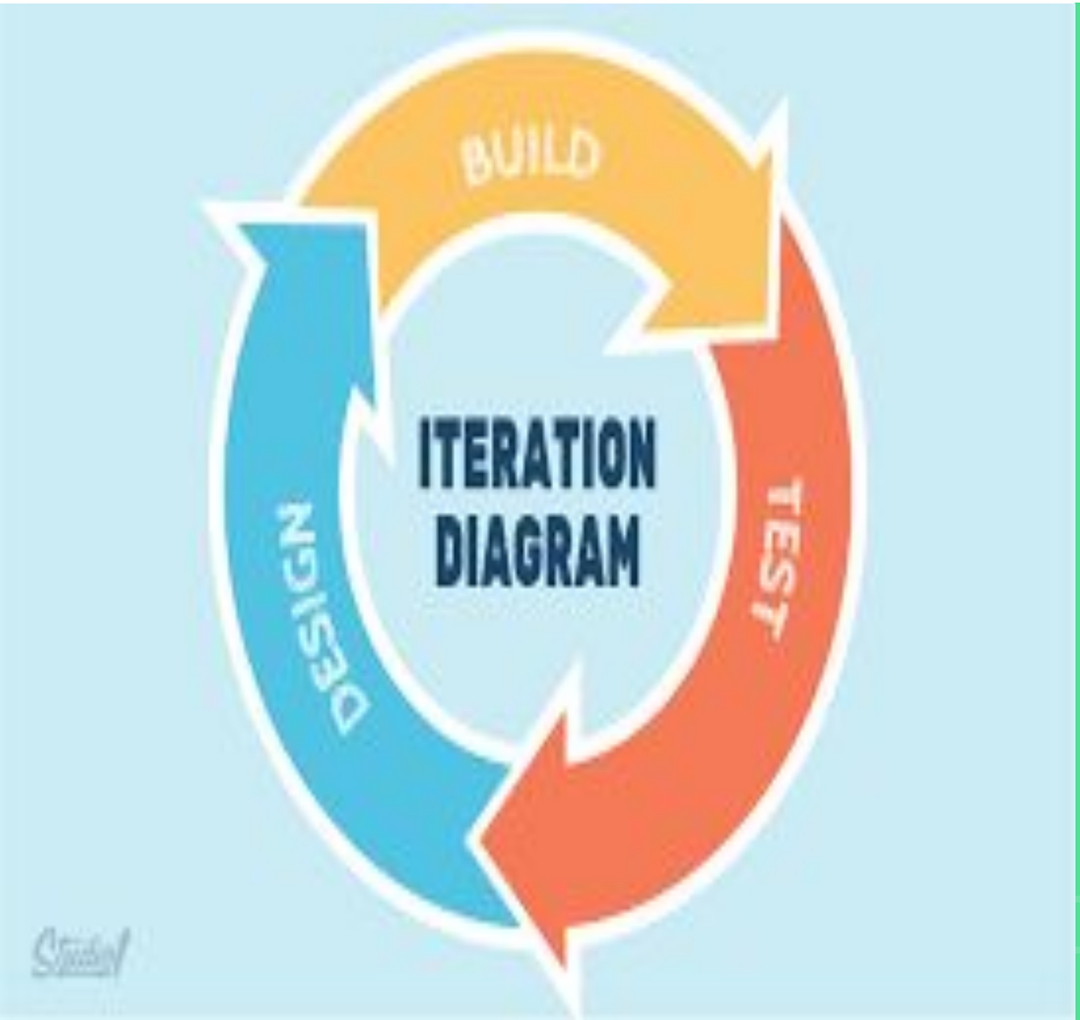
1.3.3.2: User Experience Goals

- Most of these are abstract feelings, which tell us how the client feels about the product.
- It is related more to the experience the user has while interacting with the product instead of whether the system is working or not
- While the terms used to depict usability objectives include a little but definite set, a lot more terms are utilized to portray the multifaceted idea of the client experience.

Goals :

1. Satisfying
2. Enjoyable
3. Fun
4. Entertaining
5. Helpful
6. Motivating
7. Aesthetically pleasing
8. Support creativity
9. Rewarding
10. Emotionally fulfilling

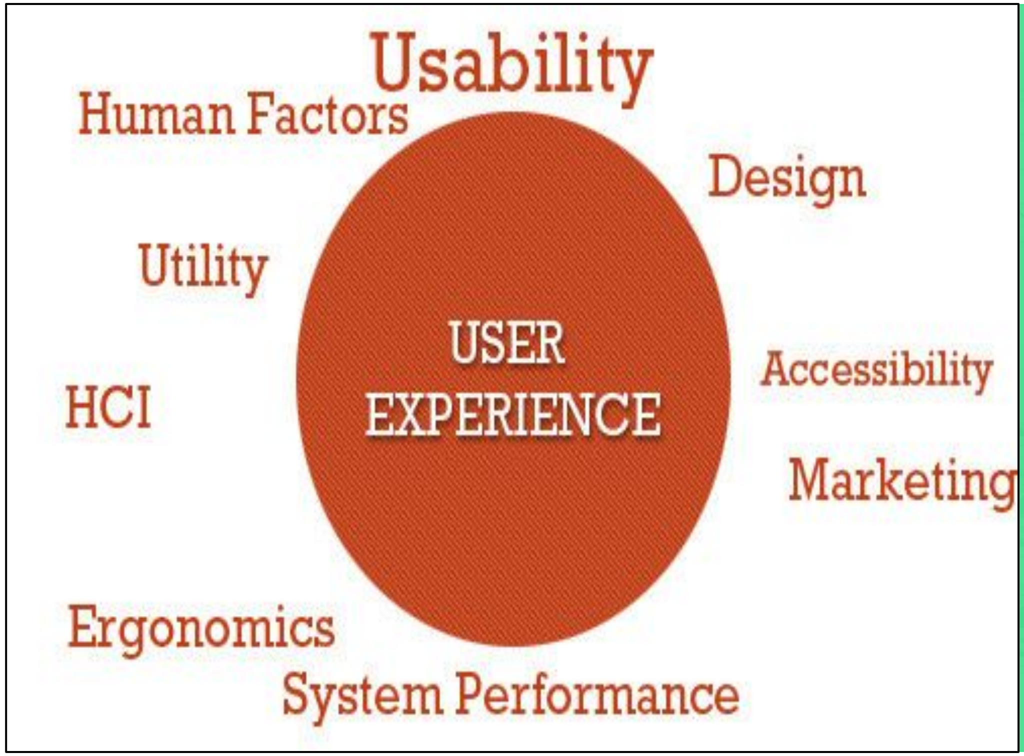
1.3.4: Iteration



Interaction design is an ITERATIVE PROCESS, involving:

1. Again and again going through various design processes and various levels of detail.
2. Design problems should be thought through i.e. thinking about design problems in different aspects such as the right amount of balance and alignment, navigation, space,etc.
3. Clients' requirements should be understood.
4. Different designs should be used as alternatives.
5. Prototyping models. Models should be prototyped
6. Evaluating them. Models should be evaluated.
7. Brainstorming about design limitations.
8. Changing the model according to the new requirements.

1.4: User Experience



- User experience is one of the factors that can cause the product to fail or be a success in the market.
- Often UX is considered as only the usability of the product which is a misconception.
- Usability is just a part of UX.
- User experience in layman terms means the overall experience of a person using a product such as a website or computer application, especially in terms of how easy or pleasing it is to use.

1.4.1: Seven factors that influence User Experience

- Seven factors that influence User Experience have been mentioned below.
- These factors are used to find out whether the user experience is good or not.
- It helps us decide in which area is the improvement needed.

01 Useful

02 Usable

03 Findable

04 Credible

05 Desirable

06 Accessible

07 Valuable

1.3.3.1: Usability Goals

Useful

A product can be successful only if it is useful in some way to someone.

Usable

Usability refers to the functioning of the system

Findable

Findability refers to how easily you can find the product in the market and if it's an electronic device then how easily you can find the desirable content or functionality in the device.

1.3.1: 5 Dimensions of Interaction Design

Credibility means the trust users have in the product that has been created.

Credible

Desirable

Desirability increases the probability of success of the product in the market.

1.3.1: 5 Dimensions of Interaction Design

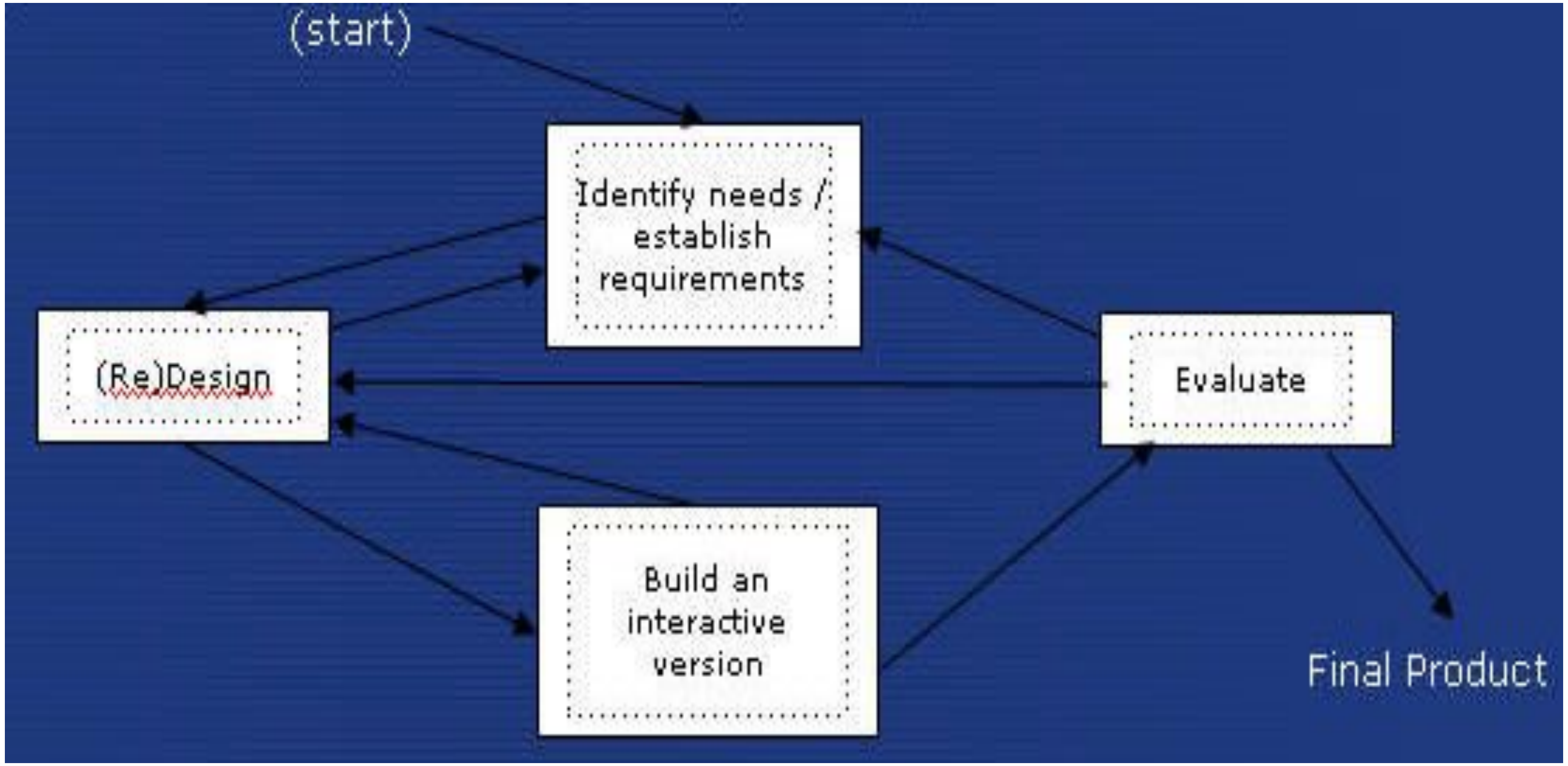
Accessibility means your product is accessible by all of the population i.e. by common people as well as people who have special needs.

Accessible

Valuable

Value should be one of the prominent factors when it comes to buying a product.

1.5: Process of Interaction Design



It is used to make products with best interaction design experience so that users are satisfied and are attracted to such products.

1.5: Process of Interaction Design

First Step | **Second Step** | **Third Step** | **Fourth Step**

1. Identifying needs and establishing requirements

A prerequisite given by the client should be satisfied. Necessities will rely upon the nature of the client, the exercises the client will perform utilizing the item, and the environment

2. Developing alternative designs that meet those requirements

Thinking of different designs empowers designers to explore various methods for deciphering and fulfilling the requirement for a specific interaction product

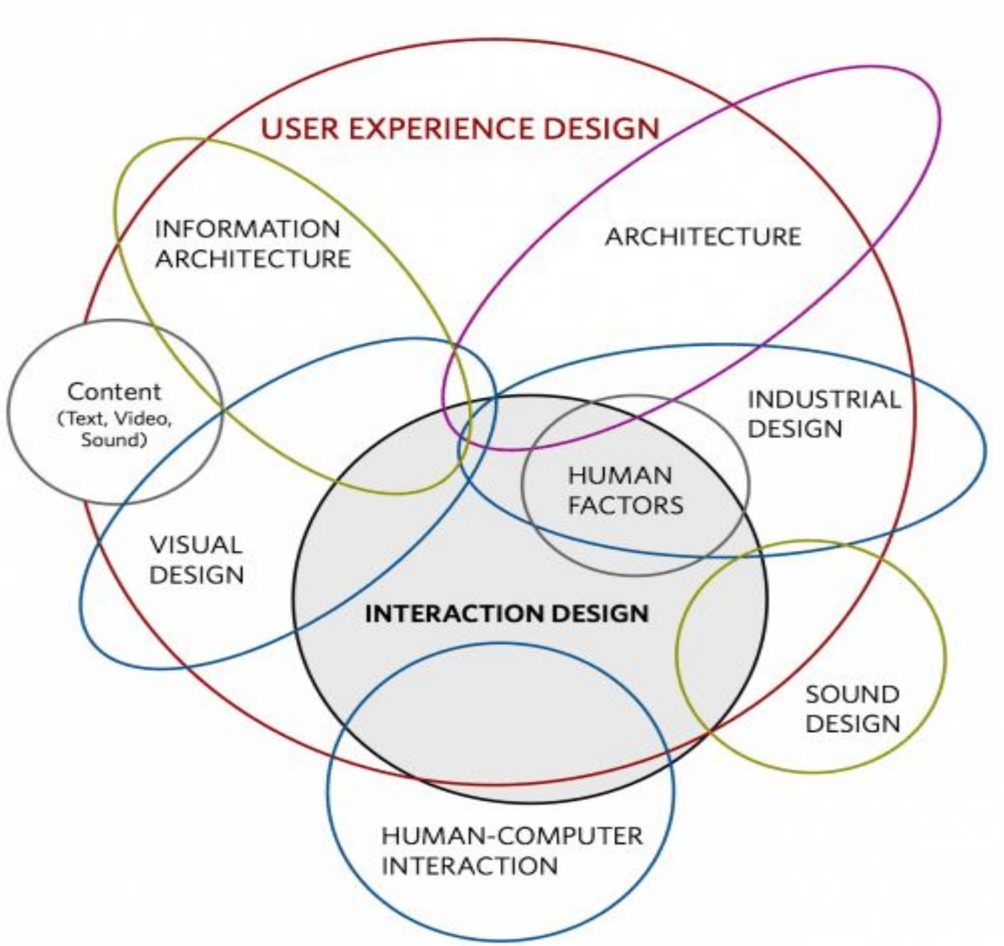
3.Make Prototypes

When designers have come up with various ideas, they now have to decide on one idea that suits the clients requirements.

4. Evaluating what is being built throughout the process

Evaluation lets the designer find what are the requirements that are already met, which requirements might crop

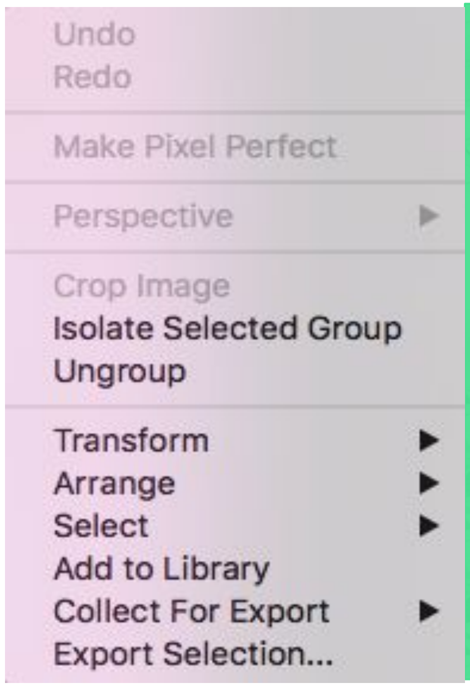
1.6: Interaction Design and User Experience



- The way the designer thinks about the client interaction with the product is the key difference between IxD and UX.
- Interaction designers concentrate only on the moment when users interact with the product. Enriching the interaction experience is the final goal.
- However, for User experience designers this moment is just a part of the process. As user experience design is a sum of all the user facing needs.

1.6: Design Principles

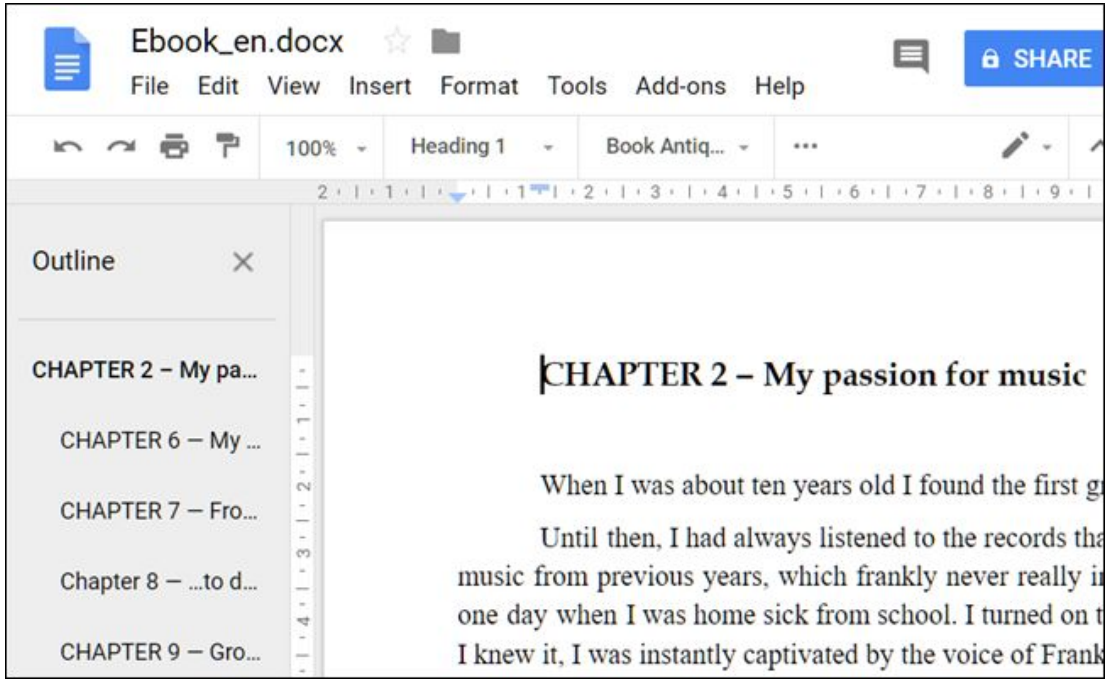
01 Constraint



- It is a principle where the user is provided with fewer options because the user might not satisfy some conditions yet.
- As shown in the figure some options are available whereas the grey text are options that are not available because the user does not satisfy some conditions.

2.8.1 : Expressive And Frustrating Interfaces

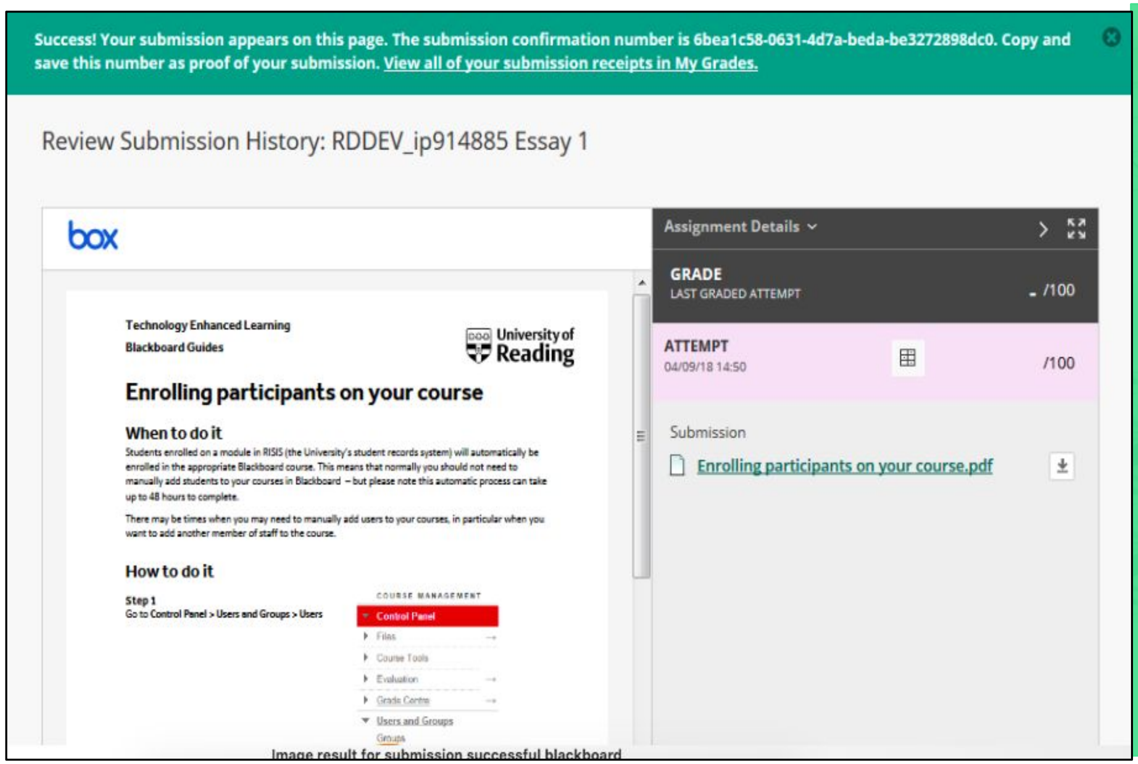
02 Discoverability



- The ability to discover something easily is known as discoverability.
- It is important because finding functions should be easy and simple instead of complicated
- To change font the user goes to the font section, to insert an image he goes to Insert section as shown in Figure 1.16. This makes the user feel safe and gives a sense of authority on what he is doing.

2.8.1 : Expressive And Frustrating Interfaces

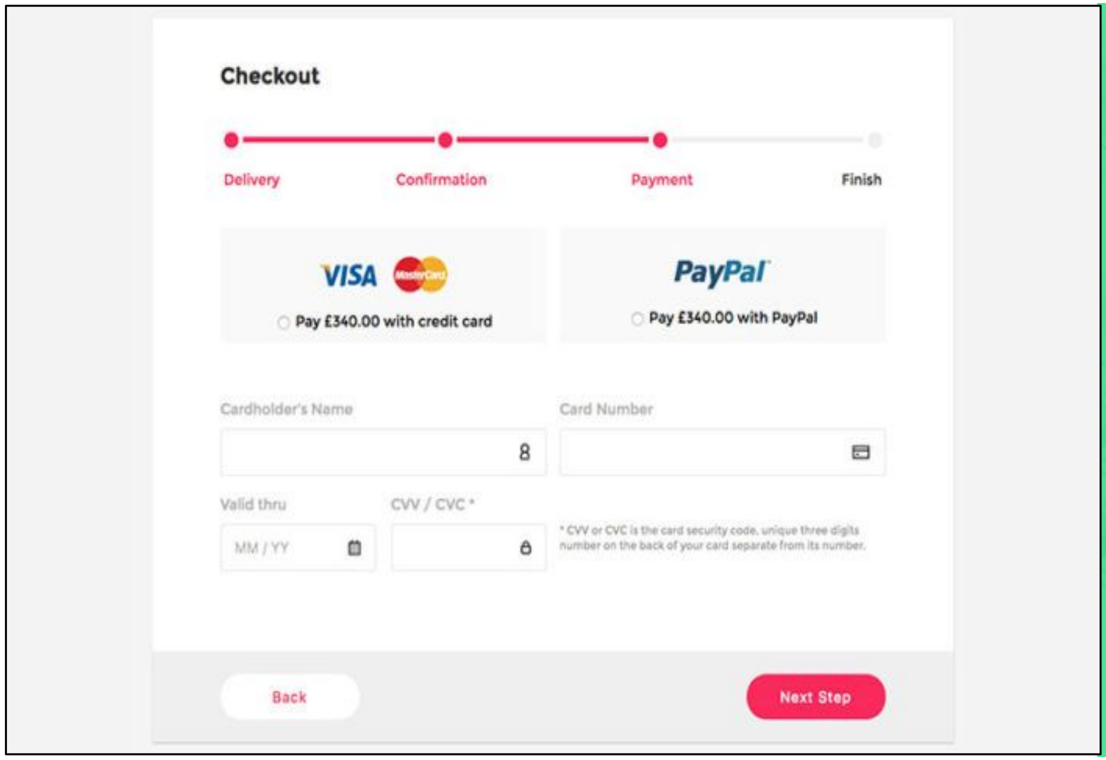
03 Feedback



- It refers to a response a user receives after completion of his actions which let him know whether the actions have been completed successfully or not.
- Feedback should be provided in the form of dialogue boxes or pop ups that show after task completion.
- For example in the figure below, we can see the document has been submitted as below SUBMISSION on the right hand side a document is visible. If it was not visible the user would have then decided to repeat the process again.

2.8.1 : Expressive And Frustrating Interfaces

04 Visibility



- Visibility refers to the ability of keeping the mechanism of the product as transparent as possible to the user.
- Visibility refers to the ability of keeping the mechanism of the product as transparent as possible to the user.
- Thus the user now clearly knows where he is and this relieves him of the stress of the unknown environment

2.8.1 : Expressive And Frustrating Interfaces

05 Consistency

- It refers to the same layout, functionality, color scheme and all properties in respect to the product are the same in every device.
- This helps the users to calm down their nerves and do their jobs in a better way.
- This helps in a trustful relation between the product and users as whatever is happening is exactly as they expected.

2.8.1 : Expressive And Frustrating Interfaces

06 Affordance

- It is an attribute that tells us about how the use of a particular product takes place.
- An example of poor affordance is the Norman Doorway.
- In this doorway, similar handles are present on both sides. This makes the user confused as to which handle is for PULL and PUSH.
- Solution for this can be either label the handles as PUSH or PULL or do not keep a handle on the PUSH side as shown in figure.

Summary

- **Interaction design means making the process of interaction with the screen a better experience for users by understanding their requirements.**
- **User experience means the process of interacting with the whole product and not just the screens.**
- **Betterment of interactive products can be done by understanding the interaction design process and carefully executing each and every step.**
- **Interaction design process has 4 steps: establishing requirements, designing alternatives, prototyping designs, and evaluating prototypes.**
- **Interaction design and user experience are interrelated and hence overlap.**
- **Design principles are useful for judging an interactive product.**
- **There are namely 6 design principles: feedback, consistency, affordance, discoverability, constraint and visibility.**
- **Usable, findable, utility, desirable, valuable, accessible, credible are seven factors that affect user experience.**

Review Questions

1. What is good design and bad design?
2. How should a designer design an application
3. What are the 5 dimensions of interaction design?
4. What are the key Characteristics of Interaction Design?
5. Write a short note on usability goals and user experience goals.
6. User Interface Design is an important part of usability. Justify the statement with an example.
7. Define Usability and identify the most relevant Usability Goals for Ecommerce web application.
8. Identify and explain the process of Interaction Design
9. Explain seven factors that influence user experience
10. Differentiate between User Experience and Interaction design.
11. Define Interaction Design and User Experience.
12. Identify the relationship between Interaction Design and User Experience
13. Identify the relationship between Interaction Design and User Experience using an example of real time products.
14. What are design principles? Explain with an example considering any application of your choice.
15. Enable you to evaluate an interactive product and explain what is good and bad about it in terms of the goals of interaction design.
16. Describe what interaction design is and how it relates to human-computer interaction and other fields.

Multiple Choice Questions

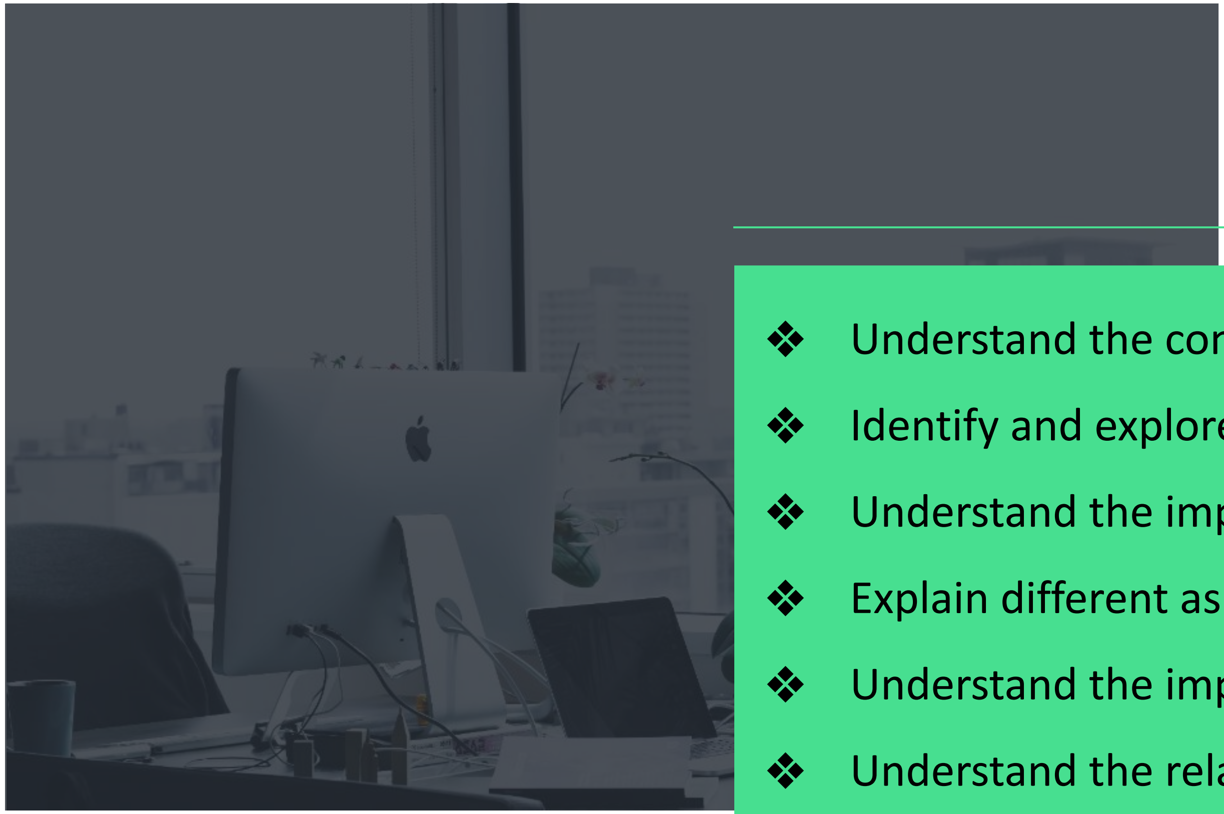
1. Which of the following design principles provides limitations to the user?
    a. Constraint
    b. Discoverability
    c. Feedback
    d. Visibility
1. Making of interaction models takes place in which step of the interaction design process?
    a. Identifying needs
    b. Developing alternative designs
    c. Building prototypes
    d. Evaluating
1. Norman doorway is a poor example of which of the design principles?
    a. Consistency
    b. Feedback
    c. Affordance
    d. Constraint

Multiple Choice Questions

4. Considering the disabled population as customers is done in which of the following factors that influences user experience?
    a. Usability
    b. Findability
    c. Accessibility
    d. Utility
5. Remembering how the system works after once learning to operate the system is known as
    a. Memorability
    b. Learnability
    c. Effectiveness
    d. Efficiency
6. A user is unable to find how he can post pictures in a photo sharing application. What do you think, does the application have good design or bad design?
    a. Bad design
    b. Good design
    c. None of the above
    d. Both a and b

Module 2

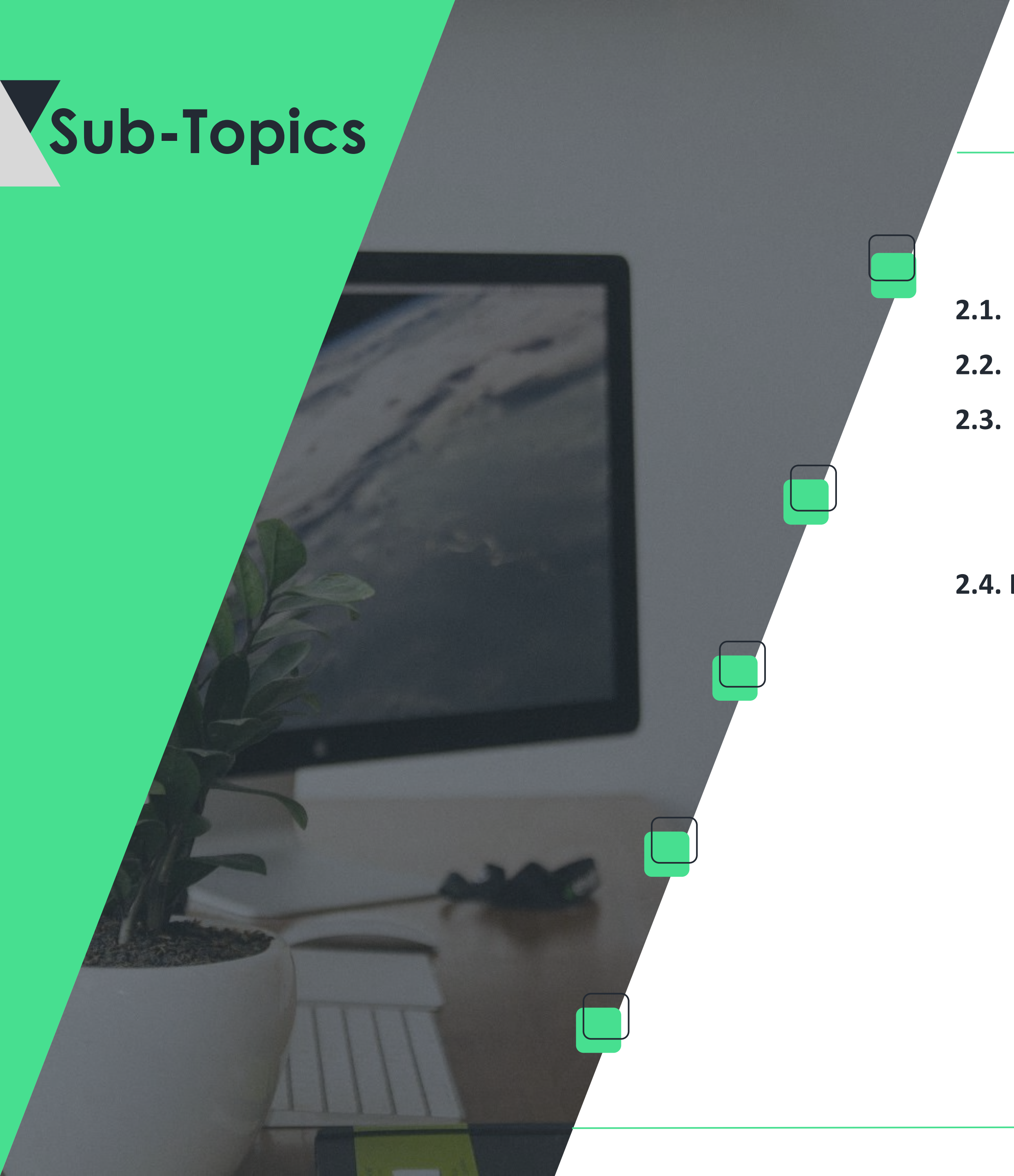
Learning Objectives



After reading this chapter, you will be able to:

- ❖ Understand the concept of problem space and conceptualization.
- ❖ Identify and explore different types of interfaces and their usage.
- ❖ Understand the importance of cognition aspect in interaction design
- ❖ Explain different aspects of cognition.
- ❖ Understand the importance of social interaction and explore its types.
- ❖ Understand the relation between emotion and user experience.
- ❖ Explain persuasive technologies and their importance.

Sub-Topics



2.1. Introduction

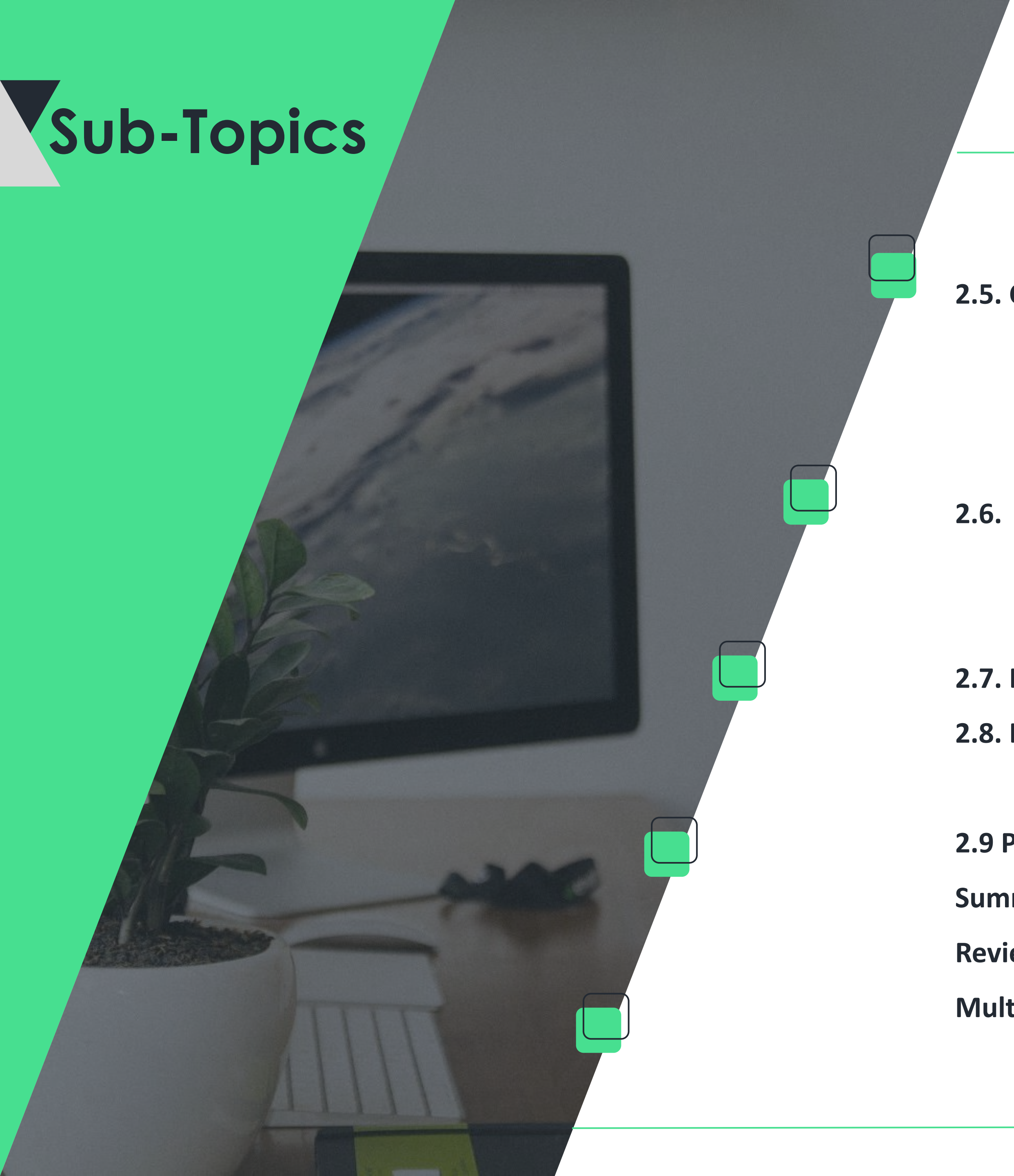
2.2. Understanding The Problem Space And Conceptualizing Design

2.3. Conceptual Model ?

- 2.3.1. Users Tasks and Goals represented in hierarchical structure
- 2.3.2. Grammatical and Linguistic 2.3.3. Device or physical level

2.4. Interface Types

- 2.4.1. Command-based 2.4.2. WIMP and GUI 2.4.3. Multimedia
- 2.4.4. Virtual reality 2.4.5. Information visualization and dashboards 2.4.6. Web
- 2.4.7. Consumer electronics and appliances 2.4.8. Mobile 2.4.9. Speech
- 2.4.10. Pen 2.4.11. Touch 2.4.12. Air-based gesture 2.4.13. Haptic
- 2.4.14. Multimodal 2.4.15. Shareable 2.4.16. Tangible
- 2.4.17. Augmented and mixed reality 2.4.18. Wearable
- 2.4.19. Robots and drones 2.4.20. Brain–computer interaction (BCI)



Sub-Topics

2.5. Cognitive Aspects

2.5.1. Cognition 2.5.2. Attention 2.5.3. Perception 2.5.4. Memory

2.5.5. Learning 2.5.6. Reading, speaking, and listening

2.5.7. Problem solving, planning, reasoning, and decision making

2.6. Social Interaction And The Emerging Social Phenomena

2.6.1. Face-to-Face Conversations 2.6.2. Remote Conversations

2.6.3. Telepresence 2.6.4. Co-presence

2.7. Emotions And The User Experience

2.8. Expressive And Frustrating Interface

2.8.1. Expressive Interfaces 2.8.2. Frustrating Interfaces

2.9 Persuasive Technologies

Summary

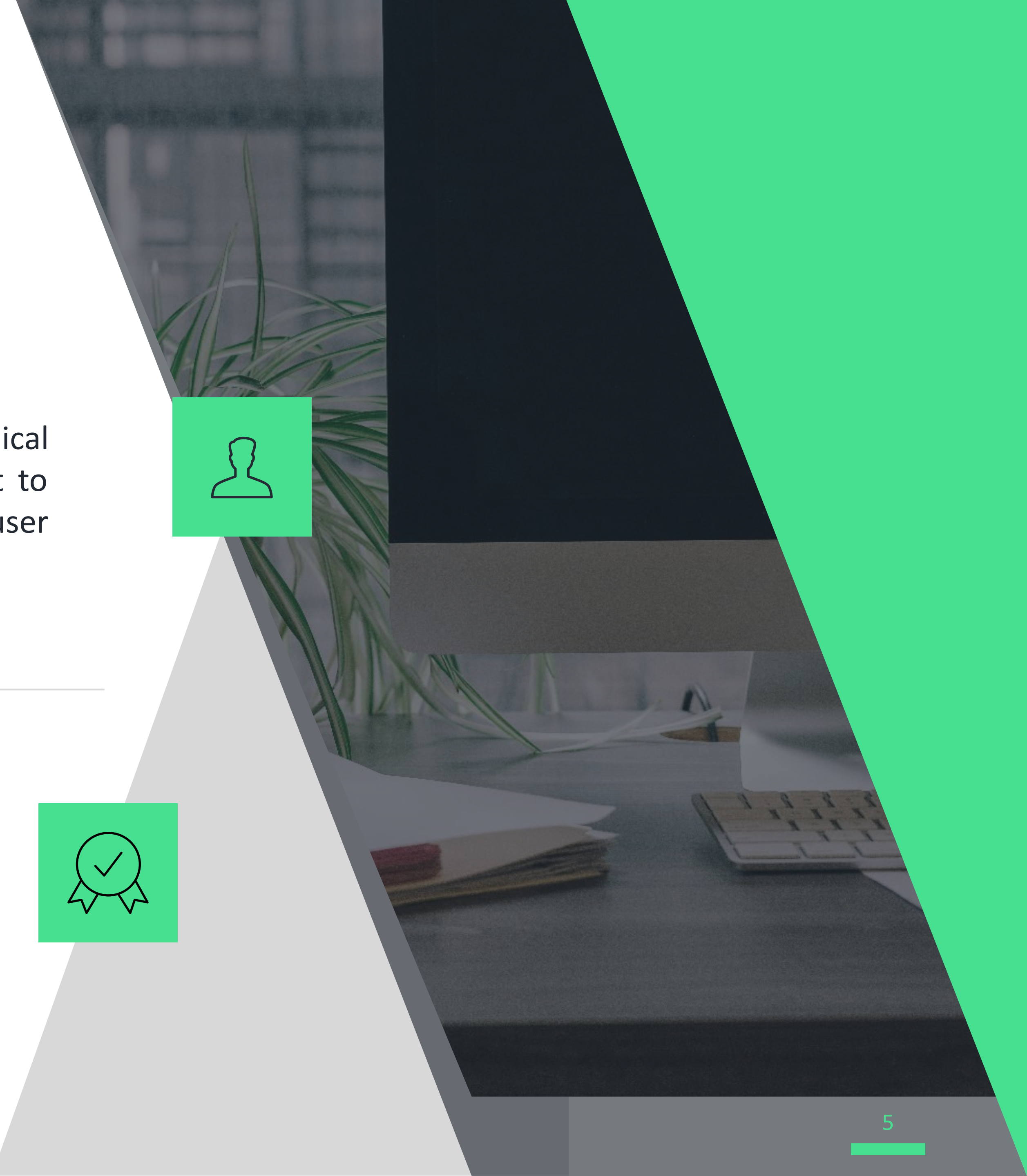
Review Questions

Multiple Choice Questions

2.1 : Introduction

Introduction

In Interaction Design Apart from the technical implementation of the project it's also very important to determine how it will interact with the users as if the user did not like the applications usability drastically reduces.



Inference

Interaction Design is an Iterative task inclusive of refining the design and hence its more of an artistic work which is not to be completed within a few hours or a day but instead requires practice and learning.

2.2 : Understanding The Problem Space And Conceptualizing Design

Introduction

While designing we come up with features that we think the product should have but in practical cases the features we think it should have, and the features that it actually should have are drastically unaligned

Understanding

We ask question such as :

1. What is actually needed by the user ?
2. Why is there a need to create such a product?
3. What is that element that is missing in a regular way of doing stuff or by using the products already available ?
4. How will the product help do a job better ?

Benefits

- Establish a common ground of understanding for all.
- Widen the scope and perspective of the design team.
- Better establish the conceptual model based on the user’s needs.
- Avoid wastage of resources on developing what is not required.

2.3 : Conceptual Model

Concepts

This refers to the operations or activities or may a mere concept which is associated with the product. Sometimes they can be new to the user and it is essential that the user understands it thoroughly in order to use the product.

Metaphors

- It provides an analogy of common understanding of what the particular product or the component in the product does.
- Also involvement of metaphors develops the interest of the user as the user can now relate to the product more.

Relation

- The concepts can be related with each other as well as interleaved with metaphors to be readily understandable by the user.
- If the concepts of the product are deeply related to each other in an obvious manner it becomes easier for the users to contemplate them and get used to it.

2.3.1 : Users Tasks and Goals represented in hierarchical structure:

01

GOMS Model

- **GOAL**: This element defines what the user wants to achieve, and also possible methods by which these goals can be achieved.
- **OPERATORS**: Placed at the lowest analysis level, methods that satisfy goals are made up of operators (User/System Actions).
- **METHODS**: There can be multiple ways of performing a task i.e satisfying a goal, all these ways need to be analysed.
- **SELECTIONS**: Used to make the choices in the GOMS model as there can be multiple ways to perform a particular task.

Example

GOAL: CLOSE-WINDOW

[

SELECT GOAL : BUTTON-METHOD

- MOVE-MOUSE-TOP-RIGHT
- HOVER-OVER-CROSS-ICON
- CLICK-CROSS-ICON

SELECT GOAL : KEYBOARD-METHOD

- PRESS-ALT-KEY
- PRESS-F4-KEY
- RELEASE-BOTH-KEYS

]

2.3.1 : Users Tasks and Goals represented in hierarchical structure:

02

Cognitive Complexity Theory Model

- It was introduced by Kieras and Polson in the 1990s, this model builds on the GOMS model and enhances the model to provide more predictability.
- CCT does provide a detailed description of every task but the disadvantage is, description becomes enormous and difficult to analyse.
- Production rules have the format:

  IF condition **THEN** action

  AND can be used to add multiple conditions as stated below

Example

(SELECT-CLOSE-WINDOW

IF (AND TEST-GOAL close window
NOT(TEST-GOAL minimize window)
NOT(TEST-NOTE executing close window))

THEN(DO-Close-window DELETE-NOTE
executing close window)

IF (AND TEST-GOAL close window
NOT(TEST-GOAL minimize window)
TEST-NOTE executing close window)

THEN(DELETE-GOAL close window)

)

2.3.2 : Grammatical and Linguistic:

01

BNF Model

- BNF stands for (Backus Naur Form) which uses a linguistic approach to describe dialogue grammar in form of rules.
- It uses two types of descriptors terminal, which are lowest level of user action and cannot be subdivided further.
- non-terminal descriptors, which are higher level descriptors and can be divided into further subtasks.
- The | operator is used to generate multiple output from the same description.

Example

create-line ::= select-line + choose-multiple-points + choose-last-point

select-line ::= position-mouse + CLICK-MOUSE

choose-multiple-points ::= choose-point | choose-point + DRAG-TO-DESIREDPOINT + CLICK-POINT

choose-point ::= DRAG-TO-DESIRED-POINT + CLICK-POINT

position-mouse := MOVE-NEAR-LINE-ICON + HOVER-OVER-LINE-ICO

2.3.2 : Grammatical and Linguistic:

02

Task-action Grammar Model

- This model is build up on BNF model, TAG model enhances BNF by parameterising grammatical rules, which impart more consistency
- Also called as TAG Model.
- non-terminal descriptors, which are higher level descriptors and can be divided into further subtasks.
- The | operator is used to generate multiple output from the same description.

Example

BNF Model:

Moving ::= ‘mv’ + file_name + file_name | ‘mv’ + file_names+ directory
Copying ::= ‘cp’ + file_name + file_name | ‘cp’ + file_names+ directory

TAG Model:

file-operation[Op] := commands[Op] + file_name + file_name | command[Op] + file_names+ directory
commands[Op=move] := ‘mv’
commands[Op=copy] := ‘cp’

2.3.3 : Device or physical level:

01

Keystroke level Model

- It provides prediction based on time required for execution of tasks using the system's facilities & user's performance.

- KLM model only considers the small tasks that require less than about twenty seconds.

- 7 different physical motor operators:
  - K == actually pressing the keys
  - B == actually pressing the mouse button
  - P == MOving the mouse or pointing i
  - H == Switching between input devices
  - D == Using the mouse to draw a line
  - M == Thinking and preparing
  - R == Ignoring system response if the user need not wait for it.

Example

All the operators are assigned estimate time such as:

K == 0.12 sec
B == 0.20 sec
H == 0.40 sec
M == 1.35 sec

These times can be added up to evaluate, users performance.

Example a method for typing a word.

Type = H + M + K
Type = 0.40+1.35+0.12 = 1.87 sec

2.4 : Interface Types

Introduction

- It is very important to choose the right interface for the right task of the product.
- It is not necessary to use only one interface.
- Provide multiple ways of doing the same thing.
- Following slides explain 20 Interfaces and their study based on aspects on the right.

