Week 2-Introduction and Overview

Objective if the study:

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

1. define HCI with examples
2. list the importance of user Interface
3. list the benefits of good design.
4. understand what usability means.

Definitions of HCI

HCI (human-computer interaction) is the study of how people interact with computers and to what extent computers are not developed for successful interaction with human beings as seen in figure 1..

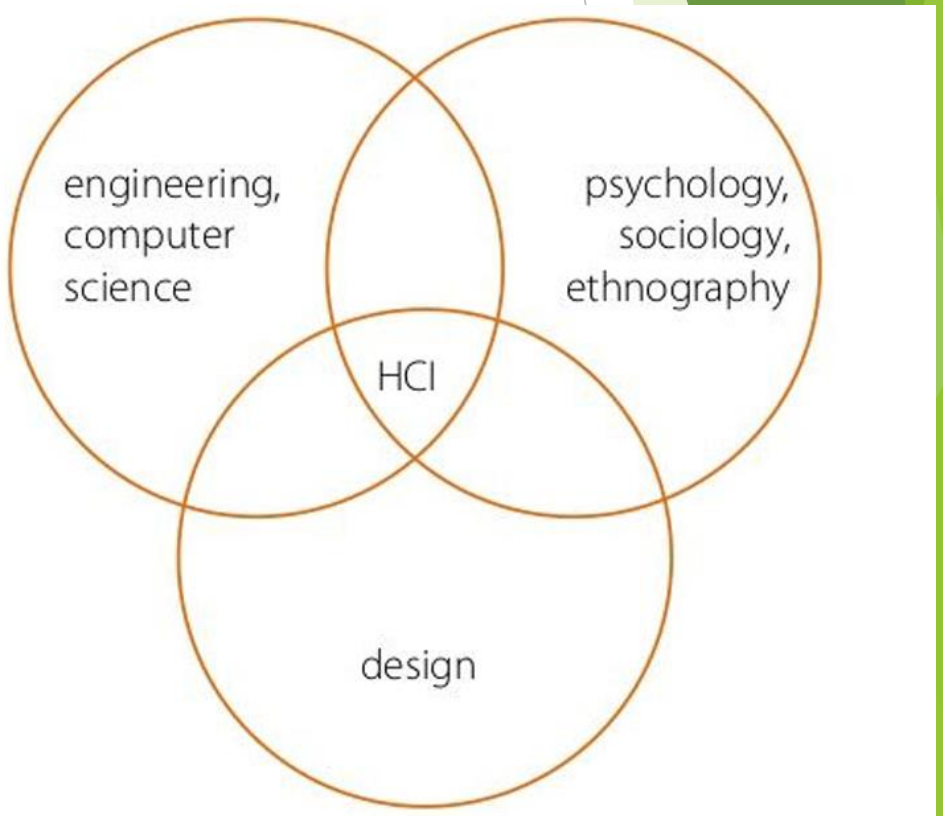


Figure 1. illustration of HCI

Introduction

Human-computer interaction (HCI), alternatively man-machine interaction (MMI) or computer- human interaction (CHI) is the study of interaction between people (users) and computers. With today's technology and tools, and our motivation to create really effective and usable interfaces and screens, why do we continue to produce systems that are inefficient and confusing or, at worst, just plain unusable? Is it because: We don't care? We don't possess common sense? We don't have the time? We still don't know what really makes good design?

Goals of HCI

1. A basic goal of HCI is to improve the interactions between users and computers by making computers more usable and receptive to the user's needs.
2. A long term goal of HCI is to design systems that minimize the barrier between the human's cognitive model of what they want to accomplish and the computer's understanding of the user's task

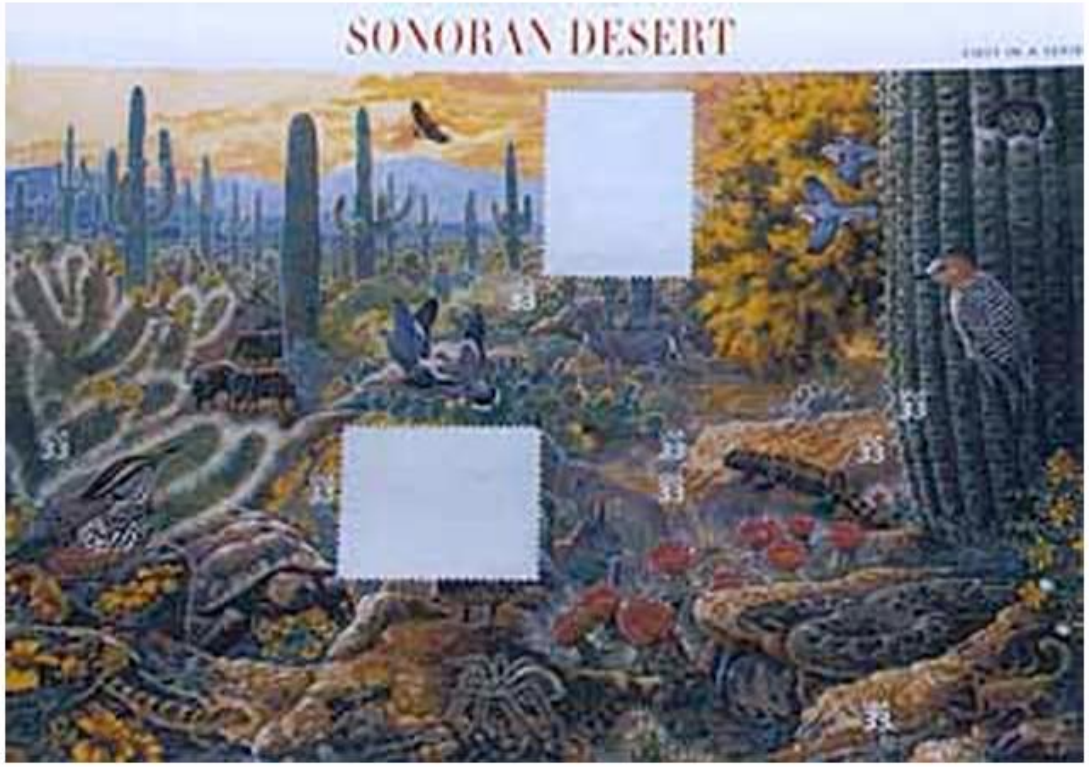
Why do we need HCI?

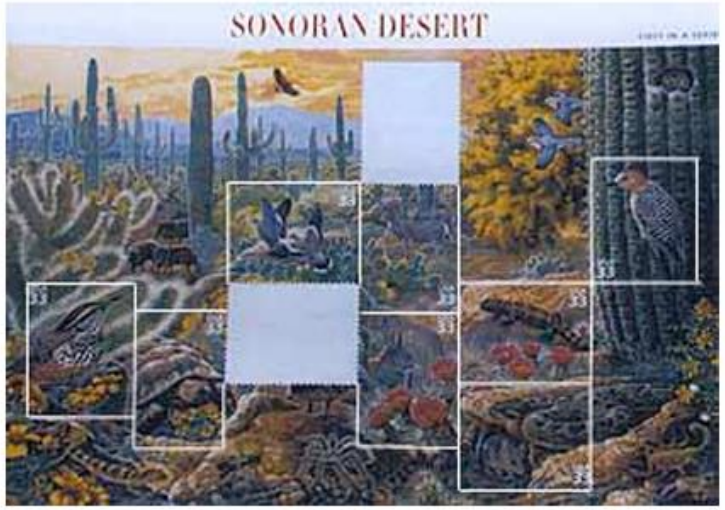
The world is full of badly designed things…

Why do we need well designed tools?

And well designed things…

And things that look good but don’t work





Does it matter?

If things are badly designed?

http://baddesigns.org

- You may camp in the wrong place
- You may crash your car and get injured.. Or worse!
- … in the best case – you might angry, make mistakes and things will take longer than they should

The Importance of Good Design

With today's technology and tools, and our motivation to create really effective and us-able interfaces and screens, why do we continue to produce systems that are inefficient and confusing or, at worst, just plain unusable?

- Is it because: We don't care?
- We don't possess common sense?
- We don't have the time?
- We still don't know what really makes good design?
- But we never seem to have time to find out what makes good de-sign, nor to properly apply it. After all, many of us have other things to do in addition to designing interfaces and screens. So we take our best shot given the workload and time constraints imposed upon us. The result, too often, is woefully inadequate. Interface and screen design were really a matter of common sense, we developers would have been producing almost identical screens for representing the real world. Example bad designs o Closed door with complete wood o Suggestion : glass door

The Benefits of Good Design:

- Poor clarity forced screen users to spend one extra second per screen.
- Almost one additional year would be required to process all screens.
- Twenty extra seconds in screen usage time adds an additional 14 person years.
- The benefits of a well designed screen have also been under experimental scrutiny for many years. One researcher, for example, attempted to improve screen clarity and readability by making screens less crowded.

HCI != Usability

A usable system is easy to learn, easy to remember how to use, effective, efficient, safe, and enjoyable to use. Usability is only one part of HCI, but has been one of the main goals For example, HCI has contributed to the development of guidelines and standards that support designers HCI has also developed methods of evaluation that help us to evaluate the usability of a given product/system (and other aspects of the user experience)

HCI uses mathematical models to predict users' performance with a system (e.g., Fitt's law to predict mouse movement time, or models that predict search time or mental effort) HCI also investigates new interaction paradigms or new ways of integrating technology in our daily lives (think smart clothes, touch displays, VR/AR, Voice-based interfaces …)

Why is HCI important?

User-centered design is getting a crucial role! It is getting more important today to increase competitiveness via HCI studies (Norman, 1990) High-cost e-transformation investments Users lose time with badly designed products and services Users even give up using bad interface Ineffective allocation of resources

How to Design Interactive Technology

- (and future stuff!)

To make better interactive technology …. We need to

- Know about how people **interact** with things
- Know about what people **can and can't do**
- Know about the **situations** in which people do things
- Know about the **basics** of good design
- Understand people's **goals**

Poor designed products in Nigeria

2 minutes exercise. Think about two products you know in Nigeria that were poorly designed and never last or saw the light of the day. Be ready to share at random

Defining the User Interface:

User interface, design is a subset of a field of study called human-computer interaction (HCI). Human-computer interaction is the study, planning, and design of how people and computers work together so that a person's needs are satisfied in the most effective way.

