

# Human Computer Interaction And User Interface Design

## Part 1 – Introduction To HCI And UID

# What is HCI?

2 What happens when a human and a computer get together to perform a task?

- task - write document, calculate budget, solve equation, learn about Antarctica, drive home,...

➤ **Human Computer Interaction (HCI)** is a cross-disciplinary area (engineering, CS, Psychology, ergonomics, design) **that deals with the theory, design, implementation and evaluation of the ways humans use and interact with computing devices**

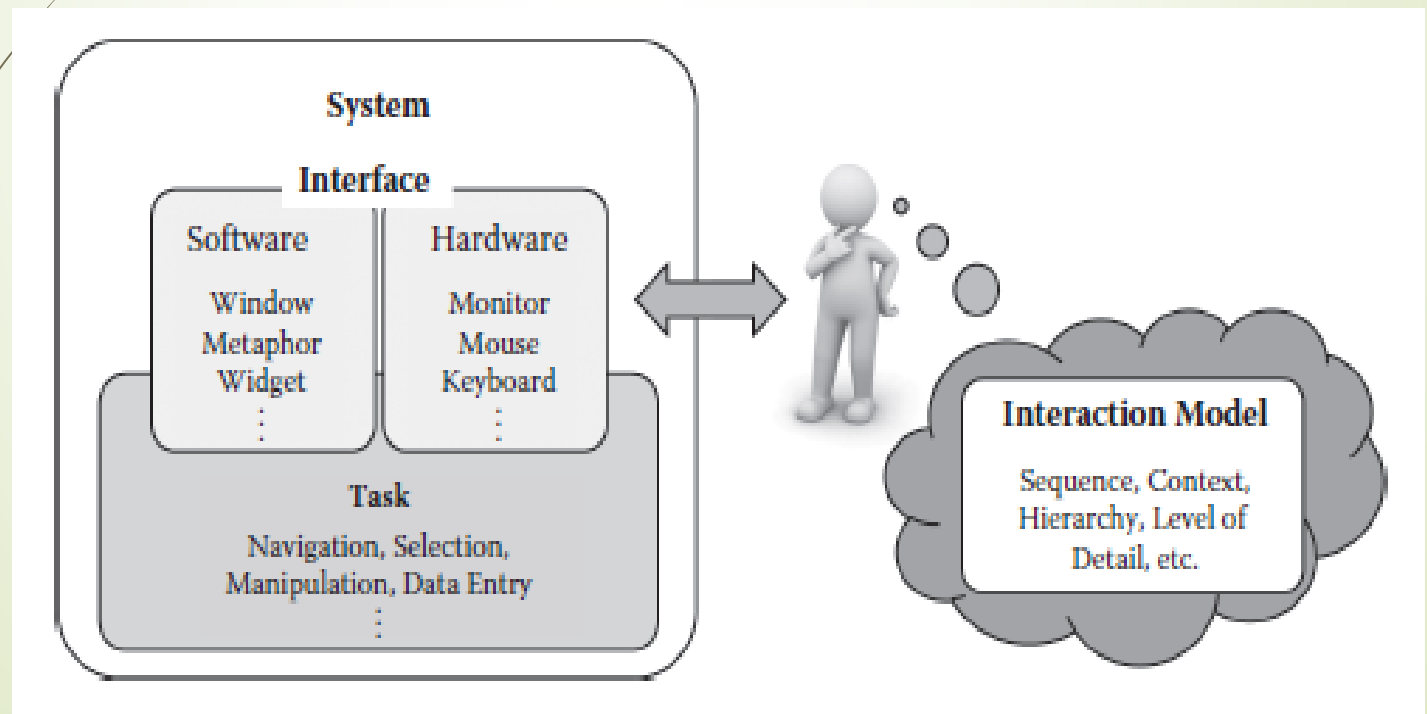
➤ The emphasis in this course concerns those aspects of HCI which are the concern of the software designer.