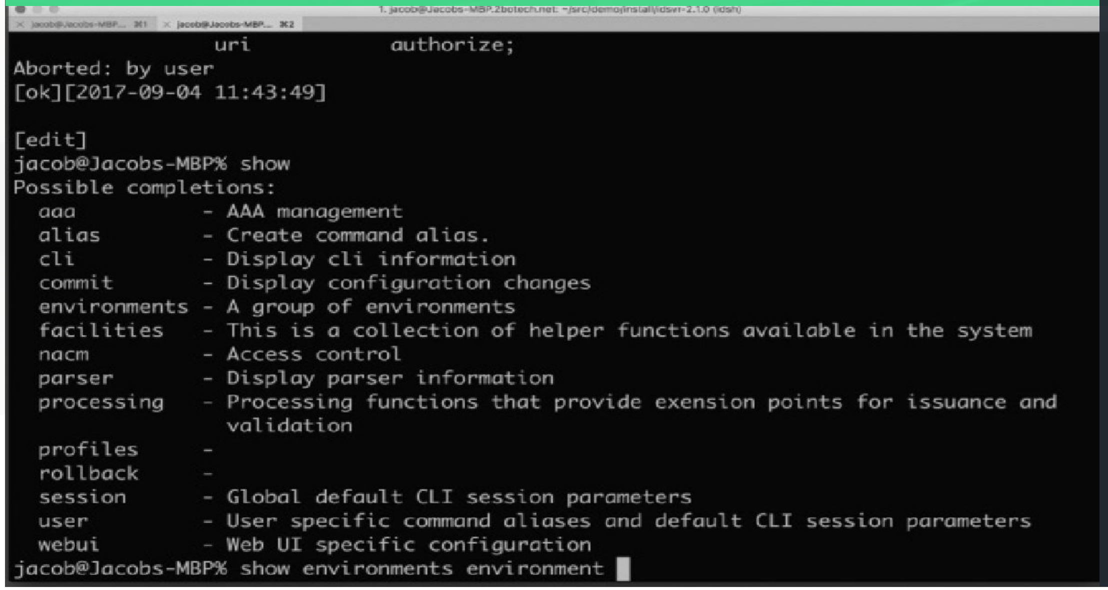
Aspects :

1. Understandability
2. Practice required
3. Speed of doing tasks
4. Enjoyability
5. Popularity among users
6. Cost of interface equipment
7. Long term usability
8. Optimal conveyability
9. Integration effort
10. Physical user effort
11. Cognitive effort
12. Aesthetic appeal
13. Learning curve
14. Skill required
15. Relativity to regular life

2.4.1 : Command-based Interface

01

The users have to type the commands and shall receive outputs on the terminal although it's not the easiest interface as the user here need to remember all the commands and the syntax.



Advantages

- Speed of doing tasks
- Popularity among users
- Cost of interface equipment
- Long term usability
- Integration effort
- Physical effort

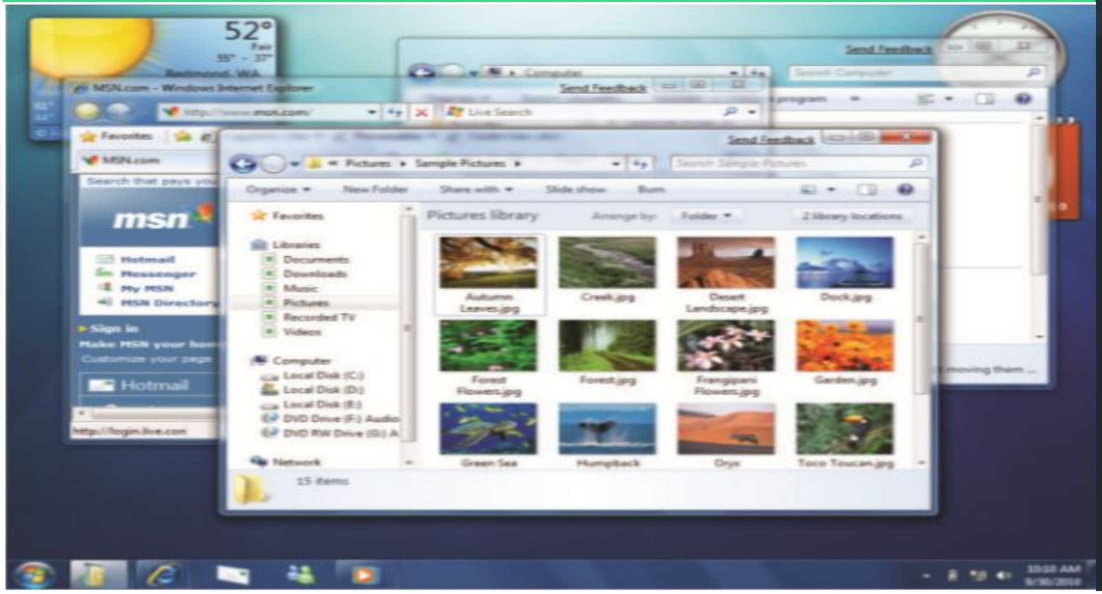
Disadvantages

- Understandability
- Practice required
- Enjoyability
- Optimal conveyability
- Cognitive effort
- Aesthetic appeal
- Learning curve
- Skill required
- Relativity to regular life

2.4.2 : WIMP (Windows, Icons, Menus and Pointing Devices) and GUI Interface

02

This is the most common and widely preferred kind of interface that you may see in your personal computers and in many softwares. The inclusion of colours, images, Iconography etc made it easy and fun to use.



Advantages

- Understandability
- Practice required
- Enjoyability
- Popularity among users
- Cost of interface equipment
- Long term usability
- Optimal conveyability
- Integration effort
- Cognitive effort
- Aesthetic appeal
- Learning curve
- Skill required
- Relativity to regular life

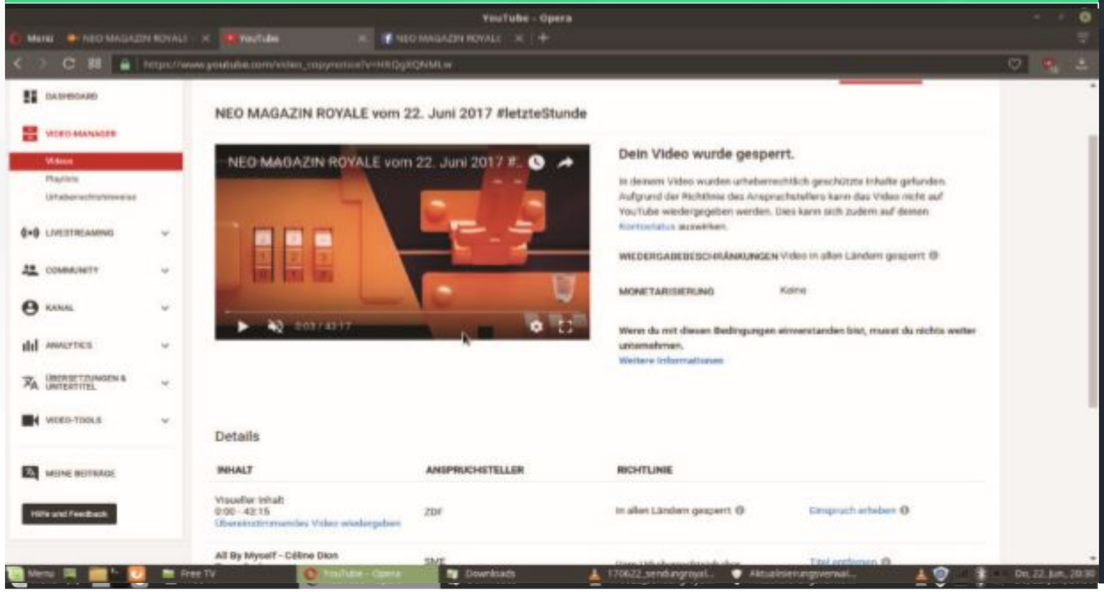
Disadvantages

- Speed of doing tasks
- Physical user effort

2.4.3 : Multimedia Interface

03

Multimedia, tends to combine different media namely, graphics, text, video, sound, and animations, and links them with various varieties of interactivity. help the user to explore different parts on the screen. Ex: Audio, Images, Animations, Illustrations.



Advantages

- Understandability
- Practice required
- Enjoyability
- Popularity among users
- Optimal conveyability
- Physical user effort
- Cognitive effort
- Aesthetic appeal
- Learning curve
- Skill required
- Relativity to regular life

Disadvantages

- Speed of doing tasks
- Cost of interface equipment
- Long term usability
- Integration effort

2.4.4 : Virtual reality Interface

04

It tries to morph reality and make the user experience reality virtually by means of superimposing media such as audio video in a 3D live environment. It is a generic term to experience interaction with the artificial world.

Advantages

- Understandability
- Practice required
- Speed of doing tasks
- Enjoyability
- Optimal conveyability
- Physical user effort
- Aesthetic appeal
- Learning curve
- Skill required
- Relativity to regular life

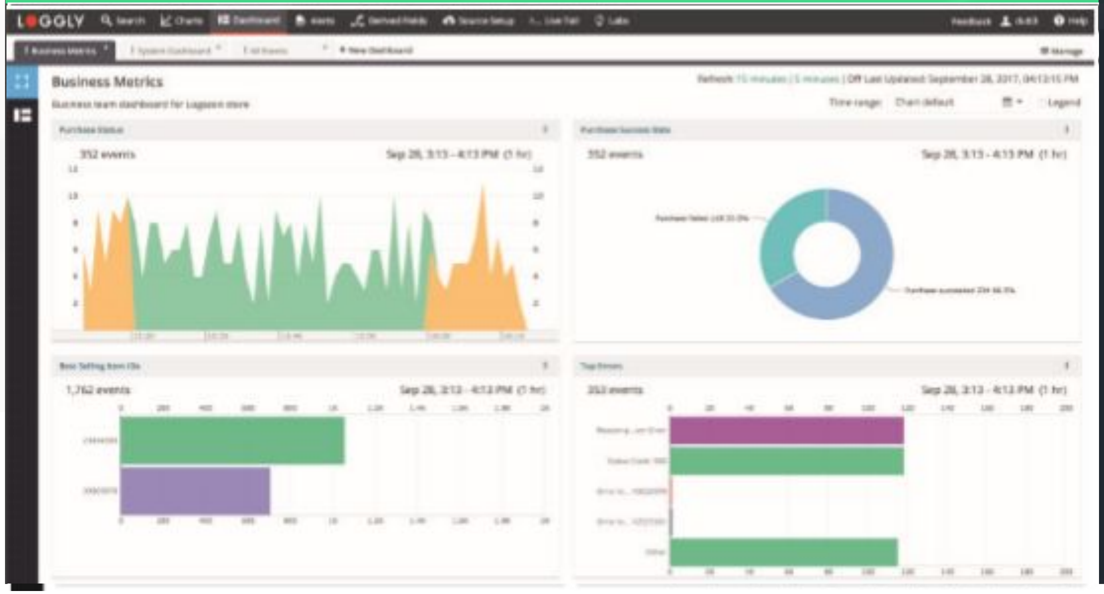
Disadvantages

- Popularity among users
- Cost of interface equipment
- Long term usability
- Integration effort
- Cognitive effort

2.4.5 : Information visualization and dashboards Interface

05

When Huge statistical data is to be displayed to the user, it becomes very important to enable the end user to observe the key factors, patterns and trends. This is possible by proper visualization of data to gain more insight about it.



Advantages

- Speed of doing tasks
- Popularity among users
- Cost of interface equipment
- Long term usability
- Optimal conveyability
- Physical user effort
- Aesthetic appeal

Disadvantages

- Understandability
- Practice required
- Enjoyability
- Integration effort
- Cognitive effort
- Learning curve
- Skill required
- Relativity to regular life

2.4.6 : Web Interface

06

While designing Web Interfaces following:

- Download and loading time of web pages.
- Proper, quick and Obvious navigation.
- Spaced Content without cluttering.
- Use consistent typography and color scheme.
- Creating Responsive and reactive web pages

Advantages

- Understandability
- Practice required
- Enjoyability
- Popularity among users
- Cost of interface equipment
- Long term usability
- Optimal conveyability
- Integration effort
- Physical user effort
- Cognitive effort
- Aesthetic appeal
- Skill required

Disadvantages

- Speed of doing tasks
- Learning curve
- Relativity to regular life

2.4.7 : Consumer electronics and appliances Interface

07

Most people use them to get things done in a short period of time, and then move to other jobs rather than spending time reading through manual and playing around with the interface.

Advantages

- Understandability
- Practice required
- Speed of doing tasks
- Popularity among users
- Cost of interface equipment
- Long term usability
- Integration effort
- Physical user effort
- Cognitive effort
- Aesthetic appeal
- Learning curve
- Skill required
- Relativity to regular life

Disadvantages

- Enjoyability
- Optimal conveyability

2.4.8 : Mobile Interface

Mobile devices have become very common, it has become an Integral part of our everyday lives. Handheld devices differ very much from PCs and laptops, in size, portability etc. Designers need to think carefully about what kind of dedicated controls to provide.

Advantages

- Understandability
- Speed of doing tasks
- Enjoyability
- Popularity among users
- Cost of interface equipment
- Long term usability
- Optimal conveyability
- Integration effort
- Physical user effort
- Cognitive effort
- Aesthetic appeal
- Skill required
- Relativity to regular life

Disadvantages

- Practice required
- Learning curve

2.4.9 : Speech Interface

09

Also called as voice user interface is where a person is talking to a device that has a spoken language program and natural language processing capabilities, such as a train timetable, travel planner, Notifier, or a digital assistant.

Advantages

- Understandability
- Practice required
- Speed of doing tasks
- Enjoyability
- Cost of interface equipment
- Long term usability
- Cognitive effort
- Aesthetic appeal
- Learning curve
- Skill required
- Relativity to regular life

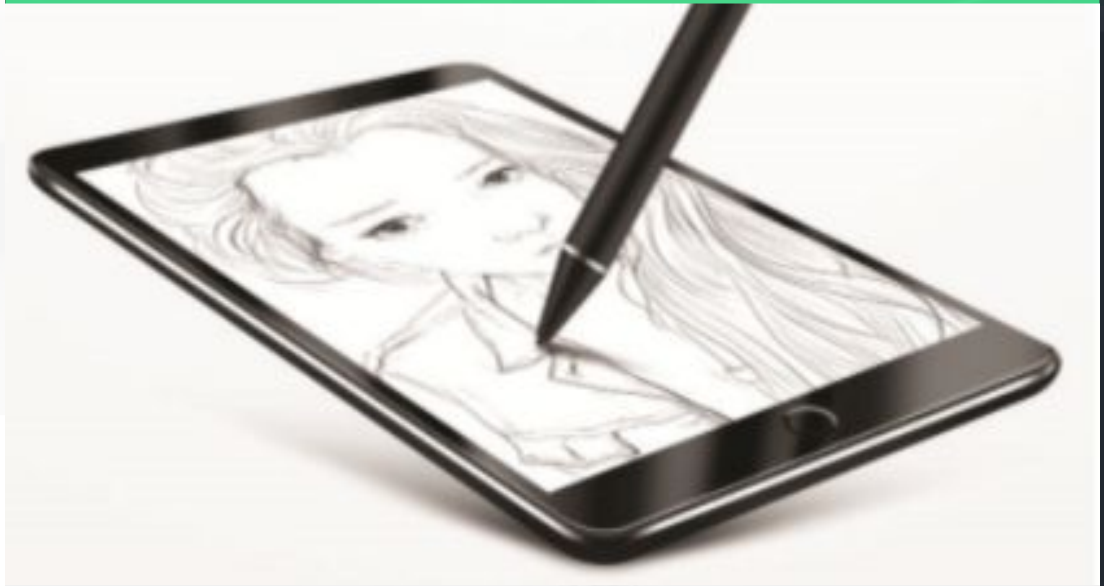
Disadvantages

- Popularity among users
- Optimal conveyability
- Integration effort
- Physical user effort

2.4.10 : Pen Interface

10

When creating products which involve illustrative inputs from the user alone mouse becomes insufficient, Pen-based devices allow people to sketch, draw shapes and figures also select, swipe and move widgets on an interface.



Advantages	Disadvantages
● Understandability ● Practice required ● Speed of doing tasks ● Enjoyability ● Cost of interface equipment ● Long term usability ● Optimal conveyability ● Integration effort ● Cognitive effort ● Aesthetic appeal ● Learning curve ● Relativity to regular life	● Popularity among users ● Physical user effort ● Skill required

2.4.11 : Touch Interface

11

The users have to type the commands and shall receive outputs on the terminal although it's not the easiest interface as the user here need to remember all the commands and the syntax.

- Understandability
- Practice required
- Speed of doing tasks
- Enjoyability
- Popularity among users
- Long term usability
- Optimal conveyability
- Integration effort
- Cognitive effort
- Aesthetic appeal
- Learning curve
- Skill required
- Relativity to regular life

Disadvantages

- Cost of interface equipment
- Physical user effort

2.4.12 : Air-based gesture Interface

12

As camera, IR sensors developed, it became easier to integrate them in devices and use them to capture gestures of the users, this makes it possible to accurately recognize people's body, arm, and hand gestures, etc.

Advantages

- Speed of doing tasks
- Enjoyability
- Popularity among users
- Cost of interface equipment
- Long term usability
- Cognitive effort
- Aesthetic appeal
- Learning curve
- Skill required
- Relativity to regular life

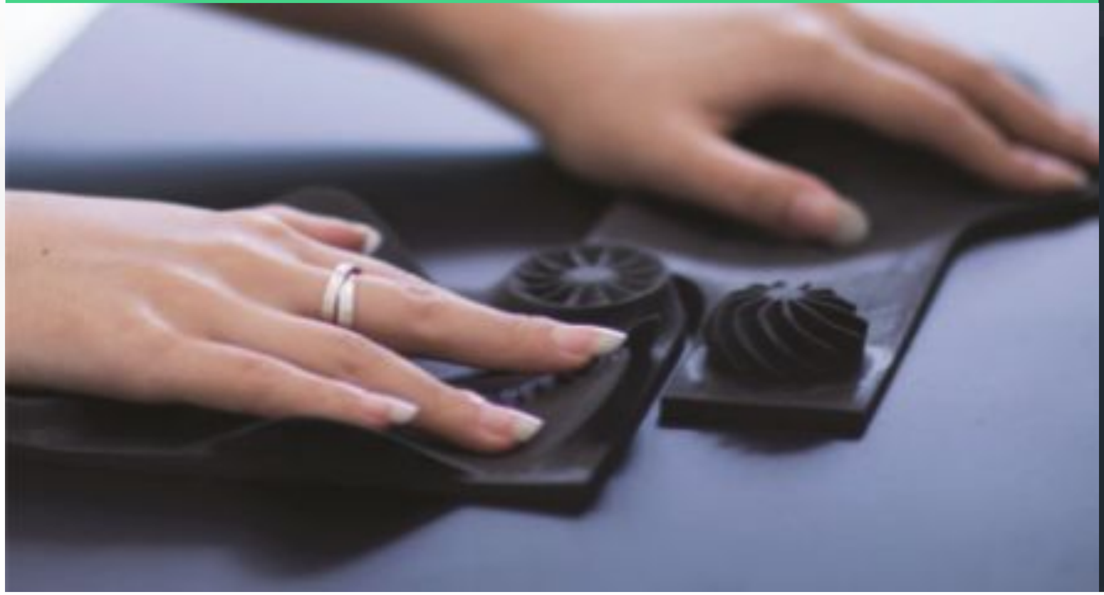
Disadvantages

- Understandability
- Practice required
- Optimal conveyability
- Integration effort
- Physical user effort

2.4.13 : Haptic Interface

13

This kind if interface is majorly used along with other interfaces and works in background and in most cases in this interface the user interacts with the product in subconscious manner, it is majorly used to provide feedback and notification in terms of vibrations.



Advantages

- Speed of doing tasks
- Enjoyability
- Popularity among users
- Cost of interface equipment
- Long term usability
- Integration effort
- Physical user effort
- Cognitive effort
- Aesthetic appeal
- Learning curve
- Skill required
- Relativity to regular life

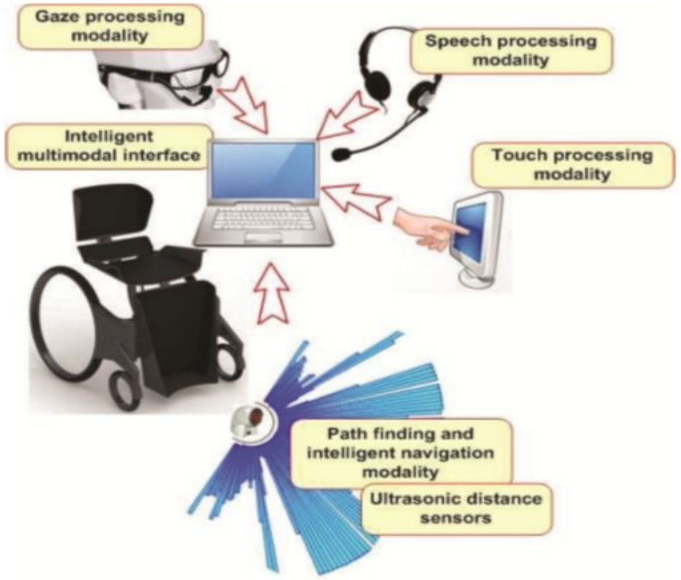
Disadvantages

- Understandability
- Practice required
- Optimal conveyability

2.4.14 : Multimodal Interface

14

A Multimodal Interface is a combination of multiple interfaces, which provide the users with different kinds of ways to interact with the product depending upon the users preference and the situation. These various ways of interaction are called modalities.



Advantages

- Speed of doing tasks
- Enjoyability
- Popularity among users
- Long term usability
- Optimal conveyability
- Integration effort
- Aesthetic appeal
- Relativity to regular life

Disadvantages

- Understandability
- Practice required
- Cost of interface equipment
- Physical user effort
- Cognitive effort
- Learning curve
- Skill required

2.4.15 : Shareable Interface

15

Shareable interfaces provide interactivity with multiple users at once and in the same time taking simultaneous inputs from multiple users provide outputs to all the users.

Advantages

- Practice required
- Speed of doing tasks
- Long term usability
- Optimal conveyability
- Physical user effort
- Skill required

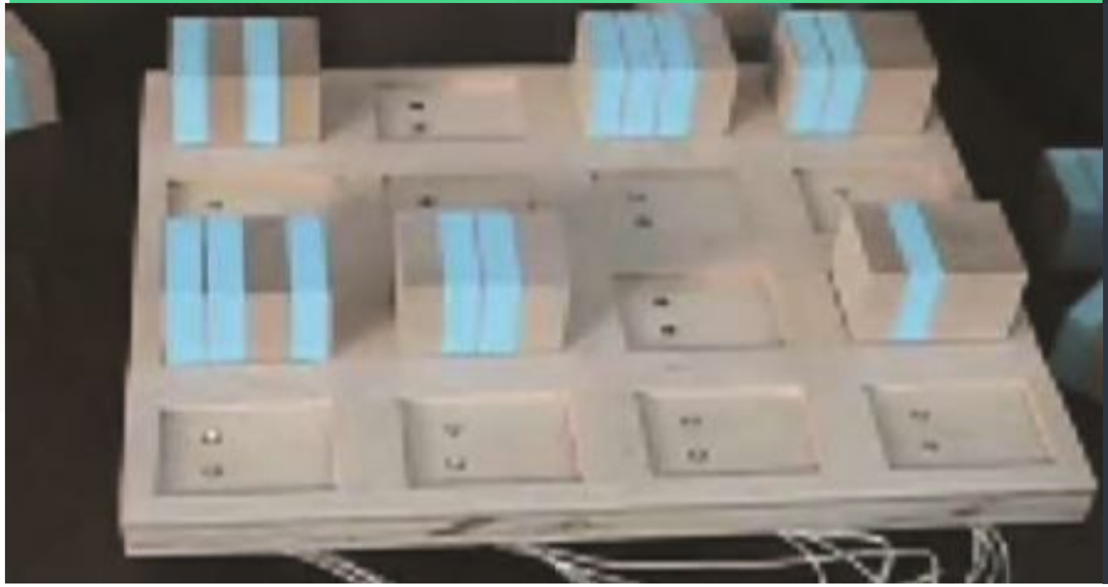
Disadvantages

- Understandability
- Enjoyability
- Popularity among users
- Cost of interface equipment
- Integration effort
- Cognitive effort
- Aesthetic appeal
- Learning curve
- Relativity to regular life

2.4.16 : Tangible Interface

16

In Tangible Interfaces Sensors are embedded in to physical objects which can be handled by the user, the user can change the configuration arrangement or activities moving or pressure becomes sensory inputs and outputs are in from color, vibration, or sound, etc.



Advantages

- Practice required
- Enjoyability
- Long term usability
- Integration effort
- Aesthetic appeal
- Relativity to regular life

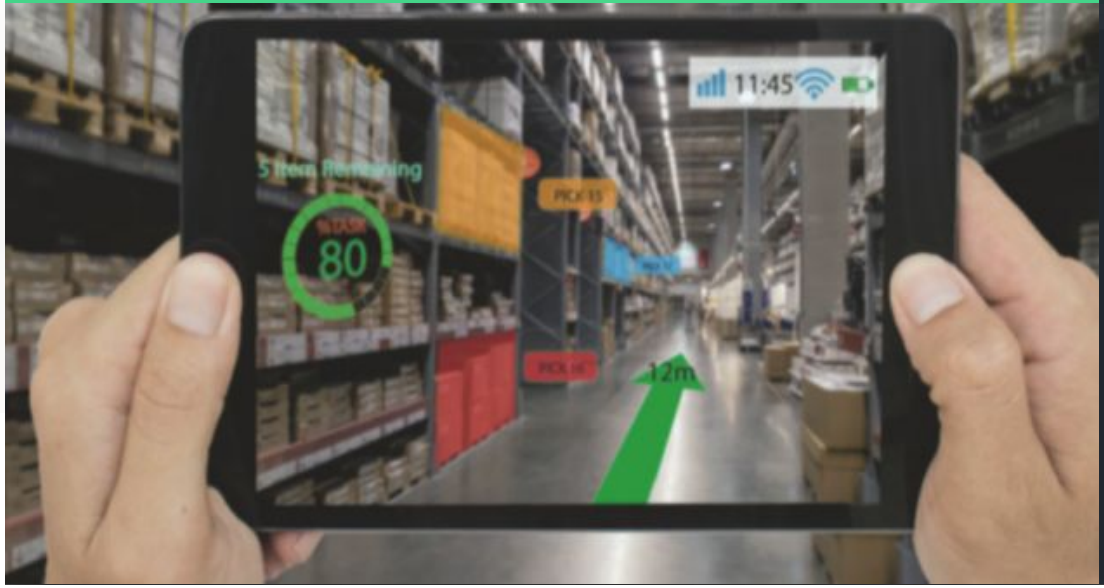
Disadvantages

- Understandability
- Speed of doing tasks
- Popularity among users
- Cost of interface equipment
- Optimal conveyability
- Physical user effort
- Cognitive effort
- Learning curve
- Skill required

2.4.17 : Augmented and mixed reality Interface

17

Augmented and mixed reality Interfaces act as a bridge between physical and digital world, this is done by superimposing virtual reality upon real life physical objects, and providing a view of the real world with added virtual representation of the objects.



Advantages

- Understandability
- Practice required
- Speed of doing tasks
- Enjoyability
- Popularity among users
- Cost of interface equipment
- Long term usability
- Optimal conveyability
- Integration effort
- Physical user effort
- Cognitive effort
- Aesthetic appeal
- Learning curve
- Skill required
- Relativity to regular life

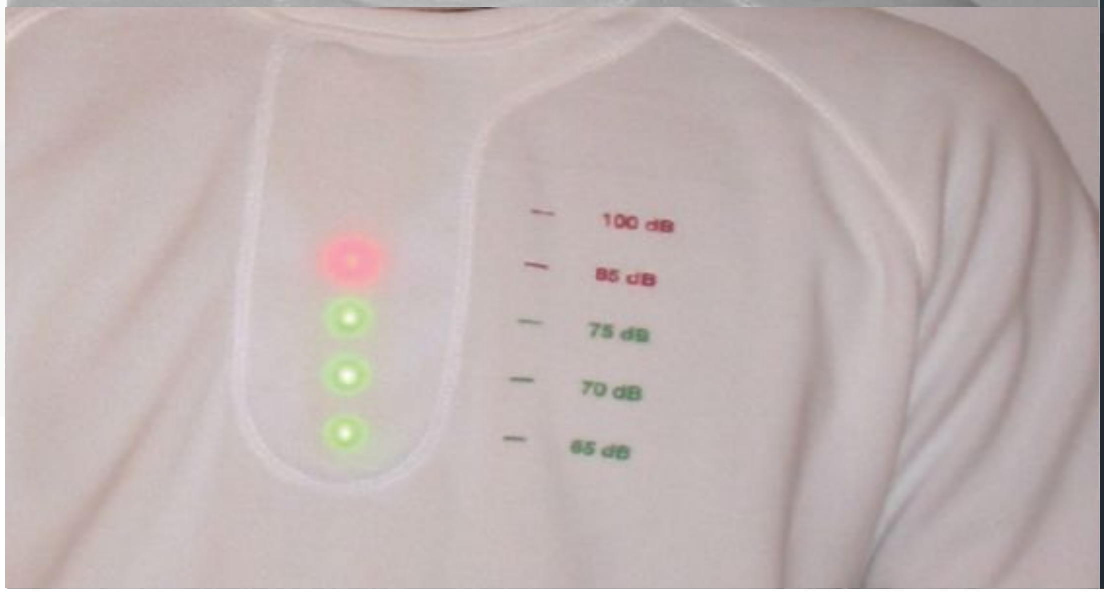
Disadvantages

- Speed of doing tasks
- Popularity among users
- Cost of interface equipment
- Long term usability
- Integration effort

2.4.18 : Wearable Interface

18

Now it's possible to integrate small computers in wearables such as spectacles, lenses, clothes etc, which can provide us information that is relevant in our day to day application we can interact with the information with minimal effort on the go



Advantages

- Understandability
- Practice required
- Speed of doing tasks
- Popularity among users
- Cost of interface equipment
- Optimal conveyability
- Cognitive effort
- Aesthetic appeal
- Learning curve
- Skill required
- Relativity to regular life

Disadvantages

- Enjoyability
- Long term usability
- Integration effort
- Physical user effort

2.4.19 : Robots and drones Interface

19

With this robots that can interact with users, robots and drones keep a great potential in aiding users in wide range of activities that ranges from as simple as everydays task to more sophisticated and challenging activities.

Advantages

- Understandability
- Practice required
- Speed of doing tasks
- Enjoyability
- Long term usability
- Optimal conveyability
- Physical user effort
- Cognitive effort
- Aesthetic appeal
- Learning curve
- Skill required
- Relativity to regular life

Disadvantages

- Popularity among users
- Cost of interface equipment
- Integration effort

2.4.20 : Brain–computer interaction (BCI) Interface

20

Using this interface brain can directly communicate with the device give direct instructions to it and similarly interpret the signals received directly in the brain and eliminate the middle link of our physical and sensory capabilities.

Advantages

- Understandability
- Practice required
- Speed of doing tasks
- Popularity among users
- Cost of interface equipment
- Long term usability
- Integration effort
- Learning curve

Disadvantages

- Enjoyability
- Optimal conveyability
- Physical user effort
- Cognitive effort
- Aesthetic appeal
- Skill required
- Relativity to regular life

2.5.1 : Cognitive Aspects (Cognition)

- Cognition Meaning : “The mental action or process of acquiring knowledge and understanding through thought, experience, and the senses.”
- There are two types of cognition on is fast and the slow.
- Cognition can also be described as the following kinds of processes.

01 Attention

02 Perception

03 Memory

04 Learning

07 Reading, speaking and listening

06 Problem solving

2.5.2 : Cognitive Aspects

01 Attention

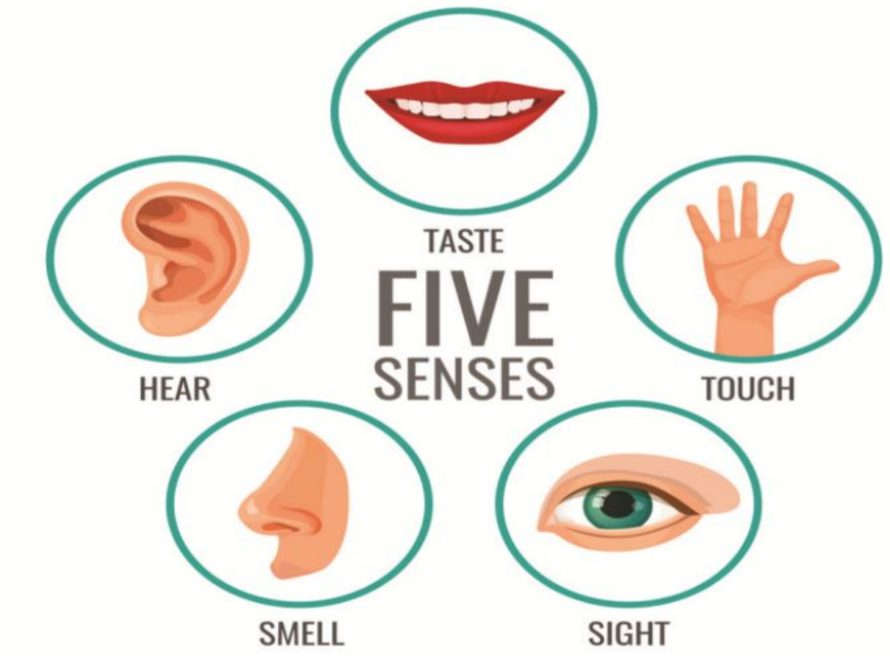
- It is a process of selecting one particular process from many process and concentrate on one process.

- A person can only focus on one task but can rapidly switch between this task

- following aspects that need to be focused upon:
  - Goal: It is the current intention and pursuit of the user and defines what the user intends to do
  - Information Presentation: Plays a vital role in what the user will perceive

2.5.3 : Cognitive Aspects

02 Perception



- Perception refers to how via different senses (Sight, Taste, Touch, Smell, Hear, Proprioception etc).
- Person gains information about the environment that is being comprehended by the brain
- To enable a user to perceive the content easily, It is recommended to keep white bank space between the content.

2.5.4 : Cognitive Aspects

03 Memory

- Memory allows people to store their gained knowledge and experience.
- Memory can be of two types short term and long term.
- Short term memory is used to store information that is more relevant in present and in immediate future
- Long term memory lasts for longer time, such information serves to be vital for the person in distant future.

2.5.5 : Cognitive Aspects

04 Learning

It easier to actually do practical and learn rather than reading instructions in the manual.

Interactivity highly aids learning as the user begins to interact with the product.

Dynalinking can be defined as “Abstract representations are linked together with a more concrete illustration of what they stand for.”

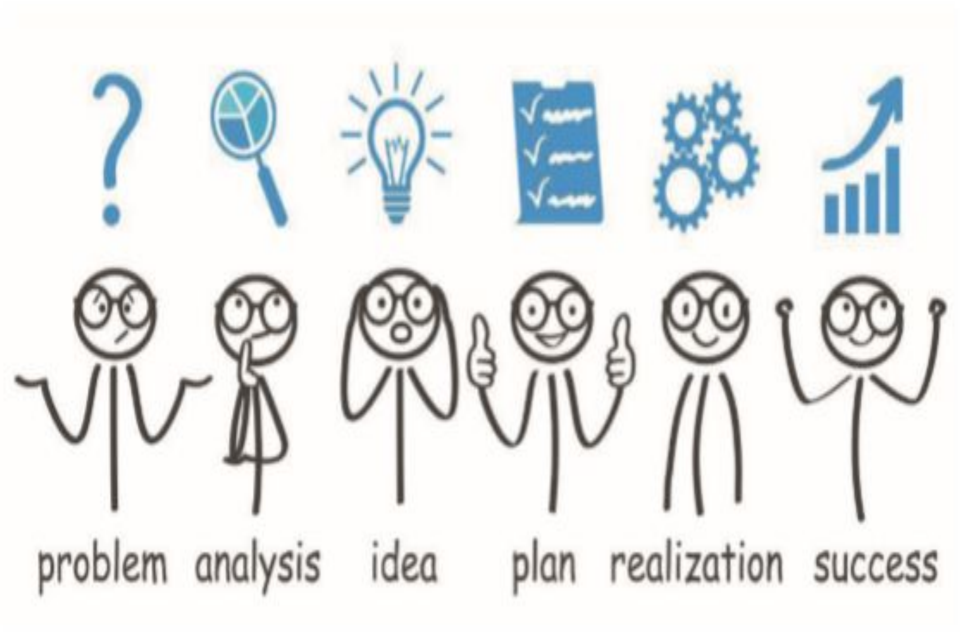
2.5.6 : Cognitive Aspects

05 Reading, speaking, and listening

- Humans have the ability to process and understand natural language this may be in the form of reading, writing or listening, Understanding which is a key factor.
- Meaning not only depends on the literal words used but also the context, stress and tone used
- It is important to develop applications that use these cognitive properties efficiently and provide alternative wherever necessary.

2.5.7 : Cognitive Aspects

06 Problem solving, planning, reasoning, and decision making



- It is a long term cognition also called reflective cognition.
- It take time to process and involves processes such as problem solving, planning, reasoning, and decision making.
- While designing enough information be provided to users they can make a good decision, and solution with minimal time and effort.

2.6 : Social Interaction And The Emerging Social Phenomena

- **With increase in development of technology there has been considerable increase in social interaction.**
- **We interact socially everyday in our life, through devices such as mobile phones and platforms such as Facebook, Whatsapp, Instagram etc.**
- **Social Interaction gives us immense power to connect to other people and exchange ideas, thoughts and information, It's subtypes are explained below:**

01 Face-to-Face Conversations

02 Remote Conversations

03 Telepresence

04 Co-presence

2.6.1 : Social Interaction And The Emerging Social Phenomena

01 Face-to-Face Conversations

Conversation is effortless and comes easily to most people but is a collaborative effort.

Usually they start the conversation with greetings and then the participants take turns asking questions.

Face to face conversation may also involve expressions, figure of speeches, tone and context.

2.6.2 : Social Interaction And The Emerging Social Phenomena

02 Remote Conversations

- Remote conversation dates back to the 19th century when Alexander Graham Bell invented the telephone.
- It enables people to connect within minutes whenever required and with advanced facilities such as call record, hold, and conferencing.
- Remote conversion is very similar to face-to face conversation except that in reality the communicators are physically located in remote places.

2.6.3 : Social Interaction And The Emerging Social Phenomena

03 Telepresence

- It’s true that Face-To-face communication is the best kind of communication but we also need to accept that it’s not possible for all to be present always.
- It allows the users to feel that they are actually interacting with real events and people.
- Example is of the people’s bot that enables people to attend events, with their audio and video feed, on a mobile bot.

2.6.4 : Social Interaction And The Emerging Social Phenomena

04 Co-presence

- Co-presence is interaction of users actually present at the site sharing the same device and working on it collectively.
- Examples of such devices are smart boards and surfaces that support multitouch.
- While designing such interfaces we must consider the following aspects: physical coordination , Control distribution and awareness.

2.7 : Emotions And The User Experience

We have wide range of options of products but we enjoy using only select few, because of our emotions for some brand.

Brand

Emotional Interaction

Understanding how a product affects our emotions like what makes us happy, sad, frustrated, annoyed, anxious, motivated, irritated, etc

People feelings, intentions and need changes along with the market trends, latest technology and the fashion changes

Change

2.8 : Expressive And Frustrating Interfaces

Expressiveness

If product is expressive in a friendly manner users can relate to the product more and hence develop an even deeper attachment with the product.

Inference

The key aspect that remains here is to create a perfect balance between design aesthetics i.e the look and feel and the usability of the application.

2.8.1 : Expressive And Frustrating Interfaces

01 Expressive Interfaces

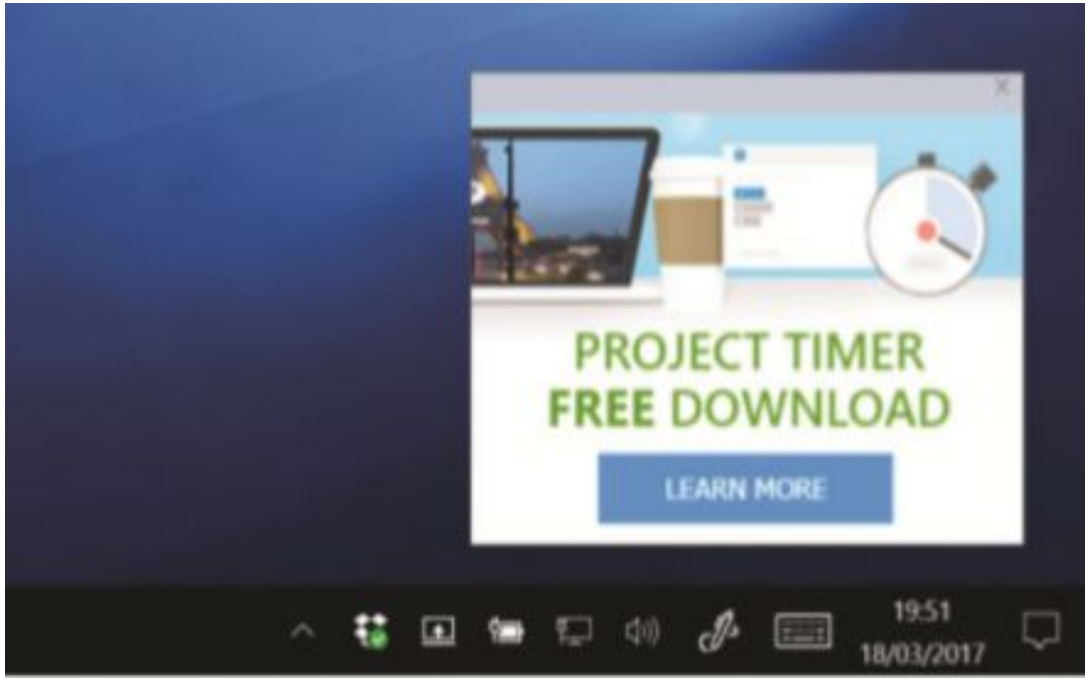
- Design of aesthetically pleasing and expressive interfaces has become one of central concern to interaction design.
- Some ways in which the product can be expressive in a positive manner:
    - Icons
    - Animations
    - Sound, Haptics etc.
- Example Mac: A simple smiling icon that conveyed a sense of Happiness.

2.8.2 : Expressive And Frustrating Interfaces

02 Frustrating Interfaces

- In many cases the user may find difficulty in using and understanding the product.
- User does not understand they might get irritated and this shall lead to loss of productivity and a bad user experience.
- Interfaces which are designed poorly bring a fool out of the user and hence lead to a bad user experience.

2.9 : Persuasive Technologies



- Real life advertisements can persuade you to buy a product.
- Similarly persuasive technologies that persuade the user to use a particular application, or perform a action.
- Examples of this can be recommendations, suggestions, prompts, alerts, warnings, pop-us etc, providing more reward with minimal effort.
- Same technology can be used to fool people and deceive them to give away their sensitive details or perform actions.

Summary

- Designing a product is a very intensive task and requires understanding and team work.
- There are a lot of aspects that are to be considered starting from understanding the root problem.
- The study of interfaces gives us a clear idea about how we can provide better UX.
- Cognition is a mental process that helps us acquire knowledge and understanding through thought experience and senses.
- Studying the cognitive aspects helps us understand how people think and hence help us design a better interaction.

Summary

- Humans are social beings hence it becomes important to understand how people interact socially and its types.

- Users link their emotions to the products they use, for a product to be successful it becomes crucial to mae uses feel good.

- It is important that there exist a proper trade off between the design aesthetics.

- Understanding the emotional reactions to the products makes us understand whether the interfaces is good or bad.

- As advertised can persuade people to buy products, there exist persuasive technologies that can persuade the user to interact with the system.

Review Questions

- Describe a conceptual model for an electronic personal calendar found on personal organiser based on
  - a. How do they differ from physical artefact
  - b. What new functionalities can be provided
  - c. Which conceptual model based on activities
  - d. Drawbacks of using metaphor [Refer Section 2.3]
- Which model is best from an aspect of cognition approaches ? [Refer Section 2.3]
- List any two applications and explain which interface type will be best suited for interactive design? [Refer Section 2.4]
- Explain Interface types in detail with diagrams? [Refer Section 2.4]

Review Questions

- **Identify the relationship between Emotions and User Experience? [Refer Section 2.7]**

- **"High user-experience in the main key for success of interaction design" give your conjecture (opinion) for it ? [Refer Section 2.7]**

- **Identify and explain specific kinds of processes which helps to describe Cognition? [Refer Section 2.5.1]**

- **Identify the situation where you have faced frustrating interfaces, explain the term Frustrating Interfaces? [Refer Section 2.8.2]**

- **Explain Good Error Messages with examples? [Refer Section 2.8.2]**

Multiple Choice Questions

- Which of the following can designers use to alter behaviour of the user.
    a. Persuasive Technologies
    b. Frustrating Interfaces
    c. Easy to use designs
    d. Tangible Interfaces

- Interface that provides a combination of multiple interfaces.
    a. Haptic Interfaces
    b. Multimedia Interface
    c. Multimodal Interface
    d. Gesture Interface

- Which of the following can designers use to alter behaviour of the user.
    a. Concepts
    b. Metaphors
    c. Relations
    d. None of the above

Multiple Choice Questions

- Understanding problem space covers questions that are inclusive of.
  a. What is actually needed by the user ?
  b. Why is there a need to create such a product ?
  c. both A and B
  d. neither A and nor B

- Which of following is/are true about Attention
  a. Its is a cognitive process
  b. Humans can only attend one thing at a time.
  c. Humans can rapidly switch their attention.
  d. All of the above

- Which of the following can designers use to alter behaviour of the user.
  a. Dynamic Icons
  b. Animations
  c. Long text paragraphs
  d. Alerts

Multiple Choice Questions

- Which of the following is not suitable for long term use
  a. Command based
  b. WIMP
  c. Tangible
  d. Virtual Reality

- Which of the following interface will be fastest
  a. Command based
  b. Speech
  c. Tangible
  d. Gesture

- What does WIMP stand for
  a. Windows Interface for Menu Pointing device
  b. Windows Icons Menu Pointing device
  c. Wearable Icons Menu Pointing device
  d. Windows Icons Mapping Pointing device

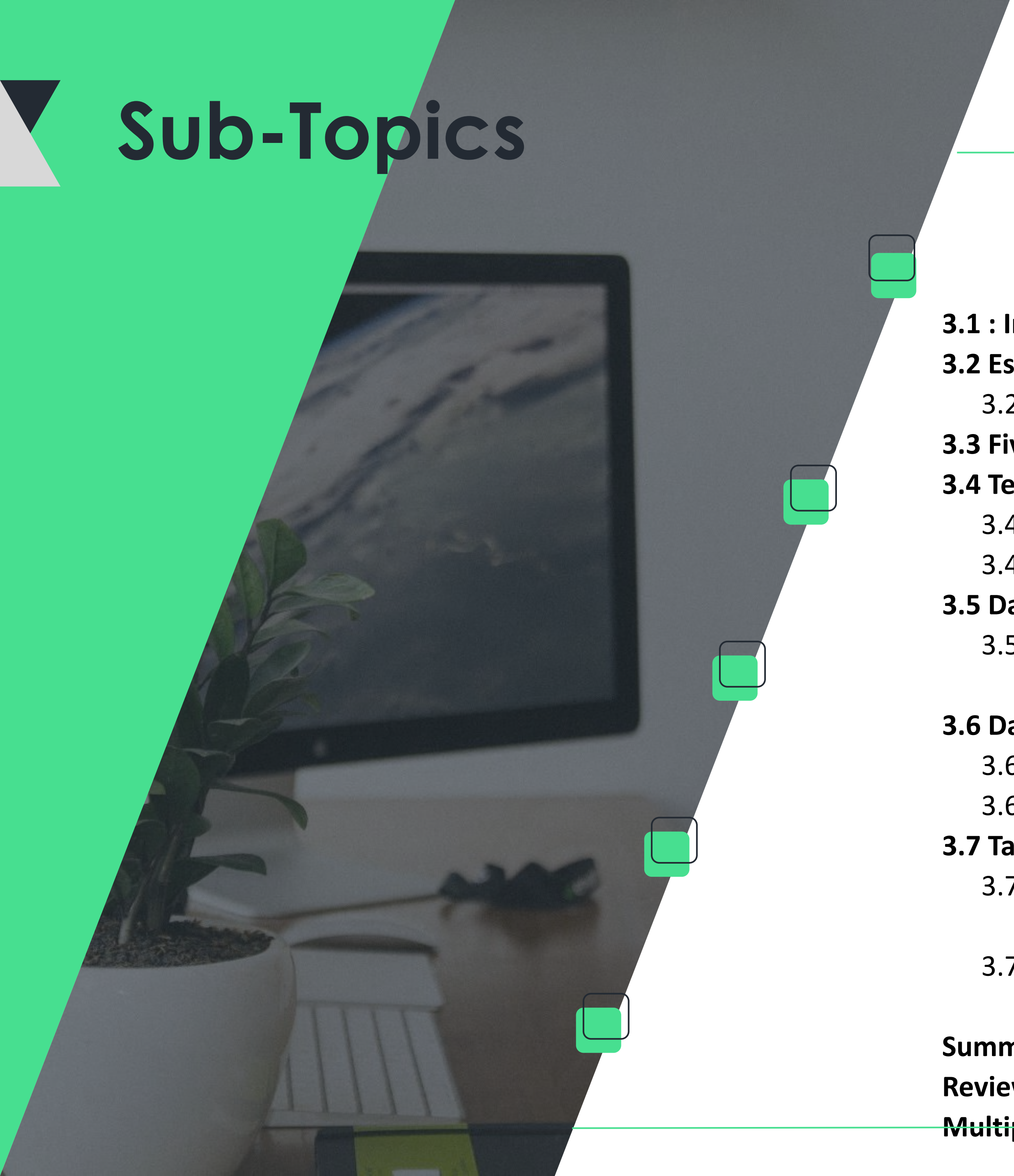
Module 3

Learning Objectives

After reading this chapter, you will be able to:

- ❖ Define and understand requirements
- ❖ Explain and perform steps for data gathering
- ❖ Understand and execute Data Analysis
- ❖ Explain the concept of interpretation and presentation

Sub-Topics



3.1 : Introduction

A User Interaction Design task may intend to supplant or refresh a set up framework, or it might plan to build up an absolutely imaginative item with no undeniable point of reference. It might be that there exists an underlying arrangement of necessities and the task may need to start by creating a lot of prerequisites without any preparation. Whatever the underlying circumstance and the point of the venture, the clients' demands, prerequisites, and desires must be talked about, sculpted, explained, and presumably re-checked. Setting up necessities isn't just composing a list of things to get highlights. Given the iterative idea of cooperation configuration, disconnecting necessities exercises from plans exercises and from assessment exercises is somewhat counterfeit, since by and by they are completely interlaced: some structure will happen while prerequisites are being built up, and the structure will advance through a progression of assessment update cycles. Be that as it may, every one of these exercises can be recognized by its own accentuation and its own methods. This section gives an increasingly point by point outline of setting up necessities. We present various types of necessities and clarify some helpful systems.

3.2 : Establishing Requirements

3.2.1 : What, How and Why ?

***What** does one mean by requirements ?*

- Dictionary meaning of the word **requirement** is ‘ a thing that is compulsory, a necessary condition’. In design requirements mean exactly the same.
- A design requirement is a necessary criterion/ thing needed for designing the proposed system.
- Requirements need clarification, refinement, completion, re-scoping
- For example : Website download time should be short enough.
- Here this is not a requirement as ‘short’ is a very relative term. How short? 5 secs? Requirements should be oddly specific.
- There are two main questions that help to identify the requirements.
  - ➢ What do users ‘want’?
  - ➢ What do users ‘need’?

Requirement analysis focuses on the tasks that regulate the needs or criteria to meet the new/ altered product or project, keeping in mind the potentially conflicting requirements/ ideas of the various stakeholders, analyzing, documenting, validating and managing software or system requirements.

How *to achieve the aims/ objectives ?*

➢ The process to achieve the defined aims is not a one time thing. It is an iterative process of the following phases.

a. Data gathering phase
b. Data analysis phase
c. Requirements determination phase

All of the above activities are iterative for e.g. Once you start to analyse your collected information it is quite possible to feel the data is insufficient and needs to be again collected and this is where the cyclic nature of data gathering, analysis and requirement analysis can be seen.

Why *do we need the requirement activity ?*

The **Requirement activity** is “ the phase of identifying needs and establishing requirements ”.
It is a notion that failure occurs usually for “unclear objectives and requirements” while critical success occurs most often for “clear, detailed requirements”.
For e.g. Pratik thought of baking a cake for his mother on her birthday. Little did he know he lacked whipped cream for the cake. This would not have happened if he had made a requirement activity.

