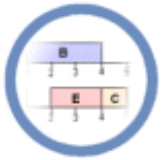




Lecture ”7”
Graphical User Interface

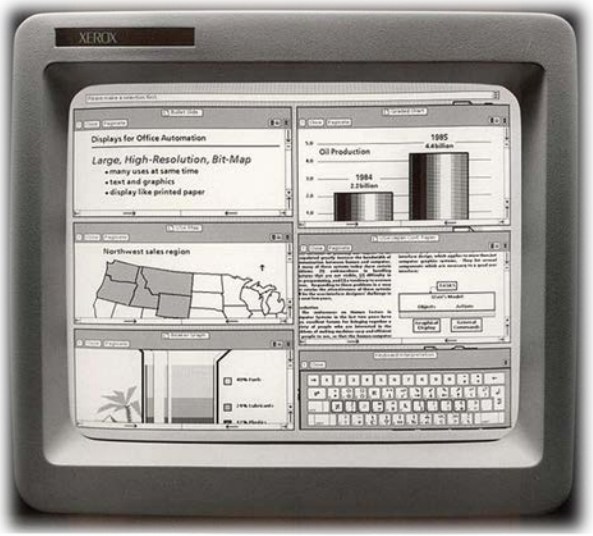
<lecturer, date>

Outline

- Graphical User Interface
  - **Overview**
  - GUI in Computer Scince
  - Human Factors
  - GUI Design
  - References

Overview

- Graphical User Interface (GUI)
  - ☞ A type of computer human interface on a computer
  - ☞ An attempt to solve the blank screen problem that confronted early computer users
  - ☞ The Xerox Star 8010 workstation introduced the first commercial GUI



Good GUI Design

- ✓ Removes the impediment of communication with the computer system
- ✓ Allows the user to work directly on the problem at hand

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GUI in Computer Science

- GUI in Computer Science
  - ✓ A visual operating display that the monitor presents to the computer operator
  - ✓ A specification for the look and feel of the computer system
- GUIs usually have common characteristic such as Windows, Icons, Menus, and Pointers (WIMP)
- The user issues commands via GUI to computer apps

GUI Major Components

- GUIs usually have three major components

1. A windowing system

   ☞ Builds the windows, menus, and dialog boxes that appear on the screen

1. An imaging model

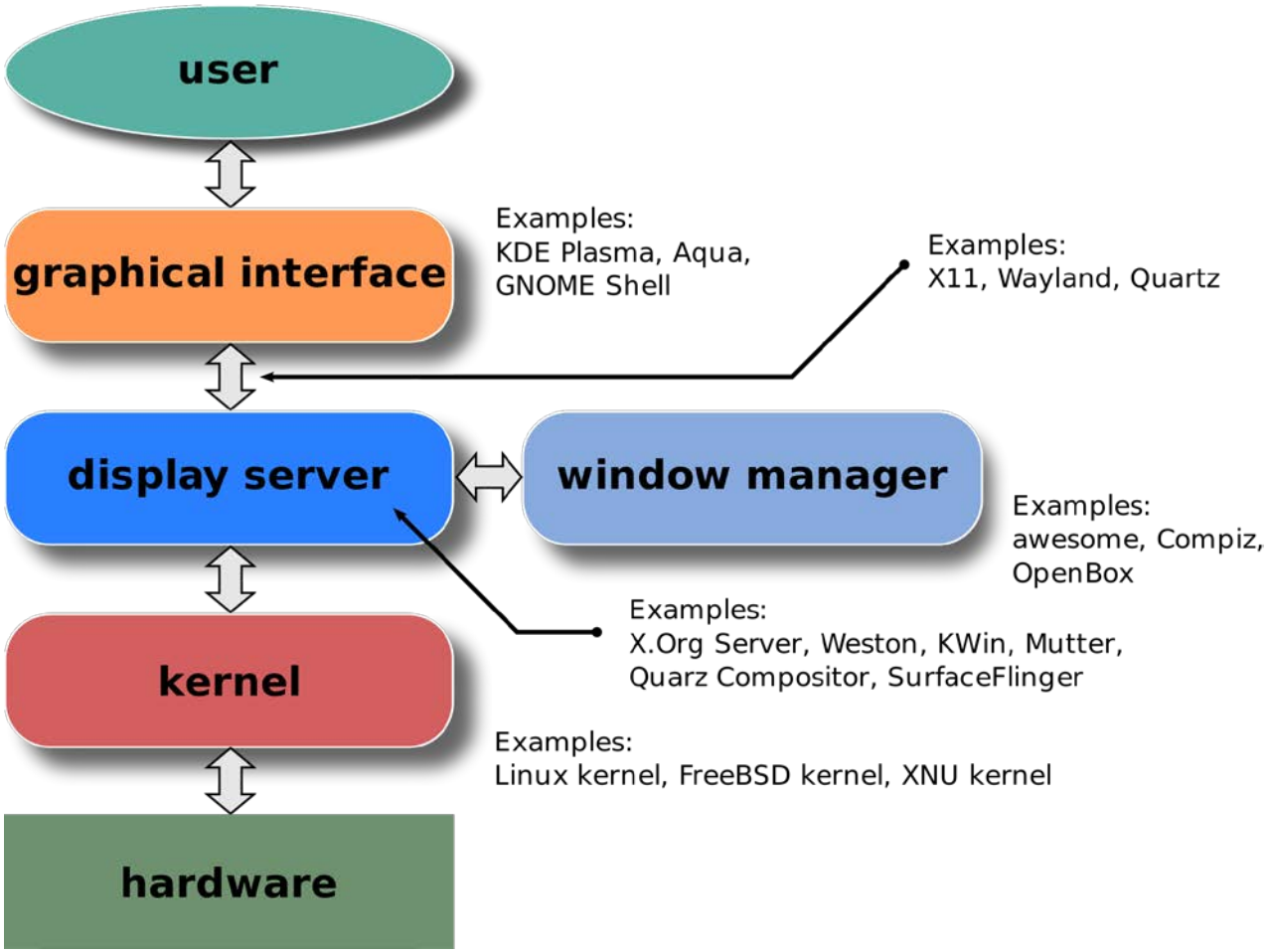
   ☞ Defines the fonts and graphics that appear on the screen