# Some terms in HCI

## 3 Interaction and Interface

**Interaction:** refers to an abstract model by which humans interact with the computing device for a given task

**Interface:** Choice of technical realization (hardware or software) of such a given interaction model



The distinguishing concepts of interaction and interface

# Some terms in HCI

4

## Usability and User Experience

**Usability:** Means that the resulting interface are easy to use, efficient for the task, ensure safety and lead to correct completion of the task

**Usability + efficient interaction**  **Higher Productivity**

**User Experience:** A notion that not only encompasses the functional completeness, high usability and aesthetic appeal of the interactive artifact, but also its seamless integration into one's lifestyle or even creating s new one around it



(a)



(b)



(c)



(d)

a) Functional completeness in an apple device, (b) High usability in Microsoft PixelSense (c) Aesthetic appeal of apple device (d) Compelling UX IN Microsoft Kinect

# Why is HCI important?

6 HCI has had a great deal in the history of computing and has changed our daily lives

- Keyboard commands to a mouse
- The spreadsheet/accounting interface making business computing a huge success
- The internet happening because of web browser interface
- From feature phones to smartphones with their touch-oriented interfaces
- Body based and action oriented interfaces revolutionizing the gaming industry

**HCI still continues to redefine how we view, absorb, exchange, create and manipulate information to our advantage**



Evolution of interfaces in the course of history of computing



# Professions in HCI

**7 interaction designers** - people involved in the design of all the interactive aspects of a product

- **usability engineers** - people who focus on evaluating products, using usability methods and principles
- **web designers** - people who develop and create the visual design of websites, such as layouts
- **information architects** - people who come up with ideas of how to plan and structure interactive products
- **user experience designers** - people who do all the above but who may also carry out field studies to inform the design of products
- **computer engineers** – People who follow the blueprint in design and build systems that users need

# History (and future) of HCI

8

- Large displays
- Small displays
- Peripheral displays
- Alternative I/O
- Ubiquitous computing
- Virtual environments
- Implants
- Speech recognition
- Multimedia
- Video conferencing
- Artificial intelligence
  - Software agents
  - Recommender systems
  - Semantic Web (3.0) etc



# What is a User Interface?

## 9 The user interface (UI)

- It is everything designed into an information device with which a person may interact. This can include display screens, keyboards, a mouse and the appearance of a desktop
- It is also the way through which a *user* interacts with an application
- The means by which the user and a computer system interact, in particular the use of input devices and software
- The user interface, in the industrial design field of human–computer interaction, is the space where interactions between humans and machines occur

# Importance of the User Interface

10

- The user interface is the **main contact between the user and the computer system**, it is the part of the system that the user sees, hears, touches and communicates with
- The user **interacts with the computer** in order to carry out **some specific task** which is of importance, often the task will be a **fundamental or critical part of the user's job**

# Importance of the User Interface

11

- The types of problems caused by poor interface design include:
  - reduced user productivity
  - unacceptable learning times
  - unacceptable error levels
- All of these factors will lead to user frustration and potentially to rejection of the system by the user

# User Interface Design

12

- **User interface design (UI)** or user interface engineering is the design of user interfaces for machines and software, such as computers, home appliances, mobile devices, and other electronic devices, with the focus on **maximizing usability and the user experience**
- What makes a "good" interface?
  - Well-designed interfaces provide a **good match** between the **user's task, skill level, and learning ability** and **will lead to satisfied and productive users**

# User Interface Design

13

- A good interface will be **easy to learn** and **easy to use**; it will **encourage the user to experiment** and **try out new features** within the system without getting frustrated
- In order to understand what is meant by a "**good**" or "well designed" user interface, we need to have some understanding of the **classes of user interface** commonly available and of their **appropriateness for given situations**

# Classes of User Interface

14

## Command Language

- These are **dialogues** in which the user types instructions to the computer in a **formally defined command language**, e.g. `mv file1 file2`, in UNIX for copying file1 into file2.
- This type of interface is **very flexible**, allowing users to **create their own commands**
- The interface requires **significant level of training** and a **high degree of memorization**



# Classes of User Interface

15

## Natural Language

- These are interfaces in which the user's **command language** is a significant, well-defined subset of some natural language such as English
- They are typically **easy to learn**; however they often require considerable **typing skills on the part of the user**

# Classes of User Interface

16

## Menu System

- These interfaces allow the user to issue commands by selecting choices from a menu of displayed alternatives.
- They are popular since they reduce learning time, reduce the number of key strokes necessary and help to structure decision making.