3.2.2 : Types of Requirements

Requirements can broadly be divided into two types:

- **Functional requirements** are those requirements that help us to know the abilities of a system.
- **Non-functional requirements** are those requirements that help us to know the conditions and the background details of the system's performance environment

Non-functional requirements can be further divided as:

- <u>Data requirements</u>: The characteristic trait like type, size, amount, accuracy, storage, etc are data requirements.
- <u>Environmental requirements</u>: These requirements are the constraints in which the proposed system is to function in.
- <u>Physical requirements</u> – These requirements are the physical quantities like lighting, noise, etc. of the operational environment.
- <u>Social requirements</u>– These requirements deal with the need of communication between the stakeholders involved.
- <u>Organizational requirements</u> – These deal with the organization level needs For example, hierarchy of the management, user support, facilities or resources for training.
- <u>Technical requirements</u> – These requirements deal with the technical aspects.
- <u>User requirements</u> –These deal with the characteristics of the intended user group.
- <u>Usability requirements</u> –These are the requirements that need to be taken care of for making the system usable by the user without much inconvenience.

Example: Suppose City A has proposed a self-service barista so that users are allowed to pay for their food (bread, sandwiches, drinks) using a credit system, e.g., payment is settled via their City A or Shark cards. Suggest one key functional, data, environmental,physical, user and usability requirement for the proposed system.

Types of requirements in the Barista Case Study :

Functional: The system/ software will calculate the Total Cost of the items cart.

Data: The prices should be available with the system.

Environmental: The users will have goods and a tray to deal with in a fast paced line.

Physical: The physical setup will be very noisy and with a lot of discussions and chatterings.

User: Generally teenagers and young people frequently make use of the barista so the technology part is convenient for them.

Usability: The system is to function in a barista so it should be made sure it is efficient and people are going to have to deal with it very often

3.3 : Five key issues faced during Data Gathering

During Data gathering every session has to be prearranged and executed slowly. The five key issues related to data gathering techniques are as follows :

1. **Setting Goals** : Goals are the driving force which help us to channelize our efforts in the right direction. Establishing goals would make it easier for deciding on how to analyze data after data collection.
2. **Identifying Participants** : In Data gathering it is crucial to decide from whom to gather data from. It is also necessary to decide the number of participants that are needed to gather data from.
3. **Relationship with participant** : The relation between the information gatherer and the information supplier should be clear and strictly professional. A data consent form must be signed to make the relationship clear.
4. **Triangulation** : Investigate the data collected with at least two perspectives. The data that is collected needs to be from different origins or it has to be ensured that they are gathered by different people who are making use of contrasting sampling techniques. Different data gathering techniques can also be implemented to ensure triangulation.
5. **Pilot Study** : Pilot studies are small-scale, preliminary studies which aim to investigate whether critical components of a main study will be feasible. A pilot study aims at answering the question "can the full-scale study be conducted in the way that has been planned or should some component(s) be altered? ".

3.4 : Techniques for Data Gathering

Data can basically be recorded using either of these methods.

- **Notes:** Running notes are recorded by the data collector during the interaction with the data provider. This method is cheap but limited to the writing speed of the collector.
- **Audio**: The data collector records the conversation between him and the data provider. This method is also cheap, difficult to match with other protocols like recording sensitive topics of the discussion. In this method consent is a critical thing.
- **Video**: This mode of data gathering is by far the most accurate one but needs special equipment. Also the user may feel uncomfortable for being under camera during the conversation. It can also be costly to store the whole video recordings as compared to the other modes.

Each method has a few advantages and a few disadvantages hence blending two modes of data gathering can be used like:

Notes + Still Camera/ Photograph

Audio + Still Camera/ Photograph

Comparing data collection techniques

Constraints	Notes + Still Camera	Audio + Still Camera	Video
Equipment	Note making items like pen, paper is readily available	Camcorder and good headphones for voice interpretation	Editing softwares are expensive
Flexibility of use	Very flexible, unobstructive	Flexible, relatively obstructive	Needs positioning to focusing camera lens, even portable versions can be bulky
Disturbance to user	Minimal	Pretty less disturbing but recording backup can be annoying	Very disturbing
Data completeness	Not complete as the scribe notes only what is important	A very vague picture is portrayed as its semi complete	Most complete method especially if more than one camera is used but coordination of video is needed
Reliability of data	Reliability is low, can be little reliable if the human recording knows what is he recording	High but external voice can muffle what is being asked for	Highly reliable but also is affected by the camera positioning
Analysis	Simple to put data into written format (transcribe), rich description can be provided	Critical discussion can be identified. Transcription is needed for detailed analysis.	Crucial happenings can be picked and scanned, and the permanent record can be revisited.

3.4.1 : Questionnaires

- A questionnaire is a series of questions designed to extract specific information.
- Questions in a questionnaire may require different kinds of answers like YES/NO, choice of answers depending on the way the user has previously answered, comment on any question or statement raised.
- This is frequently used in conjunction with other techniques as it can give quantitative or qualitative data. Questionnaires can be distributed and collected by paper, email & web.
- The advantage of an electronic questionnaire is that data collection is easy as the data goes into a database & this makes it easy to analyse.

Questionnaire design:

- The order of the questions can impact the answer of the user hence there should not be any leading questions.
- It is recommended to consider having different versions of the questionnaire for different populations e.g: It should be considered that not everyone can have time to fill a long questionnaire so they can be provided a short questionnaire for quick information gathering.
- Clear instructions should be provided clear as to how to complete the questionnaire.
- Maintain a balance between using white space and keeping the questionnaire simple yet compact.

Questionnaire format:

- ‘Yes’ or ‘No’ checkboxes that offer one option as the user’s answer.
- Checkboxes that offer many options.
- Rating scales (3, 5, 7 & 9 point scales are commonly used).
- Semantic scales is the scale that asks people to rate a product, company, brand within the frames of a multi-point rating options. These survey answering options are grammatically on opposite adjectives at each end.
- Open-ended responses are the questions where the answer is completely based on the user’s perspective about the question.

Web-based questionnaires:

A web based questionnaire is developed from the paper version of the questionnaire. It is like a soft copy of the printed/ handwritten questionnaire. The advantages of web based questionnaire are :

- Responses from user are generally received quickly
- No printing cost as its free
- Data analysis becomes easy as responses are stored in databases
- Time required for data analysis is reduced heavily
- Errors in the questions can be corrected easily

The disadvantages of web based questionnaire:

- Individuals may respond more than once which can lead to redundancy during data analysis
- Lower response rate than paper questionnaires

3.4.2 : Interview

Interview forums for talking to people can be in the form of face-to-face or telephone interviews.

Types of Interviews based on their structure

- **Unstructured Interview**- These interviews are not directed by a script. They are rich in content but not replicable.
- **Structured Interview**- These interviews are tightly scripted, often like a questionnaire. They are replicable but may lack in richness of the content.
- **Semi-structured Interview**- These interviews are those in which the interviewer has a script but he is free to break the scripted flow and indulge in discussion with the interviewee. The interviewer can be flexible and ask questions out of the script. They can provide a good balance between richness and replicability.

Types of Interview Questions:

Broadly an interviewer can ask two forms of questions:

- **Closed ended questions** are easiest to analyse, and may be done by computer as the outcomes/ answers of the user are known to be either of some fixed results as they have a predefined answer format.
- **Open ended questions** are where the user has to give his perspective which can not be guaranteed into any fixed result and these questions do not have a predefined answer format.

In an interview there are a few things that should be **avoided** like :

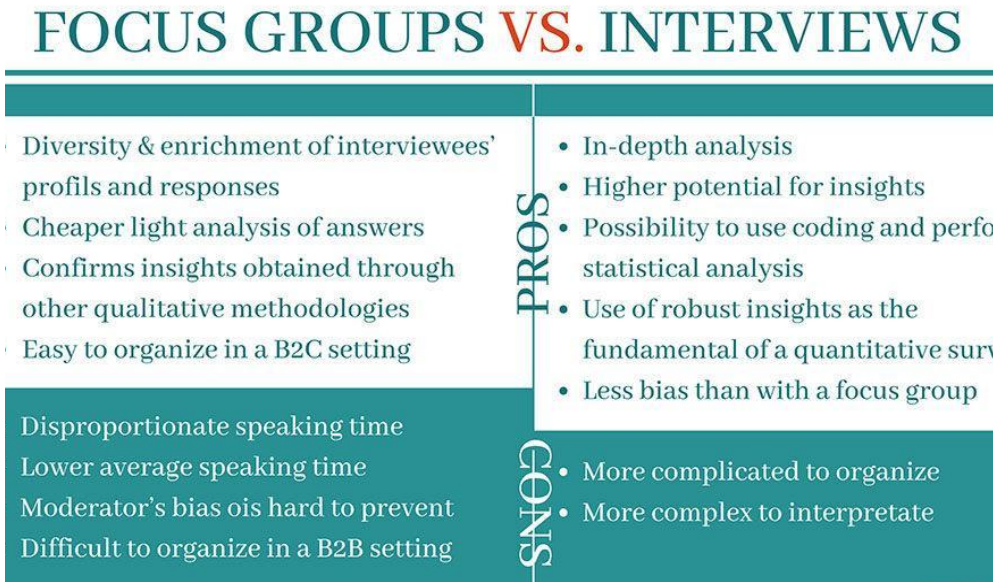
- Asking long questions
- Using compound sentences (split the question into two).
- Avoid using jargons that the interviewee may be unaware of and make it difficult for him to answer.
- Leading questions are not allowed. Example: Questions like Why do u like Kohli and not Dhoni should not be asked as it restricts the interviewee from answering independently.

Common steps for interview:

- **Introduction** – The interviewer introduces himself, explains the goals of the interview, reassure about the ethical issues, seeks consent for recording, presents an informed consent form (stating the purpose of the test, explaining the fact that it is being video-recorded, promises confidentiality and professionalism, etc.)
- **Warm-up** - The interviewer keeps the first few questions easy & non-threatening as an ice breaker.
- **Main body** – The interviewer starts with his scripted questions presenting questions in a logical sequence.
- **Cool-off period** – The interviewer includes a few easy questions to soothe the tension at the end of the interview
- **Closure** – The interviewer thanks the interviewee and affirms him, signaling the end of the interview and switches the recorder off.

3.4.3 : Group Interview

- A group interview is when we gather a group of stakeholders together for discussion on a particular topic.
- It is commonly also called a focus group and workshop.
- Majority of the projects stakeholders have conflicting ideas. So a group interview is good at gaining a general agreement on highlighting areas of conflict and disagreement. Typically there are three to ten participants in a group interview as they provide a diverse range of opinions.
- An interviewer is needed to manage and ensure everyone contributes to the discussion and also to make sure that the discussion is not dominated by one person. Prime duty of the interviewer is to ensure that the agenda of the interview is covered.



3.4.4 : Observation

- Explaining to the interviewer how an interviewee achieves a task can be very vague and poor in content and is not of much help for analysis either.
- So rather than asking how they did it the interviewer can just observe them do the task himself.
- The interviewer spends time with the stakeholders in their day-to-day tasks, observing them work in its natural setting.
- By observing the interviewer gains insights into the stakeholder's tasks.
- Observations are rich in data and can help understand the extent of the tasks being performed.
- Observations can be passive (listening and watching only) or active (asking questions to the subject of the interview who is being observed)
- There are broadly three types of observations:
  - ➢ Controlled Observation
  - ➢ Naturalistic Observation
  - ➢ Participant Observation

- **Controlled Observation** : Controlled observations are probably going to be done in a brain research lab. The scientist chooses where the perception will happen, at what time, with which members, in what conditions and uses an institutionalized methodology. Members are arbitrarily dispensed to every free factor gathering. Instead of composing a point by point depiction of all conduct watched, it is frequently simpler to code conduct as indicated by a formerly concurred scale utilizing a conduct plan (for example leading an organized perception).
- **Naturalistic Observation** : Naturalistic observation is an examination strategy generally utilized by clinicians and other social researchers. This procedure includes contemplating the unconstrained conduct of members in a regular environment. The analyst just records what they find in the manner they can. In unstructured perceptions, the analyst records all pertinent conduct without framework. There might be a lot to record and the practices recorded may not really be the most significant so the methodology is normally utilized as a pilot study to perceive what sort of practices would be recorded.
- **Participant Observation** : Participant observation is a variation of the abovementioned (common perceptions) yet here the scientist participates and turns out to be a piece of the gathering they are concentrating on to get a more profound knowledge into their lives. In the event that it were looked into by creatures we would now not exclusively be considering them in their regular territory yet be living close to them too! Member perceptions can be either spread or plain. Undercover is the place the examination is completed 'under spread'.

3.4.5 : Studying Documentation

- Document works like user manuals, regulations, stakeholder's work diaries can provide ample data for analysis. These are great to understand the work in focus and also inferring background details of the subject.
- Talking of the regulations governing a task.
- Although this form of data gathering can be very rich in content it should not be used in isolation i.e,The user may write stuff in the document but may not follow the documented work.
- An advantage over other techniques is that it does not waste the stakeholder's time.

3.4.6 : Research Similar Products

- The best way to learn is by evaluating others mistakes and finding solutions to the drawbacks present in the field of study.
- Researching similar products will provide alternative designs and help in gathering requirements as well.

Comparison of Data Gathering Techniques

Technique	Good for	Kind of data	Plus	Minus
Questionnaires	Answering specific questions	Quantitative and qualitative data	Can reach many people with low resource	The design is crucial. Response rate may be low. Responses may not be what you want
Interviews	Exploring issues	Some quantitative but mostly qualitative data	Interviewer can guide interviewee. Encourages contact between developers and users	Time consuming. Artificial environment may intimidate interviewee
Focus groups and workshops	Collecting multiple viewpoints	Some quantitative but mostly qualitative data	Highlights areas of consensus and conflict. Encourages contact between developers and users	Possibility of dominant characters
Naturalistic observation	Understanding context of user activity	Qualitative	Observing actual work gives insight that other techniques cannot give	Very time consuming. Huge amounts of data
Studying documentation	Learning about procedures, regulations, and standards	Quantitative	No time commitment from users required	Day-to-day work will differ from documented procedures

Some basic guidelines:

- ➢ Focus on identifying the needs of the stakeholder
- ➢ Involve all the stakeholder groups
- ➢ Consider having sufficient number of representatives from each stakeholder group
- ➢ Use an amalgamation of different techniques to gather data
- ➢ Provide aids to the process by making use of props, models or task descriptions
- ➢ Always run a pilot session before final prototyping
- ➢ Prioritize the things that you need first and the unnecessary extra inputs can be ignored
- ➢ Carefully record videos and data in the data gathering phase.

Choosing between data gathering techniques :

- The type of information one wants to collect affects the data gathering techniques which can be made use of. The technique can be changed for different types of data to be collected.
- The designer or end users may want to have a seminar for talking on the dataset but it may not be feasible because of the infrastructural requirements a seminar needs.
- The two main issues to consider while making your choice of technique:
  - ➢ Form of data collection mechanism
  - ➢ The reason why data is being studied
- The data collection techniques differ in the timelines, analysis criterias and risks. For example: An ATM Machine structural design is different from that of a system to support bank professionals to keep a record of datasets.

Case Study Question :

Suppose you are to develop a proposed software product to aid a small stock dealer's office. There is an existing software running whose review says that the users are quite content with it, but it seems obsolete and needs some upgrades. Based on the case study, what kinds of data gathering techniques would be appropriate for establishing requirements of the new proposed system? Justify your answer with reasoning?

Answer:

Small office implies a small number of stakeholders. Interviewing the staff rather than giving them a questionnaire would be more appropriate because of the small number of users/ staff. The data collected here will be very informative As the users are happy with the old system, observation is vital to figure out exactly where the previous system is lagging. Accountancy is regulated by a variety of laws and thus there is a need to go through the noted texts so that vital information can be gathered and not skipped. According to the case study a series of interrogations and surveys can be conducted to know about the staff's point of view of the old system and their opinion on what changes can be made in the proposed system.

3.5 : Data Analysis

- The type of data analysis that can be done on the collected data is dependent on the goals foreseen during the data gathering stage, and also the data gathered.
- For the data analysis stage there are only three approaches.
  - ➢ qualitative analysis approach
  - ➢ quantitative analysis approach
  - ➢ combination of both, qualitative and quantitative
- This may consist of tasks like characterising patterns/ trends or deducing plain numerical values like ratio, average, or percentage.
- The preliminary analysis phase is led by some more elaborated analysis which uses integrated frameworks and postulates to back the analysis.
- Rendering the conclusions generally runs synchronic with the analysis, but there are various ways to interpret the results and it is crucial to ensure that the data supports the conclusions.
- The investigator’s mindset being biased can influence the findings and this can be very critical.

3.5.1 : Qualitative and Quantitative Data

- The form of collected data in the form of numerals or numbers or in numeric format is called **Quantitative data**. Example, the number of users who use iOS in a town, the number of errors a machine finds in a humanly cut diamond, or the salary hike given to employees by a company.
- **Qualitative data** is the type of data that can not be stated in numeric terms.
  Example, the explanations, remarks quoted by the interviewees, diagrams of activity, and snippets.
- Qualitative data can can also be expressed in numerical format but it loses its meaning. There is a myth that certain forms of data gathering techniques can only be used for quantitative data and others can only be used for qualitative data. Every data gathering technique mentioned previously can be used to collect both types of data.
- While any comment field is a form is qualitative data. For an observation, quantitative data can be recorded as the number of people who eat salads with lunch or the number of students who practice Mathematics daily. While blogs about the presence of depression are examples of qualitative data.
- Quantitative analysis makes use of digital techniques to calculate the numeric values of fields.
- Example: A quantitative analysis might have a conclusion that an average African male is 5 feet 9 inches tall and weighs 169 pounds with an average age of 45 years. Qualitative analysis is directed at finding the nature of a field of study and can be formulated by patterns and trends. Example, to describe the same mass of people, a qualitative analysis might conclude that the average African male is very tall, heavy , and Middle-aged

Qualitative VS Quantitative Data

QUANTITATIVE DATA	QUALITATIVE DATA
ANSWERS “WHAT” “WHERE” “HOW” “WHEN” AND “WHO”	ANSWERS “WHY” (WHICH IS VERY IMPORTANT)
Based on numbers	Based on opinions and experiences
Larger sample size	Smaller sample size
Statistical analysis	Interviews & observation
Objective	Subjective
Closed-ended questions	Open-ended questions
To validate hypothesis	To generate hypothesis or develop ideas

3.5.1.1 : Interview

- Usually unprocessed data that is gathered during an interview resides as audio recordings and/ or notes written by the interviewer.
- These scribes have to be processed and expanded at the earliest after the interview to ensure that the interview is crisp in the interviewer's memory and the short scribes can be expanded with ease.
- The voice recordings recorded during the interview can function as an aid, or they can be transcribed later on for a further detailed analysis.
- Transcription takes substantial effort, as the speaking speed of the interviewee normally is faster than the typing speed or writing speed of the interviewer, another problem can be that the voice recordings may lack in quality and information.
- Many times the interviewer video records the interview, especially when the interviewee is to execute some work. Post interview the audio can be taken from the video and transcribed during or after the discussion.
- Closed questions ordinarily are considered as quantitative data and examined making use of easy quantitative analysis techniques. Example, Questions like Which is your favourite car ? can be used to categorize the data on the basis of car popularity.
- More complicated statistical techniques are required to identify the relation between question responses.
- Generally open questions are used to collect qualitative data for analysis which can be made use of to identify trends or repetitions in responses.

3.5.1.2 : Questionnaire

- Unprocessed data collected from questionnaires comprises the user's responses to the queries asked, and the format may be on paper or it can be an online form, the responses are mostly stored in a database so that it can be easily used for processing.
- It may be inevitable to process the responses by cleaning datasets where the user has misinterpreted the question. The data can be filtered according to the user's entries, (Example: Everyone over 80 kgs,or to evaluate the user's response to a game).
- This helps the analysis to be carried out on small chunks of data, aiding the evaluator to conclude on obligatory goals.
- It is made simple by making use of an elemental tool like a spreadsheet.
- Closed questions are more likely to be evaluated quantitatively and open questions qualitatively.

3.5.1.3 : Observation

- Such sort of information gathering procedure results in bringing about an expansive scope of crude information which includes eyewitness scribes, despite everything photos, information logs, verbally process chronicles, video and sound accounts.
- This crude information helps scaling a vivid scenario, however it can likewise make it hazardous to dissect except if an organized model is embraced.
- Introductory information preparation here incorporates expanding the written scribes, and translating components like the sound and video accounts also the verbal process conventions.
- Onlookers scribes are well on the way to be broken down utilizing subjective methodologies, on the same hand the photographs provide us with the contextual information.
- Data / System records and a few components of the perceiver's scribes could be examined quantitatively.
- For the whole time during the preliminary refining, the trends and repetitions in the dataset can be predicted.
- Making note of such initial notions can be very valuable to be used as a model for the further, more detailed analysis.
- Although we should not only trust these preliminary findings as we may get inadvertently biased and draw conclusions.

Data gathered techniques and distinctive preliminary processing steps taken

	Usual Raw Data	Example of Qualitative Data	Example of Quantitative Data	Initial Processing steps
Interviews	Audio recordings, Interviewer Notes and Video recordings	Responses to open questions, Video, Respondent's opinions	Age, job role, years of Experience and responses to closed questions	Transcription of Recordings and Expansion of notes
Questionnaires	Written responses, online Databases where responses are stored	Responses to open questions, And comments and opinions of the respondent	Age, job role, years of experience. Responses to closed questions	Clean up data. Filter into different data sets
Observations	Observer's notes, photographs, audio and video recordings, data logs, think-aloud	Records of behavior, description of a task as it is Undertaken and the copies of Informal procedures	Demographics of participants, time spent on a task and the number of people involved in an activity	Expansion of notes, transcription of Recordings and Synchronizatio n between data recordings

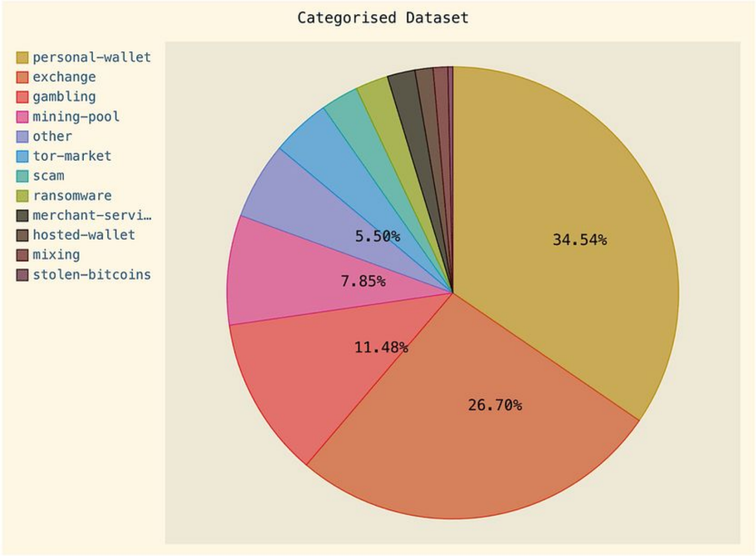
3.6 : Data Interpretation and Presentation

3.6.1 : Interpreting the data

- Starting data interpretation just after the data gathering activity is most yielding because it is a general tendency to recall incidents that are most recent and slowly they become vague biases that can be caused by recording via audio, video, etc.
- It is always recommended to carry out a session of initial interpretation before deeper analysis.
- Interpretation involves structurally recording the descriptions of requirements from the collected data.
- The analysis phase involves obtaining the requirements from the interpreted data.
- More the interpretation and analysis the examiner does deeper will be the understanding of the requirements.
- This will ensure that the requirements description will be expanded and clarified.
- After data analysis, finding the most appropriate way to present your findings is equally critical, this not only relies on the objectives but also on the data receivers for whom the findings are to be proposed.
- Example: The requirement activity is where you may want to showcase your searches in an official representation, while telling the findings of an experimental case to the group of designers you might involve a summary of problems found, supported by a video clip of a set of users who are experiencing those problems.

3.6.2 : Presenting the findings

- The most ideal approach to introduce discoveries relies upon the crowd, and the first objectives of the investigation.
- Be that as it may, it likewise is subject to the information social affair and investigation strategies utilized.
- In the past segments of this part, you met a wide range of methods for introducing data that has been used for analysis – as numbers, through different graphical gadgets, in tables, in literary depictions, as a lot of topics or classes, etc.
- These portrayals might be utilized straightforwardly to report your discoveries, if they are fitting for your crowd and your motivation, or they might be utilized as foundation proof for an alternate type of portrayal.
- Extensively, information social event and investigation in association configuration are done for one of two purposes: i)to determine prerequisites for an intuitive item, ii) to assess an intelligent item a work in progress.



3.6.3 : Rigorous Notation

- Various documentations have been created to investigate, catch, and present data for association plans.
- The term thorough isn't expected to infer custom or unbending nature, however just to state that the documentations have clear sentence structure and semantics.
- For instance, the work models advanced in relevant plans utilize straightforward yet clear shows for speaking to streams, breakdowns, singular jobs, etc.
- The displaying language UML (Unified Modeling Language) has stricter and increasingly exact sentence structure to be followed and is all the more regularly used to determine inward programming plans.
- Preferences of utilizing a thorough documentation is that it provides you clear direction as to what to aim for in the discoveries.
- Disservices incorporate that by featuring explicit components, it unavoidably likewise makes light of or disregards different viewpoints, and that the accuracy communicated by the documentation might be lost on a group of people on the off chance that they don't have the slightest idea about the documentation.
- Creating charts in these documentations definitely needs more investigation of the discoveries so as to distinguish the particular qualities and properties that the documentation features.
- For us to be able to conquer their disservices, thorough documentations are typically utilized in mix with accounts or other all the more effectively available arrangements.

3.6.4 : Using Stories

- Narrating is a simple and natural methodology for individuals to impart thoughts and encounters.
- It isn't astonishing then that stories are utilized widely in cooperation plans, both to impart discoveries of analytical investigations, and as the reason for additional advancement.
- Narrating might be utilized in three distinct manners.
- To start with, members (for example when interviewees, surveys are being conducted the passer by people may hear it and may have recounted accounts of their own during information collection. The accounts may be removed, looked at, and might be utilized to convey discoveries to other people (for example as accounts to breath life into an outline report).
- Stories might be developed from littler accounts or rehashed designs that are found in the information.
- Any accounts gathered through information social affairs might be utilized as the reason for building situations. Situations are speculated tales about individuals and their everyday life.
- They are a ground-breaking strategy for association plans and can be utilized all through the lifecycle.

3.6.5 : Summarizing the findings

- Obviously composed accounts starting with a synopsis and a nitty gritty substance sequence make for simple perusing and a decent denotation archive.
- Counting accounts, citations, pictures, and visuals cuts assists with breathing life into the examination, animate intrigue, and make the composed portrayal increasingly important.
- A few groups underscore quantitative information, however its worth relies upon the sort of study.
- Frequently both subjective and quantitative information examination are utilized on the grounds that they give elective points of view.
- They are having the option to introduce a rundown of the discoveries.
- This is the place numbers and factual qualities prove to be extremely amazing. Nonetheless, from such outlines we should significantly not exaggerate our discoveries.
- Example: Let us say 7 out of 10 clients favored structure An over plan B, this doesn't imply that structure An is 80% more alluring than plan B. In the event that you discovered 800 out of 1000 clients favored structure An, at that point you have more proof to propose that plan An is better, however there are as yet different components to consider. As a rule, be careful about utilizing words, for example, 'generally,' 'all,' 'larger part,' 'none,' and be cautious when composing avocations to guarantee that they mirror the information.

3.7 : Task Description & Task Analysis

3.7.1 : Task Description

- Portrayals of business undertakings have been utilized inside programming improvement for a long time. In the 1970-80s, commercial situations were usually utilized as the reason for toleration examination, for example the last testing phase before the client paid the last charge portion and acknowledged the framework.
- In later years, because of the focus on including clients prior in the development cycle and the enormous citations of fresh intuitive items presently being created, task portrayals are utilized all through advancement, from early necessities exercises through prototype designing, assessment, and examination.
- Subsequently, additional clips and exertion have been placed to see how to build and put them to usage.
- It is depicted by Alexander and Maiden's book which contained many scenarios, tales and use cases, it says that there exist a varied number of purposes that emphasize on numerous dimensions of the product being developed.
- Here we shall be introducing the most recurrent techniques used i.e, Scenarios, Use cases, and Essential use cases.. Neither of these are reciprocally selective and are mostly held in conjunction.

3.7.1.1 : Scenarios

- Scenarios can be characterized as an 'informal narrative description' that portray human exercises or assignments in a story which permits investigation and conversation of settings, needs, and prerequisites.
- It is not necessary to portray the utilization of programming or other mechanical help to accomplish an undertaken workload.
- Utilizing the jargon and stating of clients implies that situations are comprehensible by the partners, and they can take an interest completely in the advancement procedure. Indeed, the development of situations by partners is frequently the initial phase in building up prerequisites.
- The focal point of such tales is likewise normally liable to be details of the clients who are attempting to accomplish their objectives. Here the motive is not to save existing traits in the new item, however to comprehend current conduct and investigate the requirements, settings, disturbances, etc under which individuals work.
- Here the motive is not to save existing traits in the new item, however to comprehend current conduct and investigate the requirements, settings, disturbances, etc under which individuals work.

3.7.1.2 : Use Cases

- Use cases center around the client objectives, yet the focus here is on the client framework correspondence as opposed to the client's undertaking itself.
- Despite the fact that their emphasis is explicitly on the collaboration between the client (called an on-screen character) and a product framework, the pressure is still particularly on the client's point of view, not the system's. The term situation is additionally utilized with regards to utilize cases.
- Right now, speaks to a way making use of the utilization case, for example one specific arrangement of conditions. The two of them speak to one explicit case of conduct.
- An utilization case is related to an entertainer, whose objective in utilizing the framework that the utilization case needs to catch.
- The primary use case depicts what the typical course was. In this way, for instance, if through information gathering we have discovered that most endorsers of the film rental assistance know the title of the film they need to lease, at that point the ordinary flow of the utilization example would incorporate the means important to identify the film making use of its subtitle.
- The remaining potential groupings also termed as elective courses, normally reside at the base of the defined utilization case.

Let us take an Example of a Travel Organizer and make the Use Case

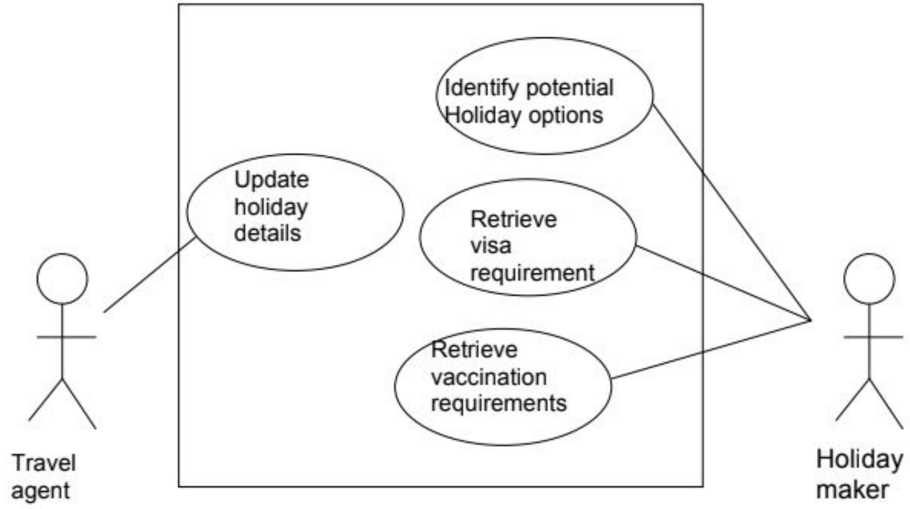
1. The system displays the various alternatives for checking the visa and inoculation essentials.
2. The tourist chooses the option to find out about visa requirements.
3. The system prompts the user for the name of the country they intend on travelling to.
4. The user enters the country's name.
5. The system checks that the country name is valid.
6. The system prompts the user for their nationality details.
7. The user enters his / her nationality.
8. The system checks the visa requirements of the entered country for a passport holder of the respective nationality.
9. The system displays the visa requirements to the user.
10. The system displays the option to print out the visa requirements for the user.
11. The user requests to print the requirements.

Some alternative courses for step 6,8 and 9 here can be:

For 6. If the country name entered is invalid:
- 6.1 The system displays an error message.
- 6.2 The system returns to step 3.

For 8. If the nationality entered is invalid:
- 8.1 The system displays an error message.
- 8.2 The system returns to step 6.

For 9. If no information about visa requirements is found:
- 9.1 The system displays a suitable message.
- 9.2 The system returns to step 1.



3.7.1.3 : Essential Use Cases

- Essential Use Cases were made, to overcome the loopholes of Use Cases.
- They are solid stories that focus on sensible and explicit exercises.
- They subsequently can darken more extensive issues worried about the more extensive hierarchical view. Fundamental use cases speak to deliberations from situations, for example they speak to a more broad case than a situation exemplifies, and attempt to stay away from the suspicions of a customary use case.
- The main reason why use case diagrams are this successful is their division into three parts : the first being their name that talks of the end user intentions from the task, the second being a formatted detail ideza of the system and the third being the detailed system feedback response.
- Essential use case for gathering visa prerequisites for the travel organizer :

User Motive	System Response
Find the visa prerequisites	
	Ask for the intended travel location and nationality
Provide details	
	Gather the correct visa prerequisites
Get a replica of the required visa documents	
	Provide the details in various formats
Select intended file format	
	Give the user the details in the respective format

3.7.2 : Task Analysis

- Task Analysis is utilized for the most part to research a current circumstance, not to imagine new items.
- It is utilized to break down the hidden basis and motivation behind what individuals are doing.
- The data collected from task examination sets up an establishment of practices that are present based on which we are to develop fresh prerequisites.
- Task investigation procedures have produced a blended gathering, out of which virtually the most broadly utilized form is Hierarchical Task Analysis.

3.7.2.1 : Hierarchical Task Analysis

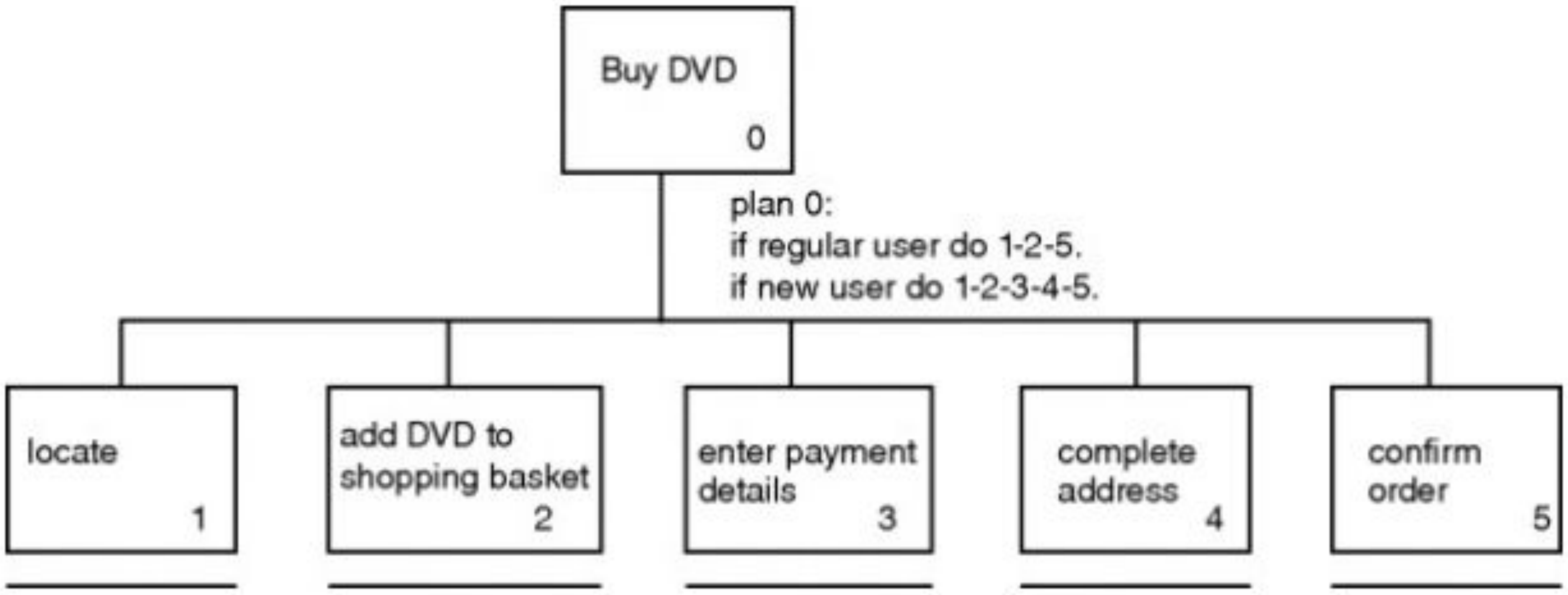
- This task analysis was initially intended to distinguish preparing needs.
- It includes separating an undertaking into subtasks and afterward into smaller fragment modules.
- Further they are assembled as functional findings which indicate how the errands may be acted upon in a genuine circumstance.
- This task analysis centers around the physiological and noticeable activities which are done, that further incorporates taking a gander at activities that are not identified with programming or an intuitive item by any means. The beginning stage has the client objective.
- Then it is analyzed and the primary errands related to the accomplishments are recognized. Wherever suitable such undertakings are further broken into smaller tasks, and later the tasks can be isolated and made into modules.

Explaining Task Analysis using a DVD buying example

- This assignment could be disintegrated into modules like finding the DVD, adding it to a checkout container, entering installment subtleties, complete location; and affirm request.
- A portion of such tasks probably won't be executed if the client is an ordinary client. This can be caught through plans. So as to buy a DVD the steps are:
    1. 1. Find the DVD
    2. 2. Add the DVD to purchase cart
    3. 3. Fill in the billing information
    4. 4. Fill in the delivery address
    5. 5. Confirmation before product is ordered
- plan 0: For usual users do 1-2-5. If new users do 1-2-3-4-5.

- An elective articulation of a HTA is a graphical box-and-line documentation.
- Here the subtasks are spoken to by named boxes with recognizing numbers.
- The progressive connection between undertakings is indicated utilizing a vertical line.
- On the off chance that an assignment isn't disintegrated any further, at that point a dense even line is made under the relating set.

A pictorial depiction of the task analysis for purchasing a DVD



The advantages of task analysis incorporate:

1. It lets you equitably look at elective structures, in light of a client's arranged errands and modules.

2. The client gets a fair idea of the collaboration at the respective stage of deliberation is fitting. This encourages great planning.

3. It bolsters configuration reusability at various degrees of deliberation.

Summary

The module helped us look into the necessity of the requirement activity, also we learned the methods by which we can gather the requirements for designing. All the studied techniques to gather data can work in various permutations to collect information for analysis. Additionally, contextual inquiry, understanding documentation, and researching similar products are some popularly used techniques for data gathering. Scenarios, use cases, and essential use cases are techniques one can rely on for documentation.

Key points :

- For a design to be successful it is a sheer necessity for the designer to get his requirements in place.
- While designing in the requirement phase many goals like functional and nonfunctional requirements need to be identified.
- Non functional requirements can be of varied types which are : data, environmental, user characteristics, usability and user experience requirements.
- During the data gathering phase the prime methods of data gathering are : questionnaires, interviews, focus groups, observation, studying documentation, researching similar products, and contextual inquiry.
- When the designing of a product is done it would be much helpful for the designer to make use cases, scenarios and essential use cases for the product under development.
- In the industry many task analysis techniques are present to help analyze and help present a task.

Review Questions

1. Explain Task Description (Refer 3.7.1)
2. Explain Task Analysis (Refer 3.7.2)
3. List Key Issues of data gathering sessions(Refer 3.3)
4. Distinguish Qualitative and Quantitative data. (Refer 3.5.1)
5. Summarize the advantages of online questionnaires. (Refer 3.4.1)
6. Summarize the problems encountered with online questionnaires (Refer 3.4.1)
7. Compare the commonly used data recording approaches. (Refer Table 3.2)
8. Illustrate the concept of structured interviews with help of example. (Refer 3.4.2)
9. Illustrate the concept of unstructured interviews with help of example. (Refer 3.4.2)
10. Illustrate the importance of observation in data gathering technique. (Refer 3.4.4)
11. List the various types of observation. (Refer 3.4.4)
12. Suggest one key functional, data, environmental, user and usability requirement for each of the following scenarios: (Refer 3.2.2 [Similar case study solved])
    a. A system for use in a university's self-service cafeteria that allows users to pay for their food using a credit system
    b. A system to control the functioning of a nuclear power plant.

Multiple Choice Question

1) Which of the following is not a technique for data gathering

A. Notes + Still Camera/ Photograph
B. Audio + Still Camera/ Photograph
C. Still Camera
D. Notes + Audio

2) Which of the following is not types of non functional requirements

A. Accessibility Requirements
B. Environmental Requirements
C. User characteristics Requirements
D. Data Requirements

3) Which of the following do not help in Task Analysis

A. Use Case
B. Scenarios
C. Essential Use Case
D. Questionnaire

4) Which is the preliminary step for making a design

A. Prototyping Phase
B. Analysis Phase
C. Requirement Analysis Phase
D. Data Gathering Phase

5) Which is not a phase after Data Gathering

A. Data Interpretation
B. Data Analysis
C. Data Sorting
D. Data Presentation

6) What are not the possible questionnaire question formats

A. Yes or No
B. Semantic Scale
C. Rating Scale
D. Describe

7) Which is not a online questionnaire advantage

A. Responses from user are generally received slowly
B. No printing cost as its free
C. Data analysis becomes easy as responses are stored in databases
D. Time required for data analysis is reduced heavily

8) Which of these are not a type of an interview

A. Structured Interview
B. Descriptive Interview
C. Unstructured Interview
D. Semi structured Interview

9) What is not a common step in an interview

A. Closure
B. Quote sharing
C. Introduction
D. Main Body

10) Which is not a type of observation

A. Naturalistic Observation
B. Participant Observation
C. Uncontrolled Observation
D. Controlled Observation

11) What is the full form of HTA

A. Hierarchical Task Analyst
B. Hierarchical Task Analysis
C. Hierarchical Time Analyst
D. Hierarchical Time Analysis

12) Data analysis can not be done on which of these

A. Interviews
B. Observations
C. Stories
D. Questionnaires

13) Which is not a part of Data Interpretation

A. Rigorous Notations
B. Using stories
C. Using Essential Use Case diagrams
D. Summarizing the findings

14) Which is not a problem for data gathering

A. Cost involved
B. Setting goals
C. Triangulation
D. Pilot Study

15) Which is not a online questionnaire disadvantage

A. Lower response rate
B. Cost is high
C. Can answer multiple times
D. Time is very less for analysis

Answer Key for MCQs

1) D) Notes + Audio
2) A) Accessibility Requirements
3) D) Questionnaires
4) C) Requirement Analysis Phase
5) C) Data Sorting
6) D) Describe
7) A) Responses from user are generally received slowly
8) B) Descriptive Interview
9) B) Quote sharing
10) C) Uncontrolled Observation
11) B) Hierarchical Task Analysis
12) C) Stories
13) C) Using Essential Use Case diagrams
14) A) Cost involved
15) B) Cost is high

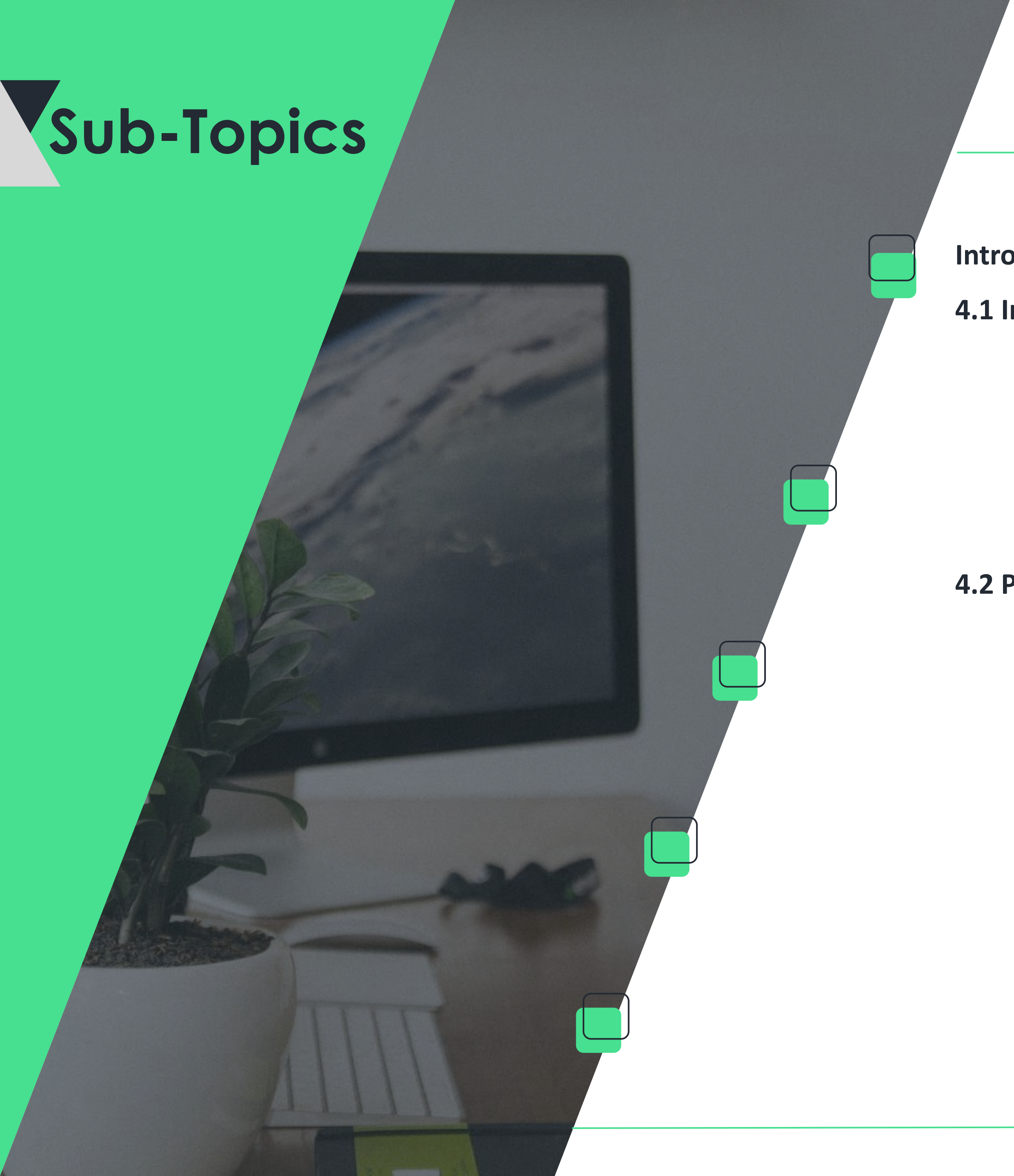
Module 4

Learning Objectives

After reading this chapter, you will be able to:

- ❖Understand the interaction design process
- ❖Identify and explore each step of the interaction design process
- ❖Understand the importance of prototypes
- ❖Identify and explore different types of prototypes
- ❖Understand interface metaphors and their importance
- ❖Identify and explore the various drawbacks of interface metaphors

Sub-Topics



Sub-Topics

- 4.2.1.3 Three Main Approaches to Prototyping
  - Throw-away
  - Incremental
  - Evolutionary
- 4.2.2 Conceptual Design
  - 4.2.2.1 Guiding Principles of Conceptual Design
    - Keep an open mind but never forget the users and their context
    - Discuss ideas with other stakeholders as much as possible
    - Use prototyping to get rapid feedback
    - Iterate, iterate and iterate
  - 4.2.2.2 Developing the Conceptual Model
    - 4.2.2.2.1 Interface metaphors
    - 4.2.2.2.2 Interaction types
      - Instructing
      - Conversing
      - Manipulating
      - Exploring

Sub-Topics

Introduction

Introduction

Till now we have seen examples of good and bad design. We explored the importance of good interaction design. In this chapter we will take a closer look at the interaction design process. We will explore each step in detail. Further we will take an in-depth look at prototyping and conceptual design. We will also learn about interface metaphors, their powers and drawbacks.

4.1

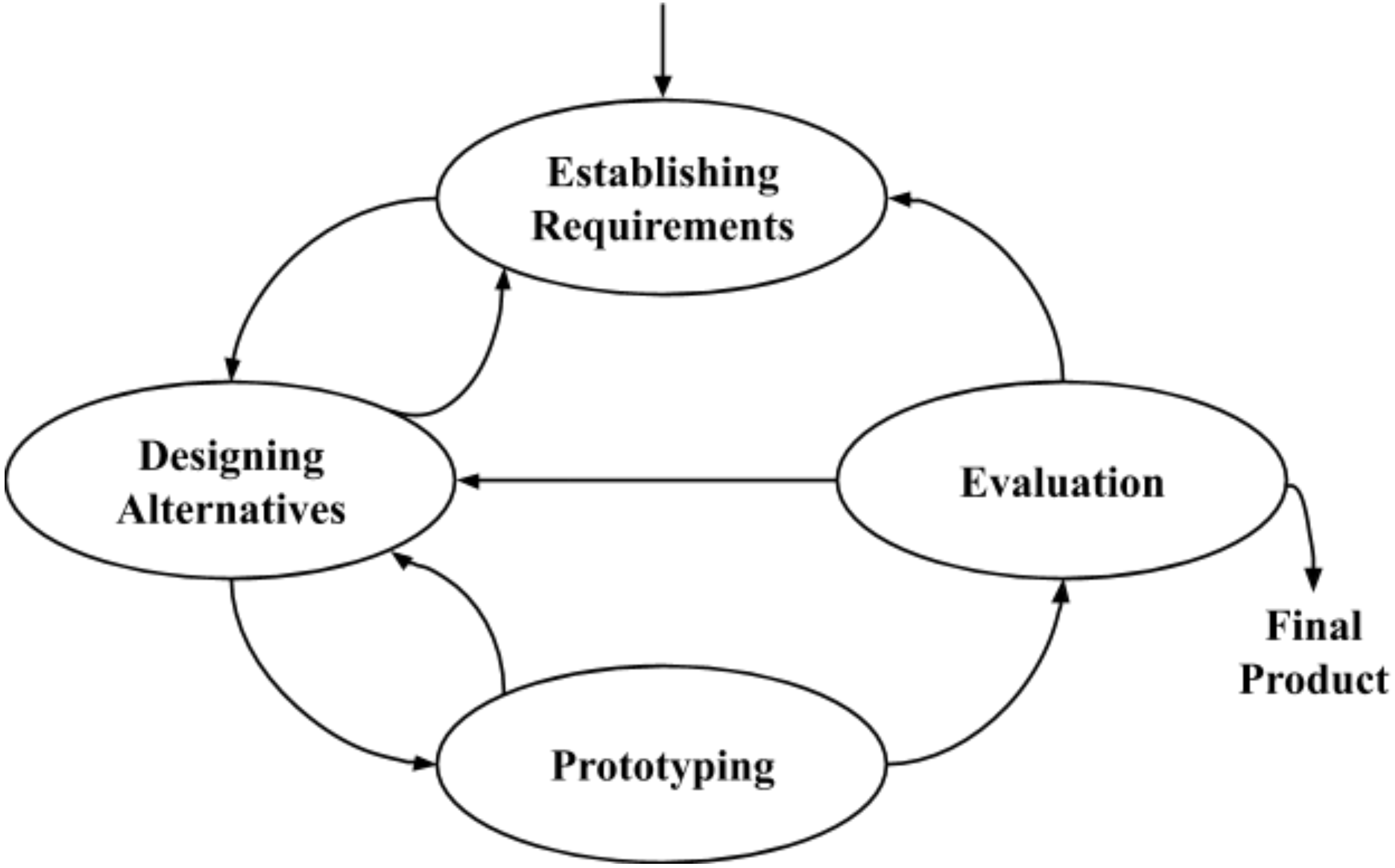
Interaction Design Process

4.1 Interaction Design Process

Introduction

- It tries to ensure the usability of a product and a good user experience.
- It is a user-centric approach.
- Users' perspective is considered throughout development. Having users' concerns guide the development helps to ensure a good user experience.
- There are 4 stages of the interaction design process:
  - Establishing Requirements
  - Designing Alternatives
  - Prototyping
  - Evaluation
- Note: The interaction design process is cyclic. The process is looped over multiple times until satisfactory design (final product) is reached.