☼ WIMPs are products of both the windowing system and imaging model

3. An application program interface (API)

   ☞ The means in which the user specifies how and what windows and graphics appear on the screen

Layers of a GUI Based on a Windowing System



Layers of a GUI based on a windowing system

GUI Major Paradigms

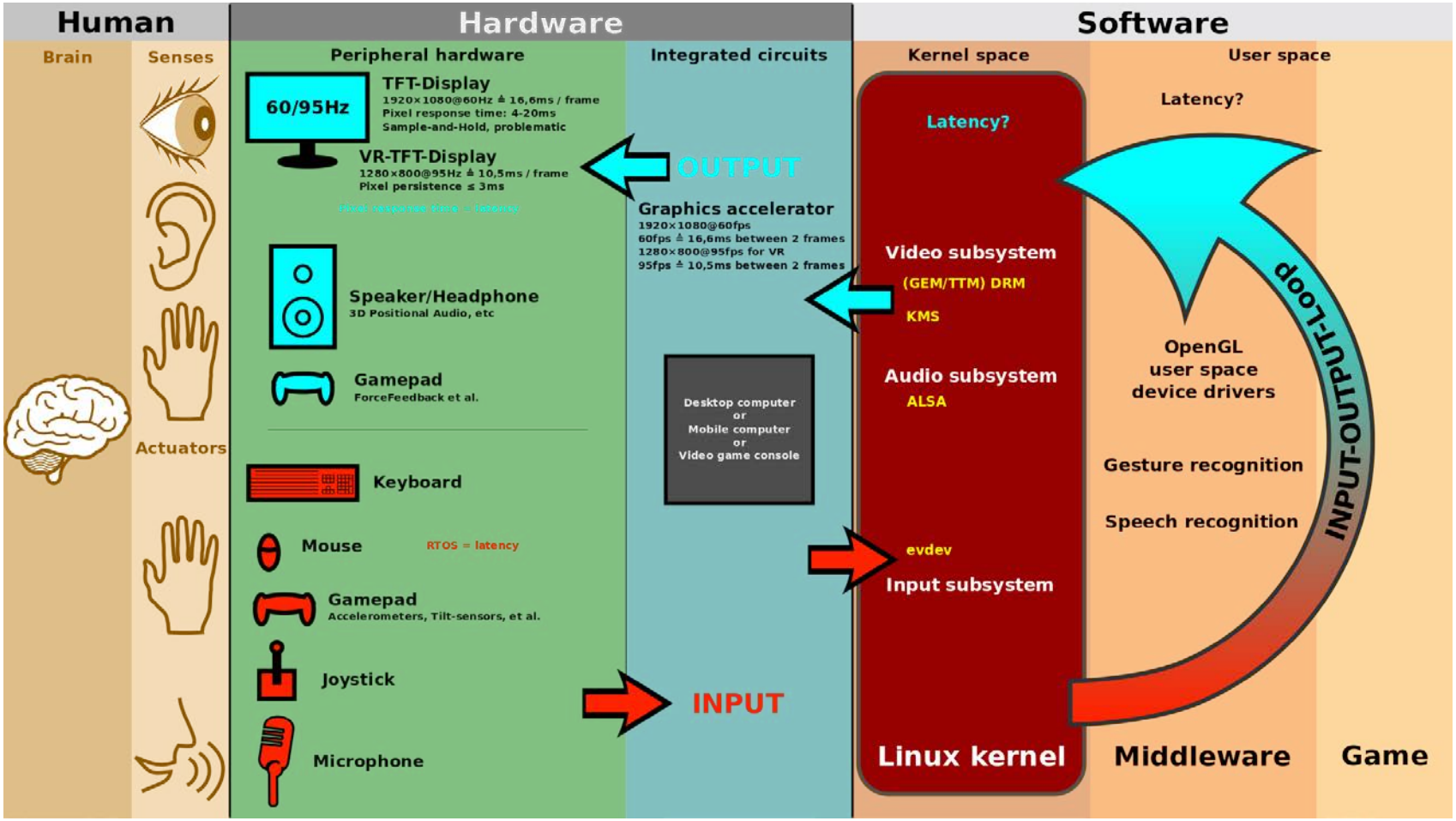
- Most applications' GUIs adhere to one of the three major GUI paradigms