HCI designers must consider a variety of factors:

- What people want and expect, physical limitations and abilities people possess,
- How information processing systems work, What people find enjoyable and attractive.
- Technical characteristics and limitations of the computer hardware and software must also be considered.

Cont'd of User interface

The user interface is the part of a computer and its software that people can see, hear, touch, talk to, or otherwise understand or direct.

The user interface has essentially two components:

- input and output.
- Input is how a person communicates his / her needs to the computer. Some common input components are the keyboard, mouse, trackball, one's finger, and one's voice.
- Output is how the computer conveys the results of its computations and requirements to the user. Today, the most common computer output mechanism is the display screen, followed by mechanisms that take advantage of a person's auditory capabilities: voice and sound. The use of the human senses of smell and touch output in interface design still remain largely unexplored.

- Proper interface design will provide a mix of well-designed input and output mechanisms that satisfy the user's needs, capabilities, and limitations in the most effective way possible. The best interface is one that it not noticed, one that permits the user to focus on the information and task at hand, not the mechanisms used to present the in-formation and perform the task.
- Separate items, which had been combined on the same display line to conserve space, were placed on separate lines instead. The result screen users were about 20 percent more productive with the less crowded version Proper formatting of information on screens does have a significant positive effect on performance. In recent years, the productivity benefits of well-designed Web pages have also been scrutinized.

Benefits Cont'd

- Training costs are lowered because training time is reduced.
- Support line costs are lowered because fewer assist calls are necessary.
- Employee satisfaction is increased because aggravation and frustration are reduced.
- Identifying and resolving problems during the design and development process also has significant economic benefits How many screens are used each day in our technological world? How many screens are used each day in your organization? Thousands? Millions? Imagine the possible savings. Proper screen design might also, of course, lower the costs.

Week 3. The History of HCI

Objective of the study

At the end of this lecture, you should be able to:

- Give detailed history of HCI
- List the benefits of HCI on the society, economy and culture
- Know where are in terms of technology and where we could be!

History of HCI

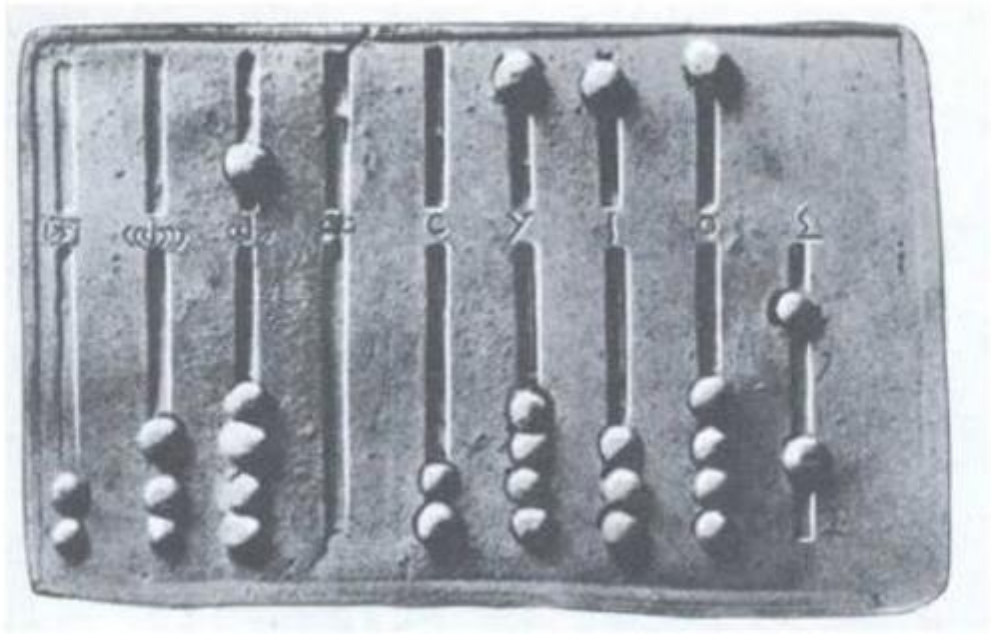
- The need for people to communicate with each other has existed since we first walked upon this planet.
- The lowest and most common level of communication modes we share are movements and gestures.
- Movements and gestures are language- independent, that is, they permit people who do not speak the same language to deal with one another.
- Most people can speak one language, some two or more.
- A spoken language is a very efficient mode of communication if both parties to the communication understand it.
- At the third and highest level of complexity is written language. While most people speak, not all can write. But for those who can, writing is still nowhere near as efficient a means .of communication as speaking.

History of HCI Cont'd

- In modem times, we have the typewriter, another step upward in communication complexity. Significantly fewer people type than write. (While a practiced typist can find typing faster and more efficient than handwriting, the unskilled may not find this the case.)
- The human-computer dialog reflected the computer's preferences, consisting of one style or a combination of styles using keyboards, commonly referred to as Command Language, Question and answer, Menu selection, Function Key Selection, and Form Fill-In.
- Throughout the computer's history, designers have been developing, with varying degrees of success, other human-computer interaction methods that utilize more general, widespread, and easier-to-learn capabilities: voice and handwriting. Systems that recognize human speech and handwriting now exist, although they still lack the universality and richness of typed input.

History of HCI Cont'd

Calculating devices in antiquity



History of HCI Cont'd

Konrad Zuse (1910-1995)

Invented the world's first programmable computer (in 1941)

This remained the only working computer in Europe up to 1951

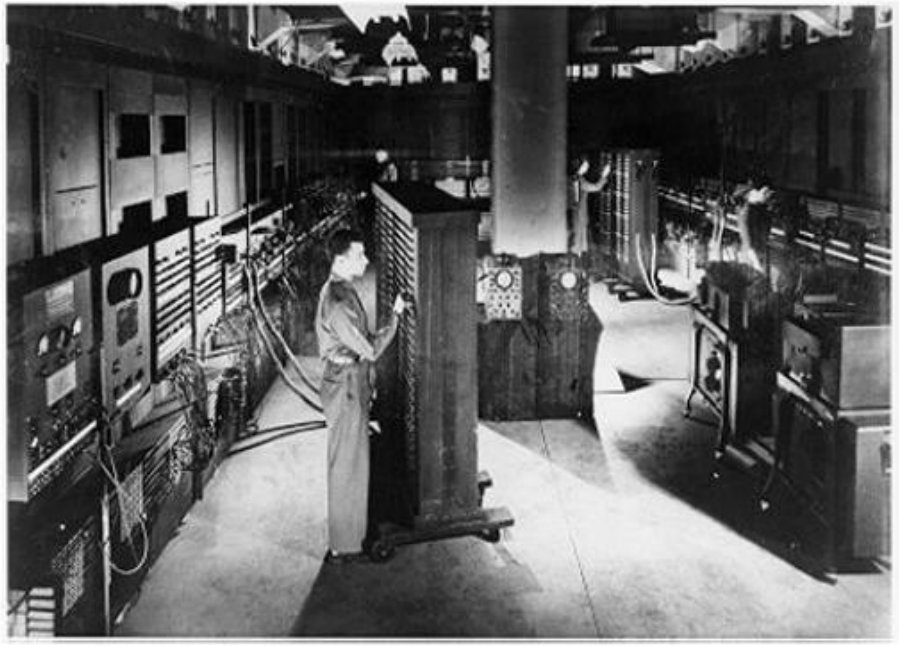
History of HCI Cont'd

ENIAC (~1946)

First electronic numerical integrator and computer in the US

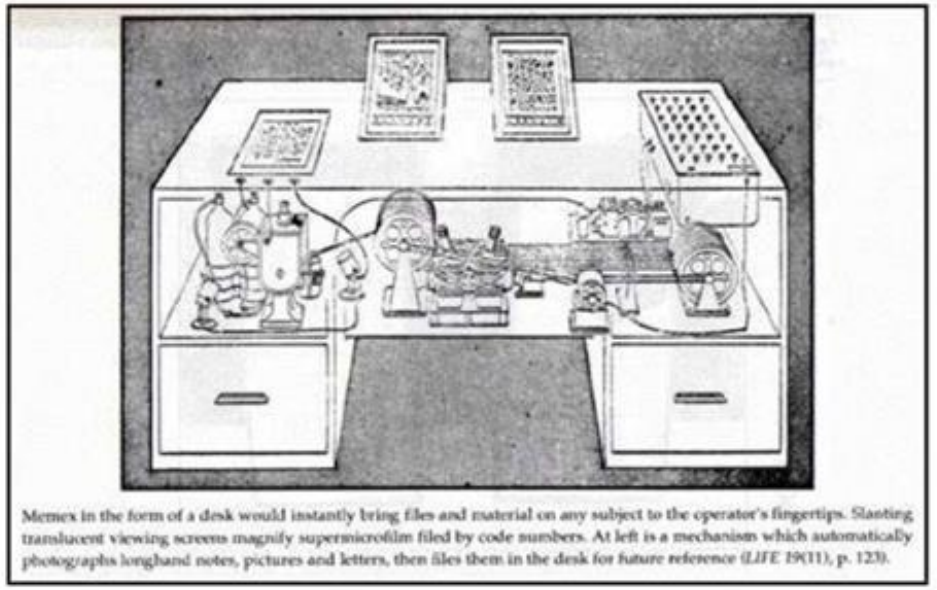
Construction contract was signed in 1943

The first programmers of the ENIAC were six women ("Refrigerator Ladies")



History of HCI Cont'd

Memex (1945)



