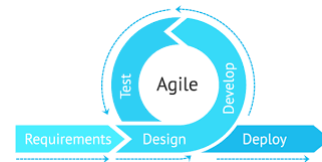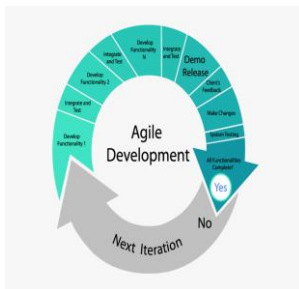# Software Engineering
User Interface Design

Outline

- User Interface analysis and design
- Interface analysis
- Interface design steps,
- Web app interface design.

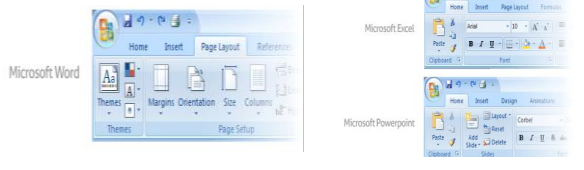# User Interface Design

Golden Rules of User Interface Design

Place the User in Control	Reduce the User's Memory Load

Make the Interface Consistent

3

Golden Rules of User Interface Design

Place the User in Control

○ During a requirements-gathering session for a major new information system, a key user was asked about.

○ Following are the **design principles** that allow the **user to maintain control**:

   ○ **Define interaction modes** in a way that **does not force a user** into unnecessary or **undesired actions**.

   ○ Provide for **flexible interaction**

   ○ Allow user **interaction** to be interruptible and **undoable**.

   ○ Streamline interaction as skill levels advance and allow the interaction to be customized.

   ○ **Hide technical internals** from the casual user.

   ○ Design for **direct interaction with objects** that appear on the screen.

Golden Rules of User Interface Design

Reduce the User's Memory Load

○ The **more a user has to remember, the more error-prone** the interaction with the system will be.

○ Following are the design principles that enable an interface to reduce the user's memory load:

   ○ **Reduce demand** on **short-term memory**.

   ○ Establish **meaningful defaults**

   ○ **Define shortcuts** that are intuitive

   ○ The **visual layout** of the interface should be **based on** a **real-world metaphor**

   ○ Disclose **information** in a **progressive fashion**

Golden Rules of User Interface Design

Make the Interface Consistent

○ The interface should **present** and acquire **information** in a **consistent fashion**.

○ Following are the design principles that help make the interface consistent

   ○ Maintain **consistency across a family of applications**

   ○ If past interactive models have created user expectations, **do not make changes unless there is a compelling** (convincing) **reason** to do so.

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7

User Interface Analysis and Design Models

o Four different models come into play when a user interface is to be analyzed and designed.

  o A human engineer (or the software engineer) establishes a user model,

  o the software engineer creates a design model,

  o the end user develops a mental image that is often called the user's mental model or the system perception,

  o and the implementers of the system create an implementation model.

8

User Interface Analysis and Design Models

- **User profile model** – Established by a software engineer
  - Establishes the profile of the end-users of the system
  - based on age, gender, physical abilities, education, cultural background, motivation, goals, and personality.
- **Design model** – Created by a software engineer
  - Derived from the analysis model of the requirements.
  - Incorporates data, architectural, interface, and procedural representations of the software.
- **Implementation model** – Created by the software implementers
  - Consists of the look and feel of the interface combined with all supporting information (books, videos, help files) that describe system syntax and semantics.

9

User Interface Analysis and Design Models

- **User's mental model** – Developed by the user when interacting with the application
  - Often called the user's system perception.
 - Consists of the image of the system; that users carry in their heads.

The **role of the interface designer** is to merge these differences and derive a consistent representation of the interface.

10

The Process

o The analysis and design process for user interfaces is iterative and can be represented using a spiral model.

o The user interface analysis and design process begins at the interior of the spiral and encompasses four distinct framework activities.

