

# User Interface Analysis

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# Intro. To Software Engineering SE-110



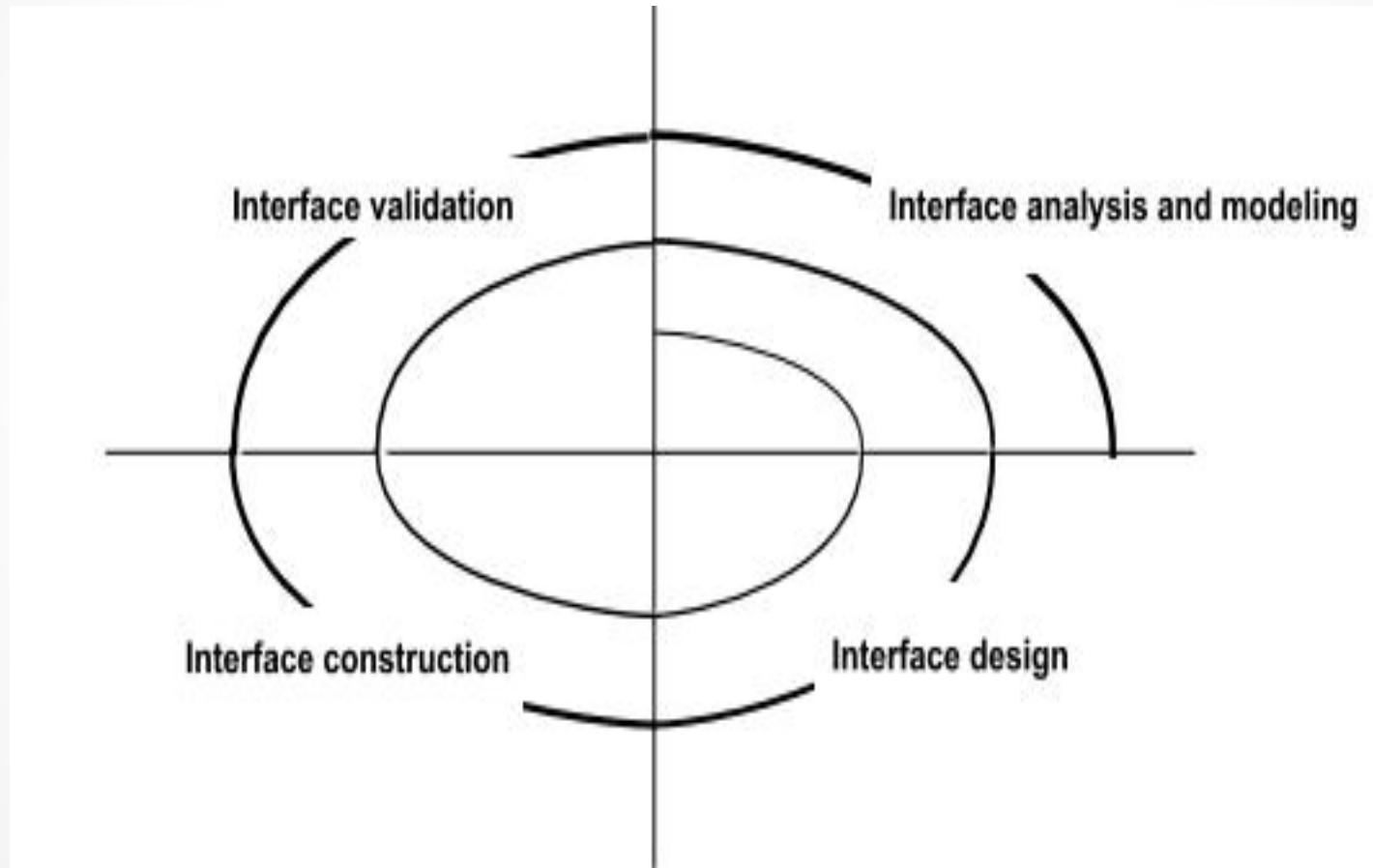
# Today's Outline

- **User interface analysis and Design Models**
- **Design Process**
- **Interface Design Models**
- **Interface Elements**
- **Interface Evaluation**

# Interface design Analysis

- **Interface design focuses on the following**
  - The design of interfaces between software components (internal Interface)
  - The design of interfaces between the software and other non human producers and consumers of information ((external Interface)
  - The design of the interface between a human and the computer (user Interface)
- **Graphical user interfaces (GUIs) have helped to eliminate many of the most horrific interface problems**
- **However, some are still difficult to learn, hard to use, confusing, counterintuitive, unforgiving, and frustrating**
- **User interface analysis and design has to do with the study of people and how they relate to technology**

# User Interface Design Process



# A Spiral Process

- **User interface development follows a spiral process**
  - **Interface analysis (user, task, and environment analysis)**
    - Focuses on the profile of the users who will interact with the system
    - Concentrates on users, tasks, content and work environment
    - Studies different models of system function (as perceived from the outside)
    - Delineates the human- and computer-oriented tasks that are required to achieve system function
  - **Interface design**
    - Defines a set of interface objects and actions (and their screen representations) that enable a user to perform all defined tasks in a manner that meets every usability goal defined for the system
  - **Interface construction**
    - Begins with a prototype that enables usage scenarios to be evaluated
    - Continues with development tools to complete the construction
  - **Interface validation, focuses on**
    - The ability of the interface to implement every user task correctly, to accommodate all task variations, and to achieve all general user requirements
    - The degree to which the interface is easy to use and easy to learn
    - The users' acceptance of the interface as a useful tool in their work