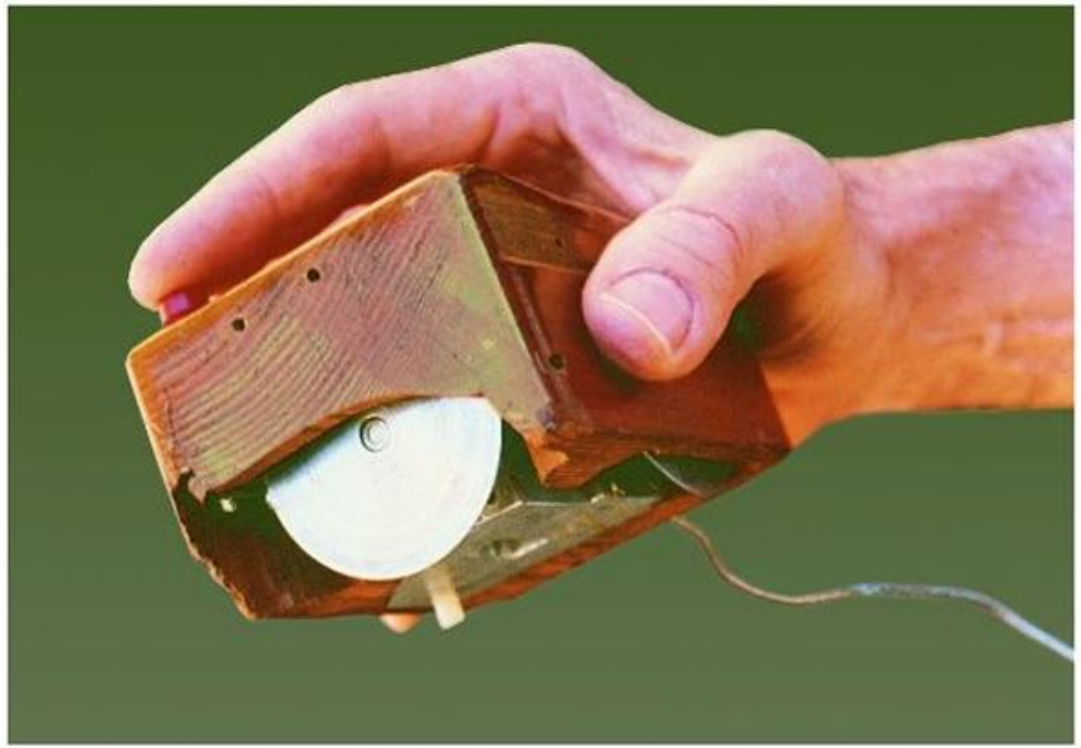
Memex in the form of a desk would instantly bring files and material on any subject to the operator's fingertips. Slanting translucent viewing screens magnify supermicrofilm filed by code numbers. At left is a mechanism which automatically photographs longhand notes, pictures and letters, then files them in the desk for future reference (*LIFE* 19(11), p. 123).

History of HCI Cont'd

SketchPad by Ivan Sutherland at MIT (1963)

History of HCI Cont'd

First mouse by Engelbard at Stanford (1963)



History of HCI Cont'd

With the emergence of personal computing in the late 1970s, everyone became a potential computer user…

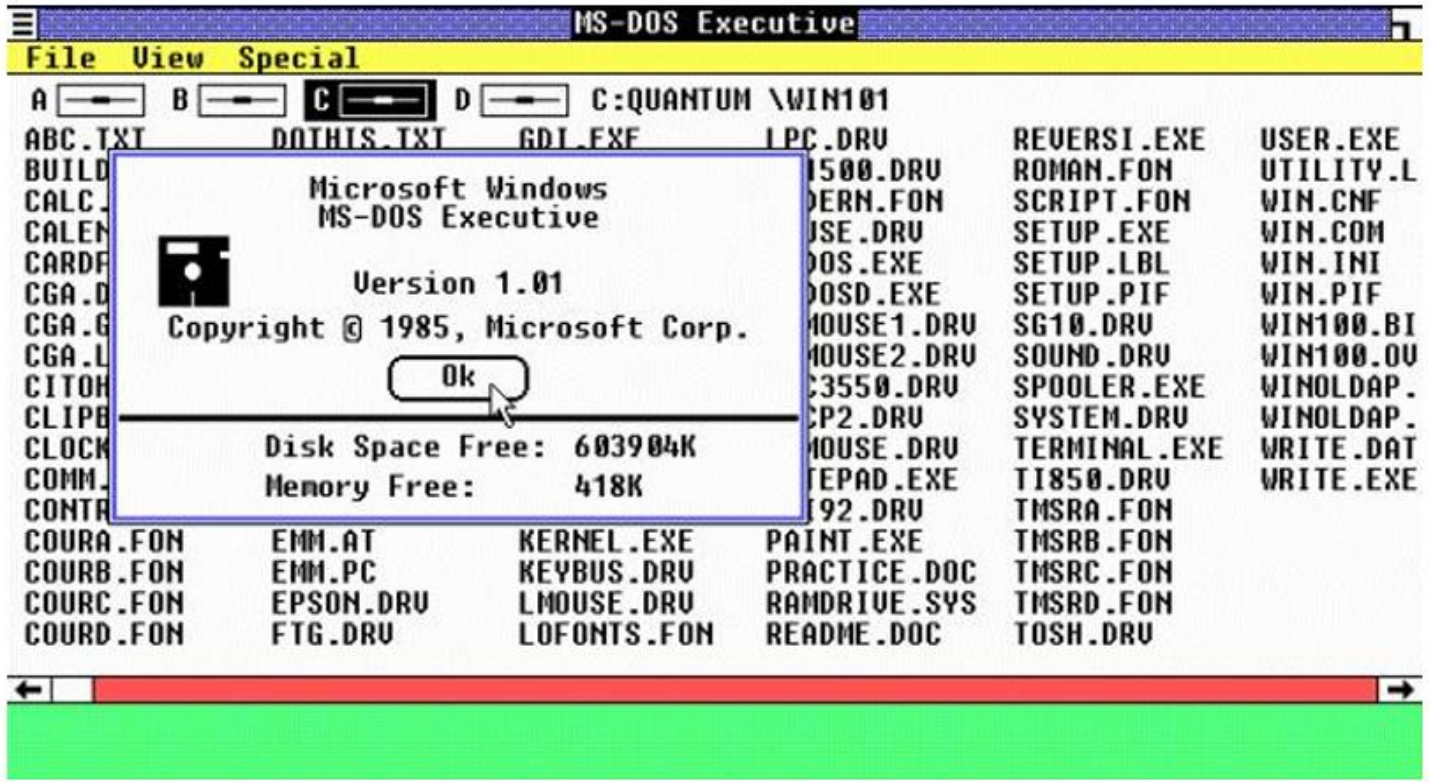
… but computer users still had to deal with arcane commands and system dialogs

History of HCI Cont'd

Apple Lisa (1981)

History of HCI Cont'd

Windows 1.0 (1985)



History of HCI Cont'd

World Wide Web (1990)

The impact of History on Society/Culture/Economy

HCI's impact on society

We can now use computers as an every-moment-partner

Less and less training is required for most application and devices

Some examples

- Touch screen: direct interaction with objects
- Voice control: for some people the only way to interact with computers

HCI's impact on culture

Smartphones have changed how we spend our "empty times": should we read the news? answer emails? chat with friends? play "2 Dots"? should we just be bored?

Social Media have influenced how we stay in touch with each other and how find new friends and lovers.

Games, more than entertainment, can be used as social and even productive tools.

HCI's impact on economy

Massive increase in productivity

HCI found how to speed up input and reduce its complexity

People can perform tasks faster than they used to

Reduced need for training

More people can use technology than ever before

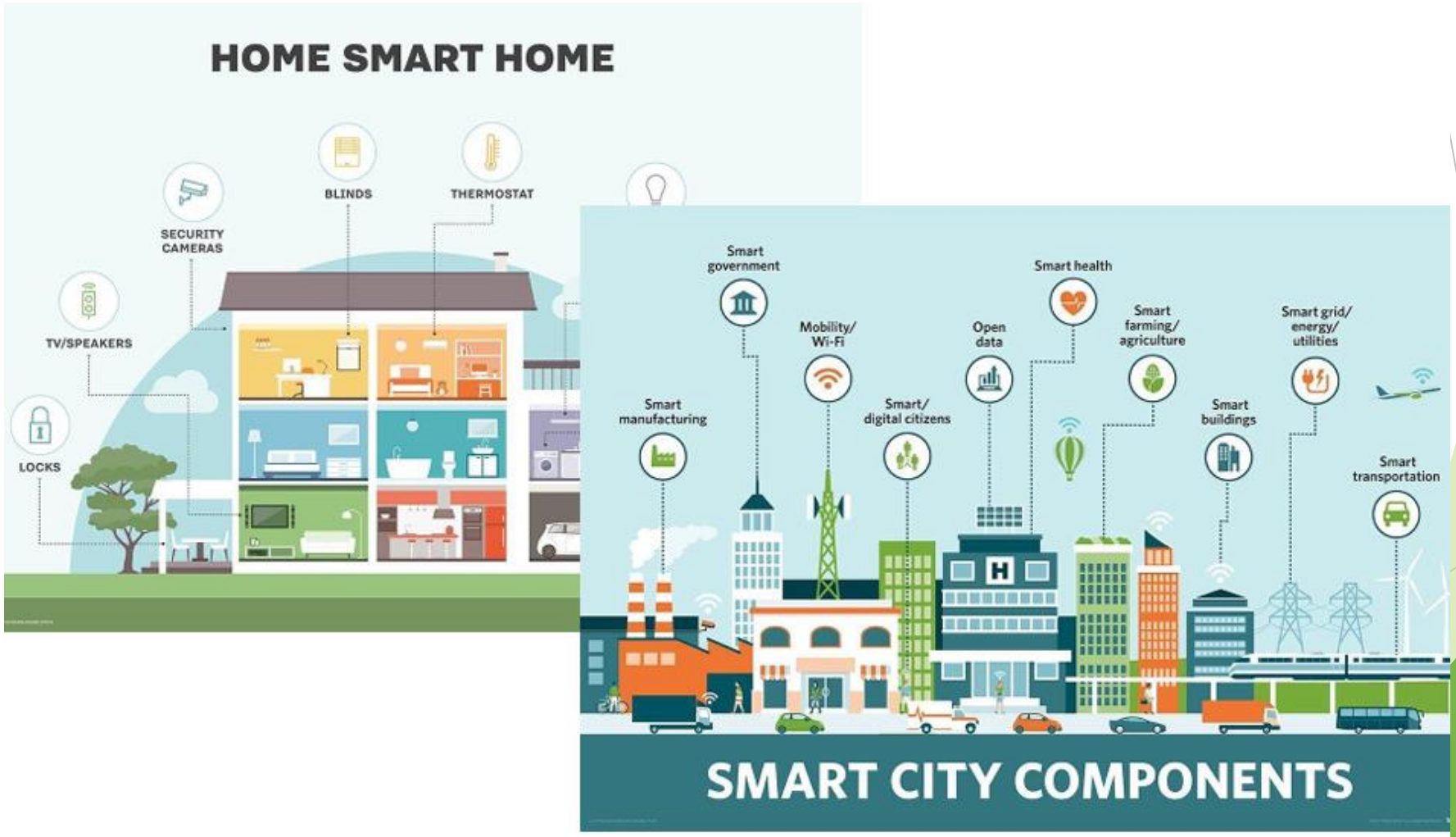
What now???

