Course: Human Computer Interface (HCI)

Week 3: Introduction to HCI – The Interface Concept

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Lecture Learning Outcomes

At the end of this lecture, the learner will be able to:

(i) Define an interface in connection to Human Computer Interfaces
(ii) Describe various interaction frameworks in HCI
(iii) Describe the various interaction styles

1. Introduction:

1.1. Definition: Interface

The user interface provides a link between users and the computer system and it is the part of the system that the user sees, hears, touches and communicates with. Users communicate with the system to carry out relevant tasks in various ways such as direct manipulation, virtual reality or batch input among others.

2. Interaction and computers[1]

Information between users and the computer flows in form of a loop of interaction with several aspects such as[2]: -

(i) *Goal* - Desired output from a performed task

[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). Pg 24

[2] 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 24

(ii) *Purpose of an interactive system* - this enables users accomplish goals

(iii) *Intention* - Specific action required to meet the goal

(iv) *Domain* - area of knowledge or real-world activity

(v) *Task environment analysis* - The problem space is identified and set by the user i.e., domain, goals, intention and tasks.

(vi) *Tasks/input flow* - operations manipulate domain concepts and the flow of information begins when the user has some tasks that require using their computer.

(vii) *Systems language* - core descriptive language showing relevant system computational attributes

(viii) *User language* - task language describing the user state psychological attributes

(ix) *System/Machine environment* - computerized application

(x) *Interface areas* – these are either *non-overlapping,* which involve processes of the human and computer not pertaining to their interaction or *overlapping,* that deal with the processes pertaining to their interaction.

(xi) *Output*: the flow of information coming from the machine environment.

(xii) *Feedback loops* that pass through the interface to evaluate, moderate, and confirm processes as they pass from the human through the interface to the computer and back[3].

The Interaction Framework[4]

For interaction to happen, users formulate a plan which is then **executed** by the computer after which, a state transition occurs in the system. The user then **evaluates** the results by translating the system's responses to determine further actions. Users communicate to the system using task-language (input language), which is phrased using psychological attributes that highlight the important features of the domain. Core language is what the system understands and user input responses are translated into stimuli for the system.

[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. 24

[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 25

HCI frameworks are based on three components:

(i) Ergonomics or the user side of the interface, has input, output and the user's immediate context.

(ii) Dialog design and interface styles.

(iii) Presentation and screen design

I. Ergonomics and HCI[5]

Ergonomics studies the physical characteristics of any interaction to determine how systems are designed by offering specific guidelines and standards.

Some common ergonomic human factors used as the baseline for standard hardware designs include: -

a) *Organization of controls* - Controls and displays that are not well arranged can lead to inefficiency, frustration or injury to users. The following guidelines apply

(i) Group the *functionally related controls* together.

(ii) *Order of use (sequence)* of the controls in a typical interaction determines their arrangement

(iii) *Frequency of use* requires that controls that are frequently used should be easily accessible.

b) The physical environment of the interaction

System's design should match the users' size, position (sitting/standing) for comfort and safety.

c) *Health issues* - some factors such as physical position, room temperature, lighting, noise could have a direct effect on the health of users.

d) *Use of colour* – 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.

[5] 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 25-26

II. Dialog Design and Interaction styles

a) **Command Line Interface (**CLI) provides a way to pass instructions to the computer directly, using function keys, single characters, abbreviations or whole-word commands.

b) **Menus –** The screen has a set of menu options available for the user which can be selected using devices such as mouse or keyboard. Menus are either text-based or graphical.

c) **Natural language -** The ambiguity of natural language makes it very hard for a machine to understand. However, systems can be built to understand restricted subsets of a language, which is relatively successful.

d) **Query dialog -** these interfaces are easy to learn and use, but are limited in their functionality and power. Users are presented with a series of questions in form of a step-by-step interaction. Query languages are used to build queries to retrieve information from a database and this requires specifications from the user who must follow strict language syntax.

e) **Form-fills –** these interfaces are mainly used used for data entry and data retrieval applications to assist users during the interaction. Spread sheets are a variation of form fills that allow users to enter and alter values and formulas in any order.

III. Windows, Icons, Menus and Pointers (WIMP) interface[6]

Windows, icons, menus and pointers are the default interface style for majority of computer systems today.

a) **Point-and-click interfaces (**PCI) is closely related to the WIMP-style. To access information, users are required to point and click within the interface.

b) Three-dimensional interfaces

A simple technique is giving ordinary WIMP elements a 3D appearance while a more complex technique uses interfaces with 3D workspaces. The objects displayed are flat,

[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. 27-28

but they are displayed in perspective: they shrink when they are further away. The most complex 3D-workspace is the Virtual Reality (VR) workspace.

Elements of the WIMP-interface

WIMP interface elements are referred to as widgets and they constitute the toolkit for interaction between the user and the system. They include: -

- ✓ *Windows* - independent areas on the screen or screen terminals that contain information and can be resized or moved around. Some systems allow windows within windows.
- ✓ *Icons* - small pictures used to represent various window features
- ✓ *Pointers* - different shapes of the cursor used to distinguish modes. Cursors provide information about the systems activity (hour-glass). Pointers are small bitmap images specifying the location of the pointed feature.
- ✓ *Menus* - they provide information in form of an ordered list of operations that can be scanned and selected with the pointer. Menus either represent context-dependent options (pop-up menus), or are always visible (pull-down menus). The most challenging aspect of menu design is to group menu items correctly.
- ✓ *Buttons* - these are individual, isolated regions within a display selectable by the user to start a specific action. Buttons can either select one option among many (radio buttons) or select multiple options (check boxes).
- ✓ *Toolbars* - similar to menus, except that they can also hold buttons.
- ✓ *Palettes* - A collection of icons used as a way of making the set of possible modes and the active mode visible to the user.
- ✓ *Dialog boxes* - information windows used by the system to bring the user's attention to some important information like error messages or warnings.

INTERACTIVITY

Interactivity determines the feel of a WIMP environment once the user selects an option among the many available options and applications[7]. Properly designed systems motivate

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users to perform their tasks well. However, if the computer system makes it difficult for users to perform tasks or does not match actual requirements, frustrations and user resistance sets in and low productivity is the end result[8].

User Experience, engagement and fun

It is not only important that users can utilize a system, they have to want to use it as well. Understanding user experience entails striking a balance between anxiety and boredom to create a sense of information flow. User experience calls for a focus on ergonomics, legal and safety issues, context and environment, aesthetics and economic constraints while designing interfaces[9].

Value addition: For people to want to use a device or application, they have to see the gains from the new technique immediately after embracing it.

[8] 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. 29-30

[9] 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. 29-30

Content Covered in Week 3: Introduction to HCI – The Interface Concept

1. We have defined an interface in connection to Human Computer Interfaces
2. We have described various interaction frameworks in HCI
3. We have described the various interaction styles

References

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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).