HUMAN COMPUTER INTERACTION

UNIT 3

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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 readability**
- **Incomprehensible components**
- **Annoying distractions.**
- **Confusing navigation.**
- **inefficient operations**
- **inefficient page scrolling.**
- **Information overload**

Design team

- **Development**
- **Human factors**
- **Visual Design**
- **Usability assesment**
- **Documentation**
- **Training**

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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

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, out-dated 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 in-tentions 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 pres-sure 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

- **Psychological responses frequently lead to, or are accompanied by, the following phys-ical 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, usu-ally 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 sys-tems. 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.

- **Modification of the task: The task is changed to match the capabilities of the system.**

  This is a prevalent reaction when the tools are rigid and the problem is unstruc-tured, as in scientific problem solving.

- **Compensatory activity: Additional actions are performed to compensate for system inadequacies.**

  A common example is the manual reformatting of information to match the structure required by the computer.

  This is a reaction common to work-ers whose discretion is *limited, such* as *clerical personnel.*

- **Misuse of the system: The rules are bent to shortcut operational difficulties. This requires significant knowledge of the system and may affect system integrity.**
- **Direct programming: The system is reprogrammed by its user to meet specific needs. This is a typical response of the sophisticated worker.**
- **These physical responses also greatly diminish user efficiency and effectiveness.**

They force the user to rely upon other information sources, to fail to use a system's complete capabilities, or to perform time-consuming "work-around" actions

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Important Human Characteristics in Design

- **Importance in design are perception, memory, visual acuity, foveal and peripheral vision, sensory storage, information processing, learning, skill, and individual differences.**

Perception

- **Proximity**
- **Similarity**
- **Matching patterns**
- **Succinctness**
- **Closure**
- **Unity**
- **Continuity**
- **Balance**
- **Expectancies**
- **Context**
- **Signals versus noise**

- **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.**
  - ***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 peo-ple 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 in-teract 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, move-ments 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, as has been said, is the process of encoding in long-term memory informa-tion that is contained in short-term memory.**
- **It is a complex process requiring some ef-fort 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 com-plex 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. Unproductive time spent learning is something frequently avoided.**

- **Skill: The goal of human performance is to perform skillfully. To do so requires linking in-puts and responses into a sequence of action.**
- **The essence of skill is performance of ac-tions 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 in-creasing 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 in-creasingly 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 : In reality, there is no average user. A complicating but very advantageous human char-acteristic 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.**

- **In the past this has usually resulted in bringing designs down to the level of lowest abilities or selecting people with the minimum skills necessary to per-form a job.**
- **But technology now offers the possibility of tailoring jobs to the specific needs of people with varying and changing learning or skill levels. Multiple versions of a system can easily be created.**
- **Design must provide for the needs of all potential users**

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Human Considerations in Design

- **The User's Knowledge and Experience**

  The knowledge possessed by a person, and the experiences undergone, shape the de-sign 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**

Human Considerations in Design

- **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).**
- **Native Language or Culture- English, another, or several**

JOB/TASK/NEED

- **Type of System Use - Mandatory or discretionary use of the system.**
- **Frequency of Use - Continual, frequent, occasional, or once-in-a-lifetime use of system**
- **Task or Need importance - High, moderate, or low importance of the task being performed**
- **Task Structure - Repetitiveness or predictability of tasks being automated, high, moderate, or low**

JOB/TASK/NEED

- **Social Interactions - Verbal communication with another person required or not required**
- **Primary Training - Extensive or formal training, self-training through manuals, or no training**
- **Turnover Rate - High, moderate, or low turnover rate for jobholders**
- **Job Category - Executive, manager, professional, secretary, clerk**
- **Lifestyle - For Web e-commerce systems, includes hobbies, recreational pursuits, and economic status**

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.**

PHYSICAL CHARACTRISTICS

- **Age** **Young middle aged or elderly**
- **Gender** **Male or Female**
- **Handness** **Left, right or ambidextrous**
- **Disabilities** **Blind, defective vision,**

  deafness, motor handicap

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Human Interaction Speeds

- **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.

Human Interaction Speeds

- **One technique that has dramatically increased reading speeds is called Rapid Serial Visual Presentation, or RSVP. In this technique single words are presented one at a time in the center of a screen.**

New words continually replace old words at a rate set by the reader. For a sample of people whose paper document reading speed was 342 words per minute. (With a speed range of 143 to 540 words per minute.)

Single words were presented on a screen in sets at a speed sequentially varying ranging from 600 to 1,600 words per minute. After each set a comprehension test was administered

Reading

- **Prose text** - 250-300 words per minute.

- **Proof reading text on paper** - 200 words per minute.

- **Proofreading text on a monitor** - 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

- **Two finger typists**

  Memorized text:. 37 words per minute

  Copying text: 27 words per minute

- **Hand printing**

  Memorized text: 31 words per minute.

  Copying text: 22 words per minute.

Understand 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 METHODS

- **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**
- **System Testing**

Determining Basic Business Functions

- **Major system func-tions 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.**

Understanding the User's 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 informa-tion 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 rep-resentation of a person's current conceptualization and understanding of something.**
- **Mental models are gradually developed in order to understand, explain, and do some-thing.**
- **Mental models enable a person to predict the actions necessary to do things if the actions have been forgotten or have not yet been encountered**

Performing a Task Analysis

- **User activities are precisely.**
- **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.**
- **listing of the user's current tasks.**
- **Another result is a list of objects the users see as important to what they do**

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 ob-jects, 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 influ-enced 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 concep-tual 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.**

- **Documentation and training also playa formative role. Mental models will be developed regardless of the particular design of a system, and then they will be modi-fied with experience.**
- **What must be avoided in design is creating for the user a conceptual model that leads to the creation of a false mental model of the system, or that inhibits the user from creating a meaningful or efficient mental 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.**

- **Make the several most important objects very obvious and easy to manipulate**

Developing Metaphors

- **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.**

- END OF UNIT 3