Activity in 10 mins

- Form a group of 5 and think about where we are and where we could be in the next decade

Where you able to think about this?

Society as the next platform



What about this?

And beyond (VR/AR)

Reflection for the next class

- Write a one page thought of where you think the technological world will be in the next 5 decades. Submit first thing before our next discussion.

Week 4

Graphical User Interface (GUI)

At the end of today's class, you should be able to:

1. Understand better what a graphical user interface is
2. tell the history of GUI
3. list five popularities of the graphics
4. understand the graphical systems
5. understand the concepts of direct manipulation
6. characteristics of GUI
7. understanding the pick and click concepts

The Graphical User Interface

A user interface is a collection of techniques and mechanisms to interact with something. In a graphical interface the primary interaction mechanism is a pointing device of some kind.

- This device is the electronic equivalent to the human hand. What the user interacts with is a collection of elements referred to as **objects**.
- They can be seen, heard, touched, or otherwise perceived. Objects are always visible to the user and are used to perform tasks.
- People perform operations, called actions, on objects.
- The operations include accessing and modifying objects by pointing, selecting, and manipulating.
- All objects have standard resulting behaviors.

The Web User Interface:

- The expansion of the World Wide Web since the early 1990s has been truly amazing. Once simply a communication medium for scientists and researchers, its many and pervasive tentacles have spread deeply into businesses, organizations, and homes around the world. Unlike earlier text-based and GUI systems that were developed and nurtured in an organization's Data Processing and Information Systems groups, the Web's roots were sown in a market-driven.
- Web interface design is essentially the design of navigation and the presentation of information.
- It is about content, not data. Proper interface design is largely a matter of properly balancing the structure and relationships of menus, content, and other linked documents or graphics.
- The design goal is to build a hierarchy of menus and pages that feels natural, is well structured, is easy to use, and is truthful.
- The Web is a navigation environment where people move between pages of information, not an application environment. It is also a graphically rich environment.

The Popularity of the Web:

While the introduction of the graphical user interface revolutionized the user interface, the Web has revolutionized computing.

- It allows millions of people scattered across the globe to communicate, access information, publish, and be heard.
- It allows people to control much of the display and the rendering of Web pages.
- Aspects such as typography and colors can be changed, graphics turned off, and decisions made whether or not to transmit certain data over non secure channels or whether to accept or refuse cookies.
- Web usage has reflected this popularity.
- The number of Internet hosts has risen dramatically:

*In 1984, hosts online exceeded 1,000;

*in 1987, 10,000;

*1989, 100,000,

* 1990, 300,000;

GUI versus Web Page Design

GUI and Web interface design do have similarities.

- Both are software designs,
- they are used by people,
- they are interactive,
- they are heavily visual experiences presented through screens,
- and they are composed of many similar components.

Introduction of the Graphical User Interface

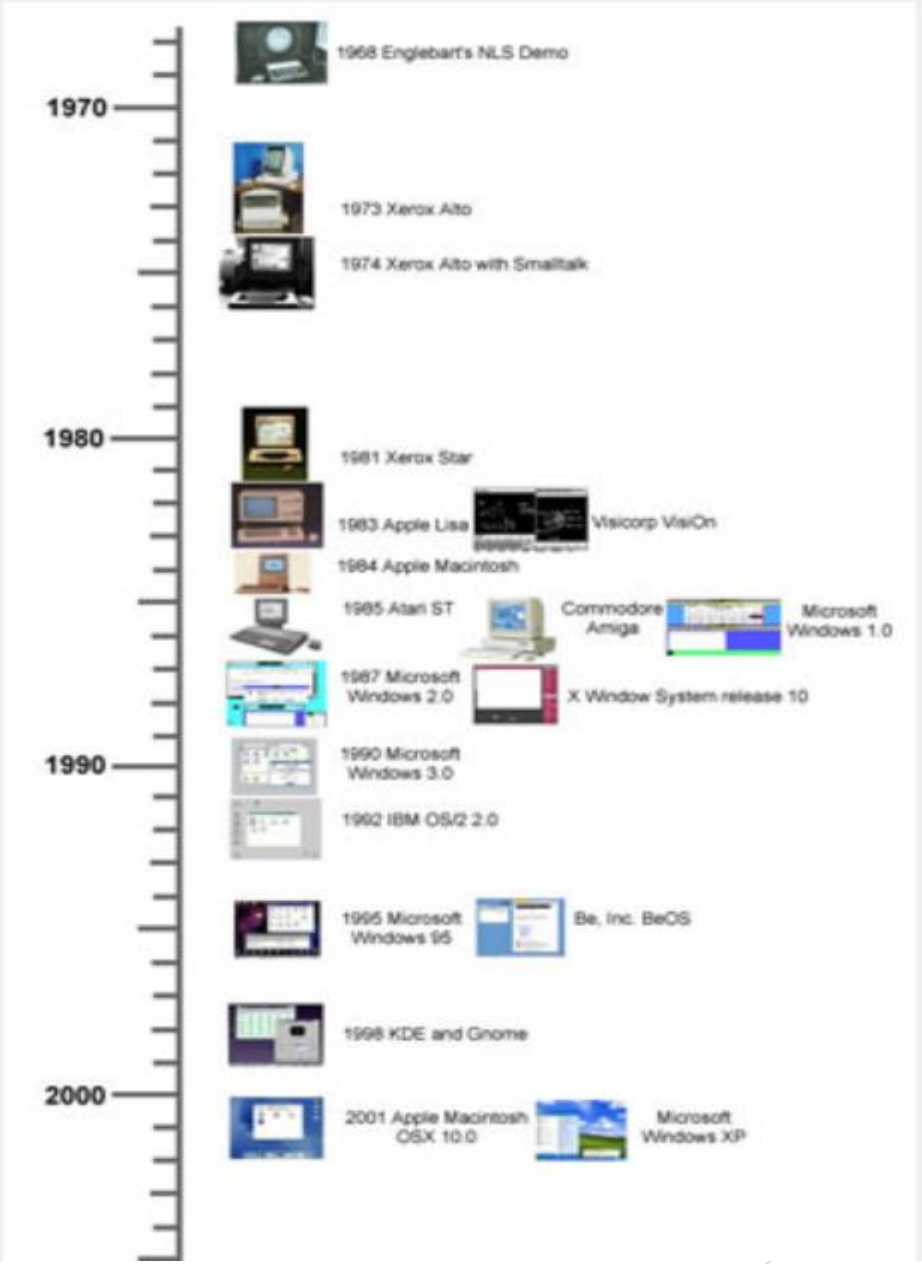
The Xerox systems, Altus and STAR, introduced the mouse and pointing and selecting as the primary human-computer communication method. The user simply pointed at the screen, using the mouse as an intermediary. These systems also introduced the graphical user interface as we know it a new concept was born, revolutionizing the human-computer interface.

Brief History of Screen Design:

While developers have been designing screens since a **cathode ray** tube display was first attached to a computer, more widespread interest in the application of good design principles to screens did not begin to emerge until the early 1970s, when IBM introduced its 3270 cathode ray tube text-based terminal.

It was visually cluttered, and often possessed a command field that challenged the user to remember what had to be keyed into it. Ambiguous messages often required referral to a manual to interpret.

GUI development timeline



The Popularity of Graphics:

- A graphical screen bore scant resemblance to its earlier text-based colleagues.
- older text-based screen possessed a one dimensional graphic screens assumed a three-dimensional look.
- Controls appeared to rise above the screen and move when activated.
- Information could appear, and disappear, as needed.
- Text could be replaced by graphical images called icons.
- These icons could represent objects or actions
- Selection fields such as radio but-tons, check boxes, list boxes, and palettes coexisted with the reliable old text entry field.

Graphical System

- Reduce the memory requirements.
- More effective use of one's information
- Dramatically reduce system learning requirements.
- Experience indicates that for many people they have done all these things.

Advantages of GUI

- Symbols recognized faster than text
- Faster learning
- Faster use and problem solving
- Easier remembering
- More natural
- Exploits visual/spatial cues
- Fosters more concrete thinking
- Provides context
- Fewer errors

Disadvantages

- Greater design complexity
- Learning still necessary
- Replaces national languages
- Easily augmented with text displays
- Smooth transition from command language system
- Lack of experimentally-derived design guidelines
- use a pointing device may also have to be learned
- Working domain is the present
- Human comprehension limitations

The Concept of Direct Manipulation

The system is portrayed as an extension of the real world:

- It is assumed that a person is already familiar with the objects and actions in his or her environment of interest.
- The system simply replicates them and portrays them on a different medium, the screen.
- A person has the power to access and modify these objects, among which are windows.
- A person is allowed to work in a familiar environment and in a familiar way, focusing on the data, not the application and tools.
- The physical organization of the system, which most often is unfamiliar, is hidden from view and is not a distraction

Continuous visibility of objects and actions:

- Like one's desktop, objects are continuously visible.
- Reminders of actions to be performed are also obvious, labeled buttons replacing complex syntax and command names.
- Cursor action and motion occurs in physically obvious and natural ways.
- One problem in direct manipulation, however, is that there is no direct analogy on the desk for all necessary windowing operations.
- A piece of paper on one's desk maintains a constant size, never shrinking or growing.
- Windows can do both. Solving this problem required embedding a control panel, a familiar concept to most people, in a window's border.
- This control panel is manipulated, not the window itself.

Earlier Direct Manipulation Systems

- The concept of direct manipulation actually preceded the first graphical system.
- The earliest full screen text editors possessed similar characteristics.
- Screens of text resembling a piece of paper on one's desk could be created (ex-tension of real world) and then reviewed in their entirety (continuous visibility).
- Editing or restructuring could be easily accomplished (through rapid incremental actions) and the results immediately seen.
- Actions could be reversed when necessary.