1. Apple Macintosh
2. IBM Systems Application Architecture (SAA)
3. X-Windowing System

GUI in Computer Science

- GUI is displayed on the computer screen
- It is the result of processed user input and usually the primary interface for human-machine interaction
- The touch user interfaces popular on small mobile devices are an overlay of the visual output to the visual input

GUI: How It Works?



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Basic Contributing Human Factors

1. Physical limits of visual acuity

   - Visual acuity: ability of the eye to resolve detail
   - At a distance greater than 2.5 degrees from the point of fixation, visual acuity decreases by half
   - A circle of radius 2.5 degrees around the point of fixation is what the user can see clearly
     - ➪ The retina of eye can only focus on a very small portion of a computer
     - ➪ Specific amount of information a user can take in at any one time
     - ➪ It limits the effective size of icons, menus, dialogs boxes, etc
   - If users must constantly move their eyes across the screen to clearly focus, the GUI design is causing a lot of unnecessary and tiring eye movement

Basic Contributing Human Factors

2. Limits of absolute memory

   - Once the user has a desired fixation point, there is a limit to the amount of information that the person can process at one time

   - GUI design rule of thumb: Range of options or choices should never be more than five or six (Miller 1956; Sarna 1994)

Basic Contributing Human Factors

3. Gestalt Principle: People use a top-down approach to organizing data (Helander 1988; Wickens 1992)

   - Can influence how one should organize graphical information on the screen

   - Gestalt school of GUI designers has attempted to identify criteria that cause people to group certain items together in a display

   - Proper grouping results in a necessary redundancy of selection information that aids the user

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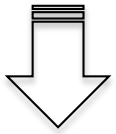
Basic GUI Standards from Basic Human Factors

1. Presentation of information

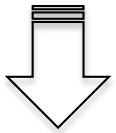
   - The amount of information to present is the most basic of GUI design considerations
   - Limiting the information to that necessary for the user reduces errors and time to perform tasks
   - Errors and performance time increase as the GUI presents more information
   - In order to display only the necessary amount of information, a thorough analysis of the tasks that the user must perform is needed
   - Compared to a randomly placed screen, a well-designed screen can reduce time needed to perform a task by as much as 40% (Helander 1988; Lin and Daly 1994)
   - Ways to conserve screen space

Basic GUI Standards from Basic Human Factors

- Ways to conserve screen space are:
  - ✓ Appropriate use of abbreviations
    - Many design documents recommend using complete words whenever possible