4.1 Interaction Design Process



4.1 Interaction Design Process

1 Establishing Requirements

- Requirements are the needs of the users and stakeholders that have to be fulfilled by the product.
- What is the current scenario? What is the user trying to accomplish? How does the user interact with the product? How does the user experience this interaction? What is the environment in which the interaction takes place? Asking such questions helps in understanding users' needs and establishing the requirements.
- Furthermore, even though this is a user-centric approach other stakeholders cannot be neglected. Their goals, objectives and needs also have to be taken into account.
- Needs and requirements of users and stakeholders are gathered and established through various techniques like questionnaires, interviews, demonstrations, etc.
- To successfully establish the requirements it is essential to identify the product's target audience.
- Modern products cater to diverse groups of users and each of their respective needs also have to be considered.

4.1 Interaction Design Process

1 Establishing Requirements - Example

In a modern well-designed elevator, the buttons also have braille script embossed.

Thus making it easier to use for people who are visually impaired.

4.1 Interaction Design Process

2 Design Alternatives

- Is the development of interfaces or systems that do a better job of meeting the needs of users and stakeholders. It is essential for the designer to consider both functional and non-functional requirements.

- At every part of this process alternative options should be looked at. Only when a large number of alternatives are considered does the best design emerge. Thus this step requires highly creative designer(s).

- This step can be further divided into two major parts.

    - Conceptual design: It entails the formulation of the conceptual model. A functional overview of the product is given by the conceptual model. In simple words, the conceptual model describes what the product does, how it behaves, how the user interacts with it and what it looks like.

    - Physical design: It doesn't dive into the overall flow or functionality of the product. Rather it is a detailed look into the UI (look and feel) of the product. Physical characteristics of the product are designed. This includes selecting icons' design, menu design, transitions, animations and colours. Since a wide variety of options are available it is important for the designer to consider multiple alternatives.

4.1 Interaction Design Process

2 Design Alternatives - Brainstorming

To promote the consideration of alternatives brainstorming technique is often used.

Brainstorming is nicely summed up in this saying “In brainstorming, we aim squarely at a design problem and produce an arsenal of potential solutions.”

A design team gathers and everyone voices their ideas and opinions. All ideas are discussed and considered. Thus many different ideas get explored. Plus individual ideas are strengthened from the feedback of other designers.

4.1 Interaction Design Process

3 Prototyping

- Once designs are narrowed down, it is important to test the suitability of the design. This is the purpose of a prototype. A prototype helps users and stakeholders to judge the design's functionality and usability.

- Since the goal is to create interactive products, the most sensible way of evaluating such products is by using interactive versions of the design. Prototypes are such interactive versions of the design.

- Real-life user interactions, made possible through prototypes, play an invaluable role in testing the suitability and validity of a design.

- In the interaction design process it is essential to create prototypes. The type and complexity of a prototype designed depends on many factors. It can be highly detailed, expensive and have a lot of the functionality of the final product or it can even be a simple paper-based representation of the idea. Further in this chapter we discuss prototyping in greater detail.

4.1 Interaction Design Process

3 Prototyping - Example

A fascinating example is of the founder of PalmPilot. He cut a block of wood to the approximate shape and size of his design vision.

Then for several weeks he carried it around in his pocket and pretended to use it when the need arose. He even took pretend notes in meetings. By changing the paper glued to the face of the block he also tried out different button configurations.

4.1 Interaction Design Process

4 Evaluation

- Evaluation is a set of techniques used to determine whether the needs of the user and stakeholders are being met.
- Using prototypes designs/ideas are evaluated to see whether they meet the needs and requirements established in the first stage of the interaction design process.
- Where there is scope for improvement is also determined.
- Insights and feedback gathered inform the next design iteration. Usually, after a prototype is evaluated, it is redesigned, prototyped, evaluated, redesigned, prototyped, evaluated so on….
- It is important to note that the interaction design process is cyclic and it is very common for a product to go through multiple such iterations till final design is reached.
- During evaluation new requirements may also surface.

4.2

Prototyping and Conceptual Design

4.2 Prototyping and Conceptual Design

Prototyping

- A prototype is an interactive representation of the design that allows users and stakeholders to judge its suitability.

- Since the goal is to create interactive products, so interacting with them is the most sensible way of evaluating such products. Prototypes are such interactive versions of the design.

- Often people think of prototypes as expensive, precise and to scale models of the design or highly complicated software. But this is not the case. A prototype can be even made out of paper or even just be some drawings.

- The prototypes can be very rudimentary. A fascinating example is of the founder of PalmPilot. He cut a block of wood to the approximate shape and size of his design vision, illustrated in figure 4.2.3. Then for several weeks he carried it around in his pocket and pretended to use it when the need arose. He even took pretend notes in meetings. By changing the paper glued to the face of the block he also tried out different button configurations.

4.2.1 Prototyping

Why make Prototypes?

- Human interactions are inherently complex. No matter how experienced the designer is it is almost impossible to make a perfect first design.
- Real-life user interactions, made possible through prototypes, play an invaluable role in getting relevant feedback.
- It is often said, “Users can't tell you what they want, but when they see something and get to use it, they soon know what they don't want”.
- A lot of insights can be gained by observing the reaction and interaction of users with the prototypes.
- Designs/ideas are evaluated using prototypes to see whether they meet the user requirements and identify where there is scope for improvement.
- Insights and feedback gathered are inputs in creating the next design iteration.

4.2.1 Prototyping

Types of Prototyping

- The type and complexity of a prototype created is dependent on the purpose it is meant to serve. Type is also influenced by the stage of development.
- During earlier iterations and for simple idea demonstrations we often see low-fidelity prototypes being used.
- For later iterations, detailed testing and/or for marketing we often see high-fidelity prototypes being used. We will now see what low-fidelity and high-fidelity prototypes are.
- We will now see what low-fidelity and high-fidelity prototypes are.

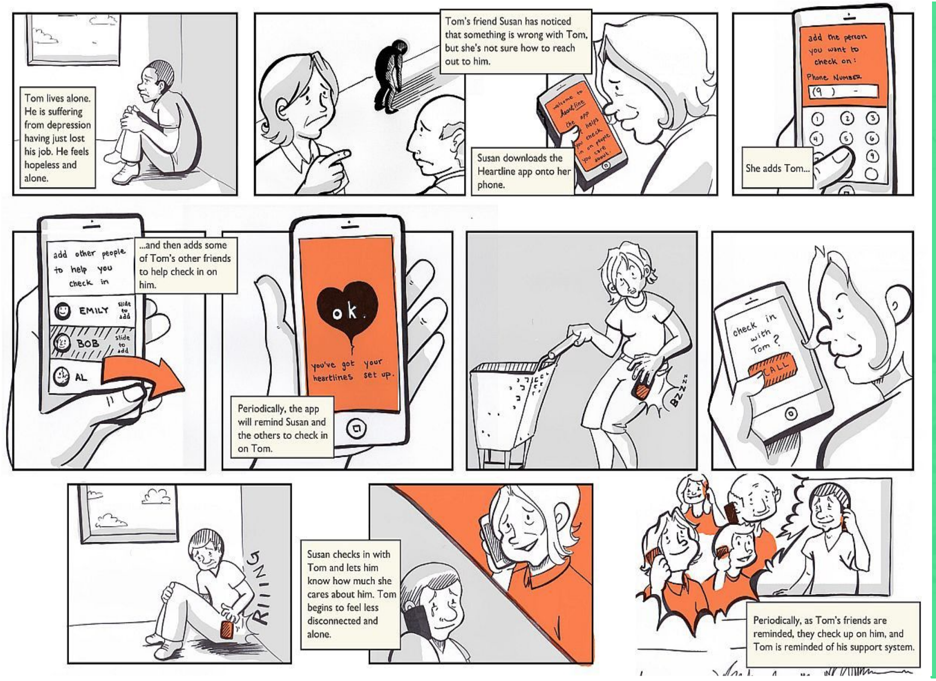
4.2.1.2 Types of Prototyping

Low-Fidelity Prototyping

- A low fidelity prototype often does not closely resemble the final product in either look or functionality.
- It is often a very bare-bones representation of the design. They are often made up of relatively inexpensive materials like paper and cardboard and often they do not perform the functionality, they only represent it.
- The benefit is that low fidelity prototypes are often very simple, cheap and fast to create and modify.
- This makes them particularly useful during the exploration of alternative design ideas. These fast, flexible and inexpensive prototypes encourage exploration of different designs and ideas.
- Note low-fidelity prototypes are almost never integrated into the final product.

Some types of low-fidelity prototypes

1 Storyboarding



It can be a series of text/series/scenes depicting the use and interaction of a product.

Often a certain scenario will be depicted in storyboarding.

It gives the stakeholders a chance to see and understand the flow of events and the interactions with products that can take place in a certain scenario.

Some types of low-fidelity prototypes

2 Prototyping with index cards

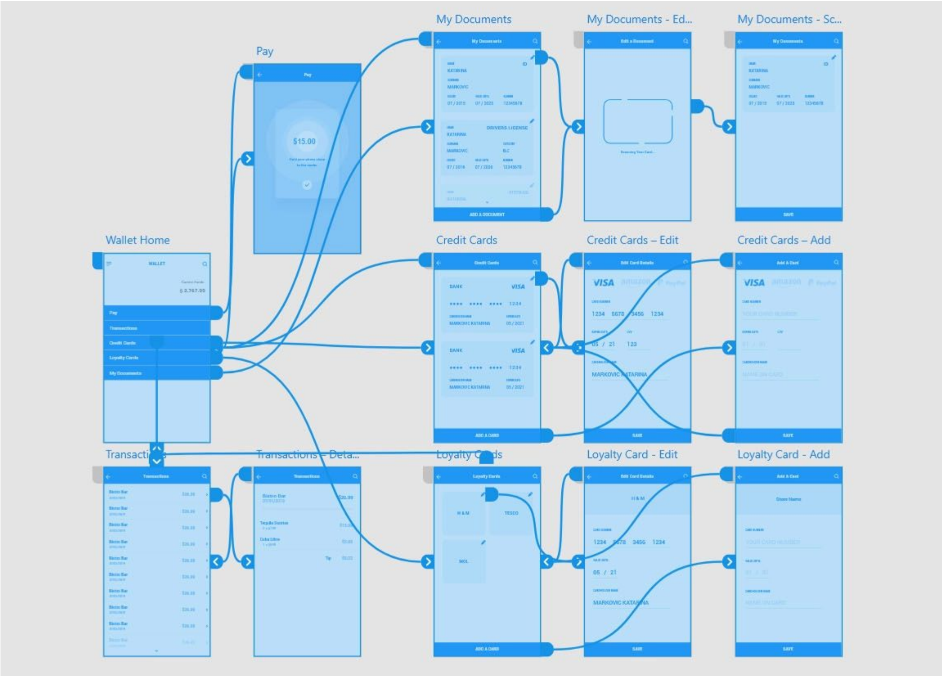
Index cards are used. Index cards are 3x5 inch pieces of cardboard.

This is often used while developing websites or phone apps. Each index card will represent a screen. The flow of the app or website can be simulated.

It is simple and gives a good understanding to users and stakeholders about the functioning and flow of the product.

Some types of low-fidelity prototypes

3 Wireframes

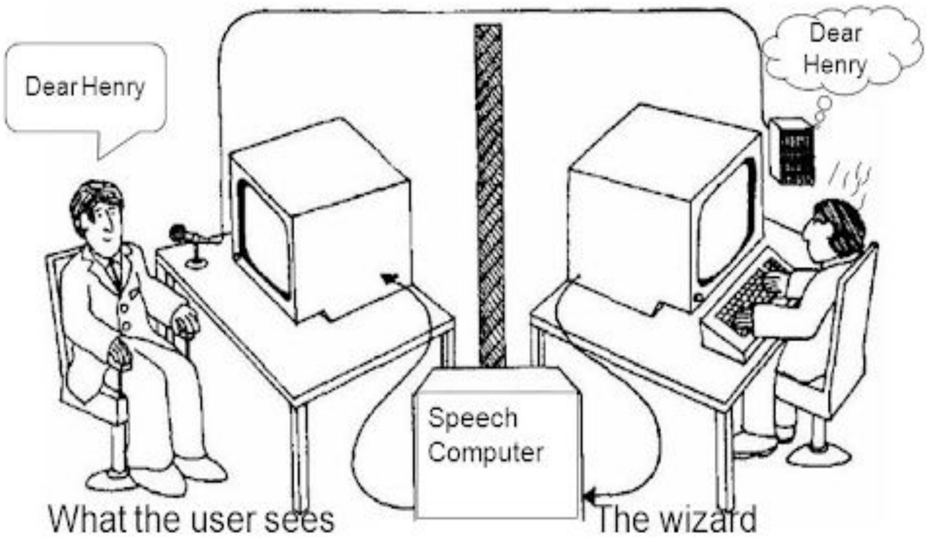


Used often for websites and mobile apps. It gives the structural design overview. Wireframes help easily demonstrate the functionality and flow of the app or website. In many ways it is similar to prototyping with index cards. However unlike prototyping with index cards, wireframes are designed in software and thus more interactive.

It is also important to note that flow shown in wireframe is meant to resemble the flow of the product but the UI (look and feel) shown is only for demonstrative purposes and not meant to resemble the actual product's look and feel.

Some types of low-fidelity prototypes

4 Wizard of Oz



Human operator (the 'wizard') is mimicking the software's response.

In the movie Wizard of Oz people interact with a large size wizard. They later discover it was a small man operating an artificial image of himself from behind a screen.

Users/stakeholders interact with the software product and think that it is responding to them. However, actually a human operator simulates the software product's response.

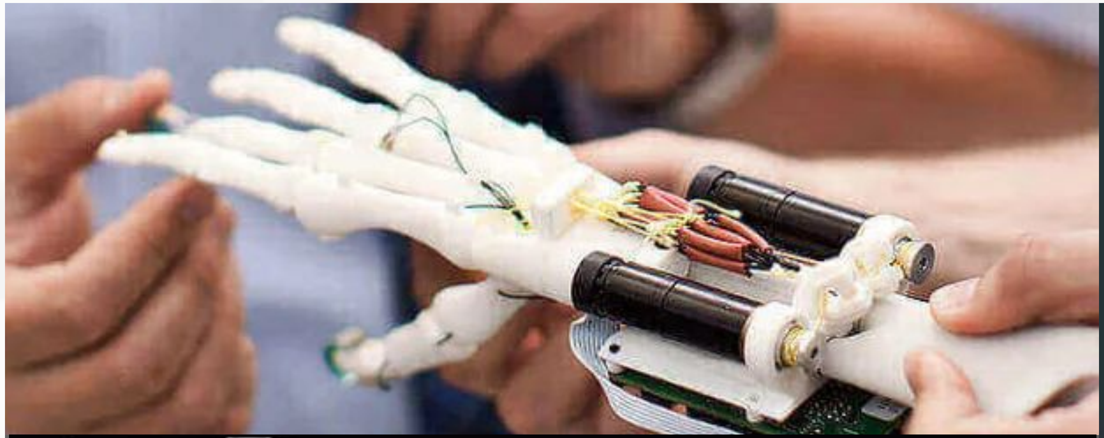
Users/stakeholders realistic interactions are obtained and very accurate insights can be gathered.

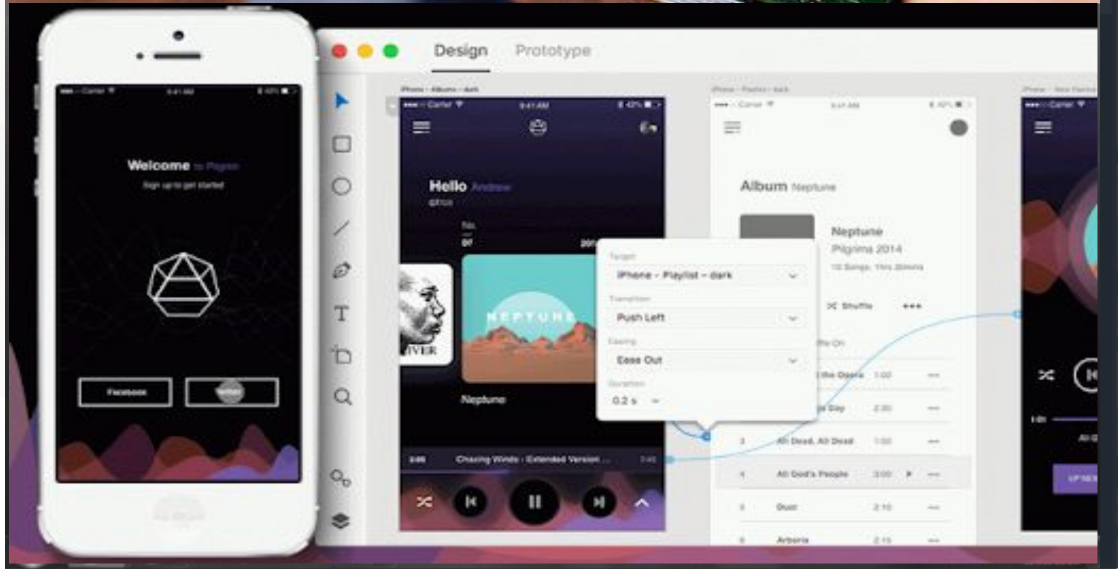
4.2.1.2 Types of Prototyping

High-Fidelity Prototyping

- Fidelity is defined as "the degree of exactness with which something is copied or reproduced". Thus as the name suggests, a high-fidelity prototype more closely resembles the final product.
- It also provides much more functionality of the product than a low-fidelity prototype. Therefore, more realistic interactions occur between user and product.
- Interactions more closely resemble that of the final product.
- Since often many of the functionalities of the final product are present in these prototypes, they can be used to test out some of the technical issues.
- The drawback of high fidelity prototypes is that they are often more expensive and time-consuming to build.
- High-fidelity prototypes are also often used in the marketing of the idea/product. Startups are often seen pitching their ideas to investors using high fidelity prototypes.

4.2.1.2 Types of Prototyping





High-Fidelity Prototyping

Both software and hardware high fidelity prototypes are often made by the tinkering and modification of existing products.

This method is widely used due to it being a cost-efficient and quick way of building the prototype.

However, with the reduction of cost of 3D scanning and printing, it is now more common to see accurate, to-scale 3D printed prototypes of designs/ideas.

For software products, there are many tools to help make a high fidelity prototype. They are very useful because they can very closely simulate some of the product’s missing functionality. Tools like Adobe XD.

4.2.1.3 Three Main Approaches to Prototyping

1 Throw-away

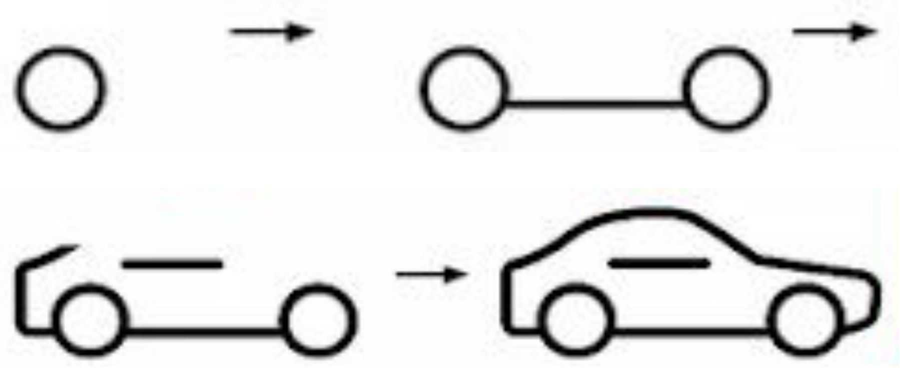
The prototype is built. Used for testing and insights are gained. These insights help inform the design of the final product. Then as the name suggests the actual prototype itself is thrown/discarded.

Throwaway prototypes are useful for exploring ideas and getting feedback from end-users.

They are also often used to answer questions and once the questions have been answered they are 'thrown away'.

4.2.1.3 Three Main Approaches to Prototyping

2 Incremental

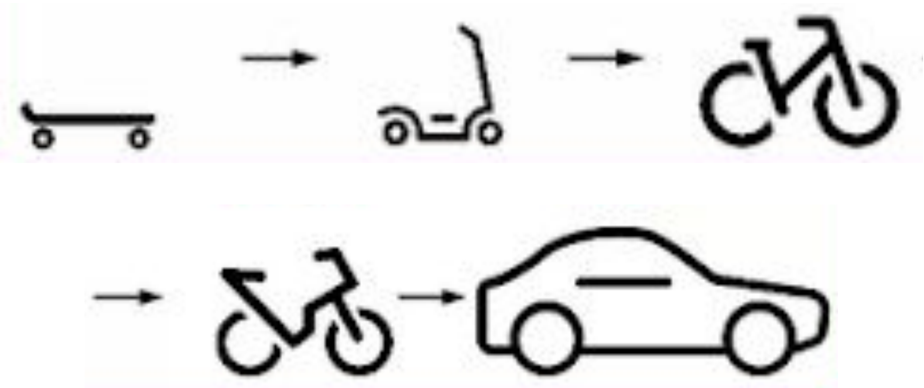


The entire product is broken down into independent components. Each ‘increment’ is when a new component is ready and integrated. The product is ready when all components have been completed.

The benefit is that users are able to provide feedback on the ready components, while the others are still under development. Often this feedback also helps in improving the components that are still under development.

4.2.1.3 Three Main Approaches to Prototyping

3 Evolutionary



In this technique, the prototype is not discarded. It forms the base from which the next iteration is designed.

The idea is that the prototype should go through multiple refinements until the prototype itself becomes the solution.

This is especially useful when some of the requirements are vague and unclear. Users provide feedback at the end of each iteration to help make the prototype closer to the solution in the next iteration.

4.2.2 Conceptual Design

Introduction

- The main activity of conceptual design is to turn the needs and requirements gathered into a conceptual model.
- The conceptual model describes what the product does, how it behaves, how the user interacts with it, what it looks like and will the user perceive the product as intended.
- There are four principles that guide the conceptual design. During the entire conceptual design process, designers should always keep these principles in mind.
  - Keep an open mind but never forget the users and their context
  - Discuss ideas with other stakeholders as much as possible
  - Use prototyping to get rapid feedback
  - Iterate, iterate and iterate

4.2.2.1 Guiding Principles of Conceptual Design

1 Keep an open mind but never forget the users and their context

It is essential to keep an open mind to the various different ways/techniques/ideas in which the requirements can be fulfilled. Since only by considering many different alternatives, it will lead to the best possible design.

Designers should also continuously try to see things from the user's perspective. This will ensure the meeting of users' needs and a good user experience.

Example of this is that many car manufacturers use an empathy suit. This suit helps young designers to empathize with older users who often have some loss of mobility.

4.2.2.1 Guiding Principles of Conceptual Design

2 Discuss ideas with other stakeholders as much as possible

Continuous discussions with the stakeholders provide instant feedback to designers.

Not only the users but it is also essential not to neglect the other stakeholders’ needs and concerns.

Sometimes designers may misunderstand some of the requirements and the discussion and feedback helps to ensure that the designers are on the right track.

4.2.2.1 Guiding Principles of Conceptual Design

3 Use prototyping to get rapid feedback

As we have discussed earlier in the chapter, prototyping is invaluable to providing reliable and accurate feedback to designers. Best way to demonstrate ideas is with interactive representations of them.

We often see low fidelity prototypes being used to continuously demonstrate ideas to stakeholders. Since low fidelity prototypes are cheap and incredibly fast to build therefore designers can get rapid feedback from stakeholders.

4.2.2.1 Guiding Principles of Conceptual Design

4 Iterate, iterate and iterate

Even for experienced designers it is almost impossible for the first design/idea/model to be the best one. It is essential to keep gathering feedback and improving the design/model.

Conceptual model continuously evolves, with each iteration feedback is gathered and the conceptual model is improved, till a satisfactory conceptual model is reached.

4.2.2.2 Developing the Conceptual Model

Introduction

- In the section we discuss the approach to developing the conceptual model.
- The needs and requirements gathered forms the basis from which the conceptual model is made.
- A deep dive into the data gathered guides the development of the conceptual model. From the data designers also extract the user experience goals.
- During development it is essential to keep the users' perspective and the user experience goals in mind.
- Developers have to consider the following questions while developing the conceptual model.
    - Which metaphors would help users to understand the product?
    - Which interaction type/types would best assist the activities performed by users?
    - Do using different interface types provide alternative design insights? Now we will look at each of these factors.

4.2.2.2.1 Interface metaphors

Introduction

- Using a good metaphor makes it easy to understand and pick up the software's functionality.

- Metaphors is this use of real-world scenarios that people are familiar with to represent and make easier the understanding of new interface concepts and designs.

- For example, when word processors were initially released, they used the typewriter metaphor. They designed the keyboard of a computer to be very similar to a typewriter. Thus it was a powerful and intuitive metaphor. Experienced typewriter typists were able to predict the behaviour keyboard due to this metaphor.

- A good metaphor is invaluable in increasing the initial familiarity of the user with the product. It even may be very enjoyable and memorable at the start. Ahead in this chapter we discuss metaphors in greater detail.

4.2.2.2.2 Interaction types

Introduction

- Oxford Dictionary defines interaction as “an occasion when two or more people or things communicate with or react to each other”. We are concerned with the interaction of the proposed system/product and the user.

- Interaction types are different ways in which the product and the user react to each other. The interaction of users with the system heavily influences the overall user experience.

- Choosing the right interaction type or combination of interaction types is essential to ensure functionality and usability of the product. The type or combination of types to be used is dependent on the scenario, functionality and the intended target audience. There is no one right type or combination of types which is correct for all scenarios. A combination of multiple interaction types can be seen in most conceptual models.

- Interaction can broadly be categorised into 4 types:
    - Instructing
    - Conversing
    - Manipulating
    - Exploring

4.2.2.2.2 Interaction types

1 Instructing

As the name suggests this interaction involves the user giving the system command(s). 'Instruction' is issued to the system by the user. The 'instruction' can be issued in a number of ways. Clicking on a menu option, typing commands, using function keys, etc are all examples of this type of interaction. ‘Instructing’ is always a one way conversation between user and system.

Examples include, instructing windows to start the task manager by pressing control alt delete, hitting control + s to save a file, clicking on a contact to initiate a call on the phone.

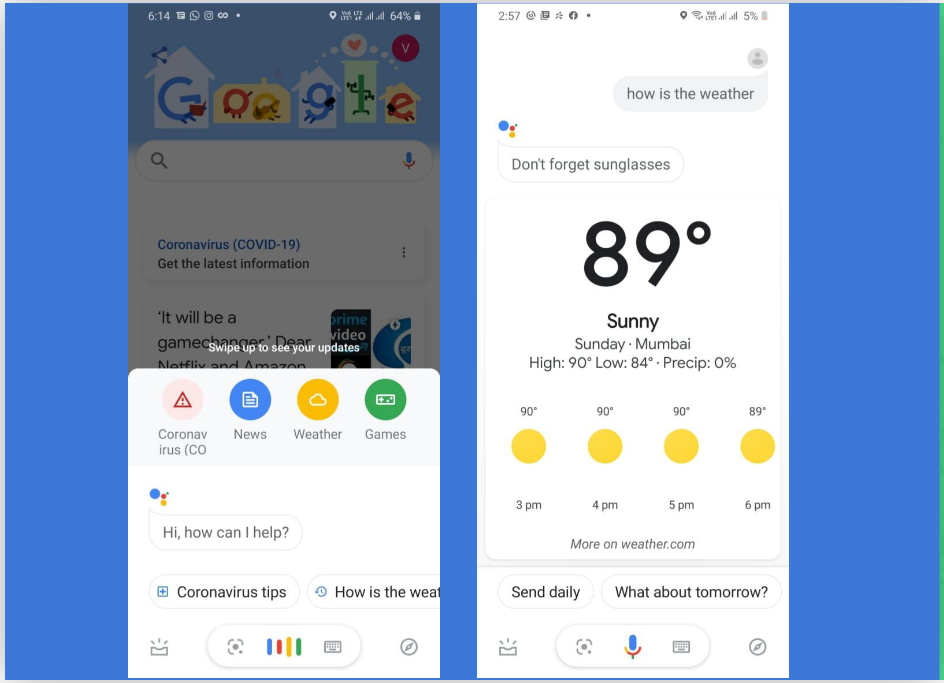
4.2.2.2.2 Interaction types

2 Conversing

- This interaction involves a two-way conversation between user and system. The system tries to mimic real life conversations.
- The system acts more like a human providing a reply. The user asks something and the system provides a reply.
- Nowadays using speech to text and text to speech softwares, systems can mimic an actual conversation. Users may physically voice questions and the systems can physically voice replies. Google assistant, Siri, Alexa are examples of such systems.
- Note an example of asking Google assistant to "switch off the Wi-Fi", becomes a combination of conversing and instructing. Since we are asking (instructing) Google assistant to perform a certain task and once it performs the task it provides a reply (conversing).
- The drawback is often such interactions can become cumbersome and inconvenient. One such example of this is the automated voice heard while calling most banks’ customer support. An automated voice provides many options and the user has to choose.

4.2.2.2.2 Interaction types

2 Conversing

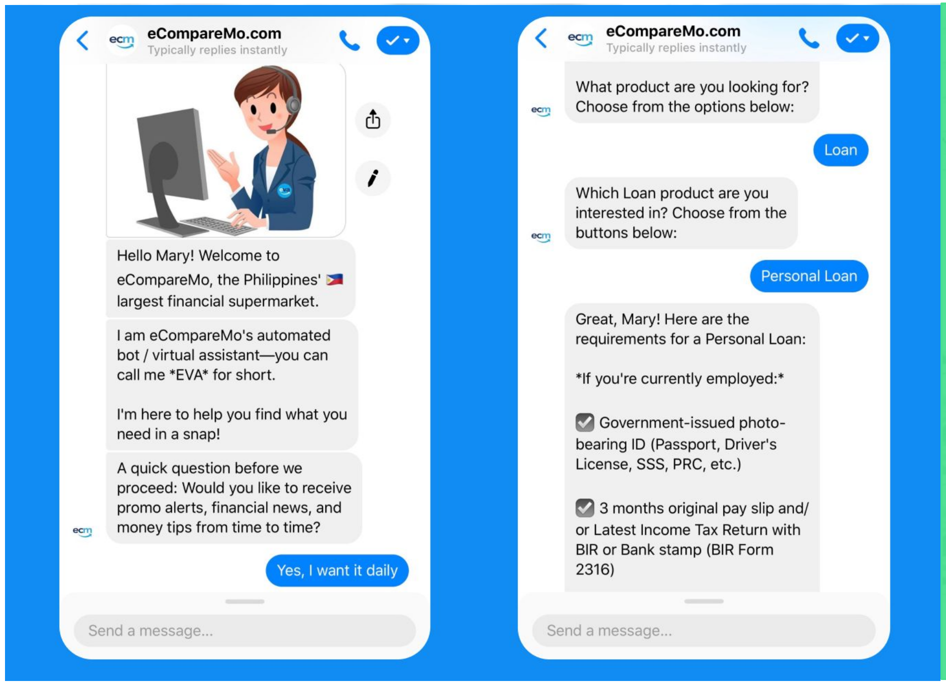


Simplest example of this is when you google something, you are asking a question to Google and the search results is Google's reply.

Another example is asking Google assistant, Siri or Alexa what is the time? What is the capital of Rajasthan? How's the weather?

4.2.2.2.2 Interaction types

2 Conversing



Converging is not only limited to voice assistants. Nowadays complicated natural language processing (NLP) systems also can be seen frequently.

Many banking, ticket booking, e-commerce websites will often have an automated chatbot. Where you can ask the chatbot questions and based on keywords in your question it will provide a response.

4.2.2.2.2 Interaction types

3 Manipulating

- Manipulate is defined by the Oxford dictionary as “to control something using the hands”. This is the essence of this type of interaction. This interaction involves the ‘manipulation’ of virtual or physical objects.

- Virtual objects are manipulated in a similar way to in the physical world. This type of interaction can be quite intuitive because the user automatically relates to his/her physical world experience. It can also involve use of physical controllers and sensors. An example is using a controller to control the movements on a screen avatar on the gaming console Wii.

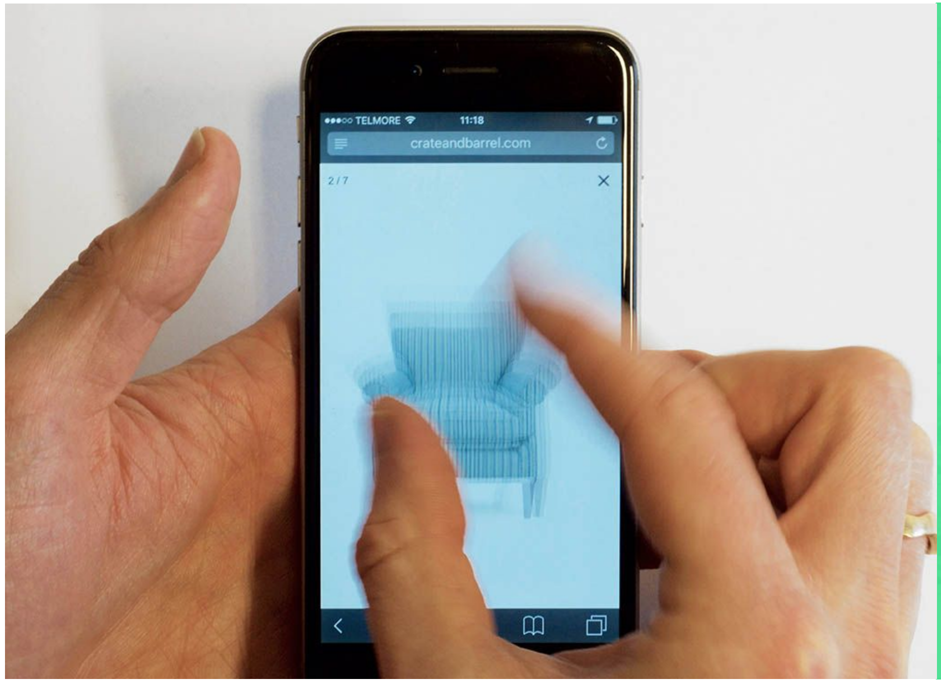
- Metaphors are often heavily incorporated in this type of interaction, thus making understanding and learning extremely intuitive. Metaphors are explored in greater detail later in this chapter.

- Selecting, dragging, opening, closing, zooming in and out using touch gestures on a smartphone are all examples of this type of interaction.

- Advantage is that the basic functionality is learnt very quickly. Error messages are rarely needed.

4.2.2.2.2 Interaction types

3 Manipulating



Examples include dragging and dropping a file in windows, zooming in and out on a phone, selecting some text in word using the mouse.

Users get immediate feedback on their actions. Example on a smartphone using the gesture, a user is trying to enlarge a photo. If this does not work the user immediately comes to know because there will be no movement on the screen. Additionally, an error message is not needed, the user has realised the gesture has not worked.

4.2.2.2.2 Interaction types

4 Exploring

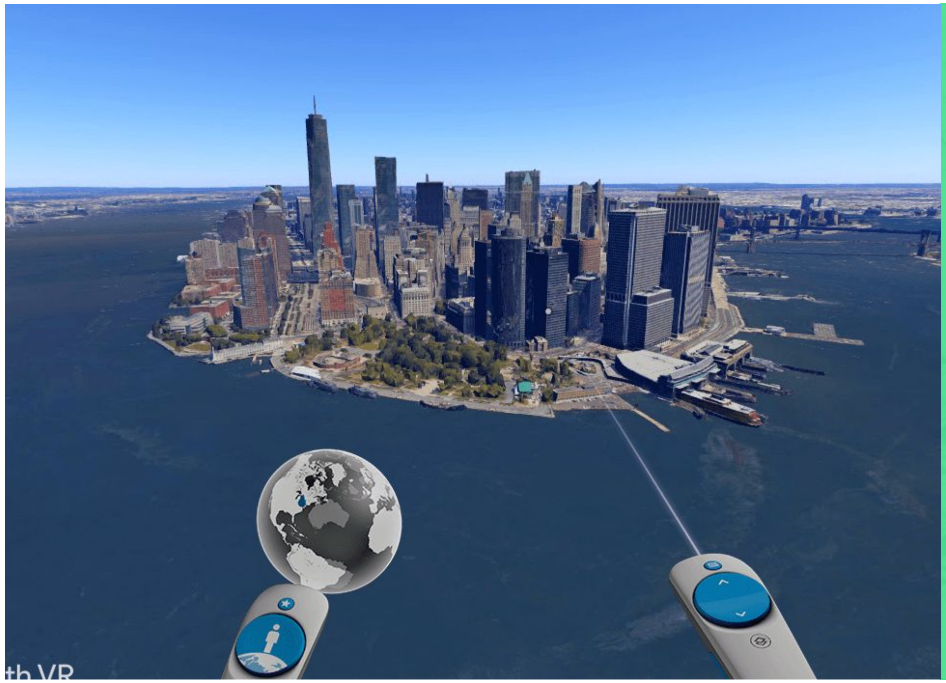
As the name suggests this interaction involves the travel through (exploration) of a virtual or physical environment.

VR is an example of a virtual environment. Physical space with sensors embedded, like smart homes, are examples of physical environments.

Most common occurrence of this type of interaction can be seen in 3D games like Minecraft and Pubg. They involve exploring a 3D virtual environment. Other interactions also occur throughout the game, but a substantial part of the game is the exploration of a virtual environment.

4.2.2.2.2 Interaction types

4 Exploring



In the last few years there has been a substantial increase in the use of virtual reality (VR) and augmented reality (AR).

Example is Google daydream that allows users to explore some cities through VR as shown in figure.

4.2.2.2.3 Interface types

Introduction

- Conceptual design also includes deciding the medium through which the above discussed interaction occurs.
- Interface is the medium through which the interaction occurs between user and system.
- There are many different types of interfaces like command-based, virtual reality, web, mobile, speech, pen, touch, air-based gesture, shareable, tangible, augmented and mixed reality. We have already discussed them in detail in chapter 2.
- Different products and different scenarios require different interfaces. Additionally, a product is not limited to a single interface.
- In a conceptual model it is important not to only consider a single interface type. Different interface types encourage and support different perspectives of the system/product. Considering multiple different interfaces prompts the consideration of alternatives.

4.2.2.3 Expanding the Conceptual Model

Introduction

In this section the conceptual model ideas that were produced in the previous section are looked at in greater detail and expanded on.

It is important to scrutinize each idea in much greater detail before they are prototyped and tested.

Designers accomplish this by ask the following 3 questions:

- What functions will the product perform?
- How are the functions related to each other?
- What information is needed?

4.2.2.3 Expanding the Conceptual Model

1 What functions will the product perform?

Establishing functions/tasks supported by the system is a fundamental part of conceptual design. Furthermore, it is important to understand and establish which tasks are to be performed by the system and which tasks are to be performed by the user.

For example in a travel agency website, the task of providing holiday recommendations is the responsibility of the product but the final selection of holiday for booking is the responsibility of the user.

4.2.2.3 Expanding the Conceptual Model

2 How are the functions related to each other?

Functions/tasks could be related and connected to each other. It is important to understand and establish any such relations/connections. This is essential since often one task can affect another. Also the relation between tasks may put constraints on the execution.

For example in a travel agency website, the task of making the hotel reservations can only be done once the user has selected and booked a vacation.

4.2.2.3 Expanding the Conceptual Model

3 What information is needed?

Often some data/information is required to perform a certain task. It is essential to design the conceptual model in a way that provides/retrieves the data when needed. It is also essential to establish what information is being passed between the user and system. How the information is presented. Additionally, structure of data can cause issues and has to be kept in mind.

For example in a travel agency website, international travel's hotel reservations may require the passport details of the traveller. Thus the hotel reservation task is dependent on having the passport details data.

4.3

Interface Metaphors and Analogies

4.3.1 What are Interface Metaphors and Analogies

Introduction

- Metaphors or analogies is this use of real-world scenarios that people are familiar with to represent and make easier the understanding of new interface concepts and designs.
- It has been seen throughout the history of computing that metaphors, or analogies, have been very successful in introducing beginners to new interaction techniques.
- It is dependent on the real-world connection users make between the interface’s visual clue and its function. We see a lot of these examples on a daily basis throughout computer and software interfaces.
- Example is seen very often on e-commerce sites like Amazon, Flipkart, Walmart etc. Most of these ecommerce sites use ‘add to shopping cart/trolley/basket’ followed by ‘checkout’. Isn’t this a good metaphor and doesn’t it have similarities to the purchase process in physical stores. Doesn’t this make a purchase intuitive for first-time users?
- However, metaphors also have some drawbacks.

4.3.2 Drawbacks of Interface Metaphors

1 Navigation Overhead After Familiarity

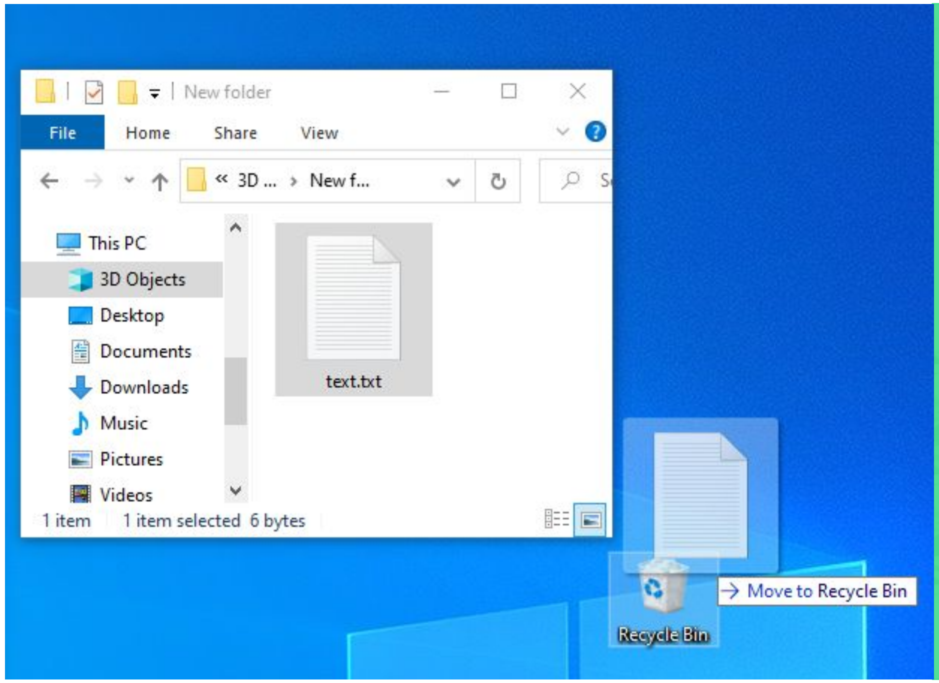
Relying on a metaphor makes it easy to understand and pick up the software's functionality. It even may be very enjoyable and memorable at the start. No one really denies the value of a good metaphor for increasing the initial familiarity of the user with the product. But once the functionality is understood, the metaphor can add a significant navigation overhead.

It is often said, "The danger of a metaphor is usually realized after the initial honeymoon period".

For example, windows recycle bin is a very powerful metaphor.

4.3.2 Drawbacks of Interface Metaphors

1 Navigation Overhead After Familiarity



Even for a beginner, it is very easy to understand and learn how to delete files using the recycle bin. But consider if the only way to delete a file was to drag and drop it to the recycle bin. Meaning other applications may have to be minimized, file explorer may have to be repositioned and then the file has to manually dragged and dropped. Isn't this inefficient? Once the user is familiar and no longer a beginner, wouldn't it be much faster to hit the delete button on the keyboard or right-clicking and selecting delete?

4.3.2 Drawbacks of Interface Metaphors

2 Cultural Bias

In modern times software has a global reach and is not limited to either one country or one culture. At the core, metaphors rely on the users' understanding of the imagery. Additionally, users should make the connection in their mind in the same way as the designer intended. However, users are from many different cultures often with different religions, languages, norms, etc. Therefore, different cultures can often have a different interpretation of the metaphor.

It often happens that the imagery and metaphor will be perfectly understood by a country or a community but will make no sense to another.

To those users who have not understood the metaphor, it will only add to the confusion. It is very hard to find a metaphor which has global recognition. Thus, unfortunately, metaphors are extremely vulnerable to cultural bias.

4.3.2 Drawbacks of Interface Metaphors

2 Cultural Bias

For example, the windows recycle bin metaphor is appropriate in countries like the U.S. and Canada where trash is collected in bins with the recycle symbol on it and/or the phrase commonly used is “Recycle bin”.

However, many countries do not collect waste in such bins and do not use the phrase ‘Recycle Bin’. To such users the phrase ‘recycle bin’ will be meaningless.

4.3.2 Drawbacks of Interface Metaphors

2 Cultural Bias

Furthermore, such users may get confused by the recycling symbol on the recycle bin icon. The functionality of windows recycle bin is the deletion of files. But such users may think - "Are the files going to be recycled?"

This metaphor works well for certain countries but not for others.

4.3.2 Drawbacks of Interface Metaphors

3 Understanding/Intuition is Subjective

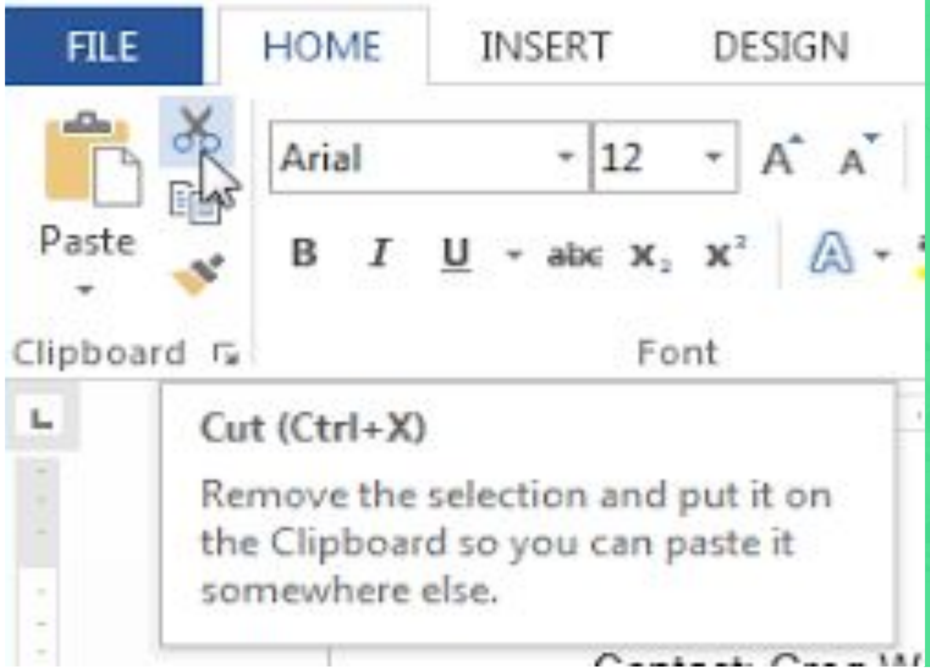
A metaphor in the context of interaction design means a visual metaphor that signals some functionality. It is then presumed that the user understands the metaphor in the same way as the designer intended and then successfully intuits the functionality.

However, intuition is a very subjective process, the way people make connections is unique to them and heavily influenced by their own past experiences. Users are from many different cultures, religions, languages, socio-economic backgrounds and have different past experiences. Therefore, everyone's interpretation of the metaphor is likely to be different.

Thus even within the same cultural group users may infer metaphors in different ways and significant misunderstandings can occur.

4.3.2 Drawbacks of Interface Metaphors

3 Understanding/Intuition is Subjective



For those users who have misinterpreted or have not understood, a meaningless metaphor will only add to the confusion.

For example, some users may assume the scissors icon when applied on a photo in Microsoft Word is for cropping a photo and not for the 'Cut' operation.

4.3.2 Drawbacks of Interface Metaphors

4 Limits Understanding of Full Functionality

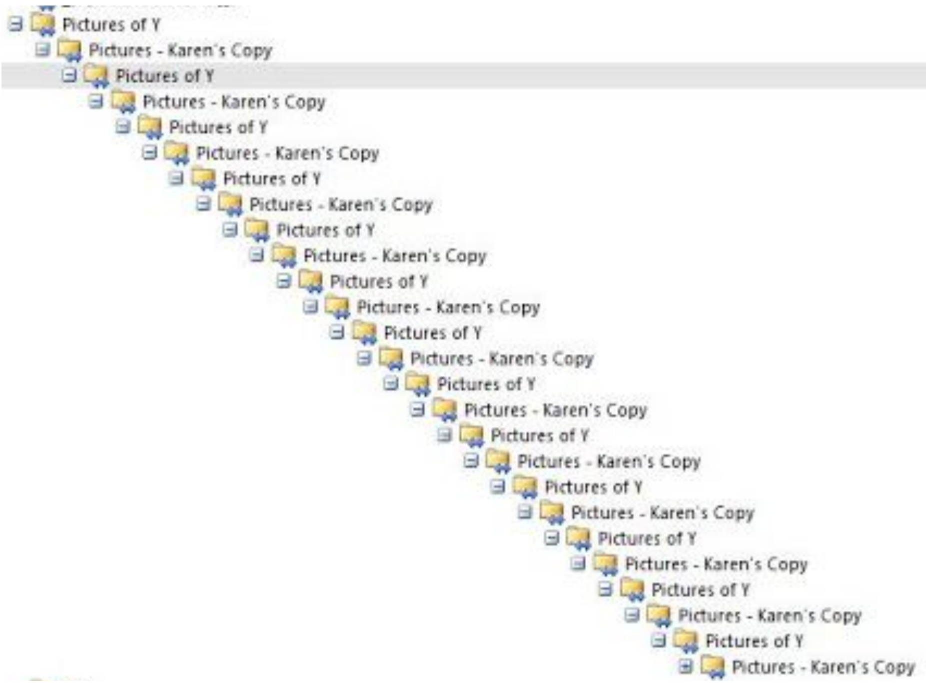
Often metaphors limit the full understanding of the functionality of the system. This issue is seen time and again.

Often metaphors are very good in providing preliminary understanding. However, they can become an obstacle in the full understanding of the functionality.

For example, the Windows file system uses the filing cabinet metaphor. This metaphor for organising documents in windows is quite easy to understand. However, there are many inherent limitations to real-world filing cabinets which are not applicable to windows file systems.

4.3.2 Drawbacks of Interface Metaphors

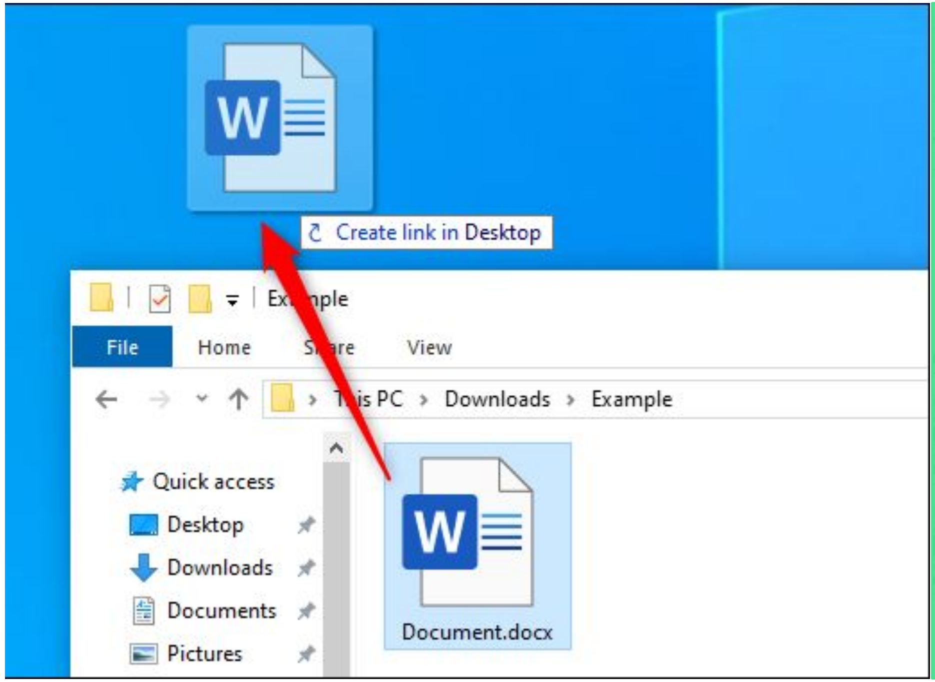
4 Limits Understanding of Full Functionality



For example, in the real world, you cannot have 50 folders nested inside one another. You cannot have the same file in multiple places in a filing cabinet.