Indirect Manipulation

In practice, direct manipulation of all screen objects and actions may not be feasible because of the following

- The operation may be difficult to conceptualize in the graphical system.
- The graphics capability of the system may be limited.
- The amount of space available for placing manipulation controls in the window border may be limited.
- When this occurs, indirect manipulation is provided. Indirect manipulation substitutes words and text, such as pull-down or pop-up menus, for symbols, and substitutes typing for pointing.
- Most window systems are a combination of both direct and indirect manipulation.
- A menu may be accessed by pointing at a menu icon and then selecting it (direct manipulation).
- The menu itself, however, is a textual list of operations (indirect manipulation).

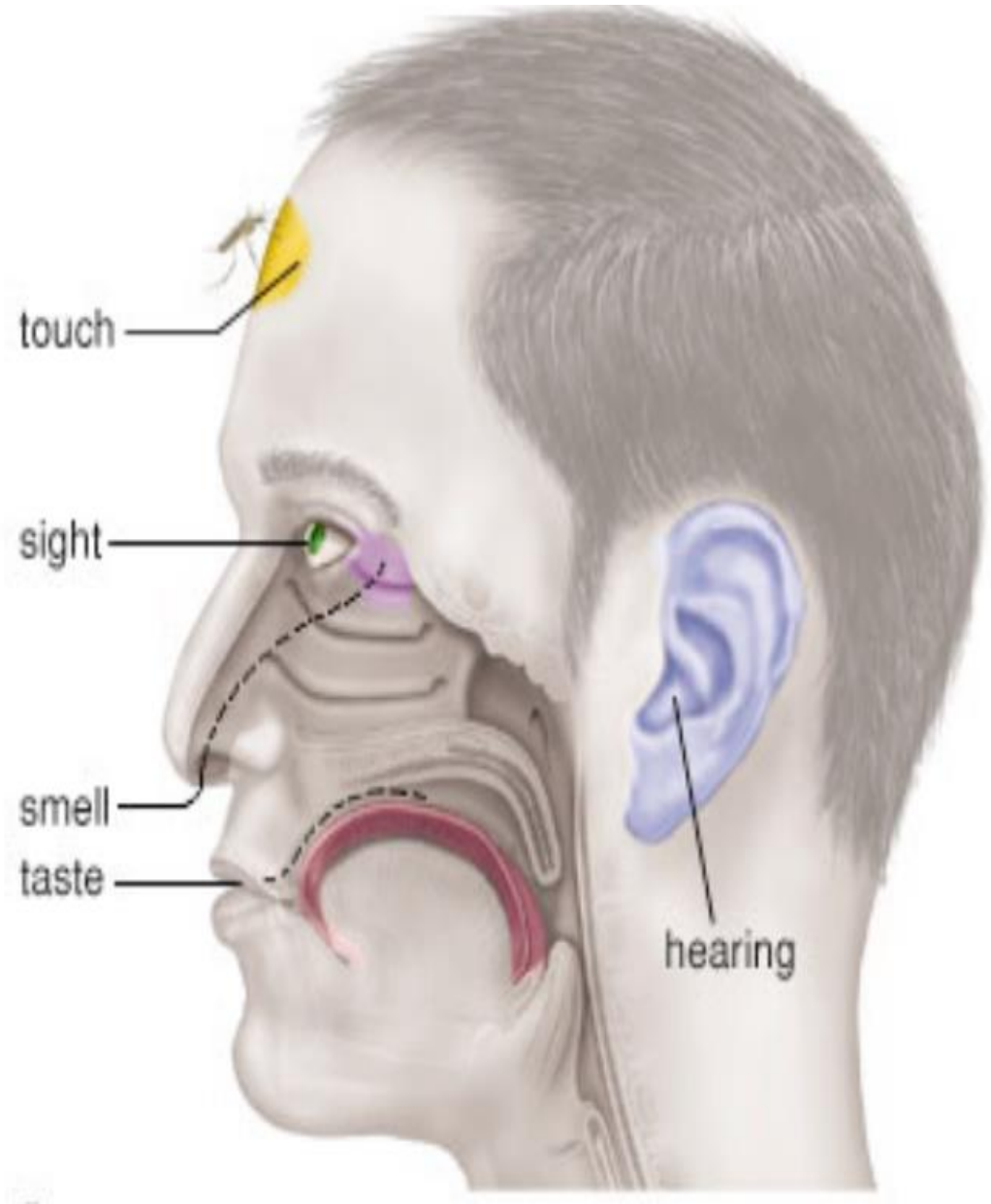
Characteristics of the Graphical User Interface

- A graphical system possesses a set of defining concepts.
- Included are sophisticated visual presentation,
  * pick-and-click interaction,
    * a restricted set of interface options,
    *visualization,
    * object orientation,
    *extensive use of a person's recognition memory,
    * concurrent performance of functions.

Restricted Set of Interface Options

The array of alternatives available to the user is what is presented on the screen or may be retrieved through what is presented on the screen, nothing less, nothing more.

This concept fostered the acronym WYSIWYG.



- How we make ‘sense’ of the world around us… inputs and understanding

Pick-and-Click Interaction

- Elements of a graphical screen upon which some action is to be performed must first identified.
- **The motor activity** required of a person to identify this element for a proposed action is commonly **referred to as p**ick, the signal to perform an action as cue .
- The primary mechanism for performing this pick-and-click is most often the mouse and its buttons.
- The user moves the mouse pointer to the relevant element (pick) and the action is signaled (click).
- **Pointing allows rapid selection and feedback**.
- The hand and mind seem to work smoothly and efficiently together.
- The secondary mechanism for performing these selection actions is the keyboard most systems permit pick-and-click to be performed using the keyboard as well.
- **Visualization**: Visualization is a cognitive process that allows people to understand. Information that is difficult to perceive, because it is either too voluminous or too abstract Presenting specialized graphic portrayals **facilitates** visualization.

- The best visualization method for an activity depends on what People are trying to learn from the data.
- The goal is not necessarily to reproduce a really graphical image, but to produce one that conveys the most relevant information.
- Effective visualizations can facilitate mental insights, increase productivity, and for faster and more accurate use of data.
- **Object Orientation**: A graphical system consists of objects and actions.
- Objects are what people see on screen.
- They are manipulated as a single unit.
- Objects can be composed of sub objects.- For example, an object may be a document.
- The document's sub objects may be a paragraph, sentence, word, and letter.
- A collection is the simplest relationship-the objects sharing a common aspect.
- A collection might be the result of a query or a multiple selection of objects.
- Operations can be applied to a collection of objects.

Week 5- Feb 22,2024

Principles of Designs

Objectives,

At the end of this course, you should be able to:

1. List five principles of design
2. Explain five principles of design
3. Understand the design process

General Principles

The design goals in creating a user interface are described below.

- They are fundamental to the design and implementation of all effective interfaces, GUI and Web.
- These principles are general characteristics of the interface, and they apply to all aspects.
- The compilation is presented alphabetically, and the ordering is not intended to imply degree of importance.

1.Aesthetically Pleasing

Provide visual appeal by following these presentation and graphic design principles:

- Provide meaningful contrast between screen elements. Create groupings.
- Align screen elements and groups.
- Provide three-dimensional representation.
- Use color and graphics effectively and simply

2. Clarity.

The interface should be visually, conceptually, and linguistically clear, including

- Visual elements
- Functions
- Metaphors

3.Compatibility:

Provide compatibility with the following:

- The user
- The task and job
- The Product
- Adopt the User's Perspective

4.Configurability

- Permit easy personalization, configuration, and reconfiguration of settings. Enhances a sense of control
- Encourages an active role in understanding

5.Comprehensibility:

A system should be easily learned and understood: A user should know the following:

- What to look at
- What to do
- When to do it
- Where to do it
- Why to do it
- How to do it.

6.Consistency:

A system should look, act, and operate the same throughout. Similar components should:

- Have a similar look.
- Have similar uses.
- Operate similarly.

The same action should always yield the same result

The function of elements should not change.

The position of standard elements should not change

Other design principles are listed below for further reading:

7. Control
8. Directness
9. Flexibility
10. Efficiency
11. Familiarity
12. Forgiveness
13. Predictability
14. Recovery
15. Responsiveness
16. Transparency
17. Simplicity

Design Process

Obstacles and pitfalls in development path

- No body ever gets it right for the first time
- Development is chock full of surprises.
- Good design requires living in a sea of changes.
- Designers need good tools.
- Performance design goals
- People may make mistakes while using a good system also

Common pitfalls

- No early analysis and understanding the users needs and expectations.
- A focus on using design features or components
- No usability testing.
- No common design team vision.
- Poor communication

Common usability problems

- Ambiguous menus and icons.
- Languages that permit only single direction movement through a system.
- Input and direct manipulation limits.
- Complex linkage.
- Inadequate feedback.
- Lack of system anticipation.
- Inadequate error messages.

Irritating characters

- Visual clutter
- Impaired information readabi
- Incomprehensible components
- Annoying distractions.
- Confusing navigation.
- inefficient operations
- inefficient page scrolling.
- Information overload

Design Team

- Development
- Human factors
- Visual Design
- Usability assessment
- Documentation
- raining

Human interaction with computers

Understanding How People Interact with Computers :

Characteristics of computer systems, past and present, that have caused, and are causing, people problems. We will then look at the effect these problems have –

- Why people have trouble with computers
- Responses to poor design
- People and their tasks

Why People Have Trouble with Computers

- Extensive technical knowledge but little behavioral training with its extensive graphical capabilities.
- Poorly designed interfaces.

What makes a system difficult to use in the eyes of its user?

- Use of jargon
- Non-obvious design
- Fine distinctions
- Disparity in problem-solving strategies an "error-preventing" strategy
- Design inconsistency

Psychological trouble

Typical psychological responses to poor design are:

Confusion: Detail overwhelms the perceived structure. Meaningful patterns are difficult to ascertain, and the conceptual model or underlying framework cannot be understood or established.

Annoyance: Roadblocks that prevent a task being completed, or a need from being satisfied, promptly and efficiently lead to annoyance.

Inconsistencies in design, slow computer reaction times, difficulties in quickly finding information, outdated information, and visual screen distractions are a few of the many things that may annoy users.

