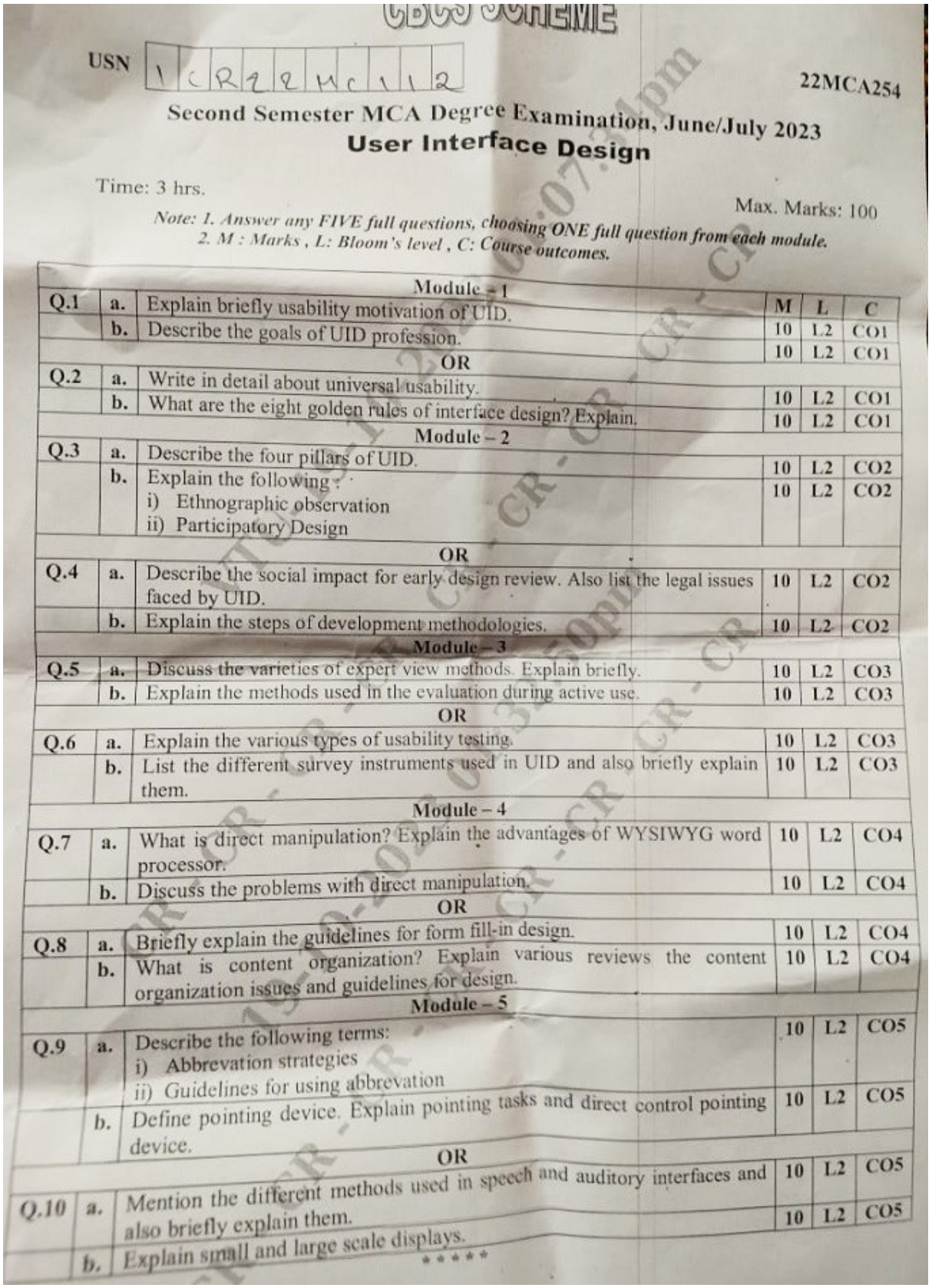
22MCA254-User Interface Design – June/July.2023 Question Paper Solutions