1. interface analysis and modeling,
2. interface design,
3. interface construction, and
4. interface validation.
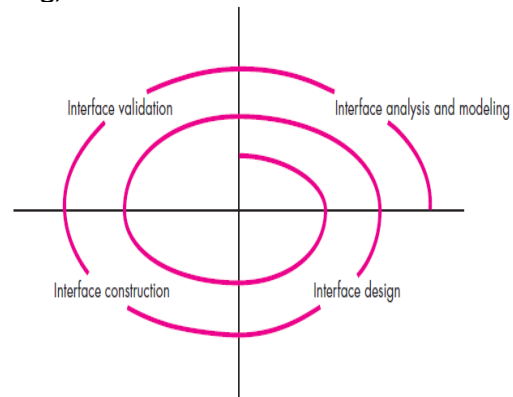
Interface Analysis

o Interface analysis focuses on the profile of the users who will interact with the system.

o Skill level, business understanding, and general receptiveness to the new system are recorded; and different user categories are defined.

o For each user category, requirements are elicited. In essence, you work to understand the system perception for each class of users.

o A key tenet of all software engineering process models is this: understand the problem before you attempt to design a solution.

12

Interface Analysis

- Elements of the User Interface : To perform user interface analysis, the practitioner needs to study and understand four elements
    - The users who will interact with the system through the interface
    - The tasks that end users must perform to do their work
    - The content that is presented as part of the interface
    - The work environment in which these tasks will be conducted
- User Analysis
- Task Analysis and Modeling
- Analysis of Display Content
- Analysis of the Work Environment

13

Interface Analysis(User)

- User Analysis : The analyst strives to get the end user's mental model and the design model to converge by understanding
    - The users themselves
    - How these people use the system
- Information can be obtained from
    - User interviews with the end users
    - Sales input from the sales people who interact with customers and users on a regular basis
    - Marketing input based on a market analysis to understand how different population segments might use the software
    - Support input from the support staff who are aware of what works and what doesn't, what users like and dislike, what features generate questions, and what features are easy to use
- – A set of questions should be answered during user analysis   14

Interface Analysis(User)

o User Analysis Questions

- o Are the users trained professionals, technicians, clerical or manufacturing workers?
- o What level of formal education does the average user have?
- o Are the users capable of learning on their own from written materials or have they expressed a desire for classroom training?
- o Are the users expert typists or are they keyboard phobic?
- o What is the age range of the user community?
- o Will the users be represented predominately by one gender?
- o How are users compensated for the work they perform or are they volunteers?

15

Interface Analysis(User)

o User Analysis Questions

- o Do users work normal office hours, or do they work whenever the job is required?
- o Is the software to be an integral part of the work users do, or will it be used only occasionally?
- o What is the primary spoken language among users?
- o What are the consequences if a user makes a mistake using the system?
- o Are users experts in the subject matter that is addressed by the system?
- o Do users want to know about the technology that sits behind the interface?

16

Interface Analysis(Task)

o Task analysis strives to know and understand
  - o The work the user performs in specific circumstances
  - o The tasks and subtasks that will be performed as the user does the work
  - o The specific problem domain objects that the user manipulates as work is performed
  - o The sequence of work tasks (i.e., the workflow)
  - o The hierarchy of tasks

17

Interface Analysis(Content)

o Content Analysis : The display content may range from character-based reports, to graphical displays, to multimedia information
o Display content may be :
  - o Generated by components in other parts of the application
  - o Acquired from data stored in a database that is accessible from the application
  - o Transmitted from systems external to the application in question
o The format and aesthetics of the content (as it is displayed by the interface) needs to be considered
o A set of questions should be answered during content analysis

18

Interface Analysis(Content)

o Content Analysis Guidelines :

o Are various types of data assigned to consistent locations on the screen (e.g., photos always in upper right corner)?

o Are users able to customize the screen location for content?

o Is proper on-screen identification assigned to all content?

o Can large reports be partitioned for ease of understanding?

o Are mechanisms available for moving directly to summary information for large collections of data?

o Is graphical output scaled to fit within the bounds of the display device that is used?

o How is color used to enhance understanding?

o How are error messages and warnings presented in order to make them quick and easy to see and understand?

