Course: Human Computer Interface (HCI)

Week 9 - Graphical User Interface

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Learning outcomes Week 9 - Graphical User Interface

At the end of the lecture, you will be able to:

(i) Define Graphical User Interface and related concepts

(ii) Describe the various HCI interfaces

(iii) Discuss the implications of cognitive aspects in designing interactive computing

Course Description

- The course begins with an introduction to Human Computer Interface (HCI) concepts, i.e. the human (brain, human visual system, visual perception and optical illusions), the computer and the interface perspectives.
- Theories and principles to design for attention will be covered and thereafter psychological and social interaction to address use of cognition and use of proper language and metaphors (menus).
- User-centered design and human-centered design will be covered in detail to understand how the two terminologies are similar and how they differ.
- Architectures for user interfaces mainly Graphical User Interface will lead the course coverage to user experience, universal design, design principles, heuristics and golden design rules.
- Information retrieval and utilization architectures will then be connected to designing rich interactive systems using styles that enhance usability (web and mobile) and easy navigation.
- User experience and support will be covered as we look into methods of evaluating interactive systems

Introduction:

Definition: What is a User Interface?

- ✓ User interface refers to the point of contact between computer systems and the users (the person using the computer).
- ✓There are different types of interfaces that HCI designers can choose from in their programs or systems.

Graphical User Interfaces (GUI)

- ✓GUI accepts input through the use of devices such as computer keyboard and mouse to provide an articulated graphical output on the computer monitor[1].
- ✓A GUI represents the information and actions available to a user through graphical icons and visual indicators such as secondary notation, as opposed to text-based interfaces, typed command labels or text navigation[2]

1. Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005). Pg 331

2. Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005). Pg. 482

- ✓The actions are usually performed through direct manipulation of the graphical elements.
- ✓GUIs allow users to interact with electronic devices using images rather than text commands.
- ✓GUIs can be used in computers, hand-held devices such as MP3 players, portable media players, gaming devices, household appliances and office equipment[3].

3. Human-computer interaction (3rd ed.), Dix, A., Finlay, J., Abowd, G., & Russell, B. New Jersey: Prentice Hall. ISBN-10: 0130461091, ISBN-13: 978-0130461094, (2004). Pg 17, 45

Other Interfaces in HCI

A. Web-based user interfaces or Web user interfaces (WUI)

- These are subclasses of GUIs that accept input and provide output by generating web pages which are transmitted via the Internet and viewed by the user using a web browser program.

B. **Touch screens**

✓These are displays that accept input by touch of fingers and they are used in mobile devices, point of sale devices, industrial processes and machines and many other self-service machines.

c. **Touch user interface**

- ✓These are Graphical User Interfaces that use a touchpad or touch screen display combined as input and output devices.
- ✓Touch User Interfaces supplement or replace other forms of output with feedback methods and they are used in computerized simulators etc.

c. **Command Line Interfaces** (CLI)

- ✓Users provide the input by typing a command string with the computer keyboard and the system provides output by printing text on the computer monitor.
- ✓CLIs are used by programmers and system administrators, in engineering and scientific environments, or by technically advanced computer users[4].

4. Human-computer interaction (3rd ed.), Dix, A., Finlay, J., Abowd, G., & Russell, B. New Jersey: Prentice Hall. ISBN-10: 0130461091, ISBN-13: 978-0130461094, (2004). Pg 17, 45

c. Direct manipulation interfaces

- ✓This is a human-computer interaction style which involves continuous representation of objects of interest and rapid, reversible, incremental actions and feedback[5].
- ✓ The intention is to allow a user to directly manipulate objects presented to them, using actions that correspond at least loosely to the physical world[6].

5. Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005). Pg 232

6. Human-computer interaction (3rd ed.), Dix, A., Finlay, J., Abowd, G., & Russell, B. New Jersey: Prentice Hall. ISBN-10: 0130461091, ISBN-13: 978-0130461094, (2004). Pg 23

Impact of cognitive aspects in the design of interactive computing

When designing a system with GUI in mind, the designer should have both the physical and psychological factors of the user in mind.

- **Importance of cognitive psychology in designing usable and useful interactive computing systems**

✓ Some of the cognitive factors that one needs to look at include:

i. Helps in managing user attention

ii. Perception & recognition

iii. Memory

iv. Reading, speaking and listening

v. Problem solving & decision-making

Color theory in Interface Design

- ✓When designing a system, a designer needs to provide colours for different items that are to be presented.
- ✓Colour choice guidelines are based on the fact that colours should correspond to common conventions and user expectations.
- ✓Whenever possible, colour should not be the only indicator of but additional hints should be used[7].

7. Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005). Pg. 64

Colour is used for a number of purposes in the design of interface including: -

i. **Drawing attention**. Colour offers rich visual feedback, and can also provide an important communication tool when used consistently.

ii. **Improving navigation and scanning speed**. Used consistently, colour can help users to navigate and promptly find desired information.

iii. **Showing relationships**.