# User Interface Analysis and Design

- The overall process for analyzing and designing a user interface begins with the creation of different models of system function.
- Four different models come into play when a user interface is analyzed and designed
  - User profile model – Established by a software engineer
  - Design model – Created by a software engineer
  - Implementation model – Created by the software implementers
  - User's mental model – Developed by the user when interacting with the application
- The role of the interface designer is to reconcile these differences and derive a consistent representation of the interface

# User Profile Model

- **Analysis of the potential users of the system**
- **Establishes the profile of the end-users of the system**
  - Based on age, gender, physical abilities, education, cultural or ethnic background, motivation, goals, and personality
- **Considers syntactic knowledge of the user**
  - The mechanics of interaction that are required to use the interface effectively
- **Considers semantic knowledge of the user**
  - The underlying sense of the application; an understanding of the functions that are performed, the meaning of input and output, and the objectives of the system
- **Categorizes users as**
  - **Novices**
    - No syntactic knowledge of the system, little semantic knowledge of the application, only general computer usage
  - **Knowledgeable, intermittent users**
    - Reasonable semantic knowledge of the system, low recall of syntactic information to use the interface
  - **Knowledgeable, frequent users**
    - Good semantic and syntactic knowledge (i.e., power user), look for shortcuts and abbreviated modes of operation

# Design Model

- **Derived from the analysis model of the requirements**
- **Incorporates data, architectural, interface, and procedural representations of the software**
- **Constrained by information in the requirements specification that helps define the user of the system**
- **Normally is incidental to other parts of the design model**
  - **But in many cases it is as important as the other parts**



# User's Mental Model

- Often called the user's system perception
- Consists of the image of the system that users carry in their heads
- mental model is a set of beliefs, not facts about how a system works and how people interact with that system based on their beliefs
- Accuracy of the description depends upon the user's profile and overall familiarity with the software in the application domain
- Discussions with people who work with the users and/or users themselves
  - What would the user want the system to do?
  - How would system fit in with the normal work?
  - How technically savvy is the user?
  - What interface look & feel is best for user?

# Implementation Model

- Consists of the look and feel of the interface combined with all supporting information that describe system syntax and semantics
- Strives to agree with the user's mental model; users then feel comfortable with the software and use it effectively
- Serves as a translation of the design model by providing a realization of the information contained in the user profile model and the user's mental model
- The biggest usability's dilemmas is the common gap between designers' and users' mental models

# 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

- 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

# Task Analysis and Modeling

- **Task analysis strives to know and understand**
  - The work the user performs in specific circumstances
  - The tasks and subtasks that will be performed as the user does the work
  - The specific problem domain objects that the user manipulates as work is performed
  - The sequence of work tasks (i.e., the workflow)
  - The hierarchy of tasks
- **Use cases**
  - Show how an end user performs some specific work-related task
  - Enable the software engineer to extract tasks, objects, and overall workflow of the interaction
  - Helps the software engineer to identify additional helpful features

# Content Analysis

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

# Work Environment Analysis

- **Software products need to be designed to fit into the work environment, otherwise they may be difficult or frustrating to use**
- **Factors to consider include**
  - **Type of lighting**
  - **Display size and height**
  - **Keyboard size, height and ease of use**
  - **Mouse type and ease of use**
  - **Surrounding noise**
  - **Space limitations for computer and/or user**
  - **Weather or other atmospheric conditions**
  - **Temperature or pressure restrictions**
  - **Time restrictions (when, how fast, and for how long)**

# User Interface Design



# Introduction

- User interface design is an iterative process, where each iteration elaborate and refines the information developed in the preceding step
- General steps for user interface design
  - 1) Using information developed during user interface analysis, define user 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
- During all of these steps, the designer must
  - Always follow the three golden rules of user interfaces
  - Model how the interface will be implemented
  - Consider the computing environment (e.g., display technology, operating system, development tools) that will be used

# Design Issues to Consider

- **Four common design issues usually surface in any user interface**
  - **System response time (both length and variability)**
  - **User help facilities**
    - **When is it available, how is it accessed, how is it represented to the user, how is it structured, what happens when help is exited**
  - **Error information handling**
    - **How meaningful to the user, how descriptive of the problem**
  - **Menu and command labeling**
    - **Consistent, easy to learn, accessibility, internationalization**
- **Many software engineers do not address these issues until late in the design or construction process**
  - **This results in unnecessary iteration, project delays, and customer frustration**

# Guidelines for Error Messages

- The message should describe the problem in plain language that a typical user can understand
- The message should provide constructive advice for recovering from the error
- The message should indicate any negative consequences of the error (e.g., potentially corrupted data files) so that the user can check to ensure that they have not occurred (or correct them if they have)
- The message should be accompanied by an audible or visual cue such as a beep, momentary flashing, or a special error color
- The message should be non-judgmental
  - The message should never place blame on the user

An effective error message philosophy can do much to improve the quality of an interactive system and will significantly reduce user frustration when problems do occur

# User Interface Evaluation

# Design and Prototype Evaluation

- Before prototyping occurs, a number of evaluation criteria can be applied during design reviews to the design model itself
  - The amount of learning required by the users
    - Derived from the length and complexity of the written specification and its interfaces
  - The interaction time and overall efficiency
    - Derived from the number of user tasks specified and the average number of actions per task
  - The memory load on users
    - Derived from the number of actions, tasks, and system states
  - The complexity of the interface and the degree to which it will be accepted by the user
    - Derived from the interface style, help facilities, and error handling procedures

# Design and Prototype Evaluation (continued)

- **Prototype evaluation can range from an informal test drive to a formally designed study using statistical methods and questionnaires**
- **The prototype evaluation cycle consists of prototype creation followed by user evaluation and back to prototype modification until all user issues are resolved**
- **The prototype is evaluated for**
  - **Satisfaction of user requirements**
  - **Conformance to the three golden rules of user interface design**
  - **Reconciliation of the four models of a user interface**



That is all