4.3.2 Drawbacks of Interface Metaphors

4 Limits Understanding of Full Functionality



You cannot have a shortcut to another location of the filing cabinet.

The filing cabinet metaphor is very useful for a preliminary understanding, but the analogy falls short in giving a full understanding of how the windows file system works. In fact, since the user was continuously trying to relate to their experience of a filing cabinet, the metaphor becomes an obstacle in the user's full understanding of the Windows file system.

4.3.2 Drawbacks of Interface Metaphors

5 Physical World Limitation

It is easy to find metaphors in the physical world for objects like a printer. But it can be difficult to find metaphors for processes, services and relations.

For example, it can be difficult to find physical world metaphors for changing a video’s resolution, changing photos border and shading, word count, performing statistical operations. Yet such operations are the most frequently used.

Additionally, metaphors don’t scale well. In today’s day and age, software is continuously changing and evolving. Thus, a metaphor that worked nicely for a process can fail once the process grows in complexity.

Summary

- ➢ The interaction design process tries to ensure the usability of a product and a good user experience.
- ➢ There are 4 stages of the interaction design process:
  - ○ Establishing Requirements: It is the formation of the requirements. Requirements are the needs of the users and stakeholders that have to be fulfilled by the product.
  - ○ Designing Alternatives: It is the development of interfaces or systems that do a better job of meeting the needs of users and stakeholders
  - ○ Prototyping: It is the creation of prototypes. Real-life user interactions, made possible through prototypes, play an invaluable role in testing the suitability and validity of a design.
  - ○ Evaluation: Evaluation is a set of techniques used to determine whether the needs of the user and stakeholders are being met. Scope for improvement is also identified.
- ➢ Prototypes play an essential role in the demonstration and evaluation of designs/ideas.

Summary

- The type and complexity of a prototype created is dependent on the purpose it is meant to serve. The type is also influenced by the stage of development.
- Types of prototyping
  - Low-fidelity prototyping: A low fidelity prototype often does not closely resemble the final product in either look or functionality. Benefit is that they encourage exploration of different designs and ideas since they fast to design, flexible and inexpensive.
  - High-fidelity prototyping: A high-fidelity prototype more closely resembles the final product. Interactions more closely resemble that of the final product. Usually high-fidelity prototypes are used for detailed testing and/or for marketing.
- Guiding principles of conceptual design
  - Keep an open mind but never forget the users and their context
  - Discuss ideas with other stakeholders as much as possible

Summary

- ○ Use prototyping to get rapid feedback
- ○ Iterate, iterate and iterate

➢ Developers consider the following questions while developing the conceptual model. Which metaphors would help users to understand the product? Which interaction type/types would best assist the activities performed by users? Do using different interface types provide alternative design insights?

➢ Types of interactions

- ○ Instructing: This interaction involves the user giving the system command(s).
- ○ Conversing: This interaction involves a two-way conversation between user and system. The system tries to mimic real life conversations.
- ○ Manipulating: This interaction involves the 'manipulation' of virtual or physical objects.
- ○ Exploring: This interaction involves the travel through (exploration) of a virtual or physical environment.

Summary

- A combination of multiple interaction types can be seen in most conceptual models. The type of interaction used heavily influences the overall user experience. The type or combination of types to be used is dependent on the scenario, functionality and the intended target audience.
- Interface is the medium through which the interaction occurs between user and system. Different interface types encourage and support different perspectives of the system/product. Thus in a conceptual model it is important not to only consider a single interface type.
- It is important to scrutinize conceptual model ideas in much greater detail before they are prototyped and tested. Following 3 questions are considered.
  - What functions will the product perform?
  - How are the functions related to each other?
  - What information is needed?

Summary

- Metaphors or analogies is the use of real-world scenarios that people are familiar with to represent and make easier the understanding of new interface concepts and designs.
- Drawbacks of Metaphor
  - Once the functionality is understood, the metaphor can add a significant navigation overhead.
  - Different cultures can often have a different interpretation of the metaphor. It often happens that the imagery and metaphor will be perfectly understood by a country or a community but will make no sense to another.
  - Users may infer metaphors in different ways and significant misunderstandings can occur.
  - They can become an obstacle in the full understanding of the functionality.
  - Difficult to find physical world metaphors for processes, services and relations.

Review Questions

1. Identify and explain the process of Interaction Design. (Section 4.1)
2. Illustrate the importance of prototype, why it is important? (Section 4.2.1.1)
3. Compare low fidelity prototyping and high fidelity prototyping? (Section 4.2.1.2)
4. List key guiding principles of conceptual design. (Section 4.2.2.1)
5. Explain interaction styles and identify which style is best for Travel Planner application. (Section 4.2.2.2.2)
6. What are the drawbacks of using metaphors? (Section 4.3.2)

Multiple Choice Questions

- Which of the following statements is true?
  a. In the first step of the interaction design process, only the users' needs are established
  b. The interaction design process is looped over only once
  c. Experienced designers can create the best and final design in the first try
  d. Evaluation is a set of techniques used to determine whether the needs of the user and stakeholders are being met

- In which stage of the interaction design process is the ideas/products demonstrated to users?
  a. Establishing Requirements
  b. Designing Alternatives
  c. Prototyping
  d. Evaluation

- In which stage of the interaction design process does the brainstorming of ideas take place?
  a. Establishing Requirements
  b. Designing Alternatives
  c. Prototyping
  d. Evaluation

Multiple Choice Questions

- Development of interfaces or systems that do a better job of meeting the needs of users and stakeholders is part of which stage of the interaction design process?
  a. Establishing Requirements
  b. Designing Alternatives
  c. Prototyping
  d. Evaluation

- Which of the following is true about the evaluation phase of the interaction design process?
  a. Scope for improvement is determined
  b. Whether the needs of the user and stakeholders are being met is determined
  c. New requirements may surface
  d. All of the above

- Which of the following statements is not true?
  a. In Wizard of Oz prototyping, a human operator simulates the software product's response
  b. The cost is the only factor when deciding which type of prototype to use
  c. Low fidelity prototype often does not closely resemble the final product in either look or functionality
  d. It is now more common to see accurate, to-scale 3D printed prototypes of designs/ideas

Multiple Choice Questions

- ➢ Which of the following is not an example of low fidelity prototype?
  - a. 3D printed to scale models
  - b. Storyboarding
  - c. Wireframes
  - d. Wizard of Oz

- ➢ High fidelity prototypes …
  - a. Do not closely resemble the final product in look
  - b. Do not closely resemble the final product in functionality
  - c. Used often for marketing
  - d. Used often for simple idea demonstrations

- ➢ Which is not one of the main approaches to prototyping?
  - a. Throw-away
  - b. Incremental
  - c. Elementary
  - d. Evolutionary

Multiple Choice Questions

- Which of the following is not a guiding principle of conceptual design
  a. Keep an open mind but never forget the users and their context
  b. Discuss ideas with other stakeholders as much as possible
  c. Use prototyping to get rapid feedback
  d. Innovate, innovate and innovate

- Which type of interaction is asking Google assistant what time is it?
  a. Instructing
  b. Conversing
  c. Manipulating
  d. Exploring

- Which of the following statements is true about interfaces?
  a. Interface is the medium through which the interaction occurs between user and system
  b. Considering different interface types encourage and support different perspectives of the system/product
  c. Some examples of types of interfaces include virtual reality, web, mobile, speech, shareable and tangible
  d. All of the above

Multiple Choice Questions

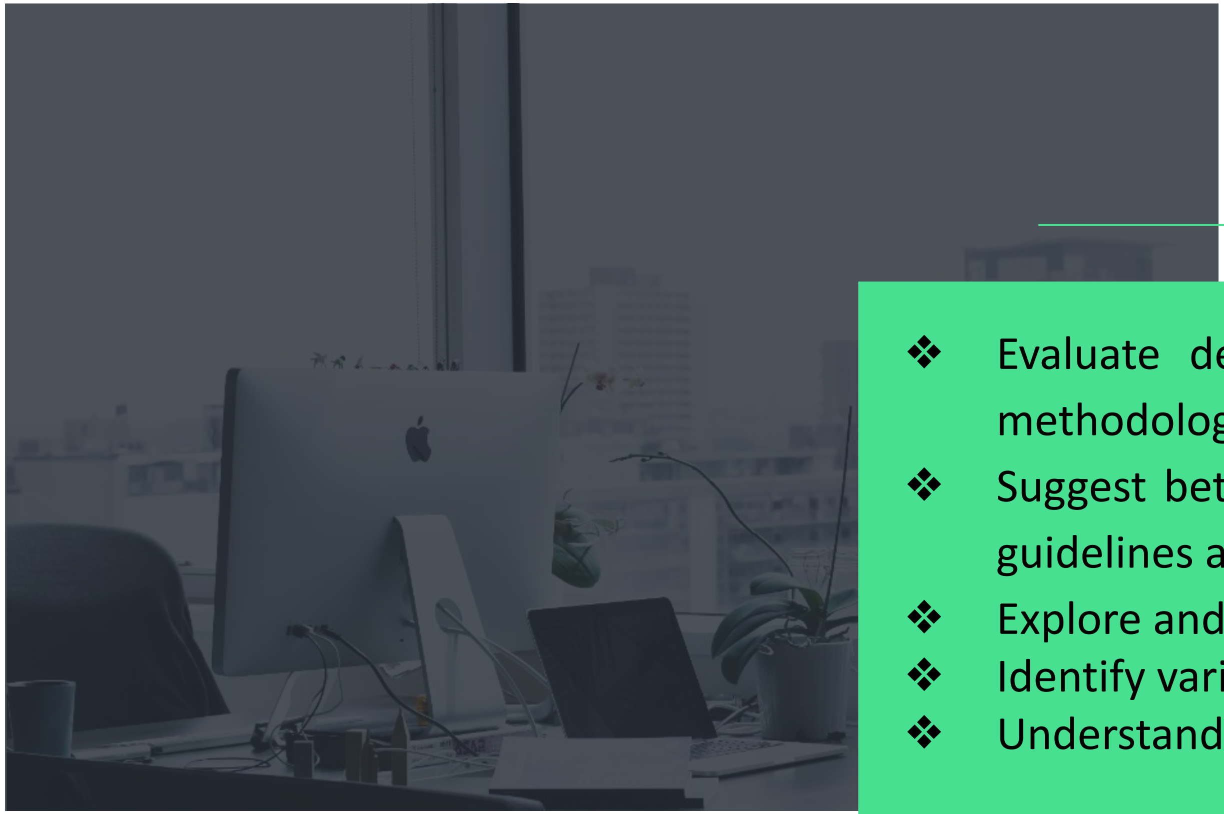
- Which of the following is not a question considered by the designers while expanding the conceptual design?
  a. What functions will the product perform?
  b. How are the functions related to each other?
  c. How difficult is it to implement the functions?
  d. What information is needed?

- Which statement is not true about interface metaphors?
  a. Metaphors or analogies is this use of real-world scenarios that people are familiar with to represent new interface concepts and designs
  b. Throughout the history of computing metaphors, or analogies, have been very successful in introducing beginners to new interaction concepts and techniques
  c. Different cultures will always have the same interpretation of the metaphor
  d. Users may infer metaphors in different ways and significant misunderstandings can occur

- Which of the following is not a drawback of metaphors?
  a. Limits understanding of full functionality
  b. Navigation overhead after familiarity
  c. Cultural bias
  d. Is very expensive to implement

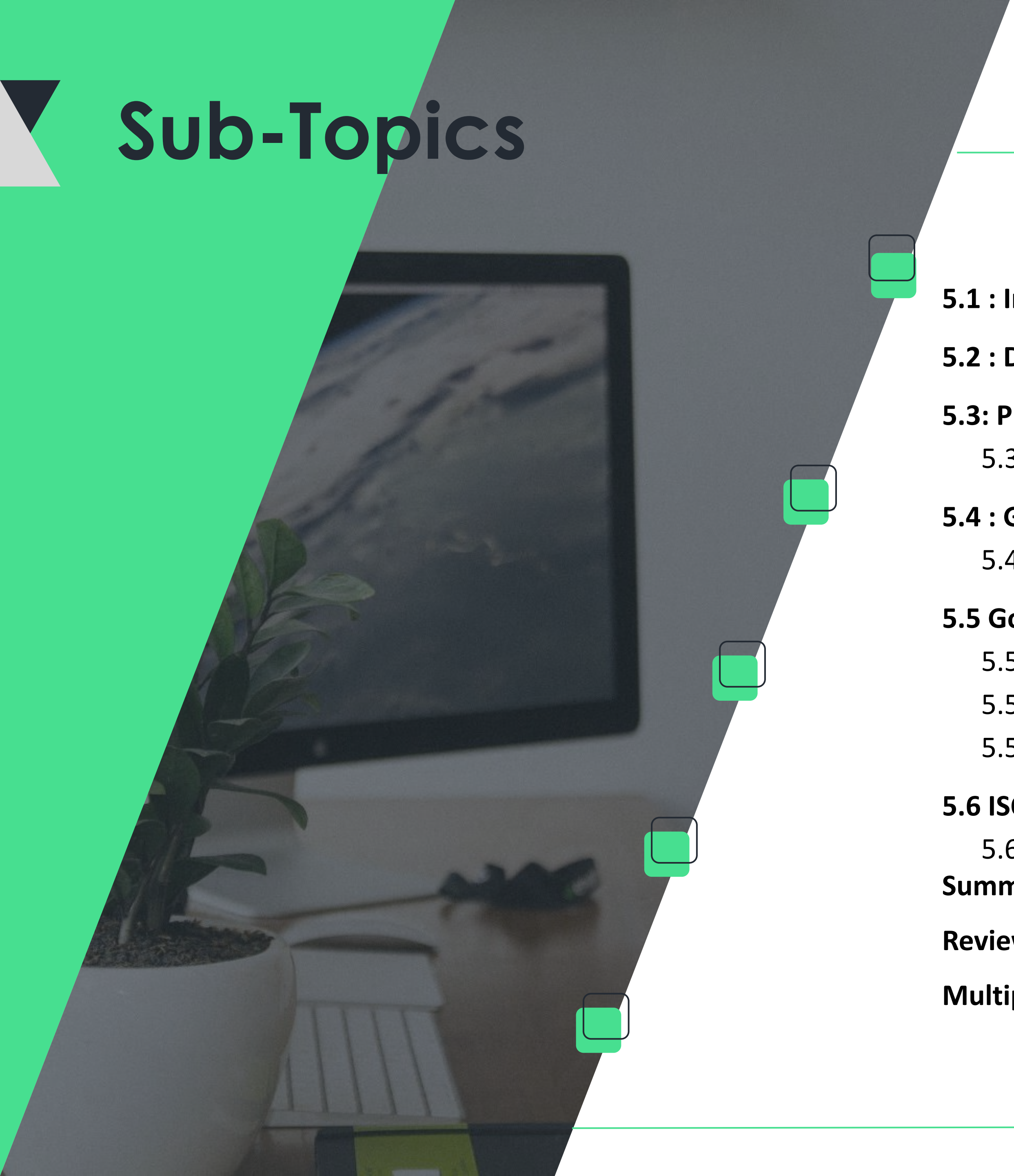
Module 5

Learning Objectives



After reading this chapter, you will be able to:

- ❖ Evaluate design based on theoretical frameworks and methodological approaches.
- ❖ Suggest better techniques for user interface design using guidelines and principles.
- ❖ Explore and study about various standards.
- ❖ Identify various heuristics to build a better design.
- ❖ Understand Design well known Guidelines and Rules.



Sub-Topics

5.1 : Introduction

5.2 : Design Principles

5.3: Principles to support usability

5.3.1 Learnability 5.3.2 Flexibility 5.3.3 Robustness

5.4 : Guidelines and Standards

5.4.1 : Guidelines to design User Interface

5.5 Golden Rules And Heuristics

5.5.1 : 8 Golden Rules of Shneiderman

5.5.2 : 7 Principles of Norman

5.5.3 : 10 Heuristics of Nielsen

5.6 ISO/IEC Standards

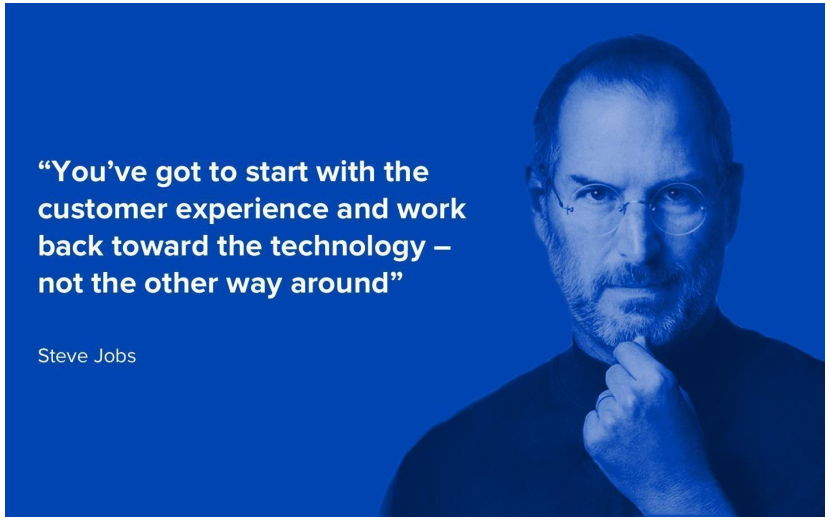
5.6.1 About ISO/IEC: 5.6.2 Standards in ISO/IEC:

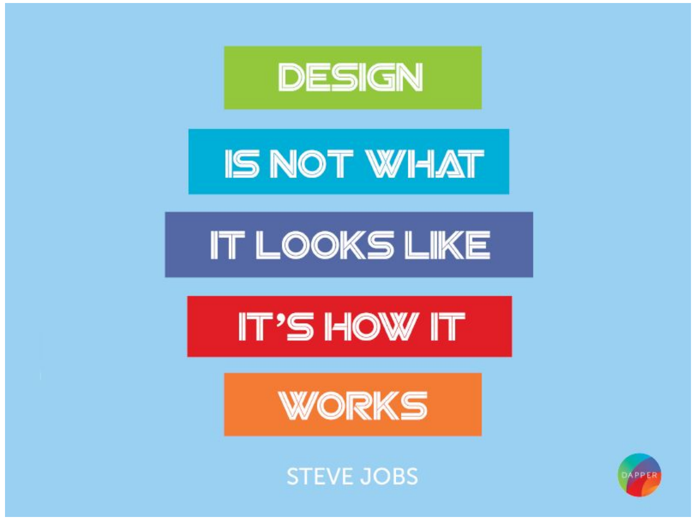
Summary

Review Questions

Multiple Choice Questions

5.1 : Introduction





Interaction design can be defined as " the art of formulating digital matter for the end user." When a designer sits down to make a user interface design they need some standards/ rules to help them get started. This is how the umbrella term of design principles gets its value. These principles are like a helping hand for the designer for making visually pleasing screens for the end user. These principles are aimed at helping the designer to put their thoughts into a contact ratio screen size. It is just like the sketch pen outlining we all have done some day before colouring any figure. The origin of these principles is an amalgamation of prior designing knowledge and theoretical notes. To make complicated user interfaces and system designs it is mandatory to keep a check on the guidelines provided in the form of these principles. These principles can be virtually used anywhere right from a cell phone screen design to a computer, or any electronic device that has a screen which has the ability to interact with the user. If a designer does not want to use interaction design principles it is like saying someone has a cheat sheet on how to lose weight and still they do not want to make use of it.

5.2 : Design Principles

- Design principles help a designer to understand the nature and framework of any user interface.
- Design principles are the linking force that bind the user with the task they need to perform.
- For the designer it is always a matter of setting up trust through his designs.
- Understanding user interface design is not very difficult if one follows design standards and follows design principles. To talk about design principles there can be numerous principles.

But if we scale all the principles down to the most broad ones, these are the ten most recurrently used design principles:

- ➢ The user interface should be at par with the end user's prospects
- ➢ Consistency in the whole design
- ➢ Functionality: Keep a note of working minimalism
- ➢ Cognition:The design and app should be easy to work on
- ➢ Engagement: The user engagement is utmost priority
- ➢ User control: End user is the boss and deserves all sorts of freedom
- ➢ Perceivability: Give the user a broad scope of available interaction chances
- ➢ Learnability: Ease of understanding and learning
- ➢ Error handling: Functional faults minimization and finding remedies should be quick
- ➢ Affordance : Provide user with what they need

The 10 pivotal principles for designing

1. **<u>Meet end user prospects</u>**

When a designer takes up a task to make a design for any client the most challenging task for him is always to start from scratch. Without any design schemas it can be very tedious to start off randomly. This is where communicating with the client is most important. It becomes easier for the designer to make a design as per the client’s needs and fancies. By using this method to communicate and hear from the client as to what they are expecting from the design makes the job of the designer very easy. After getting a rough idea on what exactly the client wants some framework or schema designing can be much less of a headache.

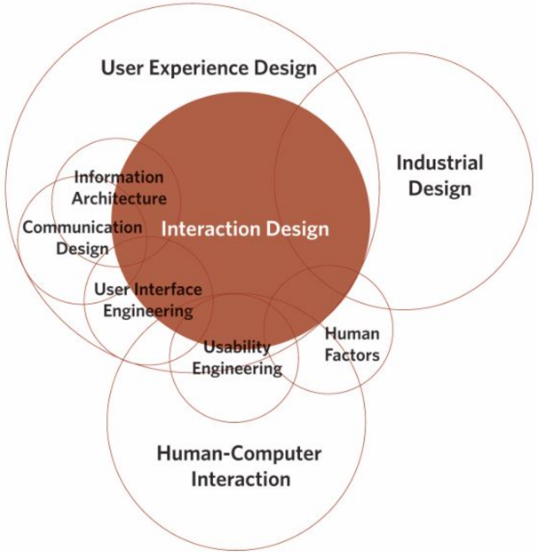
2. **<u>Maintain consistency in the whole design</u>**

The end user would be caught off guard if there are any design changes encountered. If the designer does any changes in the schema it will be highlighted as humans catch change at a very fast rate. If the design and layout are not changed much it does not grab much attention of the user. In the same scenario if the schema was modified it would get highlighted and become very dominant for the human eyes. Just like simplicity is the key to a good design consistency is the keyhole to a good design. Simple and same design throughout the whole interface would mean better understanding for the user.

LACK OF CONSISTENCY CAN BRING ON A LACK OF INTEREST.

3. Working Minimalism

While the designer is designing a schema or frame it should be kept in mind to keep the design simple and crisp. Unnecessary details and fields should be not used. For the user each and every important detail should be easy to work with and only a necessity for functioning. The user is just like a small child. The more options one gives a child to eat for lunch, the more the child will get confused as to what he should eat. Same is the case with the end user, the more design options the designer gives the more confused it leaves the user. For big modules they can be split into smaller frames and function separately.

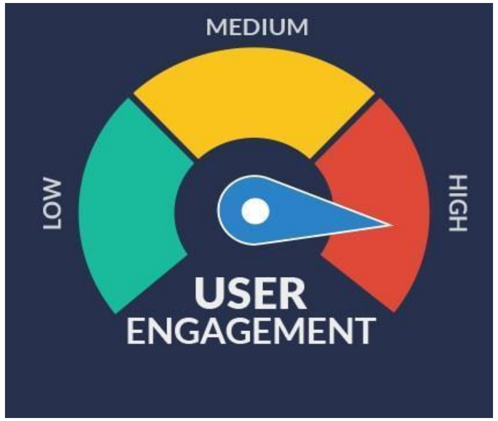


4. Minimize the thinking

When there is a designer who does have good experience and knowledge of designing then why should the user do the thinking ? A great design would be where the user does not have to utter a word and his query would be dealt with. A successful design would not allow the user to think much and get his intended work to be accomplished. The recipe to a good design would be using the features a system excels at and covering the ones where the system can not perform easily. Just like for a computer its powers lie in its calculation speed, its memory space, organizing stuff, catching human mistakes like misspells and making comparisons. Such tasks where these need to be performed the system should be used and the end user should not be bothered.

5. User Engagement is utmost priority

Engagement means at what scale is the user being able to interact and communicate with the system. User engagement is completely relative to the designed system. Each system has a target audience and the design of the system is called successful if this audience is able to communicate with the system without much difficulties. The interest of each user can be very diverse like for a cyclist. Cycling may be his passion but the same may be irrelevant for an old person whose legs do not function efficiently.

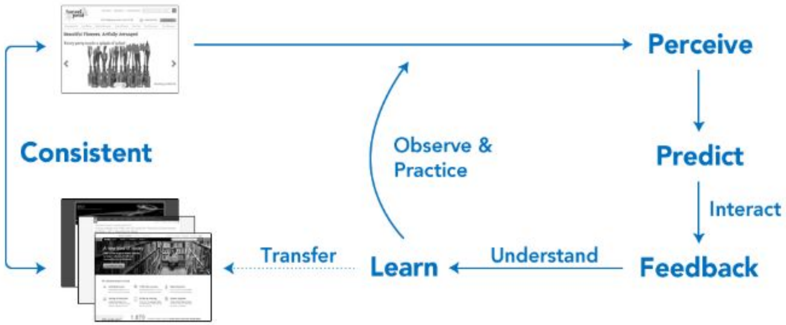


6. Freedom for the end user

The level of trust a child shows towards his parents is the level of trust the designer should have on the user. The end user is the ultimate boss and should feel like one. The end user should feel powerful, trusted and the possessor of a masterkey of the whole system. The design should be such that the user should be given full authority and freedom to explore the system. The freedom is like a chain of positivity for the end user. Freedom given can be related with feeling trusted and that makes the user more confident. A confident user will explore the system and that is exactly why this design principle is a necessity.

7. Provide interaction chances

The end user should not struggle to make an interaction with the interface or should not feel like they are not given chances to communicate with the system when needed. This design principle can be termed as perceivability. Just by looking at a design even a person with barely any design knowledge should be able to identify the places where he can communicate with the system. The use of design concepts like icon, button and bars should be made use of in the whole design. The user should be provided with enough hints that this icn can be clicked or the background colour can be scaled.

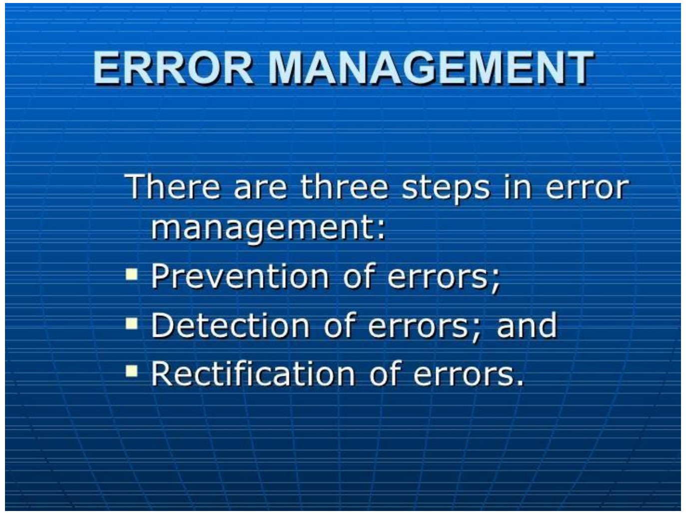


8. Ease of learning

To understand this principle we will need to answer a question. When was the last time you had to google how to use any social media application ? You did not have to google because these applications have a very simple user interface and it is very simple to understand what each button does or how a post is to be uploaded. This is the ease of understanding and the learning curve should be very smooth for the user. The whole design should be of the same designing concept. It should not be Manali in one page and Rajasthan in another. The user should feel like they have done a great task by understanding how to use the system without any external help.

9. Error reduction and mitigation

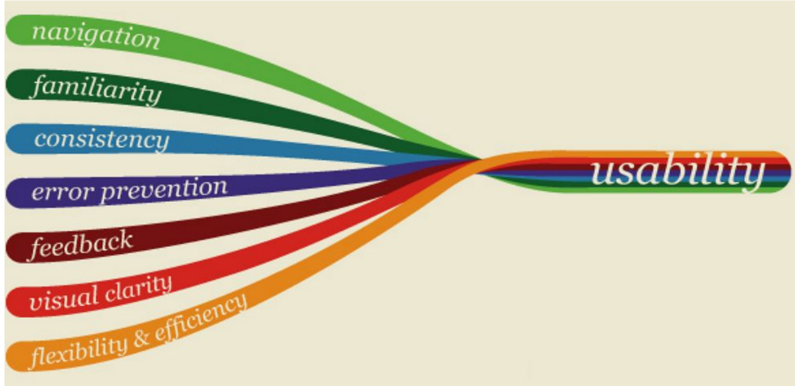
Errors are humanly made mistakes made by the end user while attempting to carry out some functionality. The most common solution to minimize the errors is very obvious, it is to find all the possible steps where an end user could possibly make a mistake and try and figure out how it can be avoided. This can be done for the easy ones where the user could face some difficulty and gets a readymade solution to get out of the error. For complex errors we can use error reduction and prevention techniques like giving only designed elements to the user which they can understand and which are at most needed for the functionality.



10. Affordance

The functionality of an object is its affordance. Just like by looking at a switch we just know that it has to be clicked that is precisely how our design interface objects should be like. Just by looking at a design element we should be able to understand its possible function. In designing affordance can be achieved in basically two ways. Either by providing buttons and switches or by maintaining widely used standards like a blue hyperlink for any URL. The formal concept of interaction design lies in the need and want system. The motive of the designer is to understand the system requirements and provide the user with what he needs and not what he wants.

5.3 : Usability



Talking of usability it is important to know why these principles are needed to be followed. One such outcome is to maximize the usability of a system. The main reason for the design principles to be followed is to ensure that a designer does not design a system that is unusable.

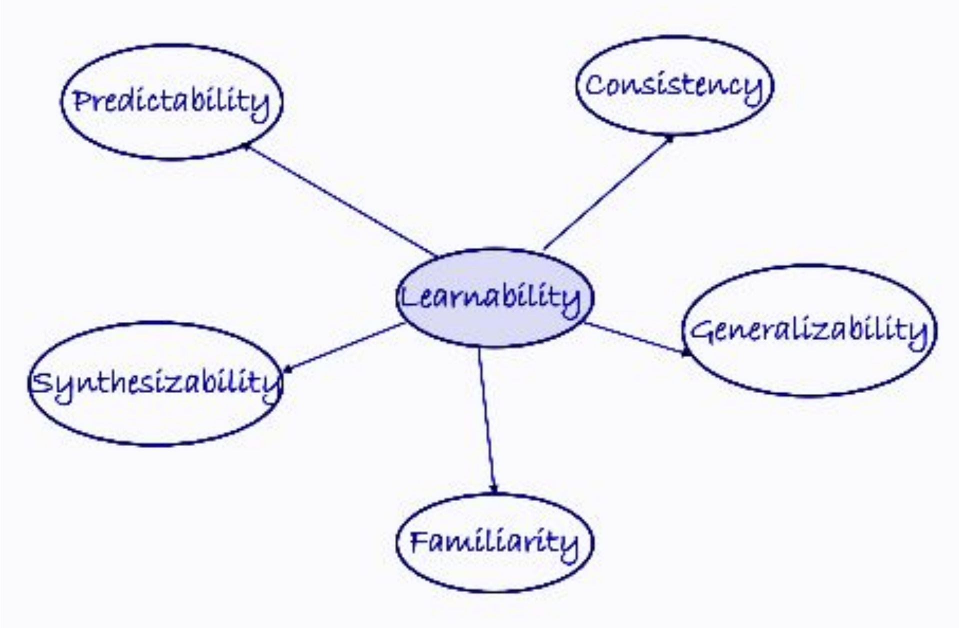
5.3.1 : Principles to support usability

An incomplete or badly designed product can not only make the end user upset but also can be fatal to people's health. One such example of the outcomes of a bad design can be the mishap that occurred at Three Mile Island in the year 1979. The cause of the incident was the poorly designed control panel. It was designed to switch off the lumination after the system had indicated to turn off the valves. But because of faulty designs the workers were indicated that the valves were shut but they were not and the outcome was over incineration of the reactor contents and an explosion. These design principles are calculated from a mix of theoretical knowledge, user understanding and experience.

The principles work like reminders for the designer rather than as guidelines. Out of all the design principles the main ones which are necessarily followed are learnability, flexibility and robustness.

3.5.1.1 : Learnability

This principle of usability means that the system under development and its functionality should be easy to understand and learn. The designer should make sure that the system is easy to understand and the learning curve should be very smooth for the user. The faster one understands how to do something the faster they can reach on their main task of how to get the task done. Faster learning makes the user confident and enhances the efficiency and performance of the system in the user's mind. To make a system implement learnability it is necessary to be familiar with Predictability, Synthesizability, Familiarity, Generalization and Consistency.

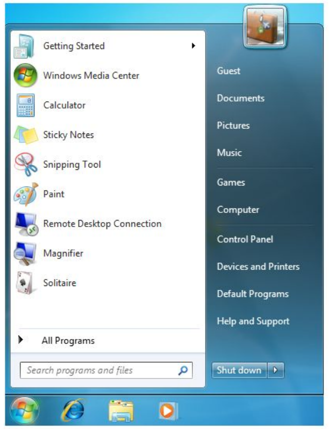


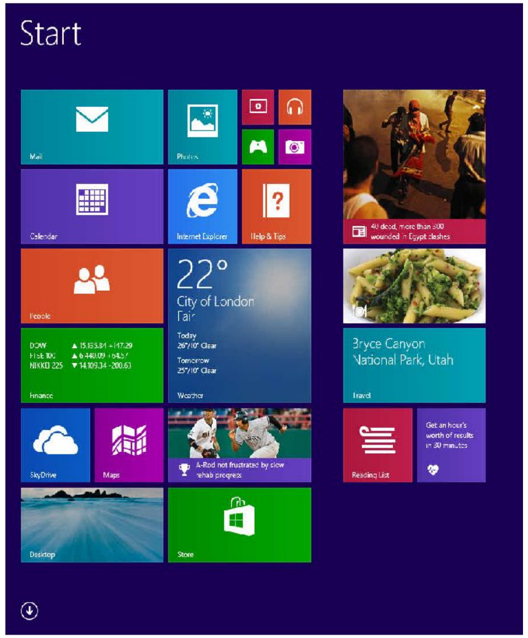
- ## Synthesizability

When the user does any task they obviously expect an acknowledgement of the task that they just performed. Acknowledging the user’s actions and efforts is very crucial as the absence of an acknowledgement causes doubt in the user on whether the task they performed was successfully done or not. Let us say the user does an online payment and does not get any acknowledgement for the same so he will be in tension as for him he has no clue of whether the payment was done or was it done to the right person. Affirming the user keeps the user connected to the system and the trust in the user’s mind for the system.

- ## Predictability

Predicting something means to guess what that thing would do or how something may respond to interaction. When you pat a dog and it wags its tail you predict that it is doing that because it is feeling loved and happy to feel the pat. This is exactly what predictability is in designing. The user should be able to predict how something will function or change if he does some system changes. If you are to find the cross button to any message box automatically our minds reach the top right corner searching for a X in red colour. If the designer does something like changing the colour of it to green and a tick mark the user would be completely shocked and this is where the design can go really wrong.





Difference in START button in Windows 7 and Windows 8

● Familiarity

Being familiar with something means knowing how something works or being acquainted with it. This principle involves using the user's understanding and his past reactions to help him understand a task. Experience is the best teacher and that is why for learning the user should use his past experience as his teacher. The end user can get experience by learning from his own encounters or by learning from someone about them. We humans have a very visual mind and this can be explored in the design like for showing some threat or loss of user entered data which is not saved, maybe red colour can be used. A cross in red is used for exit majorly so such experiences can be used to help users learn and register concepts in the system.

A System Error popup box

- ## **Generalization**

Generalizing means collectively taking something or grouping something. It can be broadly called as a step for maintaining consistency. It is a common physcology to be more confident about something when we have already done it or a similar task before. Just like that the user feels much more confident when they are talking seeing a design which looks similar to the one they have already interacted with. Generalization can be done in the design by big companies in their varied softwares. An example of which could be Microsoft. Excel, Word are both products of Microsoft and both their interface looks very similar although their functionality may vary a lot. This is because of the generalization principle being followed by their designers.

- ## **Consistency**

To explain consistency we can take the example of a cricketer. A cricketer who scored 98 in an innings and 2 runs in another is not consistent but someone who scores 51 and 49 is consistent. This is one of the finest examples. A consistent player will play in a similar fashion in both the innings. Same way a consistent design is the one which has consistent design features throughout the system. Like for example if the user is given a task where they have a checkbox so they would expect the check box to allow them to enter multiple values at the same time. This is where the design of the checkbox is said to be consistent. What it was in the above question it functioned in the same way for another question.

5.3.1.2 Flexibility

The diverseness in the method by which the developed system and the end user exchange information is termed as flexibility. A system is said to be flexible if the system gives the same output for a broad range of user inputs considering humanly errors done by the user during the information entering phase. A system can be made flexible by the following methods : Dialog Initiative, Multithreading, Task migratability, Substitutivity and Customizability.

- ## Dialog Initiative

As we studied that communication between the user and the system needs to be very lively. So in such a scene the question arises who initiates the communication and what are its types. There can be two forms of dialogues one that is initiated by the user and the other by the system. User Preemptive communication is where the user initiates the communication and System Preemptive is where the system is the initiator of the communication. Example of System preemptive could be when a popup is sent to the user informing about the failure of the harddrive to transfer data where the user only can click on the OK button. Example of User preemptive could be when someone needs to find some information about the local market on a town map application where they initiate the communication with the system.

- ## Multithreading

A thread is any line of communication and multi means more than one so multithreading means having more than one set of communication running between the user and the system at a particular time being. This interaction between the system and the end user may be on completely different sets of tasks. It is just like how your phone allows you to have many applications open at the same time but only one application is allowed to interact with you at a particular time. This is exactly how it works in multithreading. Numerous interactions may be going on between the end user and the system but at one time only one set of communication will be given permission to complete.

- **Task Migratability**

Migration means moving something from one place to another. It is like transferring some control from one state to another. In design migration comes into play while task execution. There can be two ways or modes for executing a particular task. User driven execution and system driven execution. The reason it is considered an advantage to design both driven execution models is so that incase of any problem in one mode the other can still process the execution cycle.

- **Substitutability**

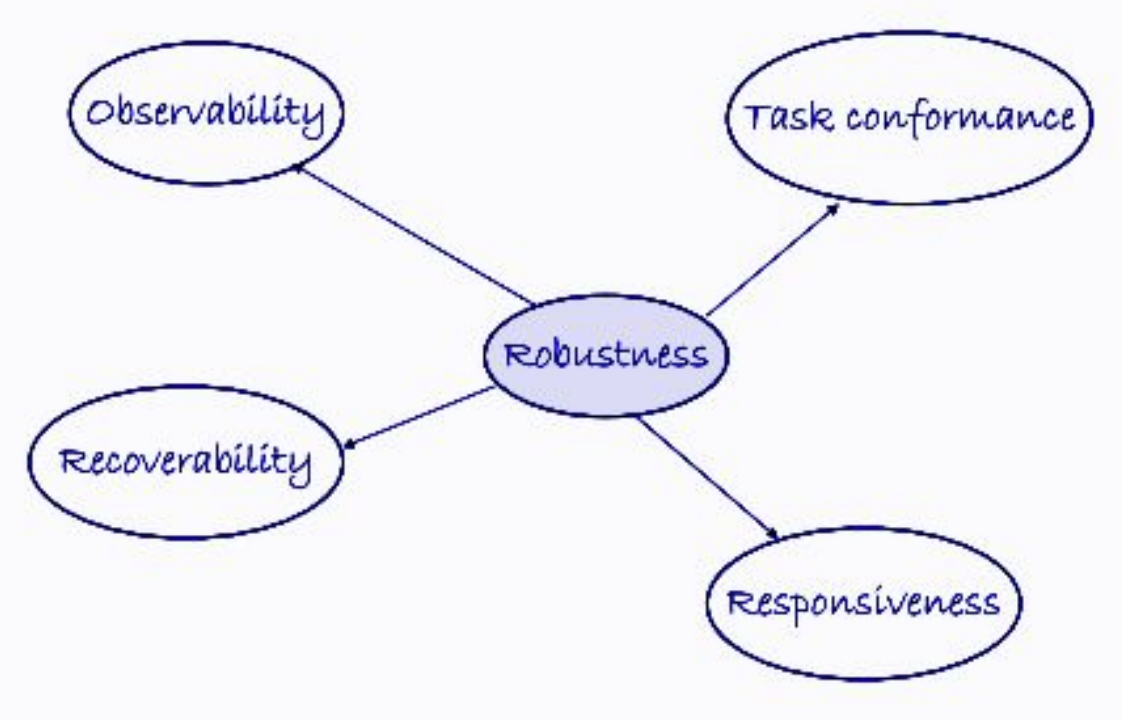
A substitute is something we add or use in the absence of a particular thing. A substitute is generally something that is of equal value to the thing that is absent. In designing a user can be given a few substitutes in terms of the actions he can perform on a system. It is like giving a child an option to choose his desired ice cream to put on a waffle cone. Each ice cream scoop would be of the same size but it is at the user's discretion that the system will pick a scoop and add it on the cone.

- **Customizability**

Customization means to make changes into something as per the user requirements. To make customizations in a design means to do alterations to some existing thing. When the user can change stuff in a design interface it is termed as adaptability. When the system changes its designing interface it is called adaptivity. Although full discretionary powers are not given to the user. Only limited things can be permitted for the user to change and modify.

5.3.1.3 Robustness

A robust system means a system that aids the user in completing a task that the user intends on doing and provides full support to the end user wherever required. A robust system does not just support the user but also has standardized testing mechanisms to make sure that the user could achieve the task successfully. Robustness of a system can be ensured by the following four principles : Observability, Recoverability, Responsiveness, Task Conformance.



- ## **Observability**

Observation is a skill that everyone possesses and visual is said to be the best form of experience. For the end user to provide feedback they need to observe the functioning of the system. The user can observe a lot of system interactive details which need more principles to talk of like : browsability, defaults, reachability, persistence and task performance.

➢ **Browsability**

Let the user use the functionality without forcing him to do any changes.

➢ **Default**

Provide the user with predefined fillings where he can get a hint on how he has to get some task done.

➢ **Reachability**

Reachability deals with the range the user can explore while interacting with the system.

➢ **Persistence**

The amount of time the user can deal with a state which is being observed is termed as persistence of the system.

➢ **Task Performance**

The efficiency with which a particular task is being performed by the system can be observed by the user and can make conclusions on the level of the system to perform a particular task.

- **Recoverability**

To recover means to come back from a problem. The recoverability of a system means the ability of the system to get functional after being down with some problem. To recover from a system error there can be two alternate ways, Forward recovery and Backward recovery. In forward recovery the system confirms that an error had occurred in the past and tries to help recover from it while in backward recovery the system tries to undo the step which caused the error in the first place. Example of forward error recovery could be the Windows operating system trying to recover from a disk failure.

- **Responsiveness**

In user interaction design responsiveness means the time required by the system developed to provide feedback to any performed task. If you were to get acknowledgement for any task that you performed it would be obvious for you to expect the system to perform the task quickly and without much wait time.The time the system takes to process variety of processings should be same as if the time differs the end user may get a thought of concern about his process execution. Example : The time taken to submit a response and time required to load next page should be the same or else the user may get doubtful if his response was submitted or not.

- ## Task conformance

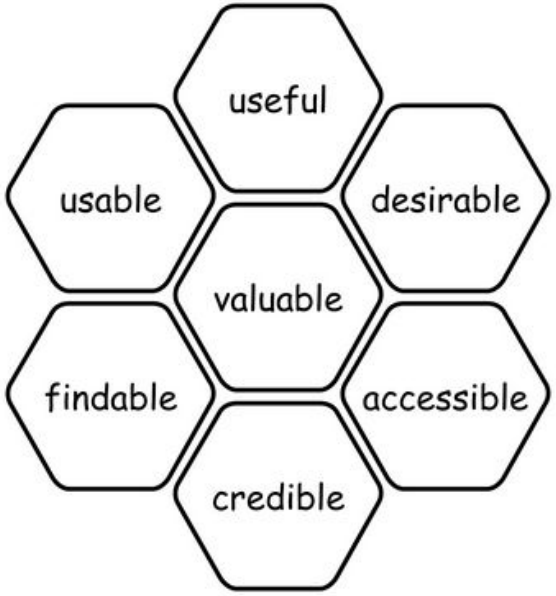
The surety that a particular system can perform a particular task when controlled by an end user is called task conformance. It is a measure of the ability of a system to perform all possible tasks. Now that we studied the principle that the end user does not need any other means to interact with the system. It is utmost important for the system to permit and aid the user in any task he wants to perform.

To maximize the usability of a system all the principles of learnability, flexibility and robustness need to be given importance. Just like the explosion of the reactor another example of a bad design which is quoted many times is of the aircraft Boeing 737 which in the year 1989 crashed because of a bad design frame. These are where usability of a system can be safeguarded by following these key principles.

The **Before** and **After** design of the Boeing 737

5.3.2 : Usability Goals

Usability goals are the final outcomes that are to be met by any system. The objectives are set, discussed and enforced by the numerous stakeholders and the designer. When the system has to be developed it is always a necessity to first discuss and understand why the system is needed and where it is going to help the user or aid them. After the goals are identified the later detailed structural and functional framework can be made in the later stages. When a system is made it is also needed to decide on a stage such that the system knows it has to exit the functioning after that stage. The two types of usability goals are : System Centric Usability Goals and User Centric Usability Goals.



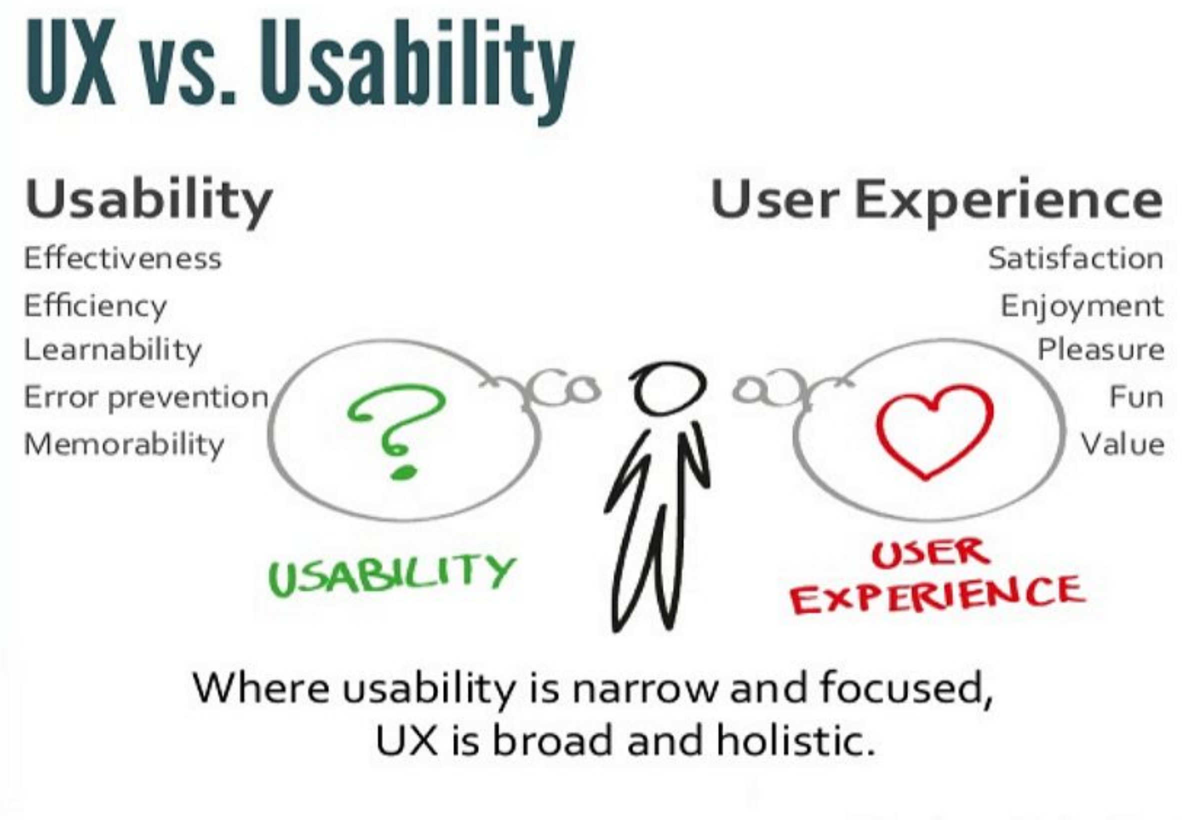
System Centric Usability Goals

- **Effectuality** : When a design is being made for a system it is already known as to what and why is the system made. The job the system will aid in is predefined.The check of whether the system is successfully being able to get the job done and is its effectuality check.
- **Productivity** : After the user is well acquainted with the functioning of the system how much effective results can the system draw for the user.
- **Safe** : The measure of how safe the user is while using the system is its safety. The way a system protects the user from potential problems which may arise from fatal errors is its measure of safety. Also is the user does some error how efficiently can the error be rolled back to the previous state.
- **Usefulness** : When a system is designed a fixed functioning and audience are targeted. The usefulness of the system is the measure of the functional help or aid the system can provide. Is the system actually filling a void in daily lives by its functioning ?
- **Adaptability** : The measure of how well the end user can understand after seeing the system function once is the measure of its learnability and adaptability. Also it is the measure of how fast does the user start being comfortable with the system.
- **Recalling power** : When a user does some functionality in the system it is a sheer necessity to maintain record of the work and not force the user to tax his brain on it later on some time to remember what was done.