# Classes of User Interface

17

## Form Filling Dialogues

- The user enters data by filling in fields in one or more forms displayed on the screen.
- The use of forms on the screens considerably simplifies data entry and requires very little training to use

# Classes of User Interface

18

## Direct Manipulation Interfaces

- The user manipulates, through button pushes and movements of a pointing device such as a mouse, graphic or iconic representation of the underlying data.
- Direct Manipulation Interfaces represent task concepts visually, are easy to learn and use, they encourage exploration and or experimentation with the system features, and generally result in a high level of user satisfaction.

# Design Guidelines

19

- Choosing the most appropriate class of user interface to **match the needs and expectations of the users** is an important aspect of good user interface design
- To **assist in making the right decisions** and hence **achieving a good user interface design**, a number of design guidelines are available
- The major guidelines common to many of the existing texts can be summarized into five categories:

# Naturalness

20

- Dialogue which **does not cause the user to significantly alter his or her approach to the task** in order to interact with the system. It is reflective of various operation in our everyday life.
- It should be **geared towards the normal order of working of the user** rather than whatever is **easier for the programmer**
- **Phrasing should be self explanatory**, e.g. print, copy end have **obvious meanings** whereas “pip” (CP/M – control program for microcomputers- keyword for copy) or “mv” (UNIX keyword for rename) do not.
- Use of **non-standard abbreviations** should be avoided since they **slow down word recognition** and introduce unnecessary stress
- Perhaps a better approach is to model interaction **metaphorically** to the real life counterpart



# Consistency

21

- A consistent dialogue ensures that **expectations which the user builds up** through using one part of the system are not frustrated by **idiosyncratic changes in the conventions** used in another part e.g where Shopping cart is placed in an ecommerce site
- **Consistent layout for screens** which **fulfill a similar function** ensures that the user knows **where to look for instructions, error messages etc**
- The dialogue should also be **consistent with established norms**
- **Diversions from norms will cause confusion**

# Non-Redundancy

22

- A non redundant dialogue requires the user to **enter only the minimum information** for the system's operation
- Too much information on one screen is **detrimental to the clarity of the screen** and will lead to **unnecessarily delay** when the user tries to **"spot"** a particular field or item.

# Supportiveness

23

- Refers to the amount of assistance which the dialogue provides to the user in running the system.
- It has three major aspects: the quantity and quality of instructions provided; the nature of the error messages produced and the confirmation of what the system is doing.
- Inputs should be confirmed: if their acceptance will result in an irreversible action, for example, delete file; if a code has been entered and the user has to check the associated description or when confirmation of completion of particular actions is desirable

# Flexible

24

- This depends largely on the skill and expertise of the user in relation to a given task.
- Different types of dialogue may be used in different situations e.g. a hierarchical menu structure for use by a first time user may be navigated using commands and parameters once the user becomes more experienced

# WIMP User Interfaces

25

- ➡ A WIMPS interface is one which:
  - ➡ **W** – presents information to users via multiple **W**indows on the display screen.
  - ➡ **I** represents data objects as **I**cons,
  - ➡ **M** – uses a **M**ouse as a selection device,
  - ➡ **P** – has menus which **P**op-up automatically on the screen or which **P**ull-down from a menu bar at the top of the screen

# Advantages of Multiple Windows

26

- ▶ Allow access to multiple sources of information
  - ▶ Allow the user to control multiple concurrent tasks in an environment where multitasking is provided for
- ▶ Allow information to be viewed from different perspectives
  - ▶ The user may examine the same information at different levels of detail, for example, overviews in one window with related windows containing further detail
- ▶ Allows the system attract the user's attention for example by displaying a new window in the middle of the screen e.g. a window with a warning message



# Disadvantages of Windows

27

- The danger of "overcrowding" on the screen
- Distraction from the task-in hand by causing the user to manipulate the interface in order to obtain the information required. *As a sidebar- Reason why I do not have whatsapp web*

# Icons

28

- An icon is a **small window** that provides a **pictorial representation of the contents of the information** which is **accessible via the icon**.
- Most WIMPS interfaces allow designers to **specify their own icons**, they also provide a set of **predefined icons**.
  - **Universal icons vs Localization of icons**