    - However, due to screen sizing constraints not always possible



    - Abbreviations should be contextual and consistent

Basic GUI Standards from Basic Human Factors

- Ways to conserve screen space are:
  - ✓ Avoid unnecessary detail e.g., use whole numbers if one does not need decimals
    - Keep the window and icon designs clear and simple
  - ✓ Use concise wording
    - Screens have limited space
    - Avoid the tendency to place additional data on the screen just because the data is available

Basic GUI Standards from Basic Human Factors

- Ways to conserve screen space are:
  - ✓ Use familiar data formats
    - With more familiar formats, the user will need less information to complete the task
  - ✓ Use tabular formats with column headings
    - Tabular formats allow for efficient labeling of related data
    - Especially preferable for data location tasks
    - Simply splitting items on one long line into a two-line result in productivity improvements of 20% (Sarna 1994)

Basic GUI Standards from Basic Human Factors

2. Grouping of information

   – Many ways one can display the information

   – Proper grouping improves the information's readability and can highlight relationships between the information

   – Several techniques to aid in the grouping of information

Techniques to Group Information

- ✓ Color
  - Presenting different groups with different color clearly creates some degree of grouping among the elements of the same color
  - GUIs that utilize color well increase productivity
  - If like color items are in close proximity, the visual association is stronger than if items are further apart
  - Different colors for the background and foreground

Techniques to Group Information

- ✓ Graphical Boundaries
  - Drawing boundaries around elements is the most common method of grouping elements in GUIs
  - Another method of grouping is to group tasks within icons
    - Icon grouping is easy because many icons can have common attributes
    - Icons are also small and therefore use less space
    - By icons recognition is faster for pictures than for text
    - Icons have smaller error rates than textual interfaces and the same as for menu interfaces

Techniques to Group Information

- ✓ Highlighting
  - Reverse video most common use of highlighting to indicate an item that is currently selected
  - Brightness to show which items are not active at a given time
  - Underlining is effective if it does not interfere with the legibility of characters
  - Flashing get attention/annoy if the user can not turn off the flashing
    - Only use to convey an urgent need
    - Overuse of highlighting causes confusion among users and defeats its purpose
  - If one highlights the wrong information, the user has more difficulty detecting the important information

Basic GUI Standards from Basic Human Factors

3. Information sequencing

   – One needs to lay out a screen in a manner that allows the user to easily find any information on it

   – Many users expect certain modes of operation in all GUIs e.g., most users expect the top of screen to contain the headings for the pull-down menus

   – Use of one the de facto GUI screen standards

Basic GUI Standards from Basic Human Factors

- The optimum sequence for screen presentations is a collection of various factors
  - ✓ Sequence of use
    - One needs to present the user the information in the order that the user will probably utilize it
  - ✓ Conventional Usage
    - If a common convention is in general usage, the GUI design should continue using it e.g., in the standard window layout, the file option is usually to the far left of the menubar
  - ✓ Importance
    - The designer needs to place the more important information in a prominent location

Basic GUI Standards from Basic Human Factors

- The optimum sequence for screen presentations is a collection of various factors

  ✓ Frequency of use

    - One should place the most frequently utilized commands at the beginning

  ✓ Generality versus Specificity

    - The more general items should precede the more specific items, especially when there is a hierarchical relationship among the data

  ✓ Alphabetical or Chronological

    - If there is no other rules for ordering data element, then one should adopt some other technique such as an alphabetical or a temporal listing

    - Faster selection time for alphabetical than for any other functional grouping

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References

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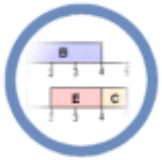


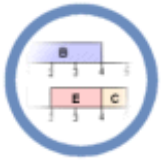
Lab ”7”
User Interface

<lecturer, date>

Lab ”7”

- Your task is to create a layout in XML that includes a text field and a button.





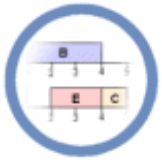
Seminar ”7”
User Interface

<lecturer, date>

Seminar ”7”

- The action bar is one of the most important design elements you can implement for your app's activities. Discuss the steps required to add action bar to your UI.





Mini-Project ”7”
User Interface

<lecturer, date>

Mini-Project ”7”

- Discuss the ways to intercept the events from user’s interaction with an Android app. More specifically, discuss *Event Listeners* and *Event Handlers* interfaces.