CBCS SCHEME

USN 1 C R 2 2 M C A 1 2

22MCA254

Second Semester MCA Degree Examination, June/July 2023

User Interface Design

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

			M	L	C
		Module – 1			
Q.1	a.	Explain briefly usability motivation of UID.	10	L2	CO1
	b.	Describe the goals of UID profession.	10	L2	CO1
		OR			
Q.2	a.	Write in detail about universal usability.	10	L2	CO1
	b.	What are the eight golden rules of interface design? Explain.	10	L2	CO1
		Module – 2			
Q.3	a.	Describe the four pillars of UID.	10	L2	CO2
	b.	Explain the following : i) Ethnographic observation ii) Participatory Design	10	L2	CO2
		OR			
Q.4	a.	Describe the social impact for early design review. Also list the legal issues faced by UID.	10	L2	CO2
	b.	Explain the steps of development methodologies.	10	L2	CO2
		Module – 3			
Q.5	a.	Discuss the varieties of expert view methods. Explain briefly.	10	L2	CO3
	b.	Explain the methods used in the evaluation during active use.	10	L2	CO3
		OR			
Q.6	a.	Explain the various types of usability testing.	10	L2	CO3
	b.	List the different survey instruments used in UID and also briefly explain them.	10	L2	CO3
		Module – 4			
Q.7	a.	What is direct manipulation? Explain the advantages of WYSIWYG word processor.	10	L2	CO4
	b.	Discuss the problems with direct manipulation.	10	L2	CO4
		OR			
Q.8	a.	Briefly explain the guidelines for form fill-in design.	10	L2	CO4
	b.	What is content organization? Explain various reviews the content organization issues and guidelines for design.	10	L2	CO4
		Module – 5			
Q.9	a.	Describe the following terms: i) Abbrevation strategies ii) Guidelines for using abbrevation	10	L2	CO5
	b.	Define pointing device. Explain pointing tasks and direct control pointing device.	10	L2	CO5
		OR			
Q.10	a.	Mention the different methods used in speech and auditory interfaces and also briefly explain them.	10	L2	CO5
	b.	Explain small and large scale displays.	10	L2	CO5

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1 a. Explain briefly Usability Motivation of UID.

1.Life-critical systems

o Air traffic control, nuclear reactors, power utilities, police & fire dispatch systems o High costs, reliability and effectiveness are expected
o Length training periods are acceptable provide error-free performance
o Subject satisfaction is less an issue due to well motivated users
Retention via frequent use and practice

2. Industrial and commercial uses
o Banking, insurance, order entry, inventory management, reservation, billing, and point-of-sales systems
o Lower cost may sacrifice reliability
Training is expensive, learning must be easy
o Speed and error rates are relative to cost, however speed is the supreme concern
Subject satisfaction is fairly important to limit operator burnout

3. Office, home, and entertainment applications
o Word processing, electronic mail, computer conferencing, and video game systems
o Choosing functionality is difficult because the population has a wide range of both novice and expert users
o Competition cause the need for low cost

4. Exploratory, creative, and cooperative systems
o Database, artist toolkits, statistical packages, and scientific modeling systems o Benchmarks are hard to describe due to the wide array of tasks
o With these applications, the computer should "vanish" so that the user can be absorbed in their task domain

5. Sociotechnical systems
o Designers have to take into consideration the diverse levels of expertise that users with different roles have.
o For the professional administrators and the seasoned investigators will enable rapid performance of complex procedures with visualization tools to spot unusual patterns or detect fraud in usage logs

2. b. Describe goals of UID Profession

- Potential research topics
  - Reducing anxiety and fear of computer usage
  - Graceful Evolution
  - Specification and implementation of interaction
  - Direct manipulation
  - Input devices
  - Online assistance
  - Information exploration
- Providing tools, techniques, and knowledge for system implementers
  - Rapid prototyping is easy when using contemporary tools
  - Use general or self-determined guideline documents written for specific audiences
  - To refine systems, use feedback from individual or groups of users
- Raising the computer consciousness of the general public

- Many novice users are fearful due to experience with poor product design,
- Good designs help novices through these fears by being clear, competent, and nonthreatening

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2. Write in details about universal usability.