✓ Colour provides another perceptual layer and can be used to reinforce groupings

iv. **Segmentation**: color is a powerful way of dividing a display into separate regions. Areas/items belonging to each other should have the same color (law of similarity). However, HCI designers need to avoid **colour pollution** whereby, too many colours are used and these increases item search time[8].

8. Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005). Pg 510-514

Metaphor in the design of interfaces

- ✓A **metaphor** is a pictorial representation of areal object that convey an abstract concept in a more familiar and accessible form.
- ✓Metaphors are widely used to make use of users' existing knowledge when learning new computer systems.
- ✓Metaphors give an idea of some unknown thing or concept, by illustrating it with something else which is known and which originally has nothing to do with it.

- Current user interfaces are based on several unmistakable metaphors that are very intuitive such as folders for data storage, trash bin for unwanted items etc.

Domains of Metaphor:

- ✓ Functionality (e.g., email - office mail)
- ✓ Interface (e.g., paperclip for attachment)
- ✓ Interaction (e.g., direct manipulation, agent)

Challenges & benefits associated with the use of metaphors in the design of an interaction style

- ✓ **Benefits:** users easily develop mental objects
- ❖ **Limitations:** translation & conceptual problems, provoke inappropriate actions

Metaphors that can help users understand systems easily

I. **Verbal metaphors** are useful tools to help users to understand a new system. These links provide basic foundation from which users develop their mental models[9].

II. **Virtual interface metaphor**: it is for the **Star** system. The overall organising metaphor on the screen was the **desktop**, resembling the top of a real office desk.

9. Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005). Pg 383

GUI design guidelines:

The standard guidelines that a programmer must adhere to during Graphical User Interface design (GUI) are: -

- ✓ Design dialogues that yield closure,
- ✓ Provide simple error handling,
- ✓ Strive for consistency,
- ✓ Reduce short-term memory load,
- ✓ Offer informative feedback
- ✓ Permit easy reversal of actions.

Design dialogs to yield closure –

- ✓Sequences of actions should be organized into groups with a beginning, middle, and end section.
- ✓Informative feedback at the completion of a group of actions shows the user their activity has completed successfully

Clearly marked exits

- ✓ If a user selects an unwanted function by mistake, there should be a clearly marked exit point without having to go through an extended dialogue.
- ✓ Undo and redo actions should be supported.

Errors

- ✓These occur due to incorrect user action(s) such as clicking the wrong link or button.
- ✓User errors need to be minimized and mechanisms to allow users recover quickly from errors provided[10].

10. Human-computer interaction (3rd ed.), Dix, A., Finlay, J., Abowd, G., & Russell, B. New Jersey: Prentice Hall. ISBN-10: 0130461091, ISBN-13: 978-0130461094, (2004). Pg. 30 Pg 313

- ✓Systems should be designed to easily detect and communicate error occurrences through proper feedback
- ✓There should be a way that allows users to **reverse** the results of an error or to recover the state of the system without blaming users for error occurrences (hostile feedback).

Role of error messages

✓When designing interactive systems, HCI designers should incorporate the element of error messages using programming codes.

✓The roles of the error messages are[11]:

i. Acts as a warning

ii. Feedback

iii. Shows corrective action

iv. informative

11. Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005). Pg 479

- ✓Systems should be designed to accommodate errors
- ✓Designers must assume that errors will occur and design the system in a way to minimize error occurrences or their effects once they occur.

Consistency

- ✓ Users should not have to wonder whether different actions mean the same thing.
- ✓ Users feel more confident in exploring the system if they know that the same command or action will always have the same effect.
- ✓ Platform conventions should be followed in system design.

Memory Load - The system should reduce user memory load. Screen elements should be meaningful and consistent across the system for users to recognize and not remember, what the elements mean from one page to another. New items and functions should relate to the ones the user already knows.

Feedback- When users perform an action, they should receive immediate feedback. E.g. upon clicking a button, some screen elements should change as indicator that the system has registered some form of action.

Content Covered in -Week 9 - Graphical User Interface

(i) We have defined Graphical User Interface and related concepts

(ii) We have described the various HCI interfaces

(iii) We have discussed the implications of cognitive aspects in designing interactive computing

Course Text Books

1. Human-computer interaction (3rd ed.), Dix, A., Finlay, J., Abowd, G., & Russell, B. New Jersey: Prentice Hall. ISBN-10: 0130461091, ISBN-13: 978-0130461094, (2004).

2. Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005).

3. The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002).

4. Designing the user interface: Strategies for effective human-computer interaction (5th ed.), Shneiderman, B., Plaisant, C., Cohen, M., & Jacobs, S. New Jersey: Prentice Hall. ISBN-10: 0321537351, ISBN-13: 978-0321537355, (2009).