# Advantages and Disadvantages of Icons

## Advantages

29

- An icon **does not occupy much space** on the screen, but, can serve as a **reminder of a potentially large amount of information**
- Icons **can be designed to match the visual memory of the user**
- They can be **used as part of an analogy** that closely matches the **user model of behavior to real world objects-emoticons** (Naturalness)

## Disadvantages

- **Potential for ambiguity** of the meaning of Icons (Need to understand the users i.e their culture and what those icons means to them)
- The **meaning** of the icon will **depend on the user and the user environment** (context-dependent, context is important)

# Design of Icons

30

- Many methods advocate for user participation in the design of the icon

## Design Steps

- Create graphical representation of the icons
  - Some recommend getting the user to “doodle” in an effort to facilitate visualization of some aspect of the user environment
- Test the representation of the icons with the users
- Make icons as realistic as possible
- Give the icon a clear outline to help visual discrimination
- When showing commands give a concrete representation of the object being operated upon (instead of an icon)
- Avoid symbols unless their meaning is already known

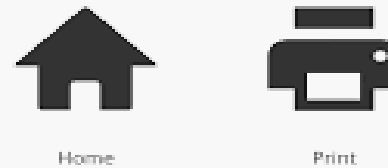
# Classifications of Icons

31

- Rogers(1989) distinguishes between **form** and **function** of icons
  - Icon types of according to form
    - Resemblance icons
    - Exemplar icons:
    - Symbolic icons
    - Arbitrary icons
  - Icon types of according to function
    - Labeling
    - Indicating
    - Warnings
    - Identifying
    - Manipulating
    - Container

# Icon types of according to Form

32 **Resemblance icons:** which depict the underlying referent through an analogous image



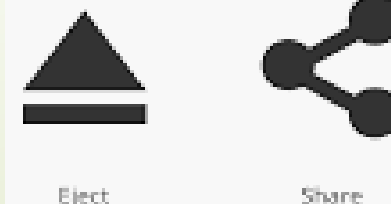
- **Exemplar icons:** which depict a typical example of a general class of objects, for example an icon of a knife and a fork depicts the availability of food.



- **Symbolic icons:** which convey the underlying referent at a higher level of abstraction than the image itself, e.g. a “wine glass” with a jagged crack depict fragile



- **Arbitrary icons:** which bear no resemblance to the referent, for example the representation of a biohazard





# Icon types according to Functions

33

- **Labeling** e.g. a menu item
- **Indicating** e.g. indicating a system state
- **Warnings** e.g. warning of an error message
- **Identifying** e.g. file storage
- **Manipulating** e.g. icon representing a tool for zooming and shrinking
- **Container** e.g. for placing discarded objects

# Underlying Analogies

34

An **Analogy** draws a comparison between two things in order to show a similarity in some respect and for the purpose of explanation or clarification

- Wimp interfaces were initially targeted at the **office system users**
- In an attempt to provide an interface that was natural, consistent and supportive of such users, **designers looked for analogies** in the clerical performance of similar tasks
- **Three** examples of analogies within the WIMP philosophy are:
  - the "Concrete Object" Metaphor
  - the "Desktop" metaphor
  - the "Travel Holiday" Metaphor

# Underlying Analogies

35

## The "Concrete Object" Metaphor

- ➡ The items here represent the physical (concrete) object
- ➡ For example: files are presented as sheaves of paper or folders, directories are presented as drawers in a filing cabinet
- ➡ Clerical operations involve physical actions on these objects

# Underlying Analogies

36

## The "Desktop" Metaphor

- Suggests that the interface should provide the user with a **similar type of flexibility as the desktop**, e.g. **have access to several information sources**, see a **variety of formats** such as pictures, graphs, etc.
- The **icons were organized into three classes** with each possessing it's own properties:
  - **container icons** such as folders or baskets
  - **data icons** such as charts, spreadsheets or documents
  - **device icons** such as printers or telephone

# Underlying Analogies

37

## The "Desktop" Metaphor

- The desktop metaphor is not appropriate for all application types
  - The desire is to provide an interface that is natural, consistent, etc., and which is also appropriate for the class of users / tasks under consideration
- We may well need to identify different types of icons, different analogies depending on the situation