- **Frustration**: An overabundance of annoyances, an inability to easily convey one's intentions to the computer, or an inability to finish a task or satisfy a need can cause frustration. Frustration is heightened if an unexpected computer response cannot be undone or if what really took place cannot be determined: Inflexible and un-forgiving systems are a major source of frustration.
- **Panic or stress**: Unexpectedly long delays during times of severe or unusual pressure may introduce panic or stress. Some typical causes are unavailable systems or long response times when the user is operating under a deadline or dealing with an irate customer.
- **Boredom**: Boredom results from improper computer pacing (slow response times or long download times) or overly simplistic jobs. These psychological responses diminish user effectiveness because they are severe blocks to concentration. Thoughts irrelevant to the task at hand are forced to the user's attention, and necessary concentration is impossible. The result, in addition to higher error rates, is poor performance, anxiety, and dissatisfaction

Physical Trouble

Physical Psychological responses frequently lead to the following physical reactions.

- **Abandonment of the system**: The system is rejected and other information sources are relied upon. These sources must, of course, be available and the user must have the discretion to perform the rejection. In business systems this is a common reaction of managerial and professional personnel. With the Web, almost all users can exercise this option.
- **Partial use of the system:** Only a portion of the system's capabilities are used, usually those operations that are easiest to perform or that provide the most benefits. Historically, this has been the most common user reaction to most computer systems. Many aspects of many systems often go unused.
- Indirect use of the system: An intermediary is placed between the would-be user and the computer.
- Again, since this requires high status and discretion, it is another typical response of managers or others with authority.

Week 6-Important Human Characteristics in Design

- Objectives

At the end of this lecture, you should be able to;

1. List six importance of human characteristics in design
2. Differentiate between memory, mental models and learning

Quiz

1. Explain what you understand by the word HCI with examples
2. What is the difference between what you do and what others are doing with design?
3. Think globally and act locally, what are the global benefits of design that you will like to share locally? (mention five).

Important Human Characteristics in Design

The importance of human xtics in design are perception, memory, visual acuity, peripheral vision, sensory storage, information processing, learning, skill, individual differences while others are:

- Proximity
- Similarity
- Matching patterns
- Succinctness
- Closure
- Unity
- Continuity
- Balance
- Expectancies
- Context

Memory

Memory is not the most stable of human attributes, as anyone who has forgotten why they walked into a room, or forgotten a very important birthday, can attest. Types of memory includes:

- Short-term, or working, memory.
- Long-term memory.
- Mighty memory
- Sensory Storage

Mental Models

As a result of our experiences and culture, we develop mental models of things and people we interact with. A mental model is simply an internal representation of a person's current understanding of something. Usually, a person cannot describe this mental mode and most often is unaware it even exists. Mental models are gradually developed in order to understand something, explain things, make decisions, do something, or interact with another person. Mental models also enable a person to predict the actions necessary to do things if the action has been forgotten or has not yet been encountered.

Movement Control

Once data has been perceived and an appropriate action decided upon, a response must be made; in many cases the response is a movement. In computer systems, movements include such activities as pressing keyboard keys, moving the screen pointer by pushing a mouse or rotating a trackball, or clicking a mouse button.

The implications in screen design are: -

- Provide large objects for important functions.
- Take advantage of the "pinning" actions of the sides, top, bottom, and corners of the screen.

Learning

Learning is the process of encoding in long-term memory information that is contained in short-term memory.

- It is a complex process requiring some effort on our part. Our ability to learn is important-it clearly differentiates people from machines.
- Given enough time people can improve the performance in almost any task. Too often, however, designers use our learning ability as an excuse to justify complex design.
- A design developed to minimize human learning time can greatly accelerate human performance. People prefer to stick with what they know, and they prefer to jump in and get started.

Skill

The goal of human performance is to perform skillfully. To do so requires linking inputs and responses into a sequence of action. The essence of skill is performance of actions or movements in the correct time sequence with adequate precision. It is characterized by consistency and economy of effort.

Economy of effort is achieved by establishing a work pace that represents optimum efficiency. It is accomplished by increasing mastery of the system through such things as progressive learning of short-cuts, increased speed, and easier access to information or data. Skills are hierarchical in nature, and many basic skills may be integrated to form increasingly complex ones. Lower-order skills tend to become routine and may drop out of consciousness. System and screen design must permit development of increasingly skillful performance.

Individual Differences

A complicating but very advantageous human characteristic is that we all differ-in looks, feelings, motor abilities, intellectual abilities, learning abilities and speed, and so on. In a keyboard data entry task, for example, the best typists will probably be twice as fast as the poorest and make 10 times fewer errors. Individual differences complicate design because the design must permit people with widely varying characteristics to satisfactorily and comfortably learn the task or job, or use the Web site.

Week 7-Human Considerations in Design

Objectives

At the end of this unit, you should be able to:

- Understand the concept of Knowledge and Experience
- Know the psychological characters
- Understand the idea of human interaction speed
- Understand the business functions
- Determine the developing of conceptual model

The User's Knowledge and Experience:

The knowledge possessed by a person, and the experiences undergone, shape the design of the interface in many ways. The following kinds of knowledge and experiences should be identified.

Computer Literacy - Highly technical or experienced, moderate computer experience, or none.

System Experience - High, moderate, or low knowledge of a particular system and its methods of interaction.

Application Experience - High, moderate, or low knowledge of similar systems.

Task Experience - Other Level of knowledge of job and job tasks

Systems Use - Frequent or infrequent use of other systems in doing job

Education - High school, college, or advanced degree

Reading Level - Less than 5th grade, 5th-12th, more than 12th grade

Typing Skill - Expert (135 WPM), skilled (90 WPM), good (55 WPM), average(40 WPM), or "hunt and peck" (10 WPM).

PSYCHOLOCICAL CHRACTERISTICS:

- **Attitude** - Positive, neutral, or negative feeling toward job or system
- **Motivation** - Low, moderate, or high due to interest or fear
- **Patience** - Patience or impatience expected in accomplishing goal
- **Expectations** - Kinds and reasonableness
- **Stress Level:** High, some, or no stress generally resulting from task performance
- **Cognitive Style:** Verbal or spatial, analytic or intuitive, concrete or abstract.
- **Age** Young middle aged or elderly
- **Gender** Male or Female

Human Interaction Speed

The speed at which people can perform using various communication methods has been studied by a number of researchers.

Reading: The average adult, reading English prose in the United States, has a reading speed in the order of 250-300 words per minute.

Proof reading text on paper has been found to occur at about 200 words per minute, on a computer monitor, about 180 words per minute.

Listening: Speaking to a computer: 150-160 words per minute. After recognition corrections: 105 words per minute.

Keying: Typewriter Fast typist :150 words per minute and higher Average typist : 60-70 words per minute Computer Transcription 33 words per minute Composition: 19 words per minute

Understanding the Business Function

* Business definition and requirements analysis
  - Direct methods
  - Indirect methods
  - Requirements collection guidelines
* Determining basic business functions
  - Developing conceptual modes
  - Understanding mental models
  - Users new mental model
*Design standards or style guides
  - Value of standards and guidelines
  - Document design
  - Design support and implementation
* System training and documentation
  - Training
  - Documentation

DIRECT METHODS

- Individual Face-to-Face Interview
- Telephone Interview or Survey
- Traditional Focus Group
- Facilitated Team Workshop
- Observational Field Study
- User-Interface Prototyping
- Usability Laboratory Testing
- Card Sorting for Web Sites
- A technique to establish groupings of information for Web sites

Indirect Method

- MIS Intermediary
- Paper Surveyor Questionnaire
- Electronic Surveyor Questionnaire
- Electronic Focus Group
- Marketing and Sales
- Support Line
- E-Mail or Bulletin Board
- User Group
- Competitor Analyses
- Trade Show
- Other Media Analysis

DETERMINING BASIC BUSNIESS FUNCTIONS

- Major system functions are listed and described, including critical system inputs and outputs.
- A flow-chart of major functions is developed. The process the developer will use is summarized as follows:
- Gain a complete understanding of the user's mental model based upon:

▫ The user's needs and the user's profile. ▫ A user task analysis.

▫ Develop a conceptual model of the system based upon the user's mental model. This includes:

- *Defining objects.
- *Developing metaphors.

UNDERSTADING USERS MENTAL MODEL

The next phase in interface design is to thoroughly describe the expected system user or users and their current tasks.

- The former will be derived from the kinds of

information collected in Step 1 "Understand the User or Client," and the requirements analy-sis techniques described above.

- A goal of task analysis, and a goal of understanding the user, is to gain a picture of the user's mental model.
- A mental model is an internal representation of a person's current conceptualization and understanding of something.
- Mental models are gradually developed in order to understand, explain, and do some-thing.

PERFORMING A TASK ANALYSIS

- User activities are precised.
- Task analysis involves breaking down the user's activities to the individual task level.
- Knowing why establishes the major work goals;
- complete description of all user tasks and interactions.
- Work activities are studied using the techniques just reviewed;
- direct observation, interviews, questionnaires, or obtaining measurements of actual current system usage.

DEVELOPING CONCEPTUAL MODELS

- The output of the task analysis is the creation, by the designer, of a conceptual model for the user interface.
- A conceptual model is the general conceptual framework through which the system's functions are presented.
- Such a model describes how the interface will present objects, the relationships between objects, the properties of objects, and the actions that will be performed.
- A conceptual model is based on the user's mental model. Since the term mental model refers to a person's current level of knowl-edge about something, people will always have them

DEVELOPING CONCEPTUAL MODELS

- Since mental models are influenced by a person's experiences, and people have different experiences, no two user mental models are likely to be exactly the same.
- Each person looks at the interface from a slightly different perspective. The goal of the designer is to facilitate for the user the development of useful mental model of the system.
- This is accomplished by presenting to the user a meaningful conceptual model of the system. When the user then encounters the system, his or her existing mental model will, hopefully, mesh well with the system's conceptual model.
- As a person works with a system, he or she then develops a mental model of the system.
- The system mental model the user derives is based upon system's behavior, including factors such as the system inputs, actions, outputs (including screens and messages), and its feedback and guidance characteristics, all of which are components of the conceptual model.

GUIDELINES FOR DESIGNING CONCEPTUAL MODELS

- Reflect the user's mental model, not the designer’s.
- Draw physical analogies or present metaphors.
- Comply with expectancies, habits, routines, and stereotypes.
- Provide action-response compatibility.
- Make invisible parts and process of a system visible.
- Provide proper and correct feedback. Avoid anything unnecessary or irrelevant.
- Provide design consistency.
- Provide documentation and a help system that will reinforce the conceptual model.
- Promote the development of both novice and expert mental models.