● User Centric Usability Goals

The goals which are targeted at increased positive responses from the end user are the user centric goals. These goals are :

- ➢ Gratifying
- ➢ User satisfaction
- ➢ Psychologically filling
- ➢ Profitable
- ➢ Eye appealing
- ➢ Inspiring
- ➢ Accommodating
- ➢ Pleasurable
- ➢ Amusive



5.4 : Guidelines and Standards

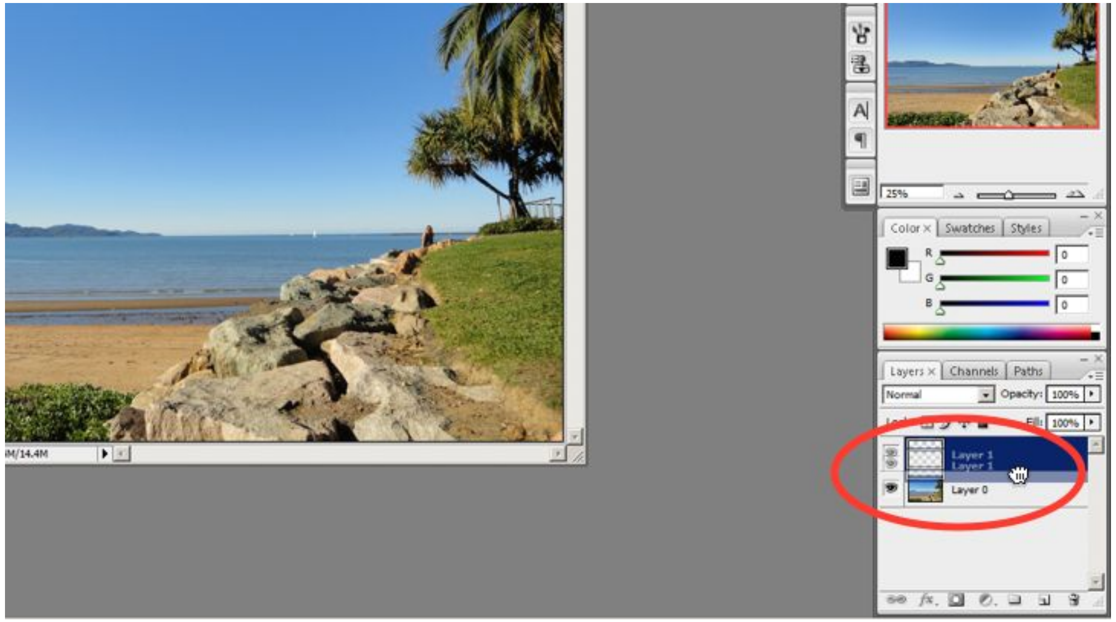
5.4.1 : Guidelines to design User Interface

Designing is all about creativity and restricting someone's creativity or caging their thoughts is not what designing is about. That is why there are not any rules as such for designing but there are a set of guidelines which can help the user in making a praiseworthy design. Many tech and IT giants like Google, Adobe and Apple have made use of these guidelines. The guidelines are called 10 User Interface Design Guidelines and are set up by Nielsen and Molich in the year 1990. Jakob Nielsen is a well known web space consultant and Rolf Molich is an expert in usability. These 10 guidelines are very crisp and hence you may see resemblance with a lot of other guidelines set up by different design experts. The guidelines are :

- **Maintaining transparency and acknowledging user input**
- **Mimic real world concepts in designing**
- **Freedom of control for the user**
- **Consistency is key for designing**
- **Minimize and prevent errors**
- **Identification over memory testing**
- **Efficient and flexible designing**
- **Simplistic yet aesthetically pleasing**
- **Error minimization, management and mitigation**
- **Assist and documentation**

• Maintaining transparency and acknowledging user input

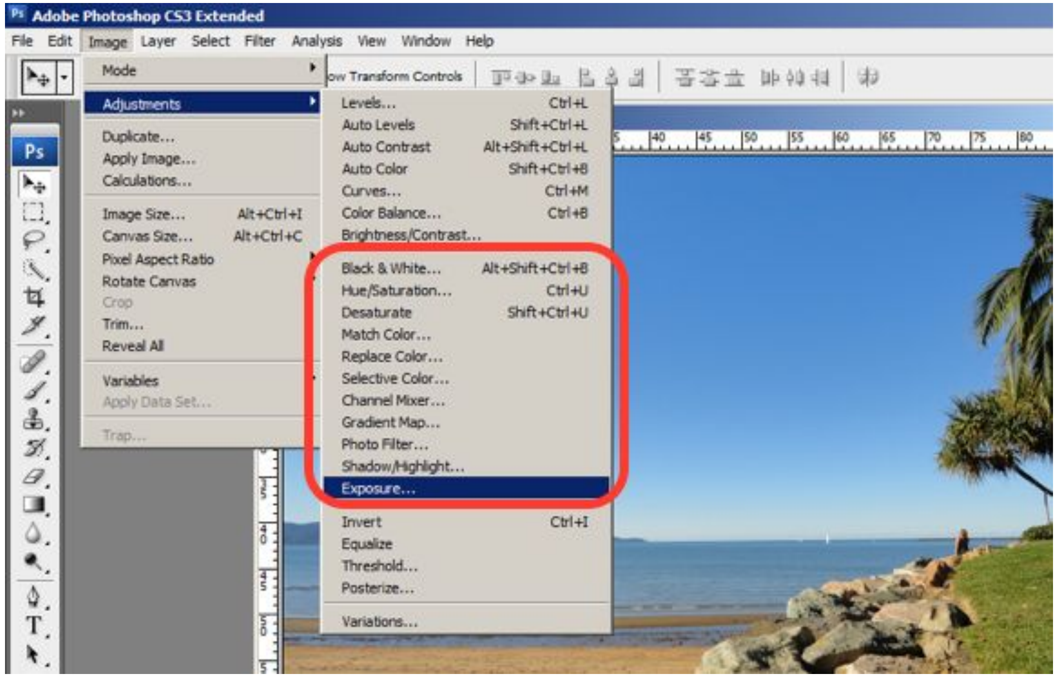
As a user one thing that feels really pleasant is when you feel valued and your inputs giving quick output responses. When the user enters any data or input it should reflect on the screen so that the user knows that the changes were made. Rather than a popup saying the changes were made the user would love to see them for himself. Acknowledging user input and real time quick changes to the design frame can take the design at greater heights. In Adobe Photoshop when the user does minor changes like lifting and placing pallettes the changes reflect on the box and the screen. The choice of the cursor being a hand makes it easier to make sure the right pallette is selected for the action.



The layer placement in Adobe Photoshop

• Mimic real world concepts in designing

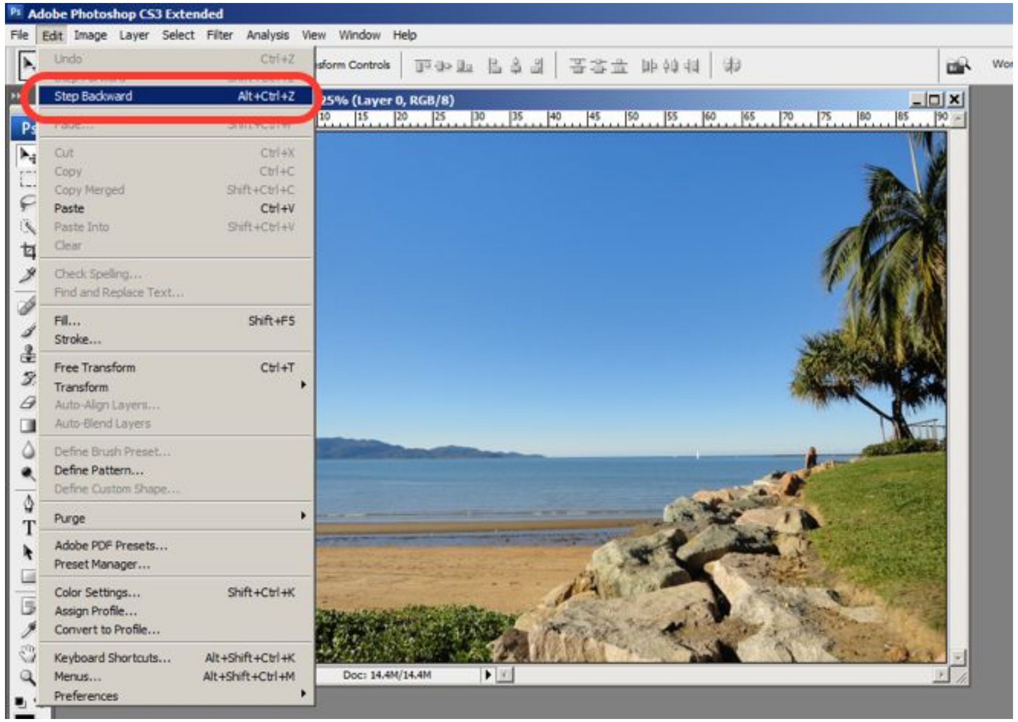
It is always easier for the user when they can relate real world functioning to the task and the system they are dealing with. That is why the user should be giving models and designs so that they can relate to them and do not feel confused about the functionality. Just like in Adobe Photoshop terminologies like contrast, brightness, exposure are used as these are terms that the user is well aware of because of photography and image editing softwares. Using colour terminologies like RGB which the user already knows represents the Red Blue Green primary colour coding.



Real world linguistic concepts like Exposure in Adobe Photoshop

• Freedom of control for the user

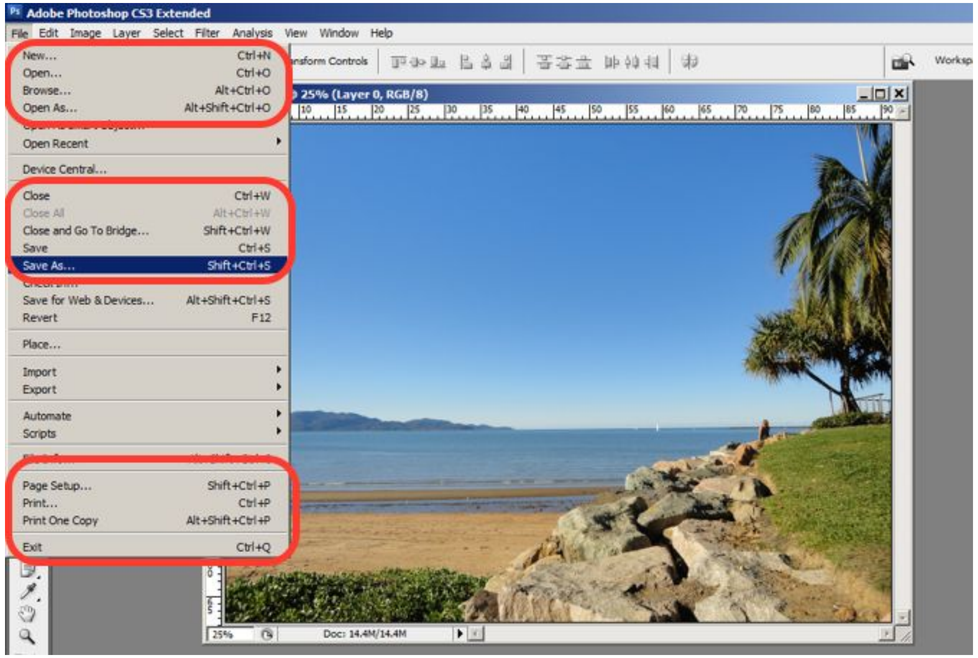
At the end of the day the design and interface is going to be used by the user. So he should be able to exercise complete freedom of doing what is in his thoughts. The changes the user tries making should be acknowledged and reflected with quick changes on the screen as well. If the user feels he made a mistake it should be as easy as snapping a finger for him to roll back to the previous state. In Adobe Photoshop this is ensured by the Undo button which helps the user to go a step back and reforms the last edit done to the system state.



The undo and step back concept of Adobe Photoshop

• Consistency is key for designing

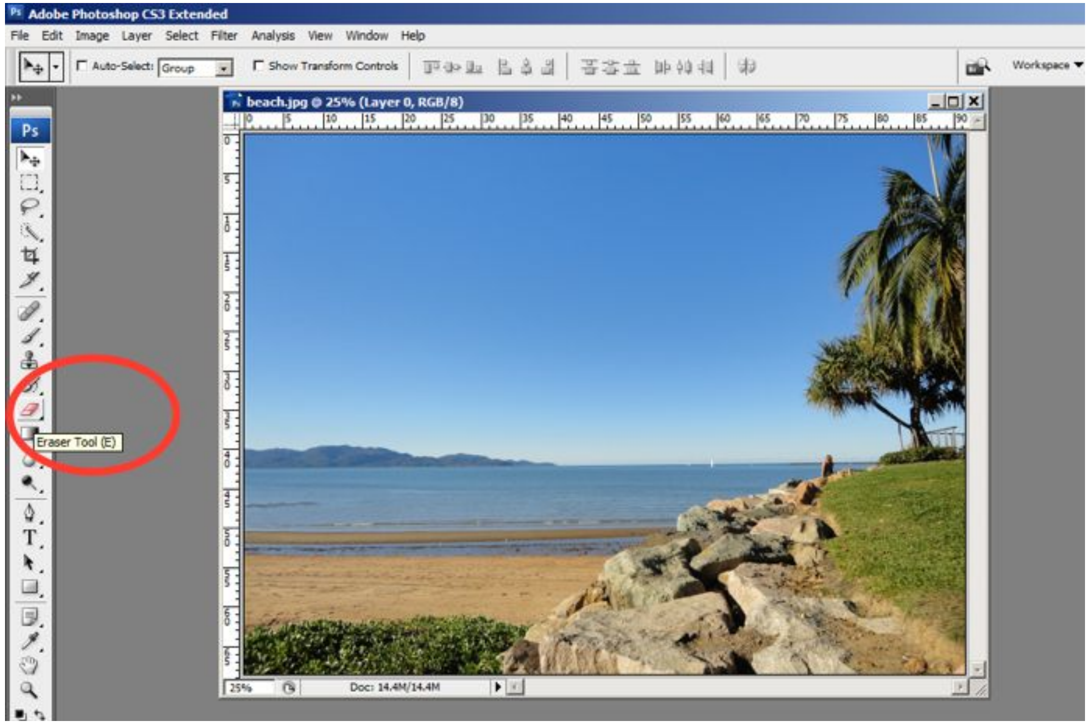
The strongest asset of your design can be its simplicity and its consistency. Just like the phrase 'two many cooks spoil the broth', an overly done design frame looks shabby and is not very pleasing to the eyes. Using standard layouts and frames for the designing phase can not only make the design amazing but also improve connectivity with the user. Usage of easy language and simple linguistic commands and words can do wonders. Just like in Adobe Photoshop simple words like 'Save', 'Open', 'Edit' make the design consistent and simple. A design that looks familiar works perfectly for the user.



Simple acquainted words used in Adobe Photoshop

• Minimize and prevent errors

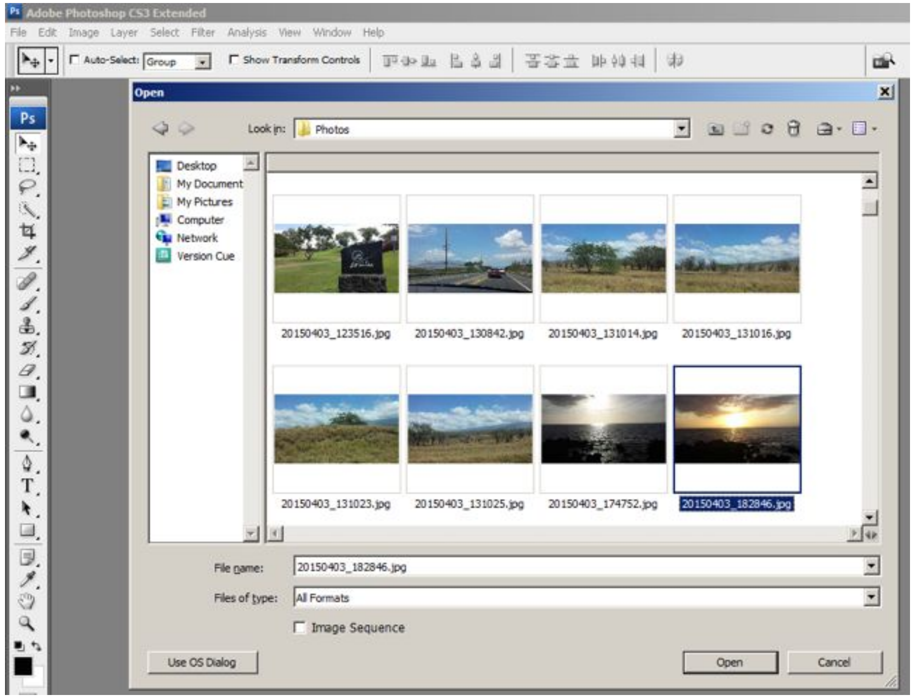
The end user is also a human and being a human making mistakes is a very obvious thing. The designer being aware of this needs to ensure that if the user is confused about some task they have methods to find a solution to their problem. Error messages can help users identify what possibly went wrong and can be rectified in which manner. Adobe Photoshop like many other softwares uses the hover mechanism for telling the user what a button or tool does. Just like having a hover saying 'Eraser' when the user goes on the eraser option on the menu bar. This prompts and aids the user in identifying what exactly they are in search of.



The error rectification tool used in Adobe Photoshop

● Identification over memory testing

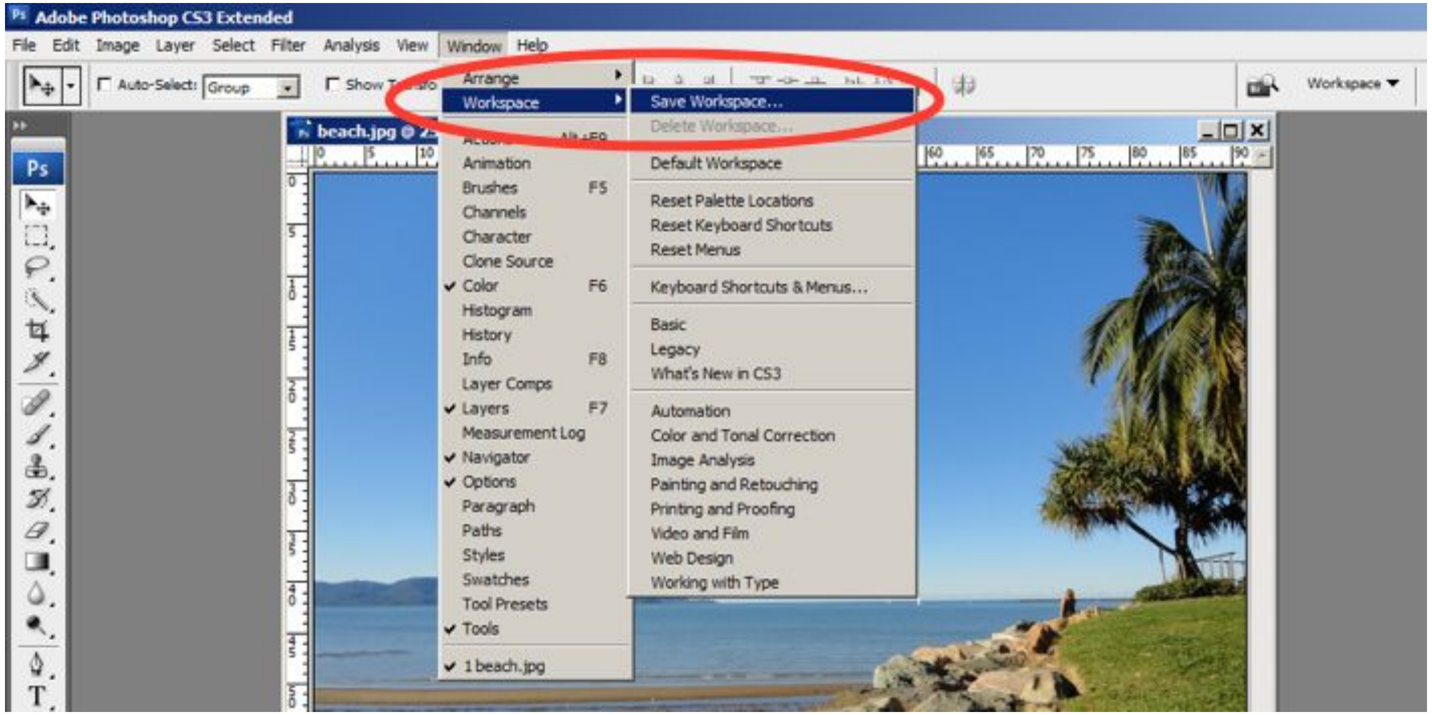
The designer being an end user for some other system himself knows that it is not very easy to remember names of files and the locations where they were saved. This is why as a designer they should provide snippets or thumbnails of the image or any file. This helps the user in identifying and being assured that they have made the right selection to carry out any functionality on the image. Like for example if you are in search of an image of a tiger which you had saved in downloads. But you do not recall the name as it was something like IMG17292468.jpg so without the thumbnail of the picture it would not be possible to find the image for further processing. In Adobe Photoshop just like majority softwares previews and thumbnails are provided to help users in searching for their desired image.



Thumbnails provided for easier identification in Adobe Photoshop

Efficient and flexible designing

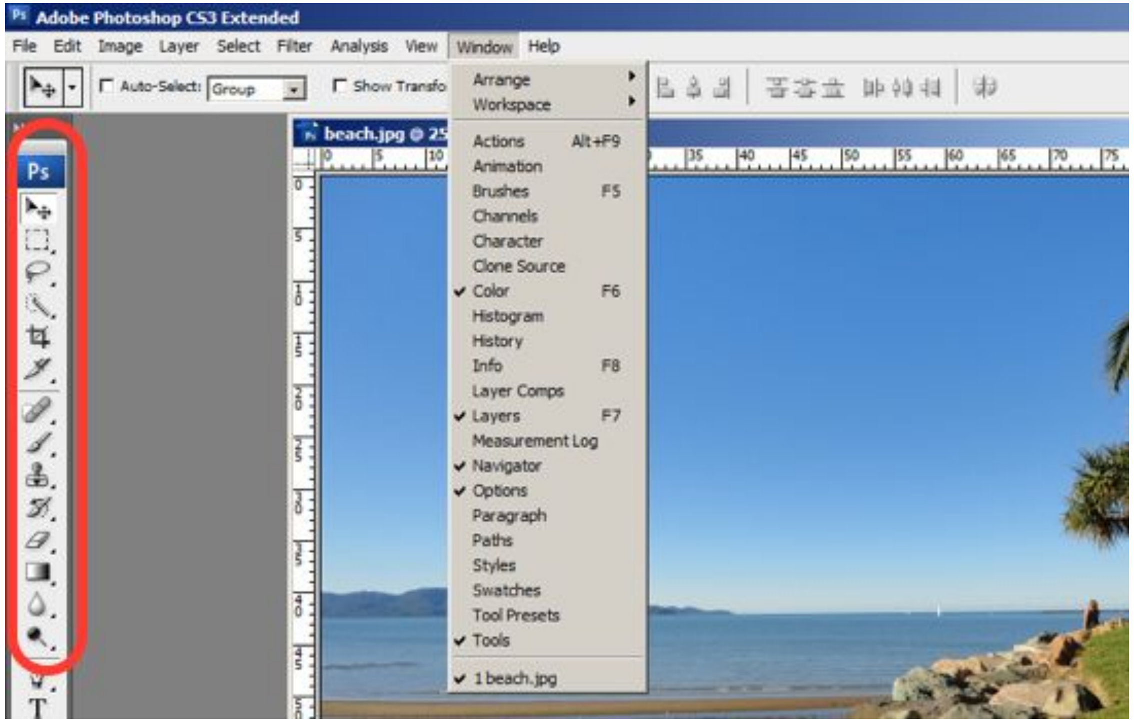
The reason why a product works and is loved by the user is its flexibility and multipurpose nature. Making a system flexible in usage and nature automatically boosts its image in the user's mind. An efficient yet flexible product will surely be in the wishlist of the majority of the users. People have heard the concept of the Flexible mop with a trolley attached to it to keep water and clean the mop with an auto soaking container attached. The mop was such a hit because of its flexibility of usage and efficient design. Adobe Photoshop is such a success because of the idea of the designer to provide a saving option for each user's workspace.



Saving workspace facility in Adobe Photoshop

- # Simplistic yet aesthetically pleasing

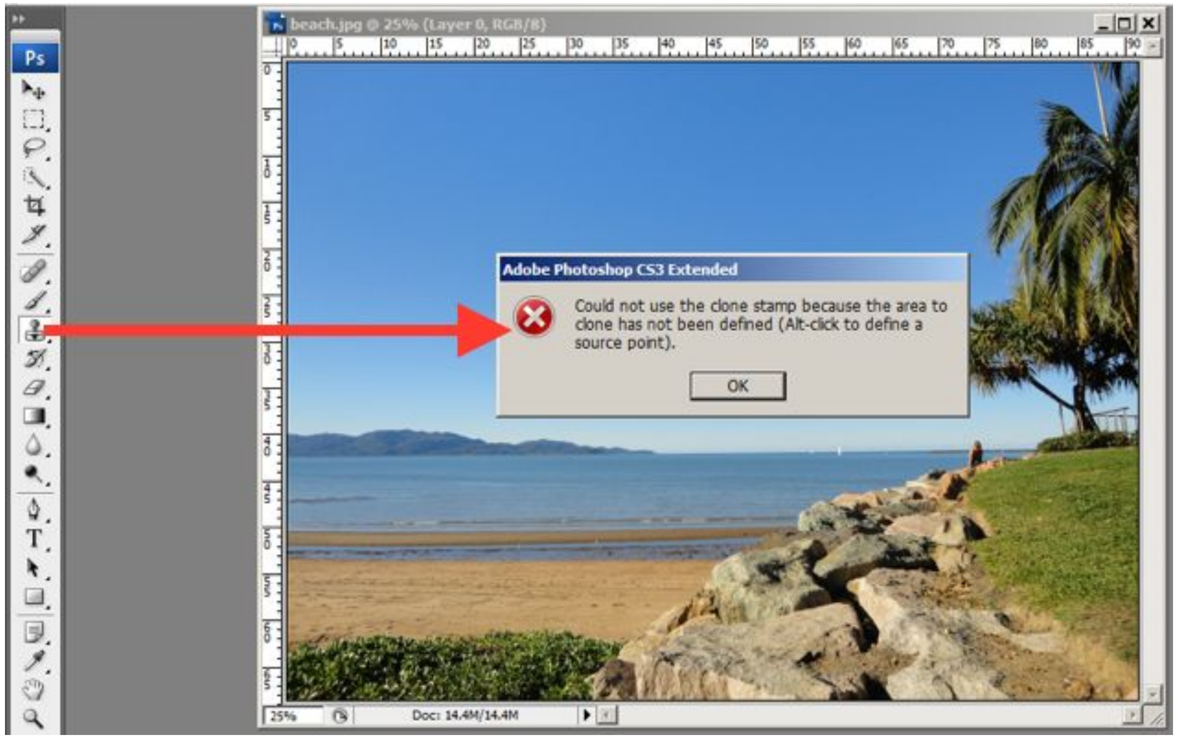
The strongest asset of your design can be its simplicity, just know that simple always does not mean basic. Simple is just about the looks not the functionality. The user would probably like a less crammed up design over a design crammed with functional and aesthetic elements. The design should be minimalistic which means not having unnecessary pomps and including only required functional elements with basic aesthetical touch. Adobe Photoshop has a small menu bar on the left side for functionality and it looks very pleasing and functional for the user to implement. The tools are just represented by icons and they look visually appealing.



Easy and handy toolbar with icons in Adobe Photoshop

● Error minimization, management and mitigation

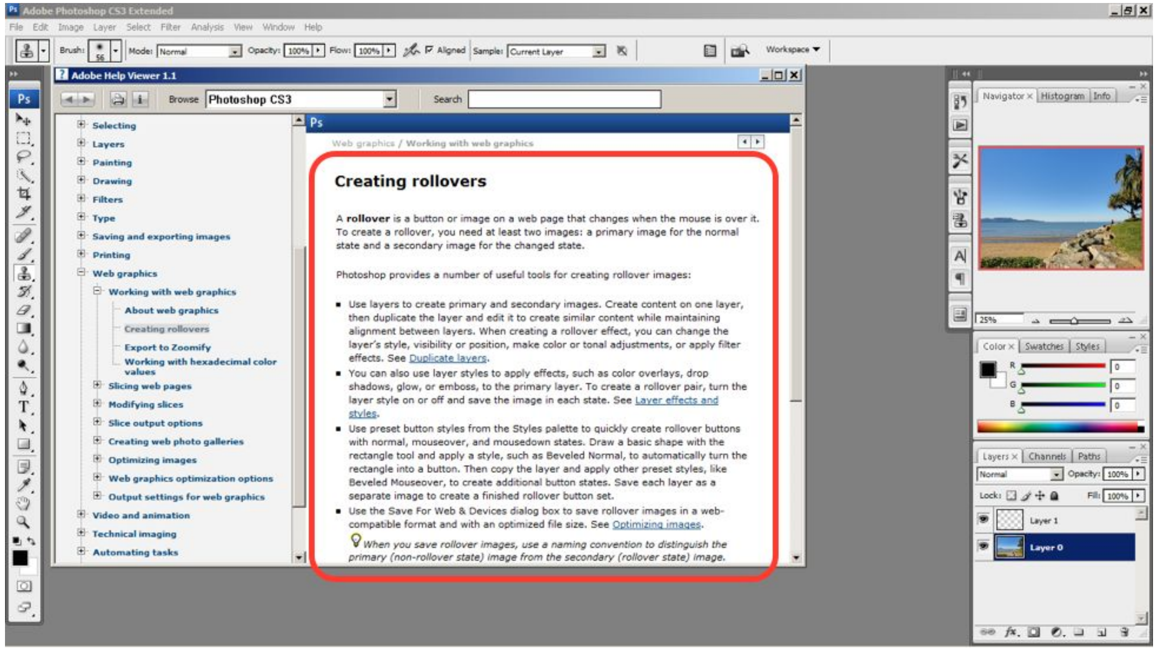
The end user is also a human and being a human making mistakes is a very obvious thing. Error messages can help users identify what possibly went wrong and can be rectified in which manner. The designer should ensure that the end user encounters minimum situations which can lead to an error. Also, if the end user encounters any error they can easily be prompted how to recover from that error. Just like most softwares Adobe Photoshop provides suggestions and error mitigation strategies for the end user.



A popup error box displaying the error and remedy to the error in Adobe Photoshop

• Assist and documentation

The end user may not always be familiar with each and every software or functionalities so the designer should consider to provide assistance mechanisms throughout the design of the system. Providing documentation of the system functionalities can aid the user to get a backup while using functionalities. The user should always have a helping hand just to make sure they do not stop using a software because they are not able to do a particular task they planned. Adobe Photoshop provides easy documentation and help tutorials which include a walkthrough of the whole app and the different tools which can be put to use.



Documentation provided for aiding user in

Adobe Photoshop

The power of these 10 guidelines may not be known until someone reads what Jon Wiley, the Head Designer of Google Search said about these guidelines - " When I think of design and creating great user experience, I generally think of it in terms of three things : Usability, Utility and Desirability ". All these are present in the ten guidelines of the Nielsen and Molich User Interface Design Guidelines.

Recognizing Nielsen and Molich's User Interface Design Guidelines

Step 1: Choose a website or an app.

Step 2: Put it to the test! Look at whether or not it follows Nielsen and Molich's 10 rules of thumb.

Rule of Thumb	Is this rule being applied? How so?	Is this rule violated? How so?
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		

Recognizing user interface design guidelines

5.5 Golden Rules And Heuristics

- Rules and guidelines provide a systematic way of doing something, even the job of interaction design can be structured and standardised
- it's not a compulsion to follow all as these rules may not be always applicable but can provide heuristics.
- Following are some of the well known golden rules and heuristics that will help us to design better systems

01

8 Golden Rules of Shneiderman

02

7 Principles of Norman

03

10 Heuristics of Nielsen

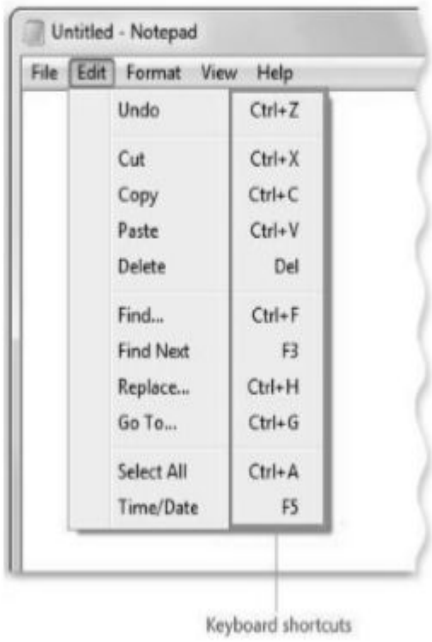
5.5.1 : 8 Golden Rules of Shneiderman

01 Strive for consistency

- **Information conveyed to the user should be standardised.**
- **The commands, terminology, icons, fonts used should be consistent.**
- **Similar sequence of actions and and representations should be maintained.**

5.5.1 : 8 Golden Rules of Shneiderman

02 Enable frequent users to use shortcuts:



- **Provide shortcuts for frequently used items or commands.**
- **Example shortcut to drive or for copy paste commands,**
- **Enabling both a experienced and new user to use the product effortlessly.**

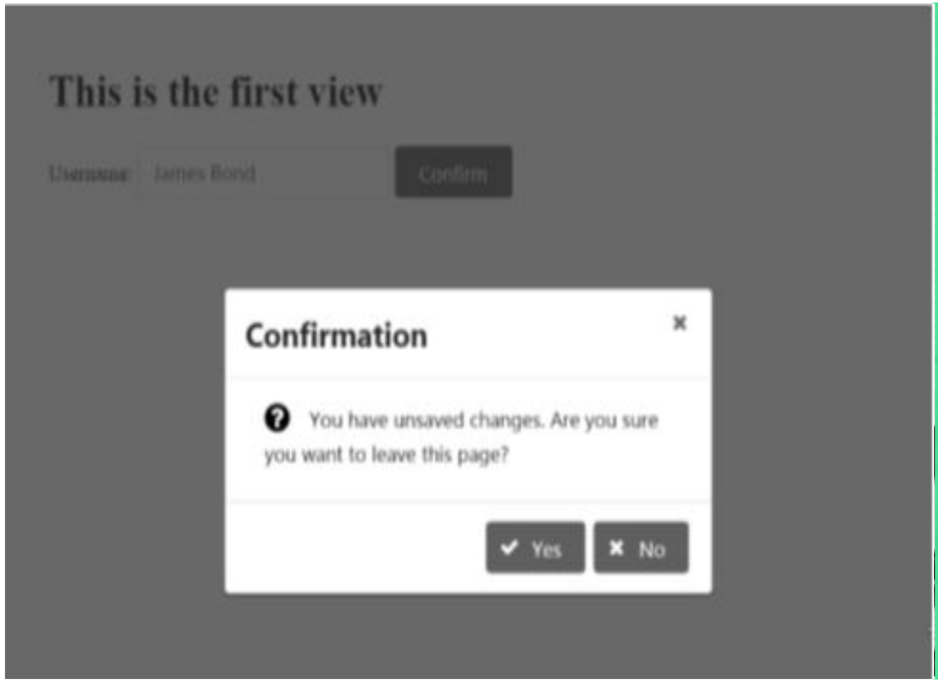
5.5.1 : 8 Golden Rules of Shneiderman

03 Offer informative feedback

- **The user should be aware of the status of the system and what is going on.**
- **This can be provided by an easy to understand informative feedback.**
- **It Should be time to time for every significant user action.**

5.5.1 : 8 Golden Rules of Shneiderman

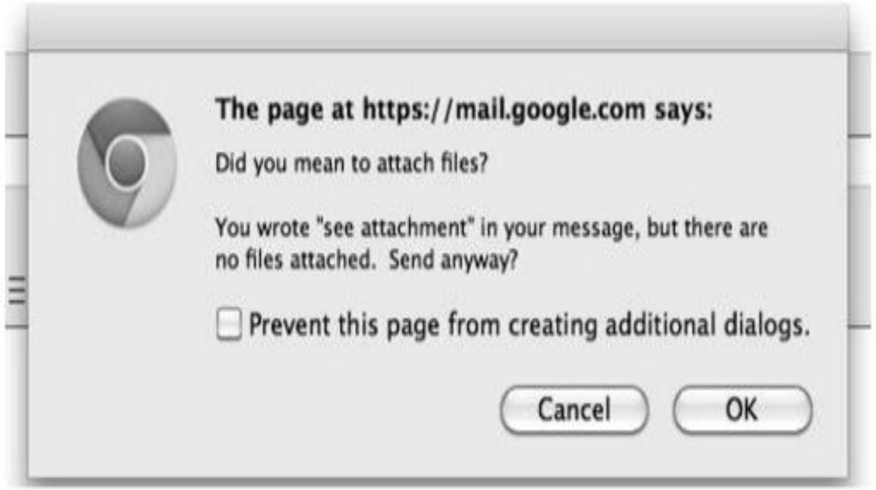
04 Design dialogs to yield closure



- **Closure means an act or process of closing something, make sure the user is notified when the action is complete.**
- **This is done to make them aware of what their actions have led them to.**
- **Example a simple “Thank You” at the end of a purchase,**

5.5.1 : 8 Golden Rules of Shneiderman

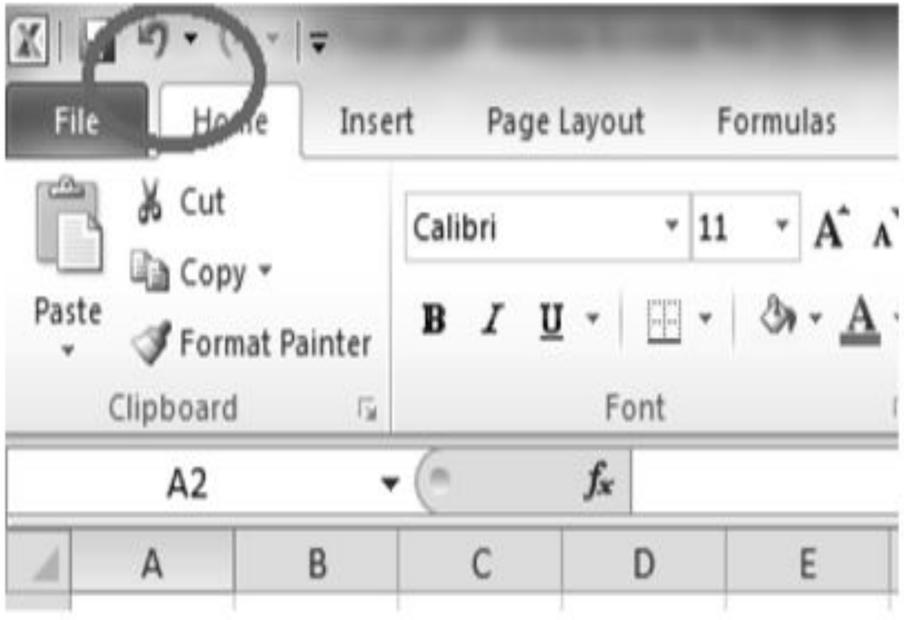
05 Offer error prevention and simple handling of error



- **People get annoyed when they are told that they are wrong.**
- **It is important to provide simple easy to follow steps.**
- **Help users not to make mistakes and in case they make mistakes, offer clear information and means to recover.**

5.5.1 : 8 Golden Rules of Shneiderman

06 Permit easy reversal of actions



- Making mistakes is a common trait of humans, considering that there has to be options to undo and redo options.
- Providing means to recover their actions users can be made comfortable to use the system
- The users need not worry about making a mistake.

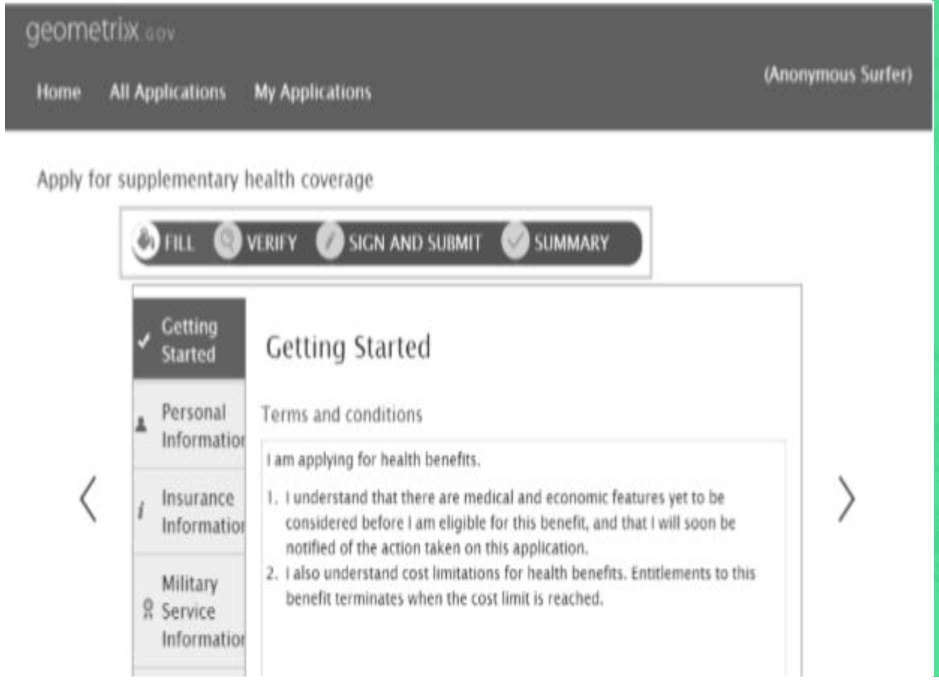
5.5.1 : 8 Golden Rules of Shneiderman

07 Support internal locus of control

- **Provide the user user with the sense that they have full control of the system.**
- **Earn their trust can be earned by making the system behave as they expect.**
- **Example: settings panel which can be used by the user to control the whole system.**

5.5.1 : 8 Golden Rules of Shneiderman

08 Reduce short-term memory load



- Humans have a very short and dynamic attention span, they can memorise limited information.
- Interface should be kept very simple with least steps and instructions to remember
- Provide ways and time for the user to learn and practice action sequences.

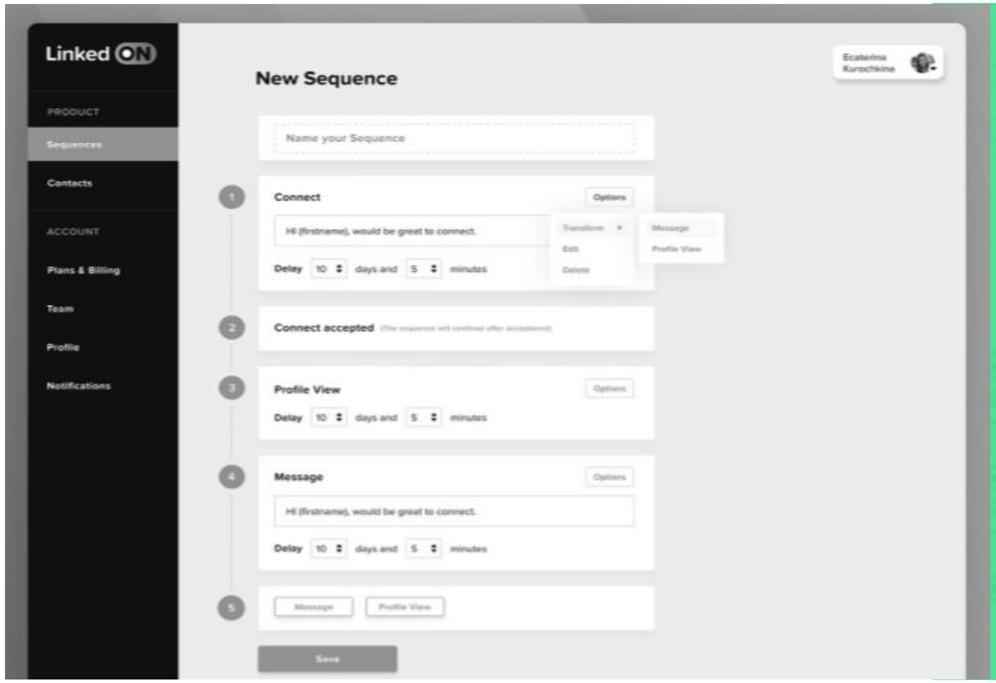
5.5.2 : 7 Principles of Norman

01 Use both knowledge that is in the world and in the head

- People learn better when the information needed to people is readily available to them.
- The system should give the user the knowledge that is required to use the system.
- Aim should be all operations remain transparent and the user is able to understand what is going on.

5.5.2 : 7 Principles of Norman

02 Simplify the structure of tasks



It is desirable that the user is required to memorise as little as possible and require minimal mental and physical effort to carry out a task

Sequence of the activity to carry out a task should be simple.

The system should provide regular feedback and status of the task being carried out.

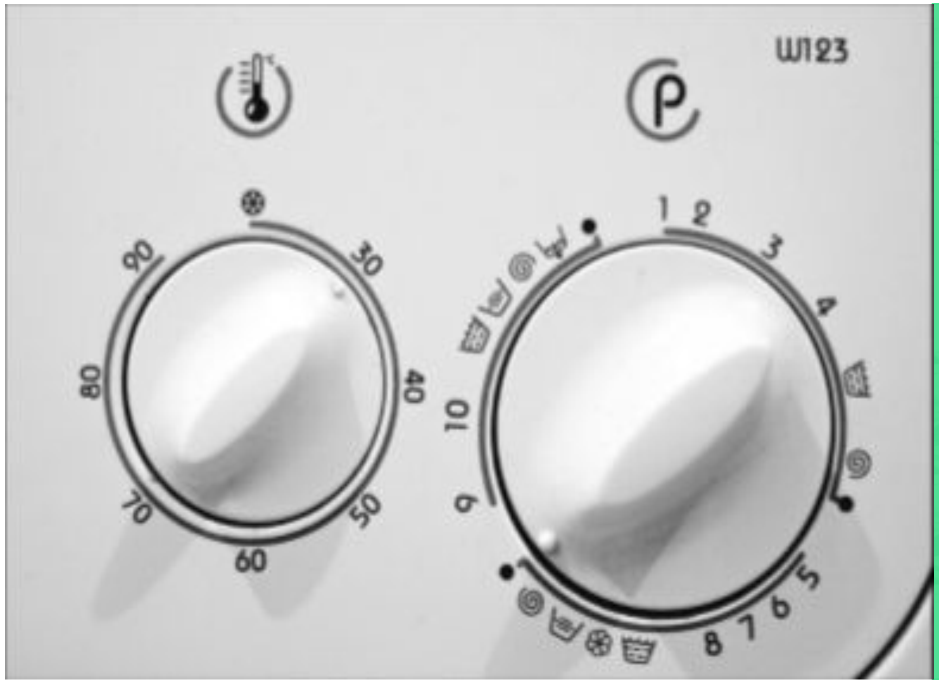
5.5.2 : 7 Principles of Norman

03 Make things visible

- The interface should be such that the user is clearly able to see all the important information.
- It should also be kept in mind that only vital information be presented.
- Looking at the interface the user is able to understand what they can do with the system and how to do it.

5.5.2 : 7 Principles of Norman

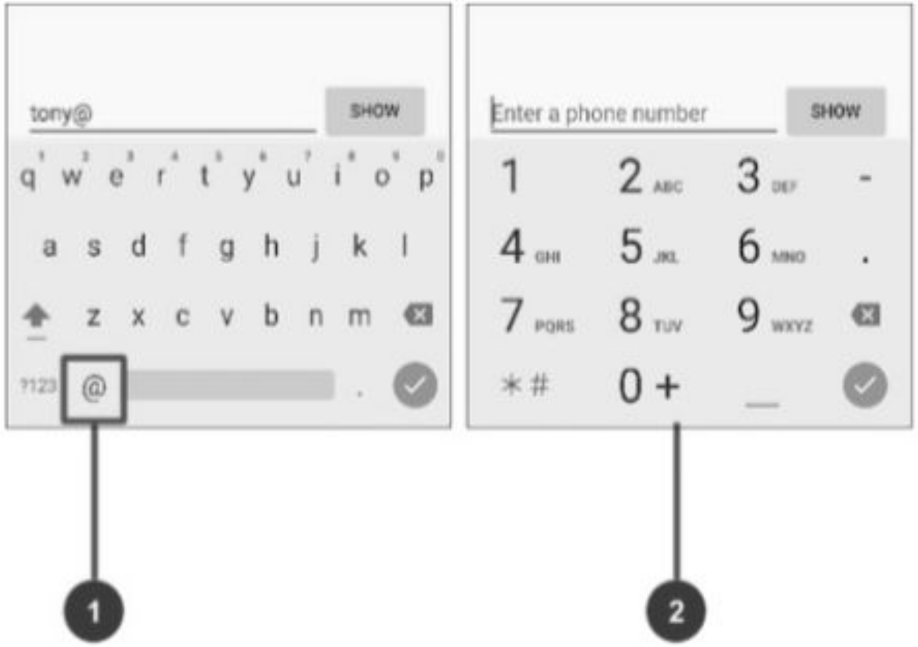
04 Get the mappings right



- All user abilities with respect to the system should rightly be mapped to the controls.
- User be able to have coarse and fine control wherever required with the appropriate use of controls and dials clearly.
- Example: small dial moment to rightly be mapped to small effect and big moment have large effect.

5.5.2 : 7 Principles of Norman

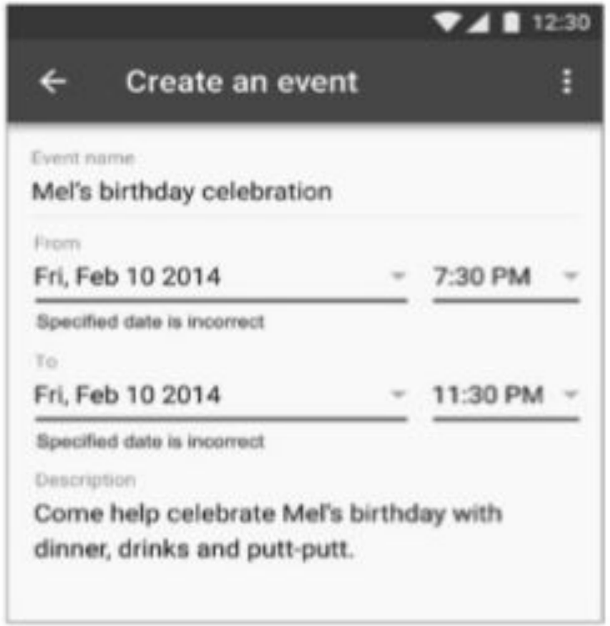
05 Exploit the power of constraints



- The usage of constraints allows to minimise the possibility of error.
- When the path narrower, the user is least likely to make a mistake and is bound to complete the sequence of tasks.
- Example : validations in the form that are bound only to accept correct input.

5.5.2 : 7 Principles of Norman

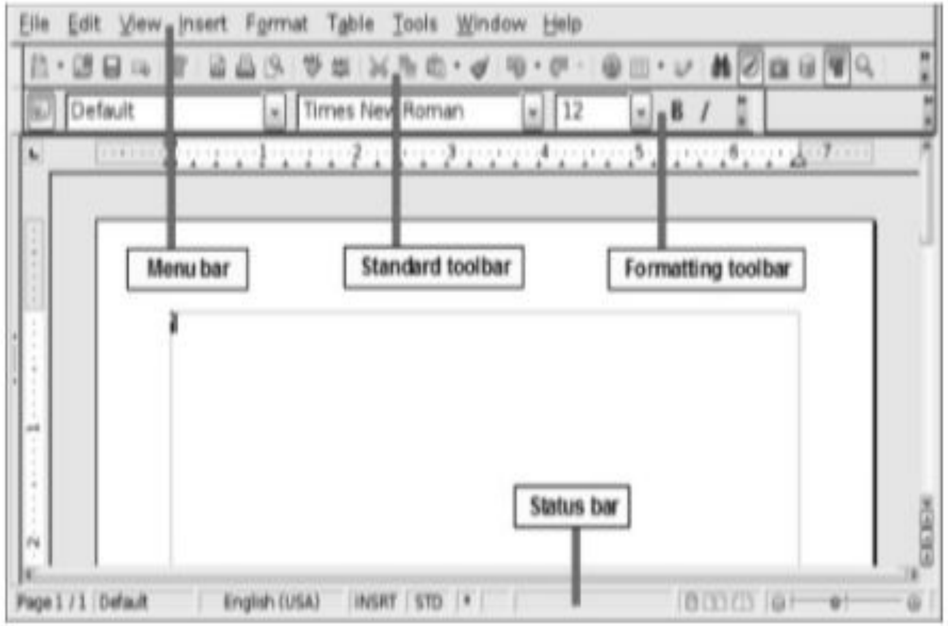
06 Design for error



- **While designing a system it is important to consider that the user will make an error.**
- **Therefore the designer should anticipate all the possible errors that can happen and design the system such that it can handle errors.**
- **Example: system reacts to erroneous input of the user.**

5.5.2 : 7 Principles of Norman

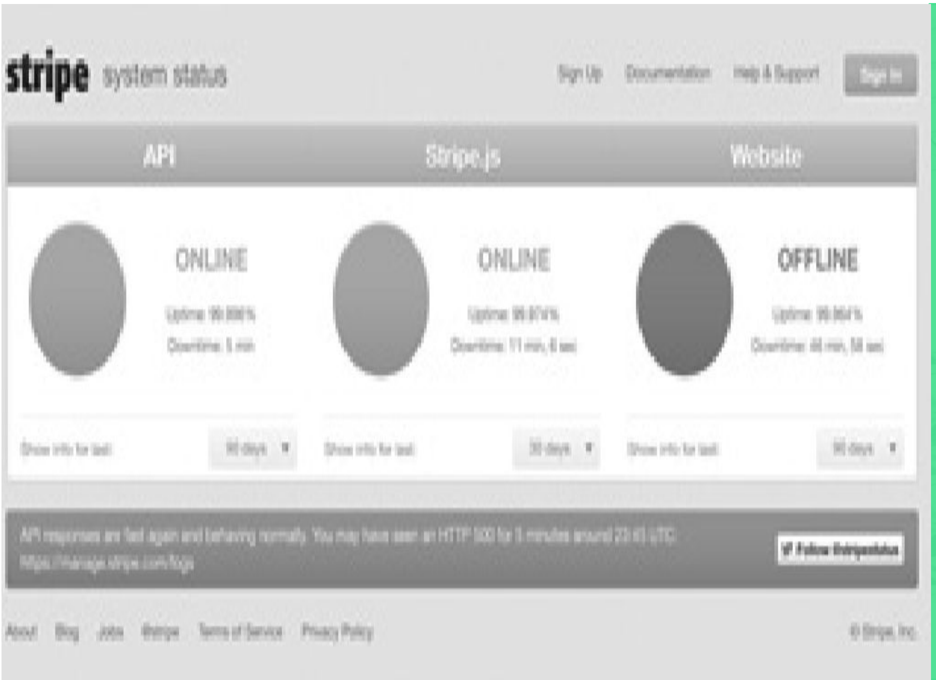
07 When all else fails, standardize



- The designer need not always find a new way to do something or map new user actions to system actions.
- Designer need not always reinvent the wheel instead use standard procedure.
- Example : when a driver drives a new car he may be little confused about opening the bonnet or storage compartment but will have no doubt about the acceleration, break and clutch pedal.