# Underlying Analogies

38

## The "Travel Holiday" Metaphor

- This was developed by Hammond and Allison in 1987 for a Computer Aided Learning System (CAL)
- The aim of the system was to **provide the student with a large amount of information** together with **various means to accessing it**
- The general **metaphor of the travel holiday** was used plus **display frames representing places to visit**, and various **facilities representing the ways and means of traveling around**
- Within the general metaphor, a number of more specific metaphors were assumed:
  - navigation e.g. **go it alone travel** and **guided tours**
  - Second, a **map** facility allowed students to see **where they were** and **where they had been**
  - The third **index** (notionally the index of a book) provided a mechanism for **key-word-based access**



# Design Guidelines for WIMPS

39

- The contents of a window should form a logically related group
- The borders of each window should be clearly delimited
- Avoid filling the screen with a multiplicity of small windows
- Windows should appear initially in a consistent position and have a consistent size
- The default position and size should be adjusted to reflect user preference
- The content of each window and of each screen should reflect a logical ordering, consistent format and utilize minimum highlighting

# Design Guidelines for WIMPS

40

- The spatial position of each window on the screen should reflect a logical ordering e.g. simple, more complex, most complex in that order
- Use of colors across the whole screen should be minimum and consistent
- Allow “popping-up” of windows to attract user attention
- Avoid complicated coding of mouse buttons
- Allow the use of commands as an alternative to the mouse – to give flexibility according to preferences and level of expertise

# Purposes of using colour in the design of user interfaces

41

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

- Improve navigation and scanning speed. Used consistently, colour can help users to navigate and promptly find desired information.
- Show relationships. As mentioned previously, colour provides another perceptual layer and can be used to reinforce groupings.
- Segmentation: color is a powerful way of dividing a display into separate regions. Areas/items belonging to each other should have the same color (note that this is also related to the Gestalt law of similarity) amount of color: too many will increase search time – colour pollution.

# Roles of error messages in the design of user interfaces

42

- When designing a system, it is important that a HCI designer incorporates the element of error message:
- Role of error messages:
  - Acts as a warning
  - Feedback
  - Shows corrective action
  - Informative

# Assignment One

43

The future of HCI is partly here as some of the applications are already using Non-WIMP/Multimodal Interfaces. Write short notes on this and provide examples for a better understanding

## NOTE

- ☐ All assignments are **handwritten**
- ☐ This Assignment should be handed in on **20<sup>th</sup> September 2019** by COB. **I will not accept any assignment after this date**

# Exercise

44

- What is Interaction Design?
- What is the relationship between Interaction Design and HCI?
- Interaction design in business - Increasing number of ID consultancies, examples of well known ones include: (Read on them)
  - **Nielsen Norman Group:** “help companies enter the age of the consumer, designing human-centered products and services”
  - **Swim:** “provides a wide range of design services, in each case targeted to address the product development needs at hand”
  - **IDEO:** “creates products, services and environments for companies pioneering new ways to provide value to their customers”
- What is Design Thinking?



# Class Project (Semester Assignment)

45

- Design and evaluate an interface
  - Part 1 - Team formation & topic choice, understand and formulate the problem, roadmap
  - Part 2 - Design alternatives, prototype & evaluation plan, evaluation, user studies

# Class Project - Details

46

## ➤ Part 1

- Identify team & topic
- Define the problem
- Describe tasks, users, environment, social context
- What components will be in your design?

## ➤ Part 2

- Discuss design alternatives
- Storyboards, mock-ups for multiple different designs
- Explain decisions
- Semi-working interface functionality
- Plan for conducting evaluation
- Evaluation: Conduct evaluation with example users (2-3 users), characterize what's working and what's not

# Class Project - Details

47

- Project Teams
  - **5 people (Will be keen on this)**
  - A project/team name
  - Start forming your teams
- Project Reports & Presentations
  - **28th/10 – low fidelity /mockup and 11/11 – high fidelity**
  - 10 minute presentation of your project
- What makes a good project?
  - Access to domain experts & users “Real” clients
  - Interesting human issues
  - Rich domain for design

# Class Project - Project Ideas

48

- ➡ Mobile sites / Web sites  
(Interface designs)
  - ➡ for elderly people
  - ➡ For Dyslexic kids
  - ➡ Pregnant mothers
  - ➡ For distance learning  
(Moodle)