DEFINING OBJECTS

- Determine all objects that have to be manipulated to get work done.
- Describe the objects used in tasks.
- Object behavior and characteristics that differentiate each kind of object.
- The relationship of objects to each other and the people using them.
- The actions performed. The objects to which actions apply.
- State information or attributes that each object in the task must preserve, display, or allow to be edited.
- Identify the objects and actions that appear most often in the workflow.

DEVELOPING METAPHORS..figure of speech used to describe other object to connote likeness

- Choose the analogy that works best for each object and its actions.
- Use real-world metaphors.
- Use simple metaphors.
- Use common metaphors.
- Multiple metaphors may coexist.
- Use major metaphors, even if you can't exactly replicate them visually.
- Test the selected metaphors.

Week 8

- Objectives of the study:

At the end of the unit, you should be able to:

1. Know the HCI and its interactions
2. Know the fields of HCI
3. Understand the Design process
4. understand the Design stages
5. Know the concept of UCSD

To make better interactive technology

* We need to !

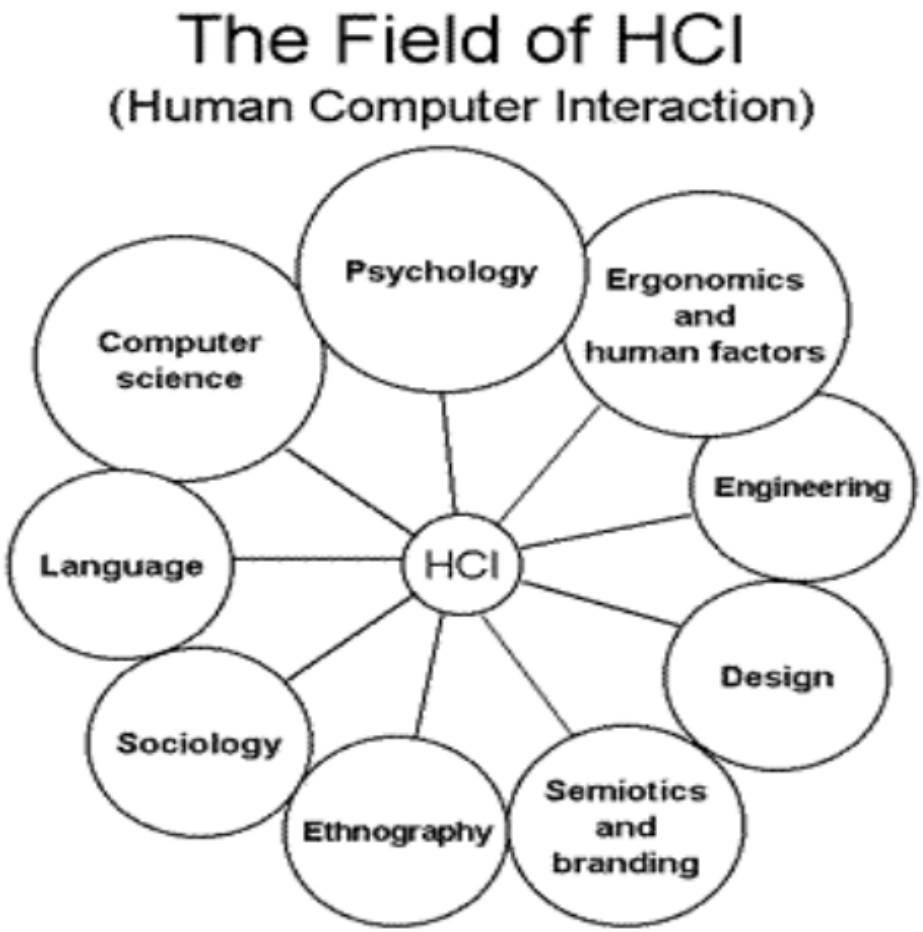
- Know about how people **interact** with things !
- Know about what people **can** and **can't do** !
- Know about the **situations** in which people do things !
- Know about the **basics** of good design !
- Understand people's **goals**

We can’t all be **designers..** But we can all **learn** things about people and design that will help us create better stuff than we would otherwise have done….

Field of HCI

Human Computer Interaction

- Ergonomics
- Sociology
- Psychology
- …and more



HCI is made up of… !

- Theories – learn and apply
- Models – create and use
- Methods – master and apply
- Guidelines – learn and use
- Principles – understand and apply
- Techniques – master and use

HCI is changing..

- Physical things
- GUI interfaces
- Collaborative interfaces
- Internet technologies
- Social technologies
- Ubiquitous technologies

Developing Interactive Products..the stages !

- **Stage 1 - design time** " System developers, with or without user involvement, create environments and tools and sometimes provide complete solutions
- **Stage 2 - use time** " Stakeholders use the system and because their needs contexts and objectives can only be **anticipated** – some changes are generally made to the product at this stage

Efficient Development..

- Relies on the systems developer having a GOOD understanding of the stakeholders

" **Needs**

" **Objectives**

" **Context**

- And.. Knowing what the technology can do

System Centered Design

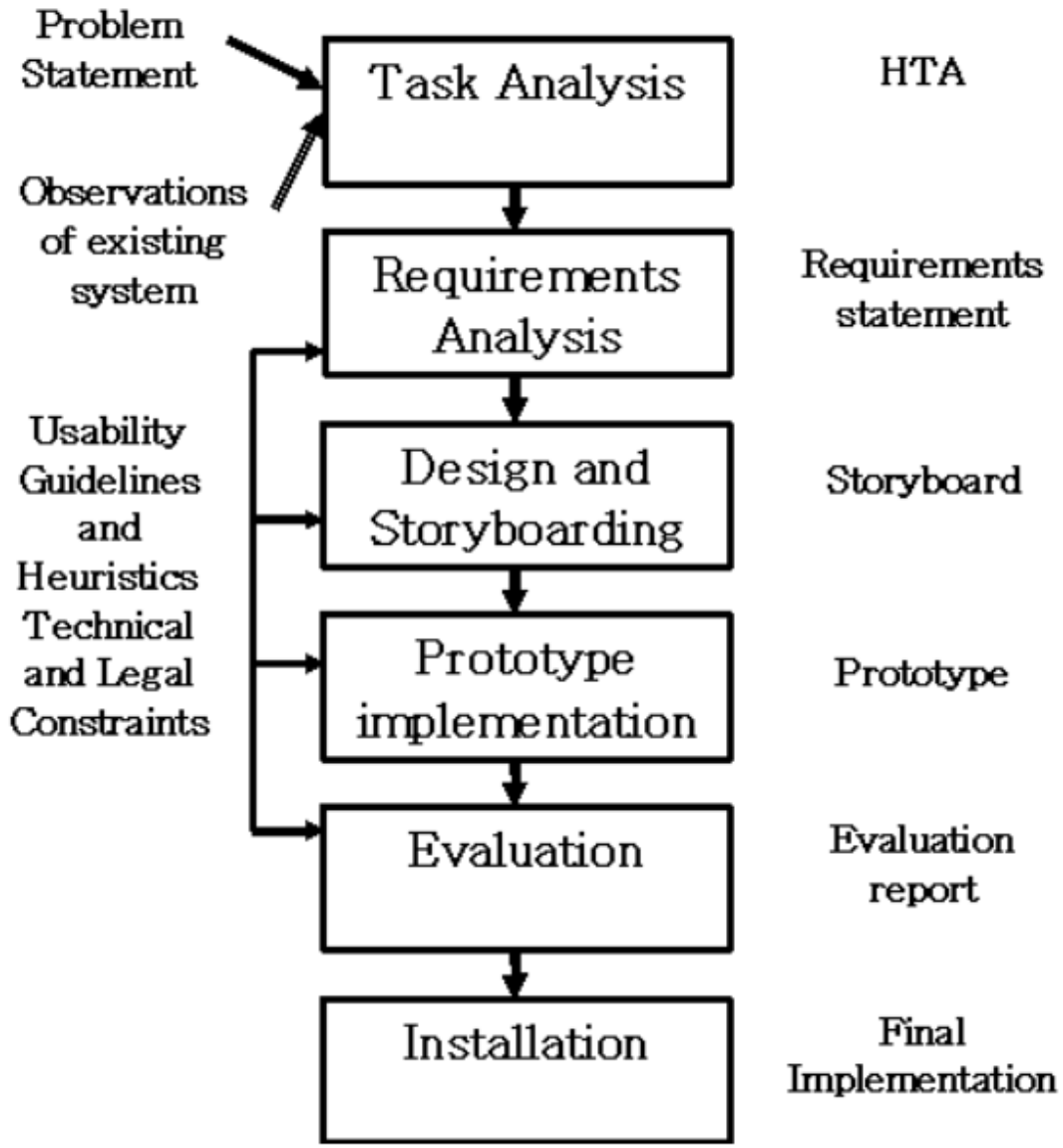
System Centered Design

- What can I easily build on this platform?
- What can I create from the available tools?
- What do I as a programmer find interesting?

UCSD

- Focus on the people who will use the system, on their preferences and their requirements
- Building models of the users, tasks and systems
- Iterative process
- Prototyping and Evaluation by users

UCSD


Problem Statement
Observations of existing system
Task Analysis
HTA
Requirements Analysis
Requirements statement
Usability Guidelines and Heuristics Technical and Legal Constraints
Design and Storyboarding
Storyboard
Prototype implementation
Prototype
Evaluation
Evaluation report
Installation
Final Implementation

Core Concepts in UCSD

- Early stages
  - User model
  - Task models
  - Context
- Later stages
  - Inclusive Design
  - Design for all
  - Universal Access

Who are Users in UCSD?

- People like you
- People like your mother!
- People like those you work with
- People that you may never have / will never meet
  - It is better to think in terms of who your users will **NOT** be

Week 9.Human Computer Interaction

Objectives

At the end of the class, you should be able to:

- Understand the concept of task and goals, context and values…
- Understanding the users

Tasks (and Goals)

Tasks (limited value) " Not all systems are task based (eg Games) " Not all tasks can be easily specified ! Goals " Irrespective of the user tasks, there can be a conflicting or complementary goal – to have fun maybe?

Context !

Where will the system be used? ! What sort of technology will be deployed? ! Will the users be able to get any help?