5.5.3 : 10 Heuristics of Nielsen

01 Visibility of system status



- Users must always be aware of what is happening and how to navigate further in the application.
- The status of the system should be available throughout the application from time to time.
- Feedback should be easy to understand and follow.

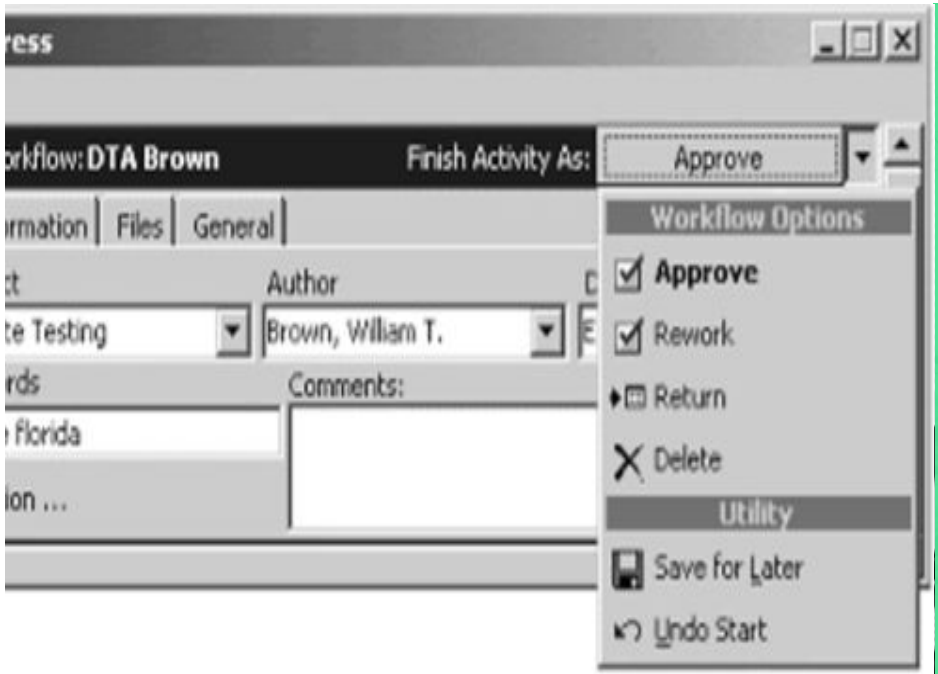
5.5.3 : 10 Heuristics of Nielsen

02 Match between the system and the real world

- More the real life concepts, more thing to relate to real life more the user finds it familiar.
- the system should speak the language which the user speaks containing similar words, phrases and concepts
- Example : The icon is analogues to real life telephone receivers.

5.5.3 : 10 Heuristics of Nielsen

03 User control and freedom



- Give your users clearly marked emergency exit to leave the unwanted state without having to go through an extended dialogue.
- Example : undo button which allows a user to exit an unwanted state when the user makes any mistake.

5.5.3 : 10 Heuristics of Nielsen

04 Consistency and standards

- If words, commands, actions, situations means different things in different contexts this will leave the user confused and frustrated.
- It is important to maintain consistency and follow a particular standard throughout the system.
- Avoiding standards shall downgrade the usability considerably.

5.5.3 : 10 Heuristics of Nielsen

05 Error prevention

- Not only is it important to make the system help the user when they make a mistake but it is also important that the system tries to warn the user before making any possible mistake
- Example : System asks for surety to confirm the action of permanent deletion of a file.
- Feedback should be easy to understand and follow.

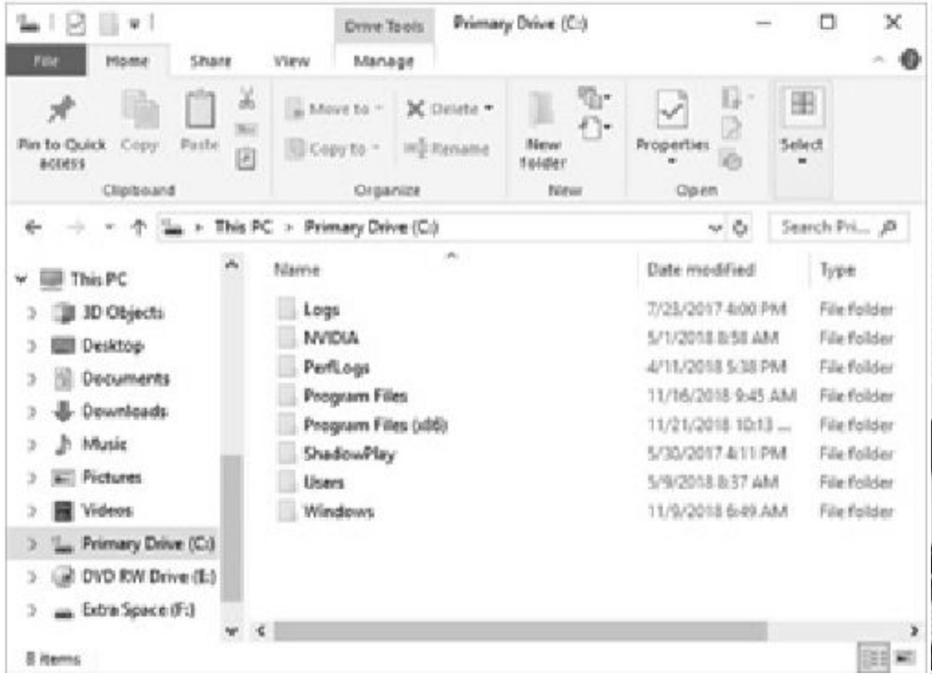
5.5.3 : 10 Heuristics of Nielsen

06 Recognition rather than recall

- **Humans are better at recognising something rather than recalling something, recall requires much more cognitive effort.**
- **Objects and actions must be readily presented to the user.**
- **User need not go searching for them and important instructions and should be easily retrievable.**

5.5.3 : 10 Heuristics of Nielsen

07 Flexibility and efficiency of use



- Novice users might require good looking GUI on the other hand experienced users might just want to get things done fast and much really appreciate shortcuts.
- it is important to provide considerable flexibility of control to the user.
- Example: Novice user can just search the items but an expert can use more options to search, filter, and view.

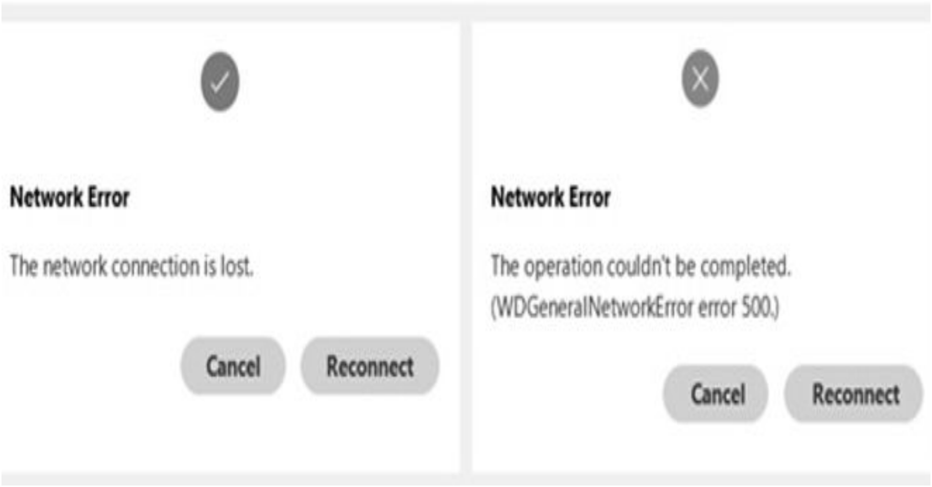
5.5.3 : 10 Heuristics of Nielsen

08 Aesthetic and minimalist design

- The usage of the system must make the user feel good and be appealing to the user.
- User will not be reading every content that is shown on the screen instead they shall just glance at it.
- It is important to keep it as simple and minimalistic as possible and as every piece of extra and unwanted information will come at the undesirable cost of aesthetics and usability.

5.5.3 : 10 Heuristics of Nielsen

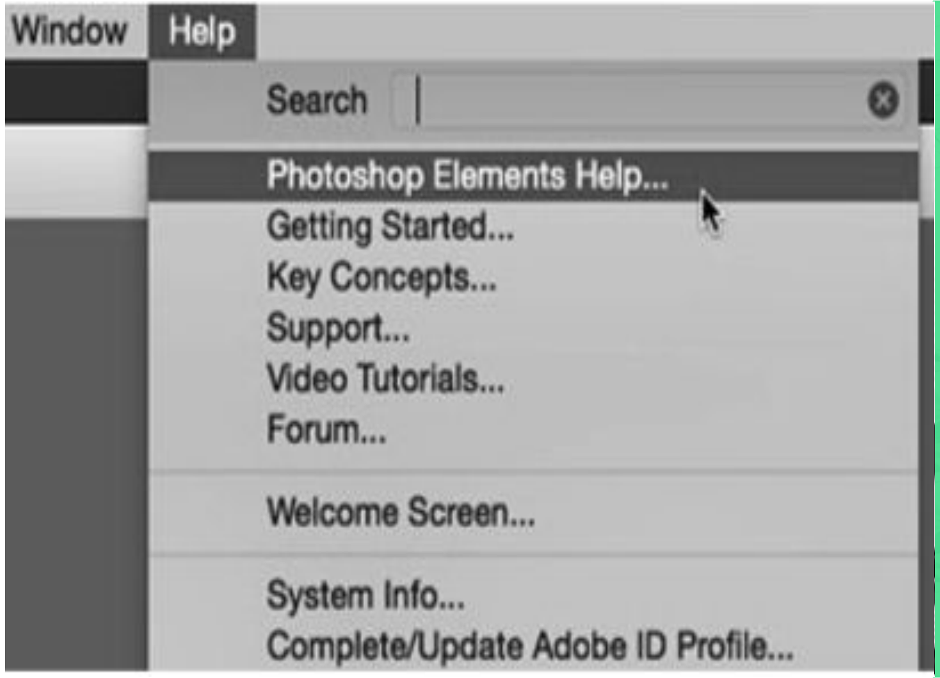
09 Help users recognize, diagnose and recover from errors



- **The system should be designed such that if any problem or an exception occurs the user should be able to resolve it on their own.**
- **User need not ask about the problem to others or spent much time searching for it.**
- **Proper error messages should be displayed, which should be right to the point and in easy to understand language.**

5.5.3 : 10 Heuristics of Nielsen

10 Help and documentation



- **Proper documentation should be provided to guide the user how to use the system.**
- **it should be readily available, well organised, with concrete steps and should be easy to search.**
- **It should not be very large but at the same time, be precise enough to deliver appropriate information.**

5.6 : ISO/IEC Standards (About)

ISO

ISO is a globally recognised standardization organization which stands for **International Organisation for Standardisation**, it is a network of National standardization institutes from all over 147 countries.

IEC

IEC Stands for **International Electrotechnical Commission.** IEC creates and publishes international standards for all the electrical, electronic and related technologies, collectively which are known as “electrotechnology”.

5.6.2 : Standards in ISO/IEC

1. ISO/IEC 25010:2011

- **Name :** Systems and software engineering--Systems and software Quality Requirements and Evaluation (SQuaRE)--System and software quality models.
- **Publication date :** 2011-03
- **Number of pages :** 34
- **Technical Committee :** ISO/IEC JTC 1/SC 7 Software and systems engineering

- Explain Characteristics related to Product Quality Model and static and dynamic properties of the computer system.

2. ISO/IEC 25023:2016

- **Name :** Systems and software engineering--Systems and software Quality Requirements and Evaluation (SQuaRE)--Measurement of system and software product quality.
- **Publication date :** 2016-06
- **Number of pages :** 45
- **Technical Committee :** ISO/IEC JTC 1/SC 7 Software and systems engineering

- This standard provides definitions of quality measures for quantitative evaluation of system and software product quality .

3. ISO/IEC 11581-1:2000

- **Name :** Information technology --User system interfaces and symbols--Icon symbols and functions--Part 1: Icons--General
- **Publication date :** 2000-04
- **Number of pages :** 9
- **Technical Committee :** ISO/IEC JTC 1/SC 35 User interfaces.

- This Standard basically provides a design and development framework of icons and their usage on screens which can display graphics and text

5.6.2 : Standards in ISO/IEC

4. ISO/IEC 11581-2:2000

- **Name :** Information technology--User system interfaces and symbols--Icon symbols and functions--Part 2: Object icons.
- **Publication date :** 2000-04
- **Number of pages :** 25
- **Technical Committee :** ISO/IEC JTC 1/SC 35 User interfaces

- Explain Object icons that are graphics which represent functions by using some associations with similar physical objects.

5. ISO/IEC 26512 : 2011

- **Name :** Systems and software engineering --Requirements for acquirers and suppliers of user documentation.
- **Publication date :** 2011-06
- **Number of pages :** 37
- **Technical Committee :** ISO/IEC JTC 1/SC 7 Software and systems engineering

- It defines the process of documentation from the both acquirer's and supplier's perspective, providing a general overview software user documentation.

6. ISO/IEC 17549-2:2020

- **Name :** Information technology--User interface guidelines on menu navigation--Part 2: Navigation with 4-direction device
- **Publication date :** 2020-02
- **Number of pages :** 12
- **Technical Committee :** ISO/IEC JTC 1/SC 35 User interfaces.

- This standard is designed to provide guidelines on menu structures and design of navigation methods for selection of menus.

5.6.2 : Standards in ISO/IEC

7. ISO/IEC 24752-1:20

- **Name :** Information technology --User interfaces --Universal remote console--Part 1: General framework
- **Publication date :** 2014-12
- **Number of pages :** 44
- **Technical Committee :** ISO/IEC JTC 1/SC 35 User interfaces

- This standard is a multi part standard, facilitating operations of electronic and information products with the use of alternative remote interfaces and intelligent agents.

8. ISO/IEC 24752-2:2014

- **Name :** Information technology --User interfaces--Universal remote console--Part 2: User interface socket description
- **Publication date :** 2014-12
- **Number of pages :** 49
- **Technical Committee :** ISO/IEC JTC 1/SC 35 User interfaces

- This standard provides definition to user interface socket, it defines it to be an abstract interface that can describe the state and functionality of a service or a device in a lower level machine language

9. ISO/IEC 24752-4:2014

- **Name :** Information technology --User interface-- Universal remote console--Part 4: Target description
- **Publication date :** 2014-12
- **Number of pages :** 19
- **Technical Committee :** ISO/IEC JTC 1/SC 35 User interfaces.

- Describe the target this standard provides XML (Extensible Markup Language) based language, and for discovery purposes this language is to be used within the universal remote framework.

5.6.2 : Standards in ISO/IEC

10. ISO/IEC 24752-5:2014

- **Name :** Information technology --User interfaces-- Universal remote console--Part 5: Resource description.
- **Publication date :** 2014-12
- **Number of pages :** 30
- **Technical Committee :** ISO/IEC JTC 1/SC 35 User interfaces

- The standard provides definitions of semantic and syntax for describing resources.

11. ISO/IEC 24752-6:2014

- **Name :** Information technology--User interfaces--Universal remote console--Part 6: Web service integration.
- **Publication date :** 2014-12
- **Number of pages :** 65
- **Technical Committee :** ISO/IEC JTC 1/SC 35 User interfaces

- Provide semantics and syntax for the embedded target's and the socket's description in the interface specification of web services in order to maintain clear mapping between the elements of WSDL documents.

12. ISO/IEC 30113-1:2015

- **Name :** Information technology -- User interface -- Gesture based interfaces across devices and methods--Part 1: Framework
- **Publication date :** 2015-04
- **Number of pages :** 13
- **Technical Committee :** ISO/IEC JTC 1/SC 35 User interfaces.

- This standard defines guidelines and framework for the gesture based interfaces across all methods and devices in order to provide interoperability support.

Summary

- Heuristics Rules and guidelines provide a systematic way of doing something, and help designers design better systems.

- Some of the golden rules are 8 Golden Rules of Shneiderman, 10 Heuristics of Nielsen, 7 Principles of Norman.

- ISO/IEC provide design standards specifications that are accepted and valued globally. ISO/IEC standards can have status as Published or Withdrawn, and are reviewed regularly with time.
- The interactive system follows a general flow : Perceive, Predict, Interact, Feedback, Learn & Understand, Observe & Practice. These steps followed thoroughly can make a system interactive and the designing easy for the designer.
- Design principles are calculated from a mix of theoretical knowledge, user understanding and experience.
- The principles to improve a system's usability are learnability, flexibility and robustness.

Summary

- To make a system implement Learnability it is necessary to be familiar with Predictability, Synthesizability, Familiarity, Generalization and Consistency.
- A system can be made Flexible by : Dialog Initiative, Multithreading, Task migratability, Substitutivity and Customizability.
- Robustness of a system can be ensured by : Observability, Recoverability, Responsiveness, Task Conformance.

Review Questions

- Explain Design Principles/Explain Principles of good UI Design. [Refer Section 5.5.2]
- What are design principles? Explain with an example considering any application of your choice. [Refer Section 5.5.2]
- Identify and Explain design principles for any website. [Refer Section 5.5]
- Identify any live example of GUI & Explain whether it follows standards & guidelines as per industry or not ? [Refer Section 5.5]
- Explain in brief any 5 Design principles [Refer 5.2]
- Explain the various principles to support usability [Refer 5.3.1]
- Explain the User Interface Design Guidelines set by Nielsen and Molich [Refer 5.4.1]

Review Questions

- Explain Learnability as a principles to support usability [Refer 5.3.1.1]
- Explain Flexibility as a principles to support usability [Refer 5.3.1.2]
- Explain Robustness as a principles to support usability [Refer 5.3.1.3]
- Define Usability and identify the most relevant Usability Goals for Ecommerce web application. [Refer 5.3.2]
- How we can minimize user memory load in the usability process. Explain in detail. [Refer 5.4.1(F)]

Multiple Choice Questions

- Shneiderman proposed how many golden rules ?
  A. 4
  B. 8
  C. 10
  D. 7

- Which of the following are most used in heuristic evaluation ?
  A. 8 Golden Rules of Shneiderman
  B. 10 Heuristics of Nielsen
  C. 7 Principles of Norman
  D. None of the above

- IEC stands for ?
  A. International Electoral Commission
  B. International Electrotechnical consortium
  C. India Electrotechnical Commission
  D. International Electrotechnical Commission

Multiple Choice Questions

- What is the minimum vote percentage required for international standard publication ?
  A. 60%
  B. 80%
  C. 75%
  D. 70%

- ISO Stands for
  A. International Organisation for Standardisation
  B. International Organisation for standard
  C. Intercontinent Standard Organisation
  D. International Standard Organiser

- Which of the following is not one of Shneiderman's golden rule
  A. Strive for consistency
  B. Enable frequent users to use shortcuts
  C. Offer informative feedback
  D. Avoid persuasive technologies

Multiple Choice Questions

- What is the meaning of error recovery in context of Nielsen's heuristics
  A. Help users recognise, diagnose and recover from error
  B. Write program that never throw error
  C. Create UI such that user never makes mistake
  D. Make task fluid and efficient

- Which of the following statement is true
  A. Users are better at remembering than recognising objects.
  B. All users comprehend the content the designer puts on the screen.
  C. There should never be more that one way of performing a task.
  D. None of the above

- Which of these is not a principle to support usability
  A. Learnability
  B. Flexibility
  C. Robustness
  D. Efficiency

Multiple Choice Questions

- Which of these is not a principle to implement Robustness
  A. Observability
  B. Responsiveness
  C. Multithreading
  D. Task Conformance

- Which of these is not a principle to implement Flexibility
  A. Dialog Initiative
  B. Familiarity
  C. Multithreading
  D. Task migratability

- Which of these is not a principle to implement Learnability
  A. Predictability
  B. Synthesizability
  C. Efficiency
  D. Familiarity

Multiple Choice Questions

- Which of these are not guidelines for designing
  A. Mimic real world concepts in designing
  B. Freedom of control for the designer
  C. Consistency is key for designing
  D. Minimize and prevent errors

- Which of these is not a standardized organization for setting design standards
  A. IEEE
  B. ISO
  C. NIST
  D. BSI

- Which is the next phase in the design cycle

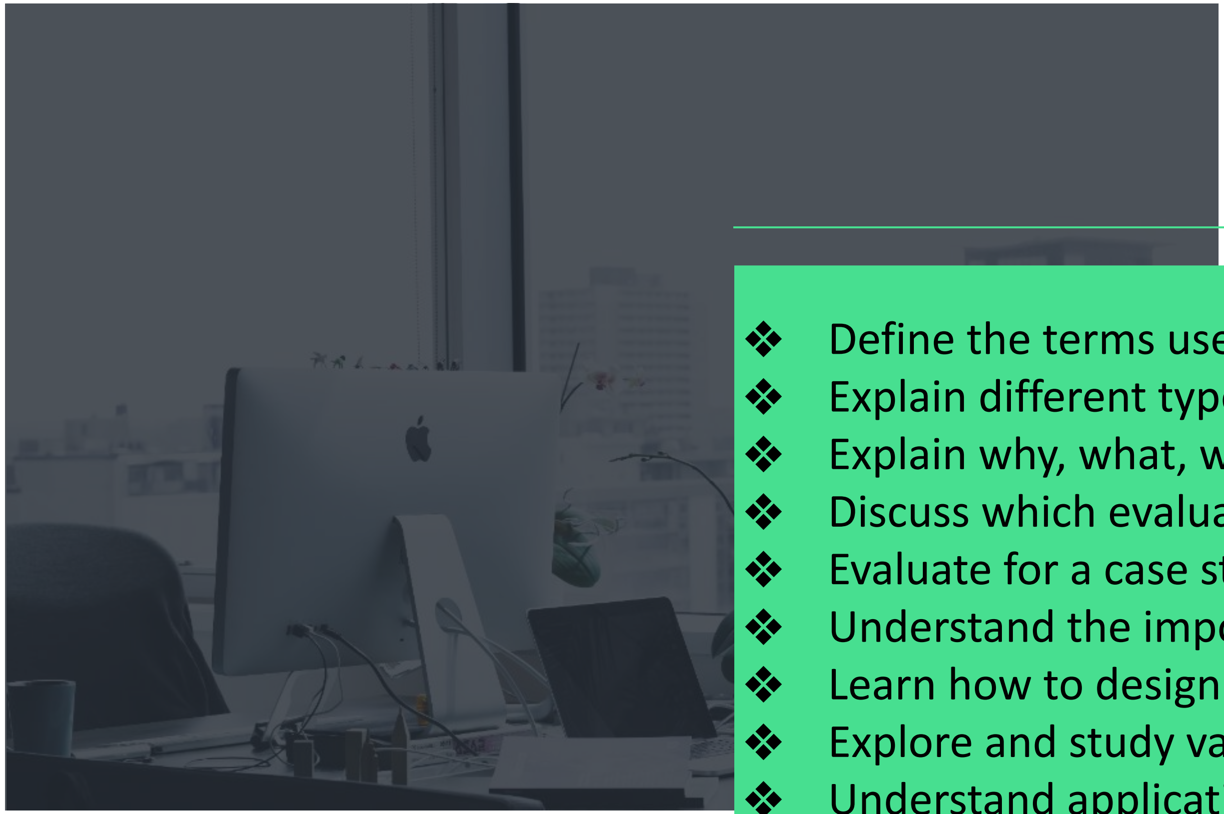
  A. Interact,
  B. Feedback
  C. Learn & Understand
  D. Predict

Answers of Multiple Choice Questions

- B. 8
- B. 10 Heuristics of Nielsen
- D. International Electrotechnical Commission
- C. 75%
- A. International Organisation for Standardisation
- D. Avoid persuasive technologies
- A. Help users recognise, diagnose and recover from error
- D. None of the above
- D. Efficiency
- C. Multithreading
- B. Familiarity
- C. Efficiency
- B. Freedom of control for the designer
- A. IEEE
- D. Predict

Module 6

Learning Objectives



After reading this chapter, you will be able to:

- ❖ Define the terms used in evaluation.
- ❖ Explain different types of evaluation.
- ❖ Explain why, what, when and where to evaluate for a product
- ❖ Discuss which evaluation method should be used for a product.
- ❖ Evaluate for a case study and discuss in depth about evaluation methods.
- ❖ Understand the importance of usability testing
- ❖ Learn how to design and conduct experiments
- ❖ Explore and study various design evaluation techniques.
- ❖ Understand application of Heuristic guidelines.
- ❖ Explain and study various predictive models.

Sub-Topics

- 6.1. Introduction
- 6.2. The Why, What, Where And When Of Evaluation
  - 6.2.1. Why evaluate?
  - 6.2.2. What to evaluate?
  - 6.2.3. Where to evaluate?
  - 6.2.4. When to evaluate?
- 6.3. Types of Evaluation
  - 6.3.1. Controlled Settings Involving Users
  - 6.3.2. Natural Settings Involving Users
  - 6.3.3. Any Settings Not Involving Users
  - 6.3.4. Choosing and Combining Methods
  - 6.3.5. Opportunistics Evaluations
- 6.4. Case Studies
  - 6.4.1. An experiment of investigating a computer game
  - 6.4.2. Study of skiers in the wild

Sub-Topics

6.5. DECIDE Framework

- 6.5.1 Determine the objectives of the evaluation
- 6.5.2 Explore the possible queries that need to be dealt with
- 6.5.3 Choose the assessment criteria and methods
- 6.5.4 Identify and address realistic shortcomings
  - 6.5.4.1 Audience
  - 6.5.4.2 Equipment check
  - 6.5.4.3 Timeline and costing
  - 6.5.4.4 Domain of assessors specialization
- 6.5.5 Decide a way to deal with the shortcomings
- 6.5.6 Evaluation, interpretation, and presenting the data
  - 6.5.6.1 Reliability of the analysis mechanism
  - 6.5.6.2 For how long will the analysis stand true
  - 6.5.6.3 The scope of biasness while analysis
  - 6.5.6.4 Further generalization scope
  - 6.5.6.5 Environmental affectance on the analysis

Sub-Topics

6.6. Usability Testing

- 6.6.1. What is usability
- 6.6.2. Purpose of Usability Testing
- 6.6.3. Methods, Tasks, and Users
- 6.6.4. Labs and Equipment
- 6.6.5. An Example of Usability Testing - iPad

6.7 Conducting Experiments

- 6.7.1 Hypotheses Testing
- 6.7.2 Experimental Design
  - Different participants design
  - Same participants design
  - Matched participants design
- 6.7.3 Statistical Analysis

6.8. Field Studies

- 6.8.1. In the wild study
- 6.8.2. Other perspectives

Sub-Topics

- 6.9. Heuristic Evaluation And Walkthroughs
  - 6.9.1. Heuristic Evaluation
  - 6.9.2. Walkthroughs
- 6.10. Predictive Models
  - 6.10.1. Fitts’ Law
  - 6.10.2. GOMS Model
- Summary
- Review Questions
- Multiple Choice Questions

6.1 : Introduction

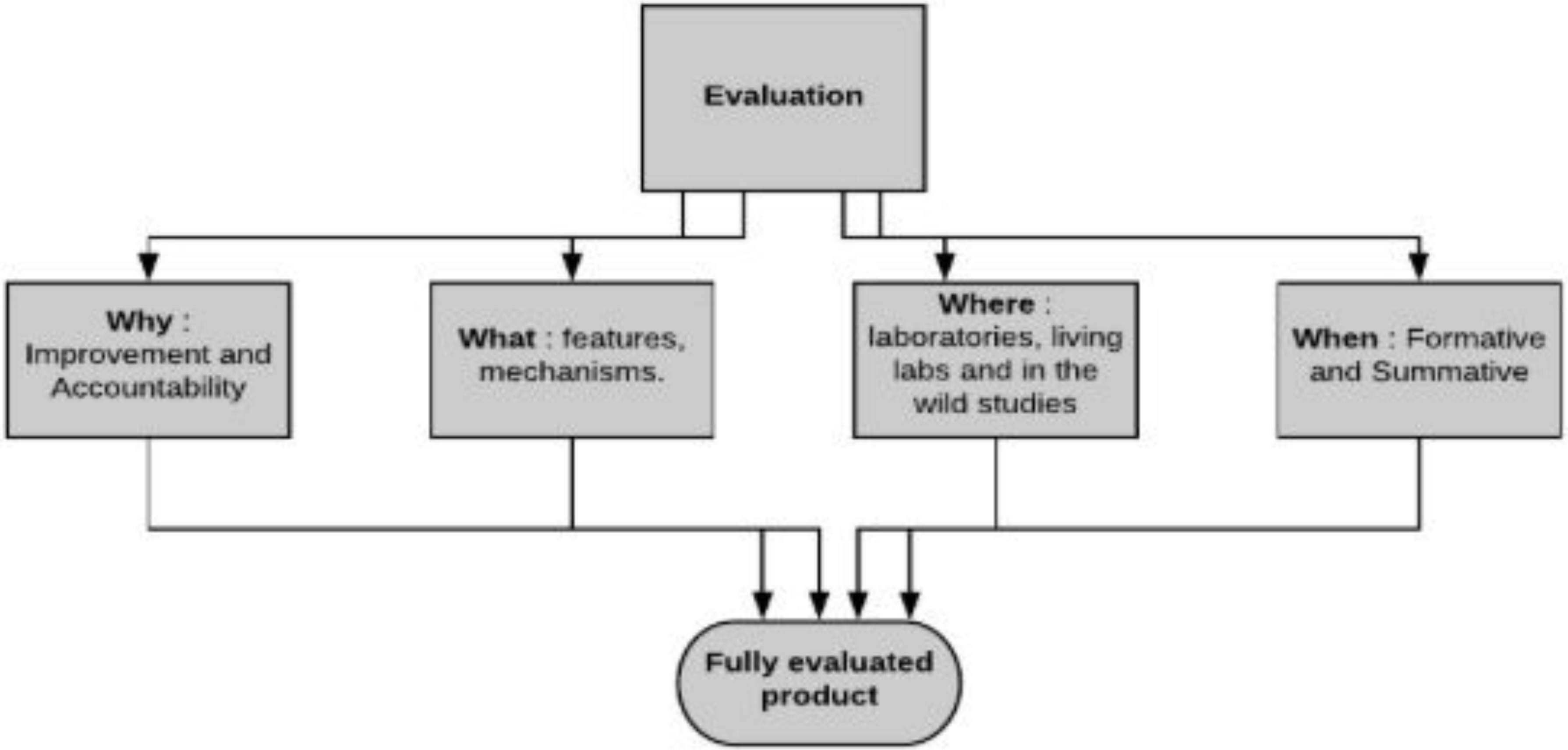
Introduction

Evaluation is a very important and iterative step in the process of making a product. Evaluation focuses on how easy the product is to use i.e. Usability and on the user’s experience with the product.

Evaluation

Evaluation means to assess the product in a critical manner. It requires to go through the characteristics, functioning and result of the project/work. The product should be evaluated not only by the designers themselves but by a wide range of users. This helps in better results as designers have made the product and would be pleased by the product as it suits their taste and needs. But it may not be similar for a third party user.

6.2 : The Why, What, Where And When Of Evaluation



6.2 : The Why, What, Where And When Of Evaluation

- **Performing evaluation, as discussed above, is extremely important.**
- **Hence we should understand why, what, where and when to evaluate so that it benefits our product to the fullest.**

01 What

02 When

03 Why

04 Where

6.2 : The What, When, Why And When Of Evaluation

What

Evaluation can be of different features ranging from small things such as button labels, color of the navigation bar to big mechanisms like email delivery system, safety features.

When

The time that is appropriate to evaluate a product depends on what type of product it is. a product can be an upgrade of an existing product or a brand new idea in the market.

6.2 : The Why, What, Where And When Of Evaluation

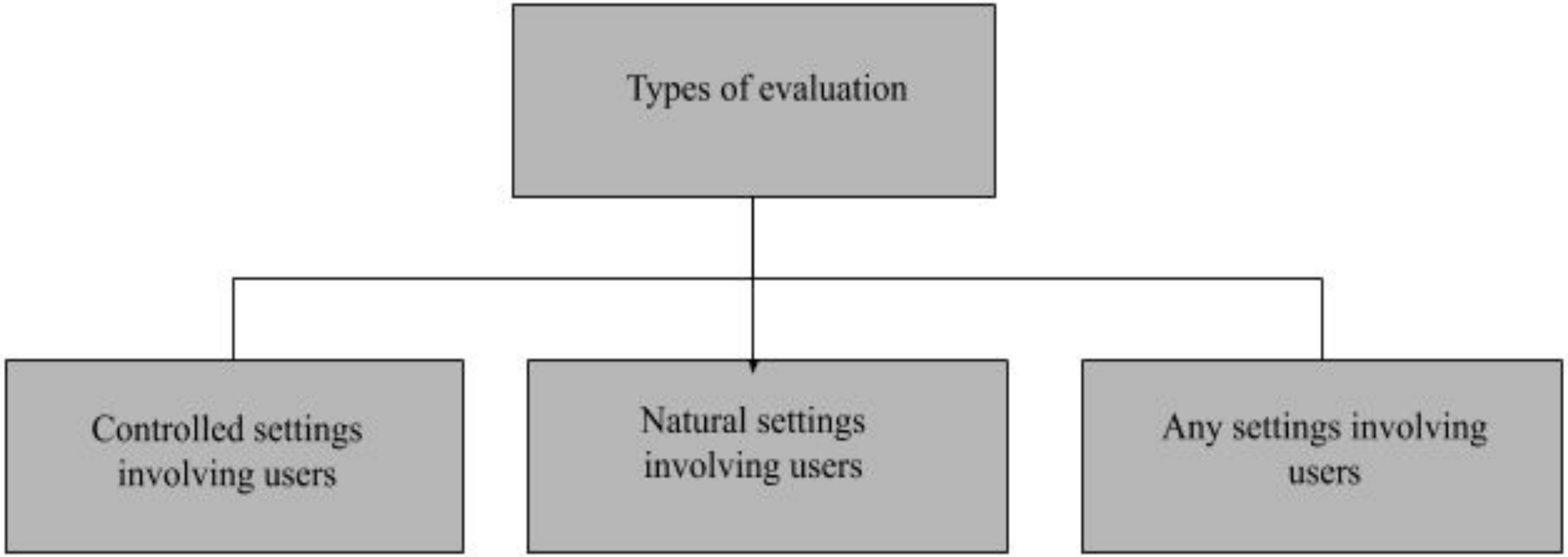
Why

Evaluation is necessary as users are not satisfied with a product which is only usable. They need a product which also attracts the customers by good aesthetic appeal providing them a very pleasing experience.

Where

The place where evaluation is happening depends on what is being evaluated. Evaluation of products can take place in laboratories, living labs and in the wild studies.

6.3 : Types Of Evaluation



6.3 : Types Of Evaluation

Controlled settings involving users

In order to test conditions hypothetically and measure or observe certain results, users' activities are controlled . The main methods that are used are experiments and usability testing. Examples are living labs and laboratories.

Natural settings involving users

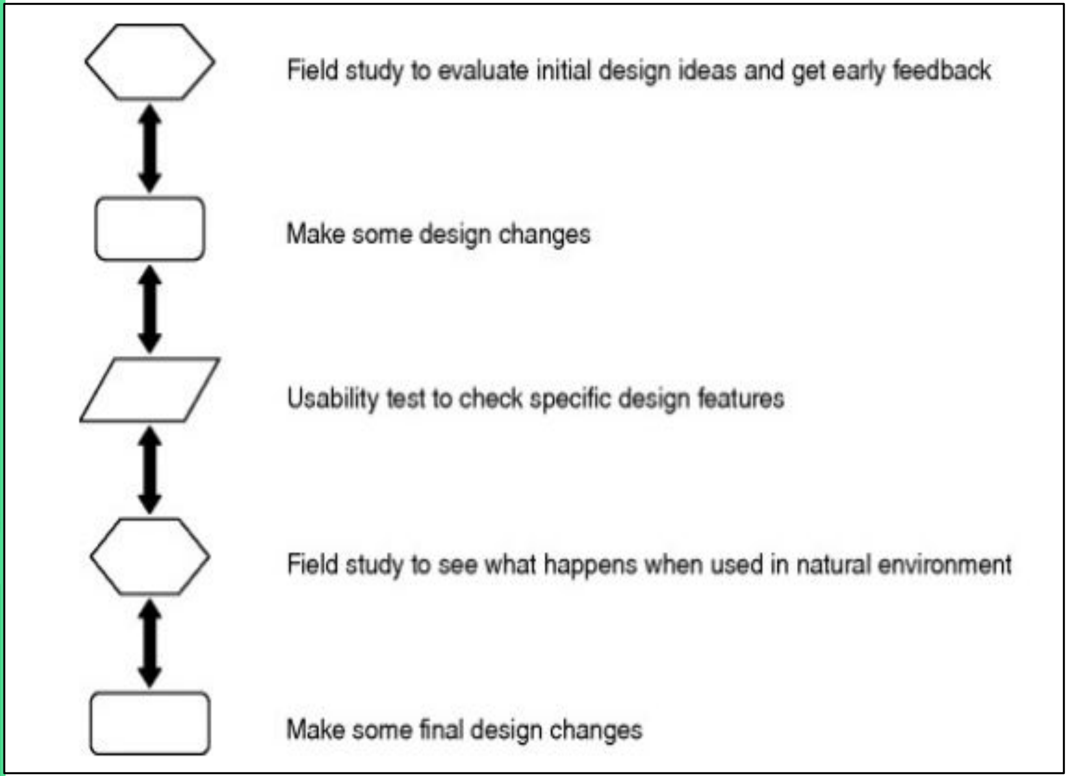
The conditions are tested in the real world where there is little to no control on the users' activities. The main method used is field studies. Examples are communities that are online and products that are used in public places.

Any settings not involving users

In order to recognize the most obvious usability problems consultants and researchers need to predict and model aspects of the interface. The range of methods includes inspections, heuristics, walkthroughs, models, and analytics.

6.3.1. Choosing and Combining Method

- Normally , combinations of two or more types are used for evaluation.
- This helps in acquiring better results as every type of evaluation has pros and cons of itself.
- In figure, we have used two types for evaluating a smartphone. First we have used natural settings as the idea is new and we need the feedback of users of how they feel about this.
- According to the feedback the changes are done. Then a prototype is made and then this prototype is tested in Laboratory i.e. a controlled setting. This helps to keep an eye on the going on evaluation and also evaluators can tell the users on what tasks to perform to get a better idea of a specific mechanism.



6.3.2. Opportunistics Evaluations

- Opportunistic evaluations are done before developing a product in order to find out whether the idea is good enough to proceed with.
- Designers can share their ideas locally and ask for their opinions and feedback.
- There is no need for formal evaluation as the product is yet not developed.
- This saves money and time as the response can be analyzed and further action of redeveloping or continuing with the current idea can be decided.

6.4 : Case Studies

- We are going to look ino two case studies, the first one in a controlled environment and second in a natural environment.
- First one is of a computer game that has users which are an expert in software games.
- Second case study is of skiers who are using a mobile application that indicates how well they are doing and will let designers know how it improved their performance.

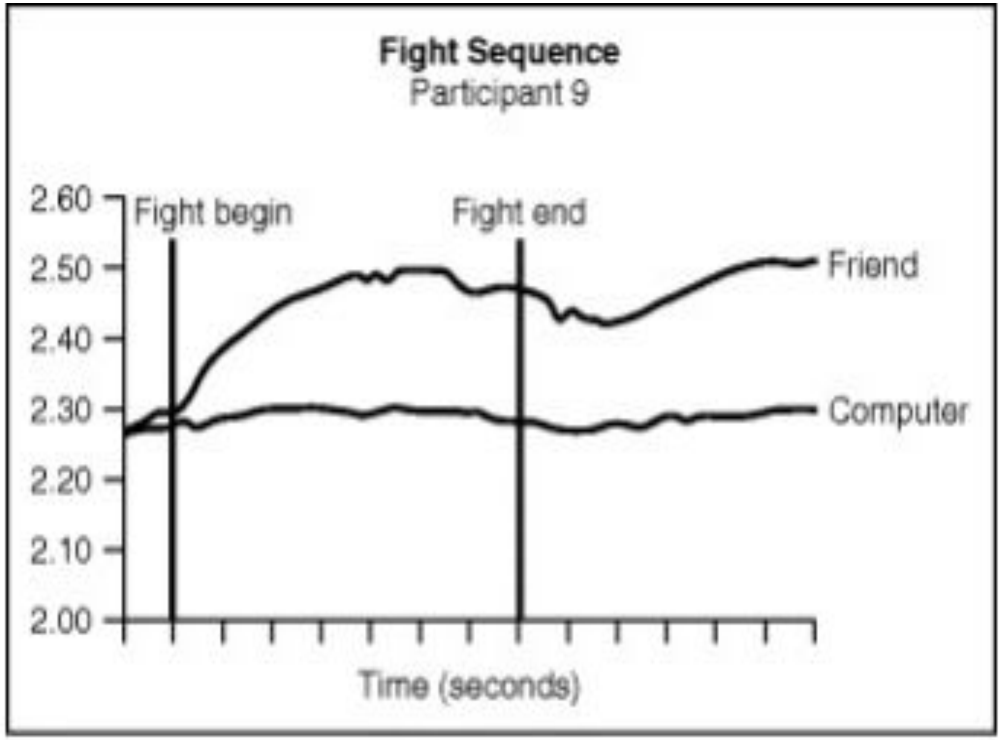
6.4.1. An experiment of investigating a computer game

- Here we have 10 well versed computer game players.
- These players will compete with the computer once and once with their friends in an ice hockey game on the computer.
- The focus is how does playing with computers differ from playing a human counterpart and whether this affects the interest of the players.
- Physiological data will also be gathered such as sweating of the hands, heart and breathing rate.
- The participants will be recorded while they are playing and also asked to fill in feedback forms. Half participants first competed with their friends and the other half competed with the computer.

6.4.1. An experiment of investigating a computer game

- **Here, the observations of participant 2 where comparison is done when human scores against a human and computer. As seen in the figure, we can say that the response of the participant against a friend increases after goal is scored whereas with respect to computer it does not change much**

6.4.1. An experiment of investigating a computer game



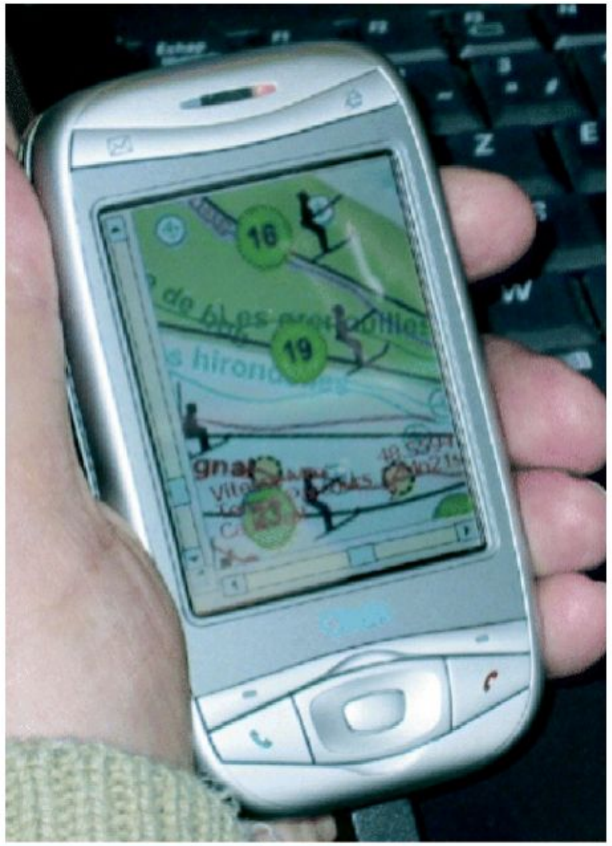
- **When the fight begins against a friend the participant's response increases till the time the fight is on, whereas for a computer it remains stable as in figure above.**

Hence we can observe that using a controlled setting we can gather enough data and analyze them for our benefit and then implement it into making our product a better one.

6.4.2. Study of skiers in the wild

- In this study intended users are the skiers.
- They are all provided with a helmet that has an accelerometer that measures speed and a mini camera on it as shown in the figure
- The study is to find out how users use the mobile application that can help them improve performance in skiing.
- The working of the application was that the skiers performance were recorded and sent to the database of the application. Later the users had to enter a chalet and then the research team could download the data. Users would then receive a message to access their clips.

6.4.2. Study of skiers in the wild



- It used to show the performance such as distance covered, highest speed, time taken to ski, etc as shown in the figure
- When and how many times did the users open the application was recorded.
- Surprisingly, it was observed that the skiers prefered to look at their performance when they took breaks between the sessions instead of looking after each skii.
- By organizing an informal dinner and asking a simple questionnaire to gather feedback, here it was found that skiers prefered to look in the break sessions because they did not want to waste time between skiing. Also , other technical issues that were faced by the skiers were discussed

6.5 DECIDE Framework

The name of the framework is an acronym of stepping stones which behaves as an auditing tool for budding evaluators.

D - Determine the objectives of the evaluation
E - Explore the possible queries that need to be dealt with
C - Choose the assessment criteria and methods
I - Identify and address realistic shortcomings
D - Decide a way to deal with the shortcomings
E - Evaluation, interpretation, and presenting the data

6.5.1 : Determine the objectives of the evaluation

- When a product is to be made, the end user, multiple stakeholders have a set of demands and objectives which need to be considered while making a design.
- There needs to be an assessment of the futuristic objectives which the design is supposed to fulfil.
- An assessment is to be done to identify the people who want this objective to be fulfilled and their reason for the same.
- There can be a lot of reasons why a stakeholder or user wants a change in the design.
- Some of the possible reasons could be that the design may be a bad design which needs to be rectified, it could be that the design is obsolete and needs an upgrade or it can be that the stakeholders have higher expectations from the design and so it needs to be revamped completely.
- This step is the first step of the framework because getting the client’s requirements right is the first step and if there is any sort of void being created here then the design ought to be a disaster in the near future.

6.5. 2: Explore the possible queries that need to be dealt with

- Now that the objectives are identified there needs to be a technique to assure the evaluator at the end of the assessment that the objectives that were set are achieved or not.
- To aid the assessor in identifying this a set of queries can be answered which are related to the objectives foreseen. Example to understand this could be of the goals on why do students in Mumbai prefer playing cricket over playing hockey. This can be evaluated by a lot of proceeding questions like :
  - ➢ Are there proper grounds for playing hockey in Mumbai ?
  - ➢ Is hockey taught as a game in different educational institutions ?
  - ➢ Are there proper hockey classes to nurture young talents ?
  - ➢ Are there any geographical barriers that hamper hockey terrains ?
- Now these questions can be subclassed even further like :
  - ➢ Are there proper grounds in Zone 5 of Thane district
  - ➢ Are there educational institutes that nurture hockey in Wadala district
- Sub questions can further be divided into more specific questions for evaluation. The more specific the question the more quality the analysis will gain.

6.5. 3: Choose the assessment criteria and methods

- Now that the objective completion is also verified it is critical to boil down to an assessment criteria and decide what will be the method of assessment.
- While the evaluation is being done numerous shortcomings can be encountered but it should be ensured that a solution is derived and the analysis is done. It is to be noted that at some or the other point the designer will have to make some considerations.
- Let us assume in a scenario the cost estimated was too much and the budget cannot be increased so the designer may have to cut short on the equipment cost or manage accordingly.
- It can also be possible that because of geographical changes some changes have to be made in the nick of time. There should always be room for complicacies and some middle way out.
- During data gathering it should be ensured that the data is gathered from more than one perspective to ensure unbiased data collection.
- It is always like a story has two or more representations and as the data analysts it is necessary to consider the different outlooks of the same scenario.

6.5.4 : Identify and address realistic shortcomings

- Now that the course of the evaluation is fixed it is important to look for the possible loopholes or rather voids that can hamper the smooth evaluation flow.
- For any assessment to be conducted it is necessary to know about where the test can halt and how to get it back on track.
- This is exactly what this step aims at, locating the pragmatic speed bumps on our road of evaluation.
- The speed bumps can be the audience, equipment check, timeline and costing, domain of assessors specialization. We had studied in the previous step that some or the other condition can force the designer to compromise in some form, these are a few possible reasons that can cause him to make a compromise.

6.5.4.1 : Audience

- The evaluation process could look quite smooth but targeting the wrong audience for directing our questions can be catastrophic.
- Like if the assessor wants to check the popularity of the video game consoles, the target audience for the evaluation should be teenagers and not senior citizens above the age of 70.
- Their responses can give a very distorted route to the evaluation.
- Same way for finding the most commonly used technique for cooking a delicacy should be asked to the homemakers and not the children in the houses.
- Every system developed is made with a fixed audience in mind and would have features the audience would enjoy.
- Targeting the wrong users makes the whole evaluation go in a bizarre direction.
- For example in the video game console example if 10 senior citizens were interrogated and only 2 knew about the console it means 20 percent is the result percentage of popularity. But possibly if 10 teenagers had been questioned maybe 9 would give a positive response which makes it 90 percent as this console was targeted to the teengaers and not the senior people.

6.5.4.2 : Equipment check

- Another bump in the evaluation could be due to the equipment that are being used for the data recording and gathering. Let us say that the data is to be recorded in an interview for later reference or processing.
- This may include a video recorder where the interviewer and the interviewee both are being recorded. But the interviewee may feel uncomfortable during the interview being on a continuous notice by the less.
- This may hamper his ideas and maybe he will not freely put across his point of view when under the lens.
- It needs to be noted that there should not be any hindrance for the user while giving any opinion as his opinion is the final input for us for data processing.
- While an interview it can also be possible that there may be battery backups and extra recorder tapes needed.

6.5.4.3 : Timeline and costing

- In the data processing each and every step is preplanned and it is important to stick to the timeline planned as delay in one stage will result in delaying the succeeding stages.
- This can lead in a heavy compromise in quality of the analysis and assessment.
- When the client is from an industrial setup delivery on time is very critical as it can hamper the image in the market.
- A survey may need about 100 responses for analyzing the data but maybe paying 100 people to take a survey can cause a heavy burden on the pockets of the evaluator.
- Hence it should be made sure that a costing is made and that the evaluator and designer both stick to the budget allocated for each stage.
- Like we have seen that there needs to be a compromise made at some or the other stage so to stick to the budget a compromise can be made on the number of respondents that take up a survey for the evaluator.

6.5.4.4 : Domain of assessors specialization

- Another bump in the investigation can be the competence of the assessor.
- Just like before playing for any team it is needed to go through tryouts, for an investigator it is needed to be experienced for doing an investigation.
- It is common sense that a science student who has no idea about balance sheets cannot be hired to identify why the total is not tallying.
- This is exactly how an assessor needs be given work which he is capable of doing and he excels in.
- Let us say that a model is to be assessed but does not have any preferred model so a naive evaluator may not be able to handle it but an expert one can easily handle it and the quality of the assessment will also be ensured.
- For a video to be evaluated it can take multiple hours so a person with ample experience is needed, not someone who is doing the evaluation for the first time.
- When some statistical analysis is to be carried out it should be ensured that someone who knows statistics is the evaluator or atleast a mentor during the process.

6.5.5 : Decide a way to deal with the shortcomings

- Consider that you were requested to be as user of new product that is to be evaluated, you gave your general and personal details and experience, feedback about using the product under evaluation, after few days it come to your attention that lot of media is focussing on because of an unfortunate quote that you did about that product, also some of your personal likes, dislikes and data like height weight come over newspaper, fliers, or advertises.
- When this happens would you be comfortable with it? Or in the worst case scenario your data might get stolen from the authorities that took the review and may be misused, would you be okay with it?
- Whenever for any cause we take data from users be it a survey, evaluation, or maybe just a form for some activity, a lot more should be taken into consideration than just taking data and evaluating it.
- It might not always be the case that the user is comfortable with our procedures.
- As when we take surveys etc we do obtain users data but at the same time we are responsible for proper use of it in terms of privacy, confidentiality, safety, and integrity.