19

Interface Analysis(Work)

o Work Environment Analysis : Software products need to be designed to fit into the work environment, otherwise they may be difficult or frustrating to use

o Factors to consider include

    o Type of lighting

    o Display size and height

    o Keyboard size, height and ease of use

    o Mouse type and ease of use

    o Surrounding noise

    o Space limitations for computer and/or user

    o Weather or other atmospheric conditions

    o Temperature or pressure restrictions

    o Time restrictions (when, how fast, and for how long)

20

Interface Design Steps

o Once interface analysis has been completed, all tasks (or objects and actions) required by the end user have been identified in detail and the interface design activity commences.

1. Using information developed during interface analysis, define interface objects and actions (operations).

2. Define events (user actions) that will cause the state of the user interface to change. Model this behavior.

3. Depict each interface state as it will actually look to the end user.

4. Indicate how the user interprets the state of the system from information provided through the interface.

21

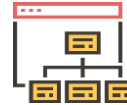## Web Application Design

22

Web Application Design

○ Design for WebApp encompasses technical and nontechnical activities that include:

- ○ **Establishing the look and feel** of the WebApp

- ○ Defining the **overall architectural structure**

- ○ **Developing** the **content** and **functionality** that reside within the architecture

- ○ **Planning** the **navigation** that occurs within the WebApp
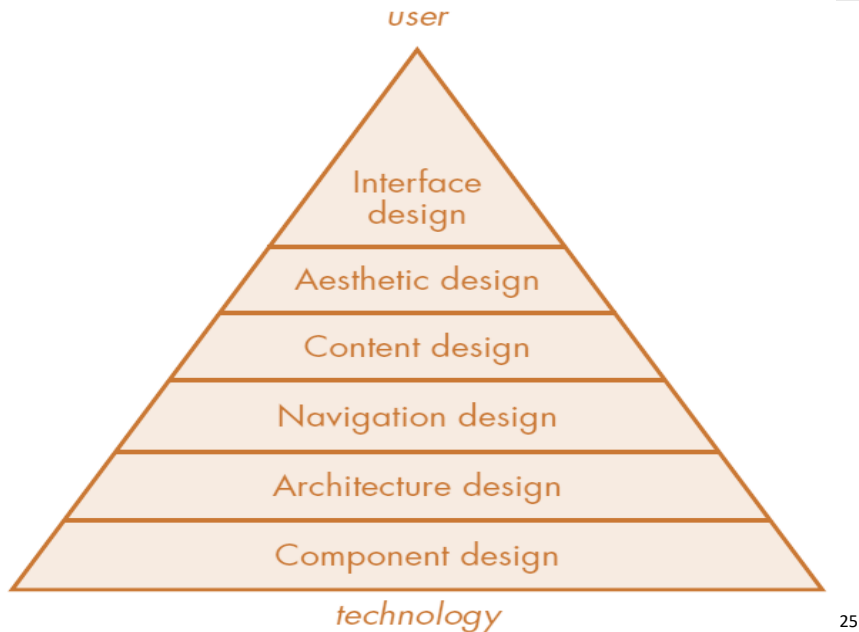
23

Web App Interface Design

○ The objectives of a WebApp interface are to

- ○ Establish a **consistent window** into the **content** and **functionality** provided by the interface.

- ○ **Guide the user** through a series of interactions with the WebApp.

- ○ **Organize** the **navigation options** and **content** available to the user

24

Design pyramid for WebApps

user

Interface design

Aesthetic design

Content design

Navigation design

Architecture design

Component design

technology

25

Design pyramid for WebApps

- **Interface Design :** One of the challenges of interface design for WebApps is the **nature of the user's entry point.**

- **Aesthetic Design :** Also called **graphic design**, is an **artistic endeavor** (offer) that **complements the technical aspects** of WebApp design.

- **Content Design : Generate content and design** the representation for content to be used within a WebApp.

- **Architecture Design :** It is tied to the goals established for a WebApp, the content to be presented, the users who will visit, and the navigation that has been established.

26

Design pyramid for WebApps

o **Component-Level Design :**
  - o Modern WebApps deliver increasingly complex processing functions that
  - o **Perform localized processing** to generate content and navigation capability in a dynamic fashion
  - o Provide **computation** or **data processing capability** that are appropriate for the WebApp's business domain
  - o Provide **complex database query** and access.
  - o Establish **data interfaces with external corporate** systems

o **Navigation Design : Define navigation pathways** that enable users to access WebApp content and functions.

27

28