Values !

What matters to the user ! What is important in the context ! What are the business concerns

What is a user?

! Norman introduced the idea that product design should address three different levels of cognitive and emotional processing: visceral, behavioral, and reflective.

Visceral Processing

The most immediate level of processing, in which we react to visual and other sensory aspects of a product that we can perceive before significant interaction occurs. Visceral processing helps us make rapid decisions about what is good, bad, safe, or dangerous.

Behavioral Processing !

The middle level of processing that lets us manage simple, everyday behaviors, which according to Norman, constitute the majority of human activity. Norman states, “historically, interaction design and usability practices have primarily addressed this level of cognitive processing”

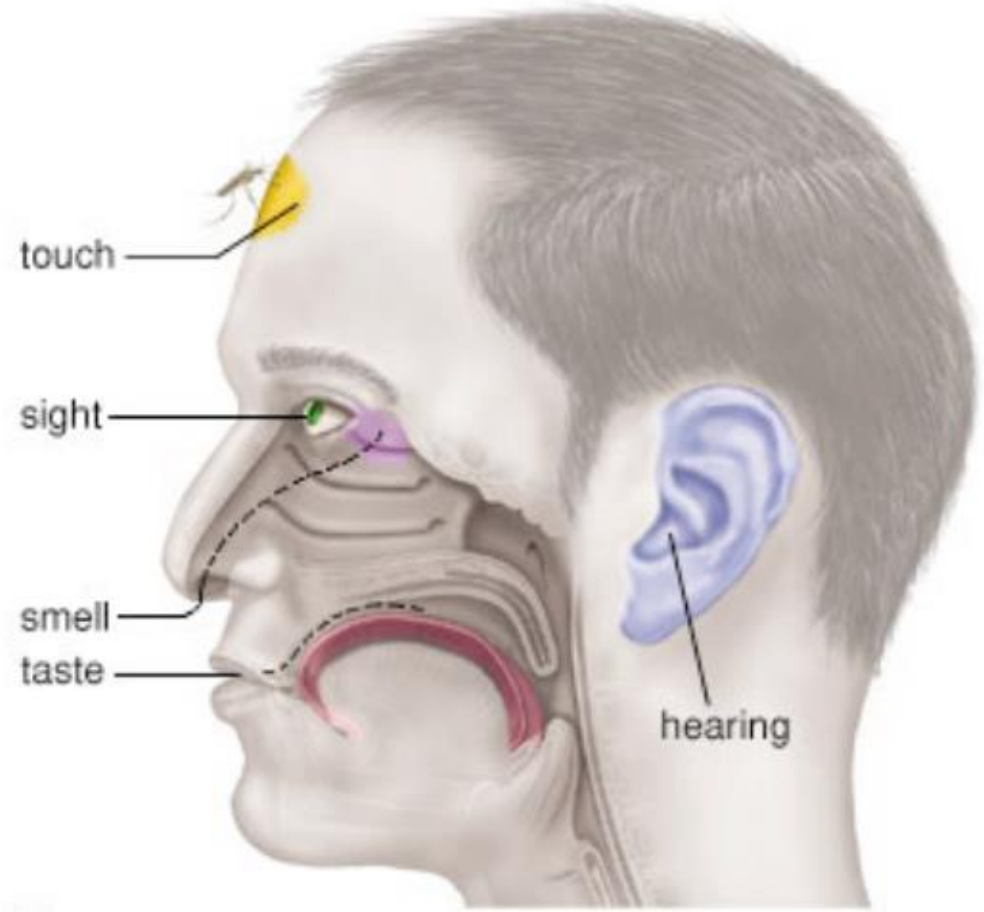
Reflective Processing •

The least immediate level of processing, which involves conscious consideration and reflection on past experiences. Reflective processing can enhance or inhibit behavioral processing, but has no direct access to visceral reactions. This level of cognitive processing is accessible only via memory, not through direct interaction or perception.

Concepts of Human

- Senses
- Body
- Thinking
- Memory

The Human as an Input Device



- How we make ‘sense’ of the world around us… inputs and understanding

Each Sense has…

- A tool – e.g.. Eye, skin, ear etc
- A process – nerves, electricity etc
- Limitations – pitch, brightness etc
- ….. And there is the added complexity of individual differences in sensory perception

Sight - Interpreting Images (1)

- Size and depth
  - visual angle indicates how much of view object occupies
  - cues like overlapping help perception of size and depth
- Brightness
  - affected by luminance of object
  - measured by just noticeable difference
  - visual acuity increases with luminance as does flicker
- Colour
  - blue acuity is lowest
  - 8% males and 1% females colour blind

Interpreting images (2)

- The visual system compensates for: " movement " changes in luminance.
- Context is used to resolve ambiguity
- Optical illusions sometimes occur due to over compensation

Hearing

- Provides information about environment:
  - distances, directions, objects etc.
- Physical apparatus:
  - outer ear, middle ear, inner ear –
- Key Sound Variations
  - pitch – sound frequency
  - loudness – amplitude
  - timbre – type or quality

Hearing (cont)

- Humans can hear frequencies from 20Hz to 15kHz
  - less accurate distinguishing high frequencies than low.
- Auditory system filters sounds
  - can attend to sounds over background noise.
  - for example, the cocktail party phenomenon.

Touch

- Provides important feedback about environment.
- May be key sense for someone who is visually impaired.
- Stimulus received via receptors in the skin:
  - thermoreceptors – heat and cold
  - nociceptors – pain
  - mechanoreceptors – pressure
- Some areas more sensitive than others e.g. fingers.
- Kinethesis - awareness of body position
  - affects comfort and performance.

Smell and Taste

- Not much used in computer interfaces but olfactory interfaces using smell are currently being developed… as we will not use these senses we are not discussing them here!

The Human as a Store

- Humans have the capacity to remember and retrieve information… this affects the way they use technology

Three Different ‘Stores’

- Sensory buffers: momentary stores for stimuli received by the senses. This information, unless encoded in the short-term memory, is quickly lost.
- Short-term memory (or working memory): short-term memory acts as a store for information required fleetingly.
- Long-term memory: this forms the main resource for memory.

Short Term Memory

- An example of this would be recalling a telephone number long enough to write it down. Short-term memory degrades quickly, and has a limited capacity.
- Quick access time – 70ms
- Short term storage – 200ms (10 – 20 second decay time)
- Limited capacity
  - Length of sequence remembered in order = 7 ± 2 (Miller, 1956)

    chunks of data are similar

    recency effect
- Maintained and increased with rehearsal
- Nowadays referred to as 'Working memory'

Chunking and STM

- Short-term memory holds information that is actively being used (thought about, reasoned with).
- A chunk can be thought of as a single object that conveys a larger amount of information (like a Chinese ideogram).
- Examples of these include words, shapes and colours. However, the information decays in seconds as items are displaced by new items coming in.
- Icons are an example of chunked information on a desktop which allows users to distinguish between the various programs available to them.

LTM – Networked chunks

Here we store everything we ‘know’. Long-term memory is characterised by huge capacity, slow access time and relative accuracy over time.

It is organised in an Episodic way

events and experiences in sequential order

……..and a Semantic way

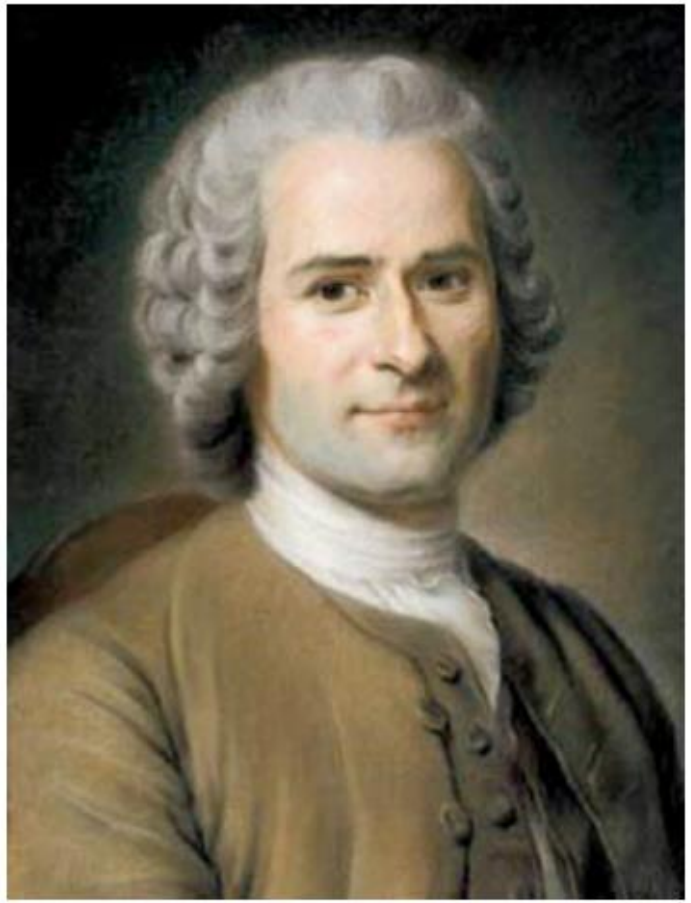
facts, concepts and skills that we have acquired

- Storage
  - Structure, familiarity and concreteness
  - Decay, interference
- Retrieval
  - **Recall** - reproduced
  - **Recognition** – clue given

Forgetting

The Human as a Philosopher

- Philosophers make sense of the world by thinking – traditionally they wonder about great things but in a micro level – humans think about small things



How humans solve problems

- Deductive
- Inductive
- Abductive
  - reasoning

Deductive Reasoning

- Deduction:

  derive logically necessary conclusion from given premises.

  e.g. If it is Friday then she will go to work
  It is Friday
  Therefore she will go to work.

- Logical conclusion not necessarily true:

  e.g. If it is raining then the ground is dry
  It is raining
  Therefore the ground is dry

Inductive Reasoning

- Induction:
  - generalize from cases seen to cases unseen

    e.g. all elephants we have seen have trunks

    therefore all elephants have trunks.
- Unreliable:
  - can only prove false not true

… but useful!

Abductive reasoning

- reasoning from event to cause

  e.g. Sam drives fast when drunk.

  If I see Sam driving fast, assume drunk.

- Unreliable:
  - can lead to false explanations

END OF LECTURE FOR THE SEMESTER