6.5.6 : Evaluation, interpretation, and presenting the data

- After the data has been collected by data gathering techniques like surveys, observations, questionnaires, researches, studying documentation or interviews, it needs to be analyzed, understood and presented in a simple format.
- Figuring out the method of analysis so that the findings can be understood and presented in the desired format. We have studied about the different types of data being qualitative and quantitative, both these types of data have different processing and analyzing techniques associated with them.
- The data after collection needs to be filtered in the form of the type of processing it needs to follow, like techniques for analyzing qualitative data not to be used for quantitative datasets.
- The following criterions should be questioned :
  - ➢ Reliability of the analysis mechanism
  - ➢ For how long will the analysis stand true
  - ➢ The scope of biasness while analysis
  - ➢ Further generalization scope
  - ➢ Environmental affectance on the analysis

6.5.6.1 : Reliability of the analysis mechanism

- When we are going to draw conclusions from an analysis it is a sheer necessity to be sure of the fact that the data that is processed is being done by a reliable technique.
- Reliability is measured by the fact if the data produces the exact same result even after multiple runs of the analysis.
- The reliability of the data also depends on the technique that was used for data gathering.
- Like for an example of an interview, structured interview data can be recreated to verify as simply the questions are scripted but for a group discussion or unstructured interview it is not possible for each and every point to be raised as it is generally impromptu.
- Hence the reliability of an unstructured interview is very low.

6.5.6.2 : For how long will the analysis stand true

- The veracity of any technique for evaluation should be checked and noted.
- Every assessment has some criterias on which a system is to be assessed.
- Like for example of a student whose grades are dropping because of stress it is necessary to carry observation when he is at home and free of foreign hindrance.
- It cannot be done in a planned setup where it is known that he will be more stressed because of the environmental changes.
- If the objective was to identify the reason he feels stressed at home and the grades have dropped then it is necessary to identify it at home and not in a laboratory setup.

6.5.6.3 : The scope of biasness while analysis

- Being biased means favouring one outcome over another.
- Like in a cricket match the reason the umpire takes the decisions and not the captains of either teams is so that an impartial decision is taken and there is no favoritism involved in the decision.
- Like we discussed earlier that experience of the assessor also plays a vital role in the assessment. A senior assessor may have seen the same designing flaw multiple times and reject a design and get a really bad impression of the system.
- But the way he would have assessed it if he did not have that much grudge against the flaw would change his opinion drastically.
- This is what we mean when we say that the evaluation should be unbiased.
- Biasness should also be shown by the data collector as one may feel some data while gathering is not that important but it may be the missing link for some analysis which could not be done as sufficient data that was needed was not collected.
- In an interview it can be very leading for the interviewee if the interviewer uses voice modulation when he disagrees or nods his head. It should always be made sure that the interviewer is being impartial and professional.

6.5.6.4 : Further generalization scope

- The generalization scope means at what scale can the generalization be carried out.
- Like for example if 20 boys play cricket out of 50 boys is it right to say that cricket is not popular amongst boys. This data is not sufficient for making such statements as the data processed is not enough to back the conclusions that are drawn.
- Although if such a conclusion is to be drawn multiple analysis should be done and using triangulation to ensure that the data processed was not biased and can support the proposed findings.

6.5.6.5 : Environmental affectance on the analysis

- When we are to do an assessment it is necessary to even note down the environmental constraints at the time of the investigation.
- These may not directly change the results or the findings but have a major indirect impact on the stages of collection, analysis and interpretation.
- For example an experiment done in a lab with pure water can have some result but it is not that reliable in the real world as the purity of tap water would not be as much as the water in the laboratory. It is often noted that interviewees become conscious and react in a different way when under the lens.
- It is a general human tendency to behave differently when we know we are under supervision.
- So when assessing the video it should be noted and considered that the data can be a little distorted because the interviewee knew he was under the lens.
- It should be made sure that the data that is being analyzed has no environmental pressure on it.

6.6 Usability Testing

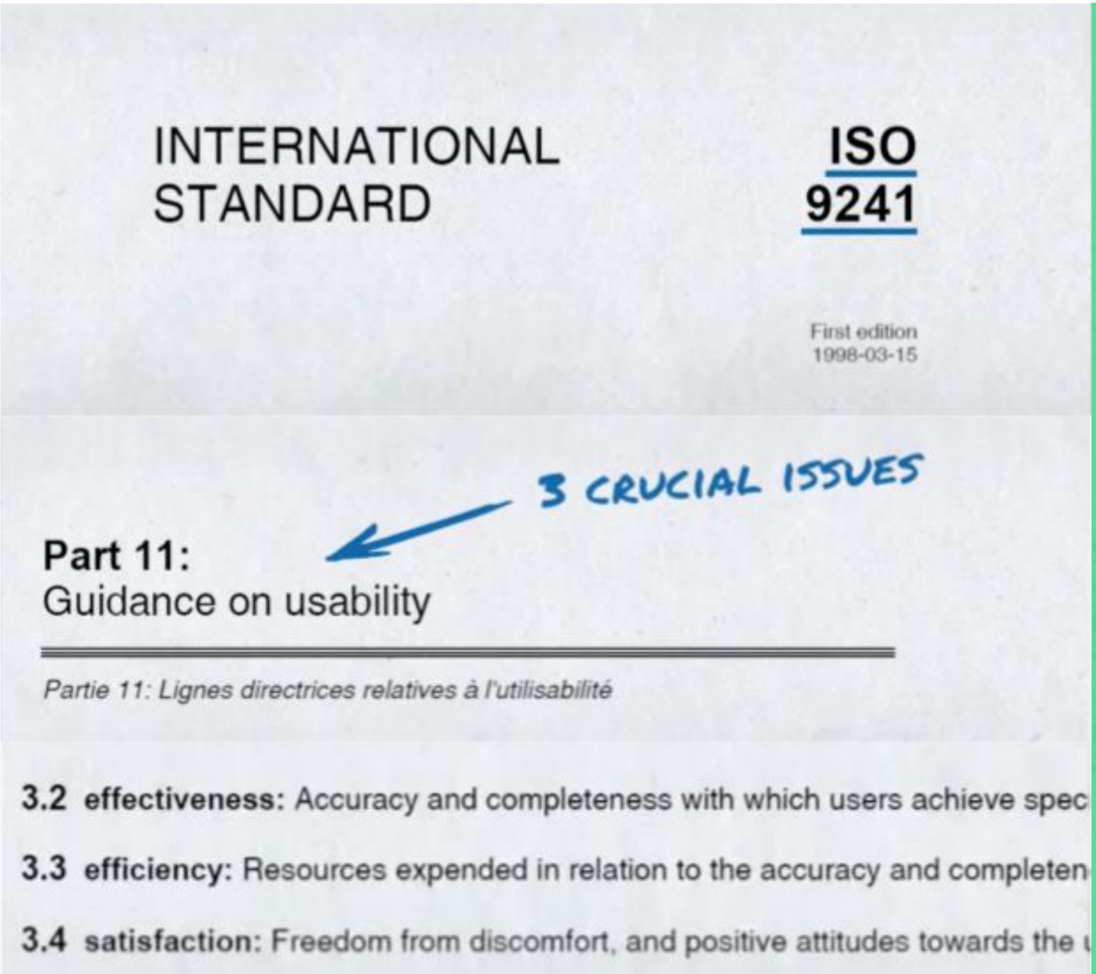
6.6.1 What is usability?

- Throughout this book we have mentioned that usability of the product should be ensured. Usability can be defined as the degree to which the product is able or fit to be used.
- An usable interface has three main outcomes:
  - First time users should be able to easily use and become familiar with the user interface. For example, a well-designed travel agency website is intuitive and first time users can also easily figure out how to book a holiday.
  - It should be easy for users to achieve their goals and objectives. For example, if booking a holiday is the user’s goal then a good design should easily facilitate the booking.
  - On future visits the user should be able to recall the user interface and how to use it.
- At the end of the day, the usability of a product plays a huge part in determining a product's success or failure.

6.6.2 Purpose of Usability Testing

- ➢ Purpose of usability testing is twofold.
- ➢ Firstly, through usability testing, communication between user and designer is established. Designers learn about the user’s goals, problems and perceptions. Thus designers start to better understand the user's perspective.
- ➢ Secondly, usability testing helps evaluate the product. Whether the product meets users’ needs and expectations is assessed. Design decisions are also tested and validated. Potential problems and improvements are identified. It helps prevent issues from slipping through the cracks.

6.6.2 Purpose of Usability Testing


INTERNATIONAL STANDARD

ISO 9241

First edition 1998-03-15

3 CRUCIAL ISSUES

Part 11:
Guidance on usability

Partie 11: Lignes directrices relatives à l'utilisabilité

3.2 **effectiveness:** Accuracy and completeness with which users achieve spec

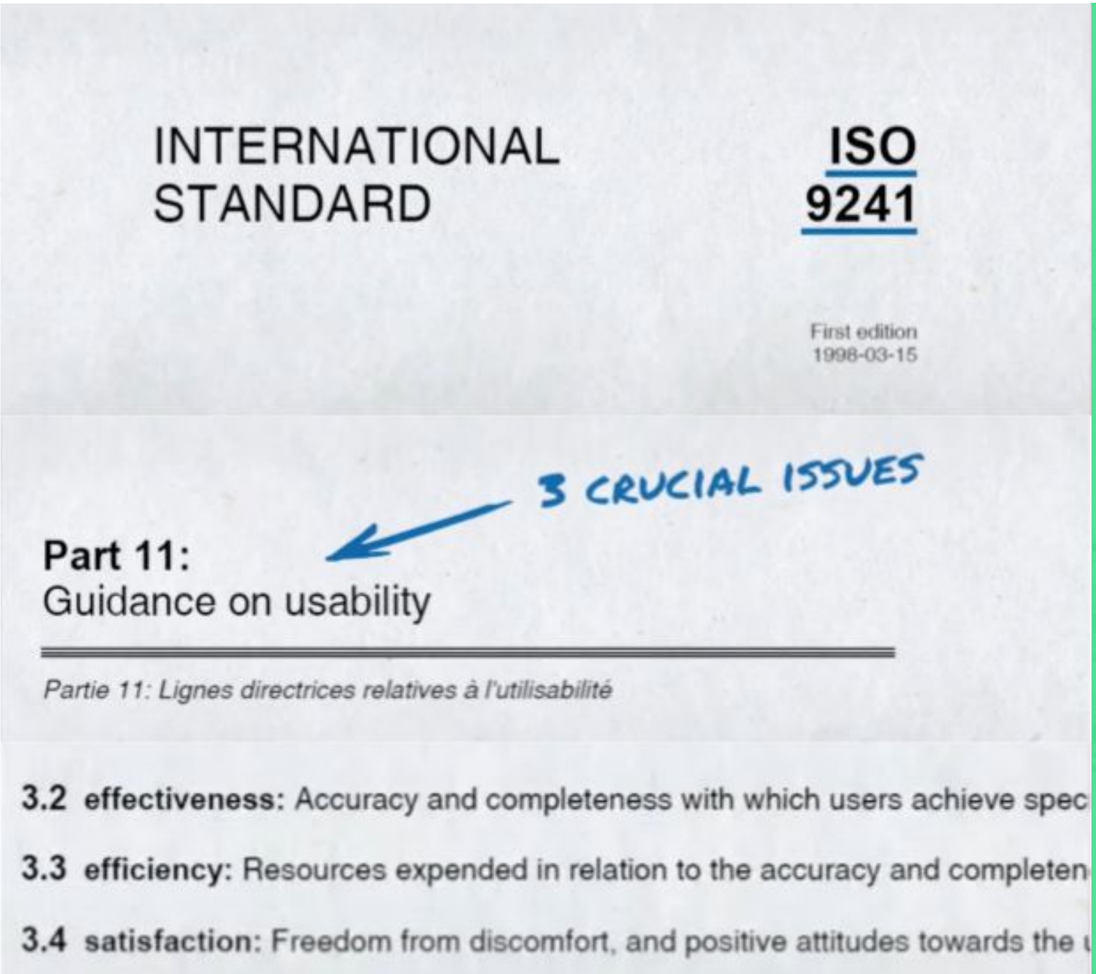
3.3 **efficiency:** Resources expended in relation to the accuracy and completen

3.4 **satisfaction:** Freedom from discomfort, and positive attitudes towards the u

ISO 9241 (1998) was the one of the first to provide guidance on usability. It stated 3 critical components to usability, using these factors usability is evaluated.

- **Effectiveness: Accuracy and completeness with which users achieve specified goals**
- **Efficiency: Resources expended in relation to the accuracy and completeness with which users achieve goals**
- **Satisfaction: Freedom from discomfort and positive experience on using of the product**

6.6.2 Purpose of Usability Testing



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3.4 satisfaction: Freedom from discomfort, and positive attitudes towards the

Nowadays, in addition to the above mentioned characteristics two more are used to assess the usability of products:

- ➢ **Error tolerant: How well the design prevents errors and helps with recovery from errors that do occur. The product should be idiot proof**
- ➢ **Easy to learn: How well the product supports both initial orientation and an increase in the understanding of its capabilities**

6.6.3 Methods, Tasks, and Users

- Traditionally usability testing is performed in special laboratories.
- Testing in these laboratories enables evaluators to control environmental and social influences. These often can impact the performance of users and thus need to be controlled to ensure accurate results. Nowadays however tests are often also collected in the field.
- The heart of usability testing is collecting data of users' performing some predefined tasks. Data can be collected using various techniques. Data will include video, audio, screen recordings, keystrokes, mouse tracking, touch tracking, screen, facial expressions, notes by observers, etc.
- Users' are also asked to provide their feedback and ratings through questionnaires or interviews.
- Additionally number of users/participants to be involved in the test should be selected carefully. Generally for a single task 5 to 12 participants is enough. For a quick feedback on a small design idea, like the colour of the navigation bar, even just considering 2-3 users is enough.

6.6.3 Methods, Tasks, and Users

During the test the performance of users are measured. Wixon and Wilson say the quantitative performance measures obtained are the following:

- Time to complete a task
- Time to complete a task after a specified time away from the product
- Number and type of errors per task
- Number of errors per unit of time
- Number of navigations to online help or manuals
- Number of users making a particular error
- Number of users completing a task successfully

6.6.4 Labs and Equipment

- There are often dedicated facilities built for usability testing. These facilities not only consist of the main testing lab but will also have a viewing/observation room attached.

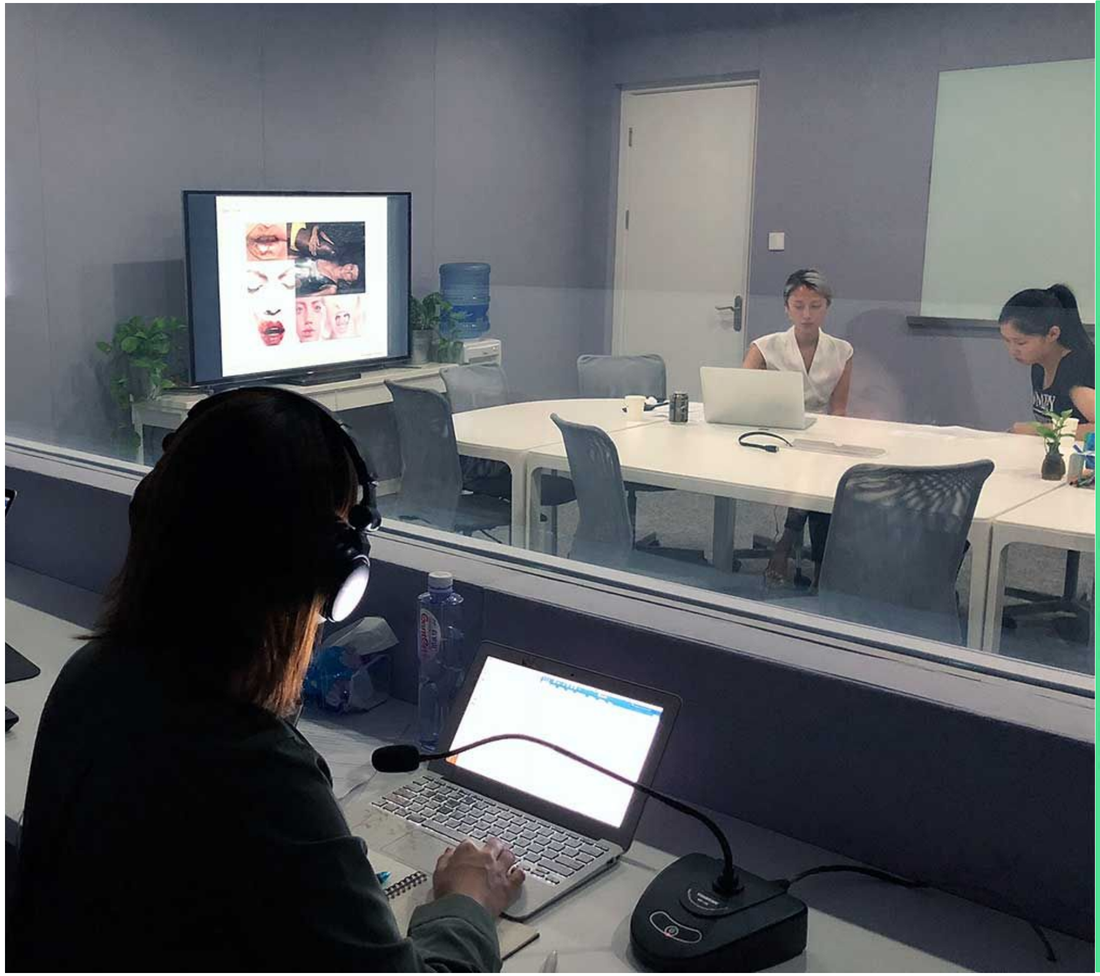
- The main testing lab will have recording equipment setup. Not only are the audio and video recorded but keystrokes, touches, mouse movements etc are also recorded.

- The lab space itself will resemble the real world and can be changed according to task and scenario being tested.

- The main lab is isolated from the real world, i.e. the room is soundproof, there are no windows and no phones. This ensures that there are no external factors/distractions that can skew the tests.

- Additionally during tests and while participants are interacting with products it is essential that observers do not invade the personal space of participants. Since this can skew tests.

6.6.4 Labs and Equipment



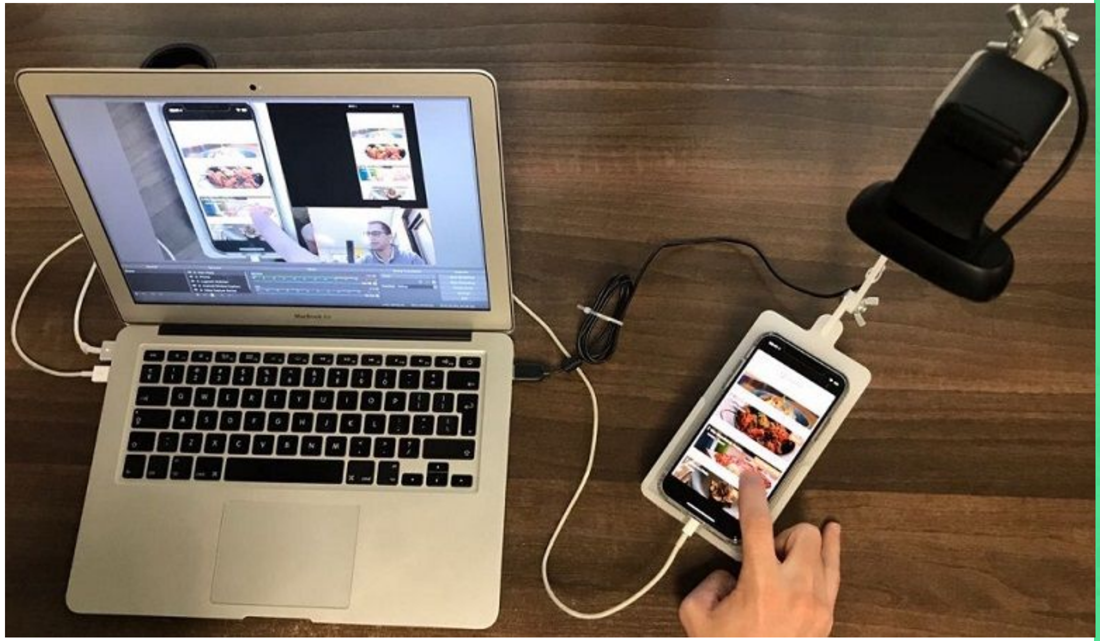
Additionally an observation room is normally also attached to the main laboratory.

A one-way mirror separates the testing lab and the observation room so that observers can watch participants without users/participants being aware of the observer’s presence.

Such labs are very useful since they ensure a controlled testing environment.

However such labs are very expensive to set up and maintain.

6.6.4 Labs and Equipment



Nowadays many companies prefer using mobile testing labs/kits.

Small testing kits can easily be transported anywhere. One of the biggest benefits is the significant lower costs. Additionally the mobile testing labs have the advantage of being portable and tests can be performed in real world scenarios also. It is also more convenient for participants/users since the test itself is brought to them.

Mobile labs/kits normally consist of recorders, cameras, laptops, and other measuring and recording equipment that can easily be transported and temporarily set up in an office or any other space.

6.6.5 An Example of Usability Testing - iPad

- In 2010 individuals from Nielsen Norman Group conducted usability testing on the iPad. The iPad was new in the market and they wanted to test whether the iPad lived up to the hype.

- The important questions they wanted to answer were: ‘Are user expectations different for the iPad compared with the iPhone?’ Additionally, an earlier study had established that iPhone users prefer to use apps over visiting websites in the web browser because the latter is slower and more cumbersome.

- Participants with at least 3 months’ of iPhone experience were chosen. In the start of the test the participants were asked to explorer applications on the ipad that they found interesting. Later the participants were asked to open 32 different apps / websites and perform over 60 tasks. The participants were asked to comment on what they were doing and what they liked and disliked about the app / website. Additionally there were three evaluators who were observing the users and taking notes. Video cameras recorded participants' interactions with iPad and the iPad's screen itself was mirrored to the evaluators' laptops.

Usability Problems of iPad

- The tests showed that on iPad the participants' interactions with websites were not optimal. For example, page links were often very small and it was difficult to tap on this small target area.
- Another problem found was that often users did not know where to find the back button and struggled to return to the home screen.
- Another problem was due to the two orientations possible on the iPad: landscape and portrait. Some apps displayed more information in landscape than in portrait which confused some participants.
- Problems that were identified were then classified depending on interaction design principles. Examples include getting lost in the application, quality of images, touch screen with small target areas, changing orientations issues, etc.

6.7 Conducting Experiments

6.7 Conducting Experiments

- Interfaces are sought to be designed in a way that best supports the product's functionalities and a good user experience. During this interface design, designers always have to make certain educated guesses and predictions. These assumptions can be on the basis of past data, well known theories or even the designers own past experience.

- With experienced designers there is a high probability that many of the assumptions made will hold true but the only way to be certain of any assumption is by conducting experiments.

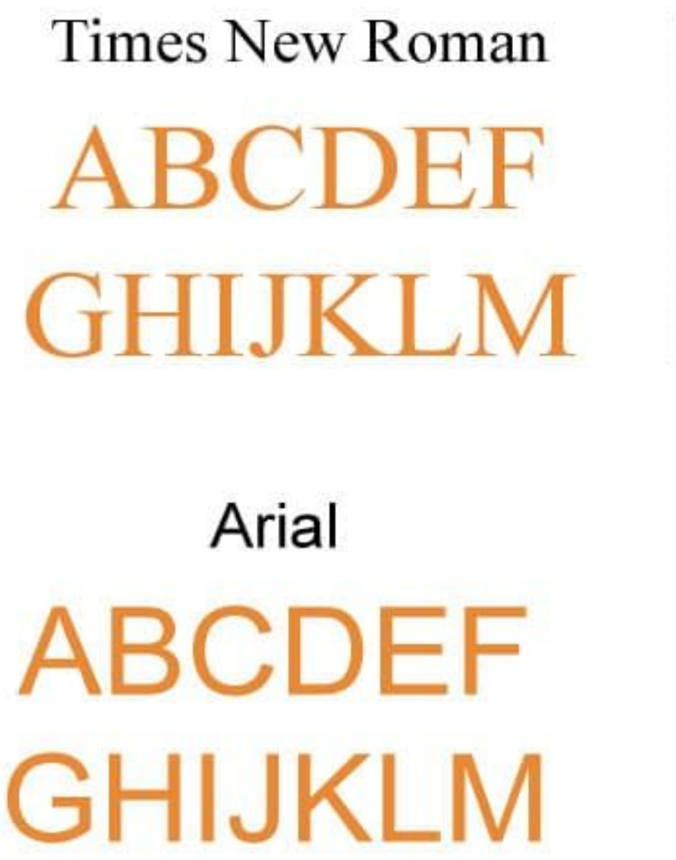
- Furthermore, in reality, it is seen that the majority of the times assumptions made do not hold true. It has been found that on average designers predictions of user control preferences are correct only 31% of the time.

- Hence it is essential to test and validate theories, assumptions and predictions made by designers.

6.7.1 Hypotheses Testing

- Based on the assumptions and predictions to be tested a hypothesis is made.
- Cambridge defines hypothesis as "an idea or explanation for something that is based on known facts but has not yet been proved". Once hypotheses are made, experiments can be conducted.
- Based on evidence found during testing hypotheses are either accepted or rejected.
- Thus as seen a hypothesis is a theory/assumption made by the designer. It is important to test the hypothesis and validate that the assumptions and predictions made by the designers are correct.
- A wrong assumption can really affect the usability and overall functionality of the final product. Not testing assumptions and predictions can be very costly in the long run.

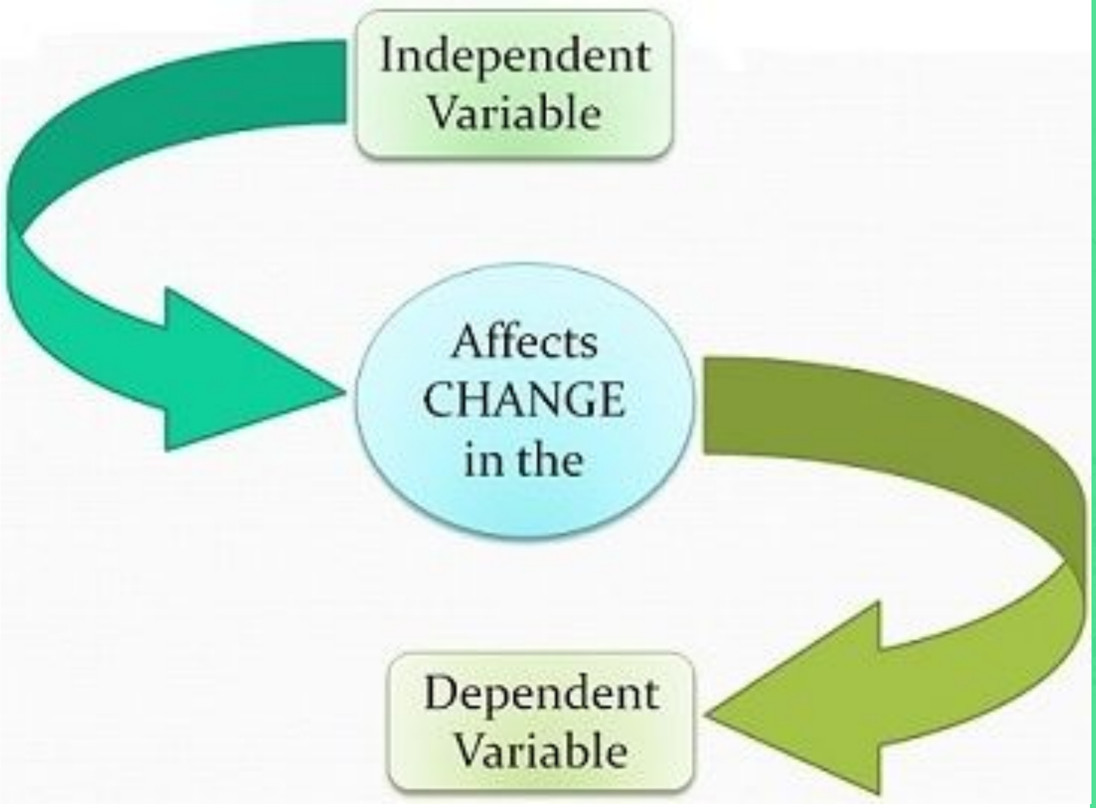
6.7.1 Hypotheses Testing



Furthermore different interface features of a product can also be compared by conducting experiments.

For example testing a hypothesis that compares the readability of two different fonts. The hypothesis states “there is no difference in the speed of reading between Times New Roman and Arial font”.

6.7.1 Hypotheses Testing



Hypothesis looks at the relationship between two or more variables. Variables are broadly of two times dependent and independent.

Independent is a variable which is not dependent on any other variable. It is the one which is often modified during testing. Dependent variable is a variable that is dependent on another variable. The value of a dependent variable is directly or indirectly affected by the value of another variable(s).

Often hypotheses will consist of one dependent and one independent variable. The independent variable is modified by the investigator and the effect/change in dependent variable is looked at.

6.7.1 Hypotheses Testing

- **Hypothesis can be either one-tailed or two-tailed. When there is past experience/data indicating that one of the scenarios is more likely, one tailed hypotheses are used. Example of one tailed hypothesis is "the speed of reading of Times New Roman font is faster than Arial".**

- **When neither one of the scenarios is more likely, two tailed hypotheses are used. Hypothesis stating that "there is no difference in the speed of reading between Times New Roman and Arial font" is an example of a two tailed hypothesis. A benefit of two tail hypothesis is that they can be rejected without providing evidence to support the opposite statement.**

- **It is important to note hypotheses are not limited to the comparison between one independent and one dependent variable. Additionally experiments are not limited to only two variables and can consist of a larger number of variables. However, such experiments are less frequently seen since they are highly complex and much harder to design and analyse.**

6.7.2 Experimental Design

- ➢ **Experimental design is the designing of experiments in such a way that ensures accuracy in findings.**
- ➢ **Many factors have to be kept in mind during the design to ensure integrity of experiments.**
- ➢ **First, it is essential to conduct experiments in such a way that all other variables, those not part of the hypothesis, are kept constant.**

6.7.2 Experimental Design

Font Size 18 (Times New Roman)

Font Size 24 (Arial)

For example testing a hypothesis that compares the readability of two different fonts. The hypothesis states that there is no difference in the speed of reading between Times New Roman and Arial font. During the experiment if the font size of one is 18 and the other is 24. The experiment may find a difference of speed and reject the hypothesis. Even though there is no actual difference in the reading speed between Times New Roman and Arial and the difference in speed found was due to the difference in font sizes. In any experiment it is essential to keep all other variables constant.

For the above example we will keep font size, colour, line spacing, alignment, etc all the same.

6.7.2 Experimental Design

- Another important factor is to consider how the participants are to be involved in the experiment. Which participants should be involved for which parts/conditions of the experiment.

- To involve a participant in multiple parts of an experiment should be done carefully. A bias can be created when one participant has some past knowledge of the system that others do not. Some relevant past knowledge of the system may be gained during involvement in a previous part of the experiment.

- Such bias if not considered can really skew the results and even lead to wrong conclusions.

- Now we will look at different ways of allocating participants to tasks.

Different participants design

The entire group of participants is randomly allocated to different parts/conditions of experiment. No participant is repeated. Advantage is that there is no past knowledge of system bais. Drawback is a large number of participants are required and ‘individual differences’ will impact experiment.

For example the hypothesis comparing the reading speeds of two fonts. If each participant is only assigned to one of the fonts and the time taken to read is recorded. Since by nature each individual's reading speed varies, ‘individual differences’ will impact the experiment. It will be hard to distinguish the difference in speed due to the different fonts or due to natural differences of reading speeds between participants.

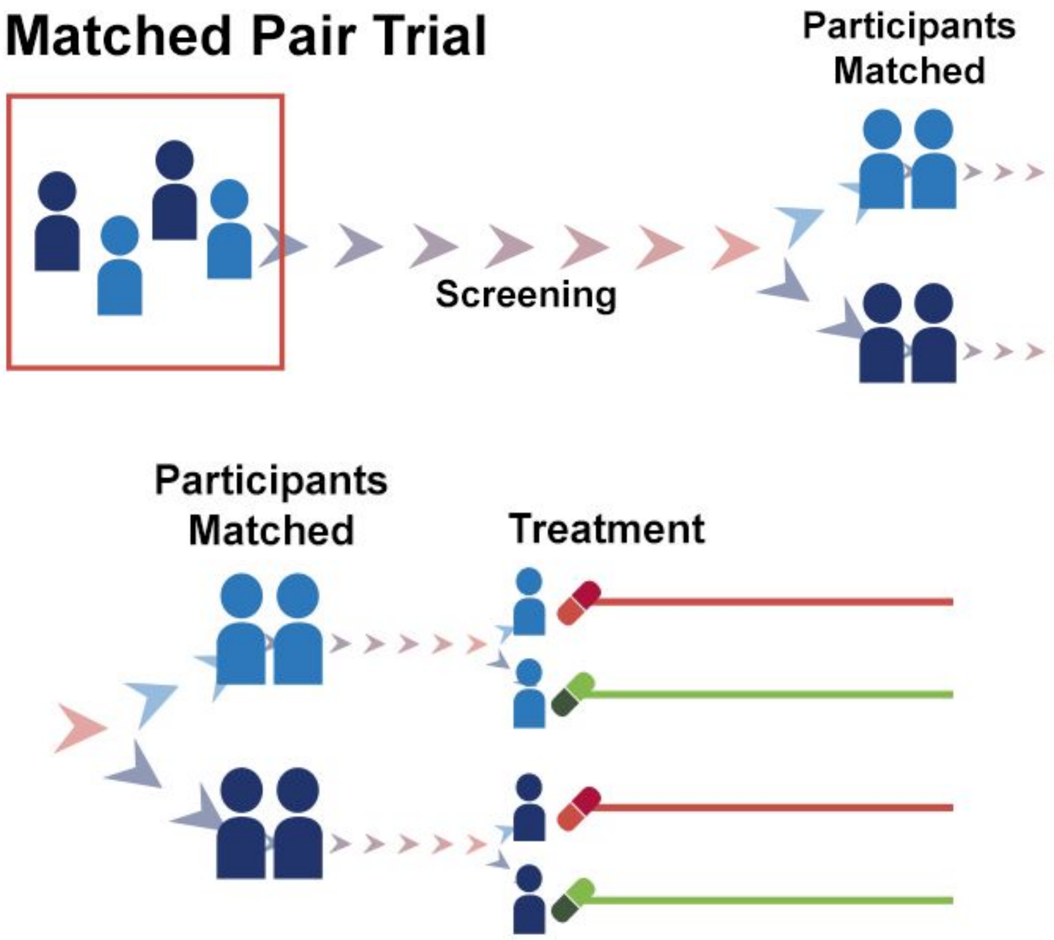
Same participants design

All participants perform all tasks. Advantage is lesser participants are required and individual differences do not affect experiment.

Order has to be counterbalanced to avoid bias. This means if there are two tasks X and Y, half participants will be made to perform X followed by Y and the other half will be made to perform Y followed by X.

Thus during overall statistical analysis of all participants bias or advantage gained from learning the earlier task is nullified.

Matched participants design



Participants are paired together based on certain characteristics. Characteristics like age, education, past experience etc.

Then each participant in the pair is randomly allocated to each of the tasks.

Advantage is the impact of individual differences is reduced. However evaluators cannot be sure that they have eliminated the impact of individual differences since other characteristics, those not considered may be what is influencing the performance.

6.7.2 Experimental Design

- Participants' behaviour has to be measured and recorded.
- Data can be collected using various techniques. Data will include video, audio, keystrokes, mouse tracking, touch tracking, facial expressions, notes by observers, etc.
- Users’ are also asked to provide their feedback and ratings through questionnaires or interviews.
- Behavioural measures broadly fall into 4 main categories latency, frequency, duration and intensity.
- These participant’s behavioural data is recorded and will be analysed to finally confirm or reject a hypothesis.

6.7.3 Statistical Analysis

- Statistical analysis is performed on the data collected. The data collected is often complicated and has to be analysed. There are many factors that affect any interaction and only analysing an individual participant will not give an accurate picture.

- Before any conclusion can be extracted from the data, the data has to be normalised between participants. Many statistical analysis can be used but t-test is the most popular statistical analysis technique used to analyse experiments.

- Considering the example “there is no difference between reading speed of Times New Roman and Arial”. Mean and standard deviation of the time taken by participants for each font will be calculated. If the difference in the mean values is significant then the hypothesis is rejected. Else if the difference is insignificant then the hypothesis is confirmed. The significance of the difference is assessed using probability and t-test’s equations. The t value and degree of freedom is calculated and helps accessing the significance.

6.8 : Field Studies

Introduction

Evaluation is increasingly being done in the manual setting involving users.This method is preferred as users have little to no restrictions on them. This helps us to get more accurate results as they behave on their own will just as they would behave on any other day using the product. Unlike in a controlled setting where the users are told to perform actions.

Results

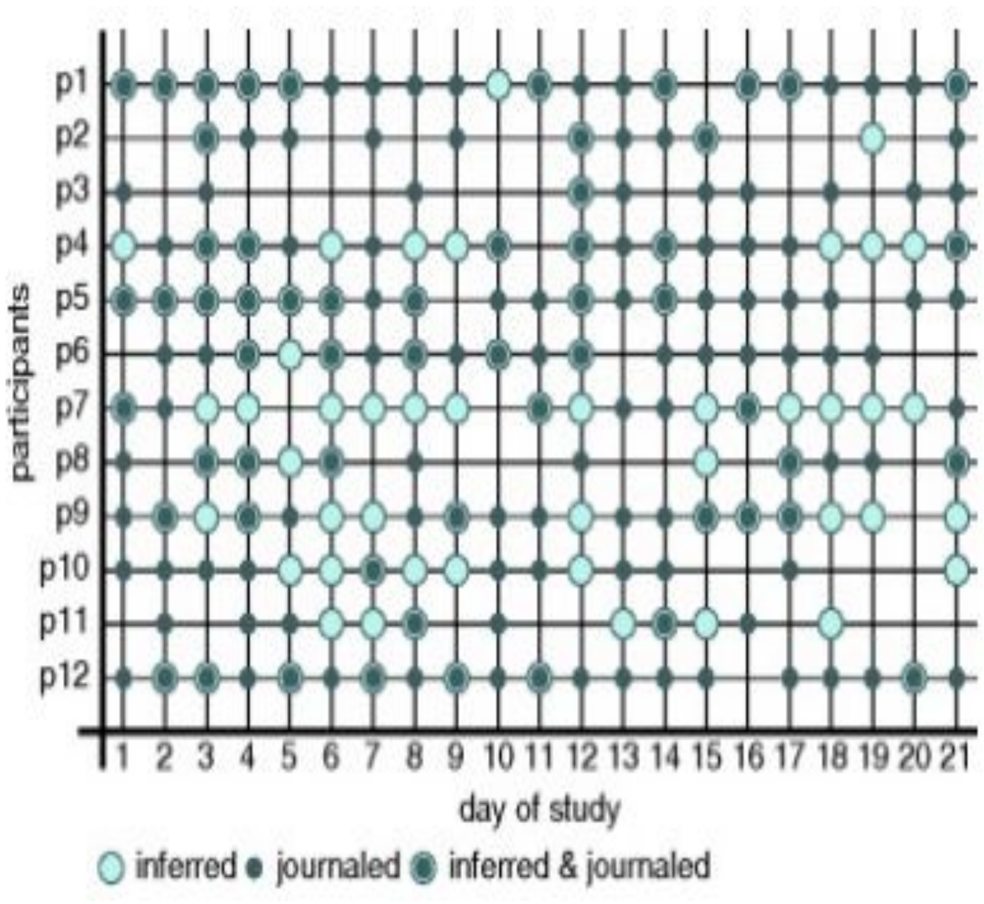
The results of field studies are : recorded in audio, video or sometimes a feedback is taken by telling the users to fill a feedback form. Here questions like what did you expect, did it fulfill your expectations,etc are asked which helps the designer understand the users opinion about the product.

6.8.1. In the wild study

(a) (b) (c)

- Let us take an early example for field studies i.e. UbiFit garden project. This application helped users track their physical activity to stop hem from living their sedentary life
- It encouraged the movement of its users as it measured the movement by motion sensors.
- The application has 3 modules: fitness device that keeps track of users activities, gives a detailed account of movements and a visual of all the activities performed.
- The device tracked the users activity like running, walking, usage of gym equipment by accelerometer and barometer sensors. This data was then shown on the cellphone by transferring this data to the device by bluetooth.
- The device was used for 3 weeks by 12 participants in the age group of 22-25

6.8.1. In the wild study



- The above figure is the analysis of the performance of the device.
- As we can see that some of the activities were inferred by the device, some had to be written down by the participant or user and some activities were a combination of both
- For example, gardening was inferred as bicycling by the device. Also some activities like swimming had to be written or journaled as the system is not trained to infer them.
- The evaluators took note of the feedback of how the UbiFit garden helped them to increase their physical activity or what features they did not like about the device. Common complaints were: cannot recognise the right activity, start time delay, end time delay, counting as an activity when none occurred.
- Hence, the system was liked but yet it had a scope of improvement in its technical features.

6.8.2. Other perspectives

- In field studies , it is possible that after long term use of tools the evaluators are successful in revealing their behaviour of interest.
- Users should evaluate such tools in natural settings using their own personal data as then they might get results they wish.
- The participants are questioned before the experiment for their own availability of data to work on and a plan for completing the work.
- Prior to the experiment training session, first 2-4 weeks of beginners work on the tool, then next 2-4 week the participant is expected to do an intermediate level of work and then an exit interview is conducted.
- The progress of the work is observed by the developer by providing help to the participant. This helps the developer understand the issues and success rate with the tool.
- The understanding of tools can be also done by diaries, logs and questionnaires. This helps understand the tool with different data available.
- Thus, evaluators prefer to use natural settings when they need to find out that how the adaption of new technology or idea is possible in natural day to day life

6.9 : Heuristic Evaluation & Walkthroughs

Introduction

We have studied various kinds of evaluation techniques, drawback with other evaluation methods is feasibility in terms of cost and time that the user is availability.

Heuristic Evaluation & Walkthroughs

Heuristic Evaluation & Walkthroughs overcomes this drawback where there is not need of the user in the evaluation process instead we shall use experts who shall play the role of users or walkthrough each step and evaluate the product.

6.9.1 : Heuristic Evaluation

Introduction

- Nielsen and his colleagues in 1990 developed a usability inspection method which is called as Heuristic Evaluation.
- Inspection is guided by well defined usability principles which are also called heuristics.
- Deciding the number of experts should be based on proper tradeoff it is to be maintained for quality of assessment and feasibility.
- Set of heuristics widely known as 10 Heuristics of Nielsen are used which are explained in detail in chapter 5.

10 Heuristics of Nielsen

1. **Visibility of system status**
2. **Match between the 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**

6.9.2. Walkthroughs

- System developers have been using Walkthroughs for code inspection since many years for the inspection of codes.

- It involves walking through each step one by one and recording the errors or problems that may occur during execution of these steps and not necessarily involve users instead they majorly involved developers, testers and experts.

- Following are some of the well known Walkthroughs:

01

Cognitive Walkthroughs

02

Pluralistic Walkthroughs

6.9.2. Walkthroughs

Cognitive Walkthroughs

- In Cognitive walkthrough user's problem solving capabilities are simulated at each step of the user and system interaction

- As compared to Heuristic evaluation this method gives more focus to specific problems users may experience, however this method requires more time.

- Steps involved in cognitive walkthrough:
  - Building a prototype interface
  - Expert analyse the prototype
  - Evaluators play role of user
  - Summarize assumptions, issues, design changes
  - Revision of the design to fix the problems

Pluralistic Walkthroughs

- Each evaluator is asked to play the role of a user, who are provided with scenarios of use which consist of prototype screen.

- The evaluators note the steps they would take to complete the task without discussing with other evaluators.

- Involving multiple evaluators provide multiple perspectives to the evaluation.

- This provides various opinions and feedback about the system which can improve the system.

- It could be difficult and costly to get big team and and do complex this complex task.

6.9.2. Predictive Models

- Predictive models also provide means to evaluate a design of a system without the need of the user, but unlike other techniques instead of involving experts.
- Predictive models make use of mathematical formulas to determine various characteristic measures of user performance.
- Predictive models can be used to find the approximate efficiency of a design, following are some of the well known Predictive models:

01 Fitts' Law

02 GOMS Model

6.10.2 : GOMS Model

01

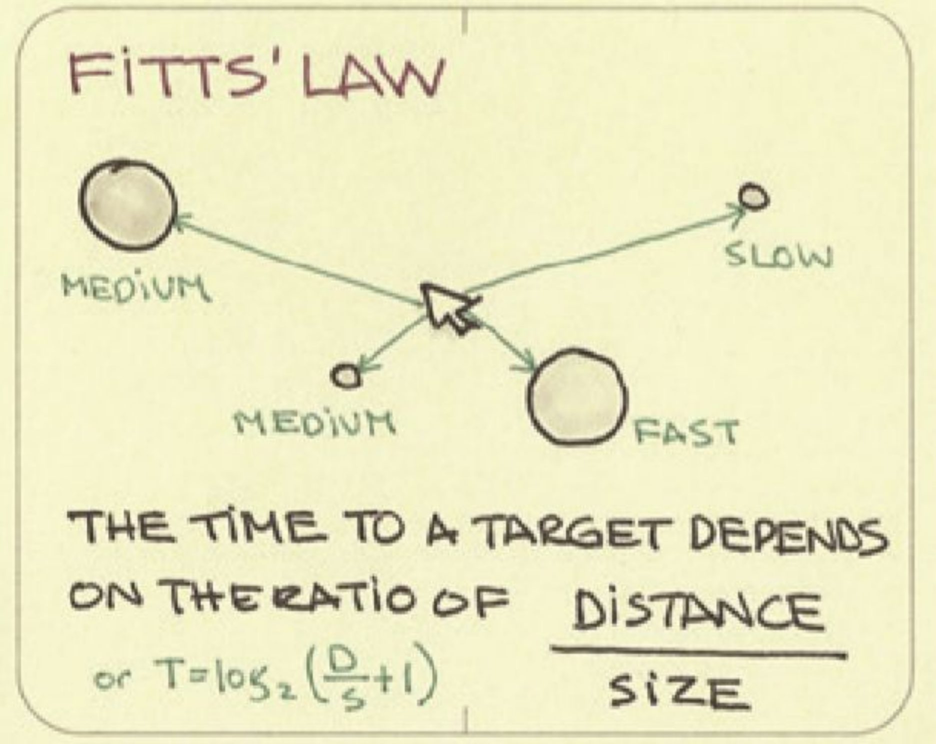
Fitts’ Law

- Fitts in 1954 created a law that can predict the time that is required by the user to reach a target on the screen using a pointing device.

- Designers can use fitts law to find to decide where to place the icons, keyboard, buttons etc on the screen, and also help to determine what should be the shape and size of these targets

- Fitts law uses following parameters:
    - T = Time required to reach the target
    - D = Distance between target and pointer
    - S = Target Size
    - k = A constant in the equation having a value of ~200 ms/bit

Illustration



6.10.2 : GOMS Model

02

GOMS Model

- **GOAL**: This element defines what the user wants to achieve, and also possible methods by which these goals can be achieved.
- **OPERATORS**: Placed at the lowest analysis level, methods that satisfy goals are made up of operators (User/System Actions).
- **METHODS**: There can be multiple ways of performing a task i.e satisfying a goal, all these ways need to be analysed.
- **SELECTIONS**: Used to make the choices in the GOMS model as there can be multiple ways to perform a particular task.

Example

GOAL: CLOSE-WINDOW

[

SELECT GOAL : BUTTON-METHOD

- MOVE-MOUSE-TOP-RIGHT
- HOVER-OVER-CROSS-ICON
- CLICK-CROSS-ICON

SELECT GOAL : KEYBOARD-METHOD

- PRESS-ALT-KEY
- PRESS-F4-KEY
- RELEASE-BOTH-KEYS

]

Summary

- Design and evaluation are interrelated.
- Controlled setting gives the evaluators more authority whereas in field study the evaluators impose little or no restrictions on the users .
- Different methods of evaluations help to achieve better and more accurate results.
- Over generalization of findings from an evaluation should be avoided.
- The DECIDE framework is a form of a checklist for budding assessors.

Summary

- During this interface design, designers always have to make certain educated guesses and predictions, hence it is essential to test and validate theories
- A hypothesis is an idea or explanation for something that is based on known facts but has not yet been proved
- Heuristic evaluation overcomes the drawback of need of user availability, and instead use heuristics for evaluation
- Nielsen in 1990 proposed 10 heuristics that can be used by experts as guidelines to evaluate designs.
- Walkthroughs can be used as evaluation techniques, where experts act as users, unlike Walkthrough predictive models use mathematical formulas for design evaluation.

Review Questions

1. What aspects would you want to evaluate: [Section 6.2]
   a. A personalized game
   b. An application for online grocery shopping
2. A company is willing to make an application that makes sure that you wake up on time instead of hitting snooze by making the user solve mathematics problems. Where and what would you evaluate? [Section 6.2.3]
3. Explain the why,what,when and where of evaluation. [Section 6.2]
4. Differentiate between the three types of evaluation [Section 6.3]
5. Explain the types of evaluation with each of their pros and cons. [Section 6.3]
6. Summarize the role of analytics in evaluation. [Section 6.3.3]
7. Write a case study on Crowdsourcing discussing the method for evaluation and its probable results. [Section 6.4]
8. Write a case study on any mobile application of your choice. [Section 6.4]
9. Explain usability testing. [Section 6.6]
10. Illustrate the concept of experimental design [Section 6.7.2]
11. Explain the usability problem of the iPad. [Section 6.6.5]
12. Illustrate the concept of heuristic evaluation. [Section 6.9]
13. Summarize aspects which should be considered to be important for good usability and user experience? [Section 6.9.2]

Multiple Choice Questions

- What is the drawback that heuristic evaluations overcome from other evaluation
  a. Requires less effort and attention.
  b. Universally accepted.
  c. Does not require user involvement.
  d. None of the above.

- Which of the following is true about Nielsen heuristic evaluation method
  a. It uses 10 Heuristics of Nielsen.
  b. There is a strict number of evaluators defined by Nielsen.
  c. With less evaluators more accuracy of evaluation is possible.
  d. The number of experst does not affect the evaluation.

- Which of the following is true about walkthroughs
  a. It requires involvement of users.
  b. Experts evaluate the development process step by step.
  c. The possible sequence of actions of users are evaluated.
  d. both A and C

Multiple Choice Questions

- **Fitts' law takes how many parameters into consideration to determine time to reach the target.**
  a. 1
  b. 2
  c. 4
  d. 5

- **Which is not one of the critical components to usability**
  a. Effectiveness
  b. Efficiency
  c. Satisfaction
  d. Cost effective

- **When users are monitored, recorded and instructed to do tasks, which evaluation type is it?**
  a. Natural settings involving users.
  b. Controlled settings involving users.
  c. Any settings not involving users.
  d. Combining methods.

Multiple Choice Questions

- **Which aspect of evaluation provides us with accountability and improvement?**
  a. Why evaluate.
  b. What to evaluate.
  c. When to evaluate.
  d. Where to evaluate.

- **Case study of investigating a computer game is which type of evaluation?**
  a. Controlled settings involving users
  b. Natural settings involving users.
  c. Any settings not involving users.
  d. Combining methods.

- **Case study of investigating a skier is done in which environment?**
  a. Living labs.
  b. Laboratories.
  c. In the wild study.
  d. Home.

Multiple Choice Questions

- Evaluation that is done during the designing process to figure out whether the requirements are being accomplished or not is what type of evaluation?
  a. Formative evaluation
  b. Summative evaluation
  c. Both a and b
  d. None of the above.

- Field study is done majorly in which type of evaluation?
  a. Controlled settings involving users
  b. Natural settings involving users.
  c. Any settings not involving users.
  d. Combining methods.

- Case study of investigating a skier is done in which environment?
  a. Living labs.
  b. Laboratories.
  c. In the wild study.
  d. Home.