- **Physical abilities and physical workplaces**
  - Basic data about human dimensions comes from research in *anthropometry* (Anthropometry refers to the measurement of the human individual)
  - There is no average user, either compromises must be made or multiple versions of a system must be created
  - Physical measurement of human dimensions are not enough, take into account dynamic measures such as reach, strength or speed
  - Screen-brightness preferences vary substantially, designers customarily provide a knob to enable user control
  - Account for variances of the user population's sense perception
  - Vision: depth, contrast, color blindness, and motion sensitivity
  - Touch: keyboard and touchscreen sensitivity
  - Hearing: audio clues must be distinct
  - Workplace design can both help and hinder work performance
  - The draft standard *Human Factors Engineering of Computer Workstations* (2002) lists these concerns:
  - Work-surface and display-support height
  - Clearance under work surface for legs
  - Work-surface width and depth
  - Adjustability of heights and angles for chairs and work surfaces
  - Posture—seating depth and angle; back-rest height and lumbar support
  - Availability of armrests, footrests, and palmrests
- **Cognitive and perceptual abilities**
  - The human ability to interpret sensory input rapidly and to initiate complex actions makes modern computer systems possible
  - The journal *Ergonomics Abstracts* offers this classification of human cognitive processes:
    - Long-term and semantic memory
    - Short-term and working memory
    - Problem solving and reasoning
    - Decision making and risk assessment
    - Language communication and comprehension
    - Search, imagery, and sensory memory
    - Learning, skill development, knowledge acquisition and concept attainment
  - They also suggest this set of factors affecting perceptual and motor performance:
    - Arousal and vigilance
    - Fatigue and sleep deprivation
    - Perceptual (mental) load
    - Knowledge of results and feedback

        - Monotony and boredom
        - Sensory deprivation
        - Nutrition and diet
        - Fear, anxiety, mood, and emotion
        - Drugs, smoking, and alcohol
        - Physiological rhythms
    - But note, in any application, background experience and knowledge in the task domain and the interface domain play key roles in learning and performance
- **Personality differences**
    - There is no set taxonomy for identifying user personality types
    - Designers must be aware that populations are subdivided and that these subdivisions have various responses to different stimuli
    - Myers-Briggs Type Indicator (MBTI)
        - extroversion versus introversion
        - sensing versus intuition
        - perceptive versus judging
        - feeling versus thinking
- **Cultural and international diversity**
    - Characters, numerals, special characters, and accents
    - Left-to-right versus right-to-left versus vertical input and reading
    - Date and time formats
    - Numeric and currency formats
    - Weights and measures
    - Telephone numbers and addresses
    - Names and titles (Mr., Ms., Mme.)
    - Social-security, national identification, and passport numbers
    - Capitalization and punctuation
    - Sorting sequences
    - Icons, buttons, colors
    - Pluralization, grammar, spelling

2.b. Eight Golden Rules of UID

The following rules are mentioned to be the golden rules for GUI design

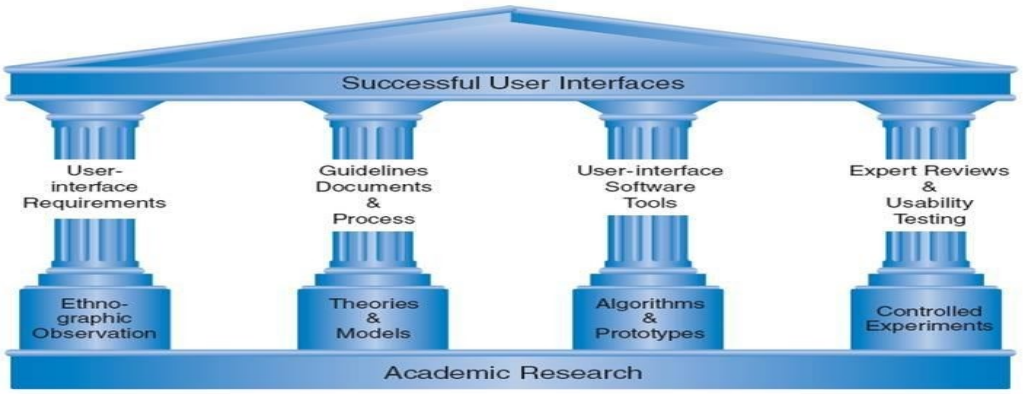
1. Strive for consistency - Consistent sequences of actions should be required in similar situations. Identical terminology should be used in prompts, menus, and help screens. Consistent commands should be employed throughout.
2. Enable frequent users to use short-cuts - The user's desire to reduce the number of interactions increases with the frequency of use. Abbreviations, function keys, hidden commands, and macro facilities are very helpful to an expert user.
3. Offer informative feedback - For every operator action, there should be some system feedback. For frequent and minor actions, the response must be modest, while for infrequent and major actions, the response must be more substantial.
4. Design dialog to yield closure - Sequences of actions should be organized into groups with a beginning, middle, and end. The informative feedback at the completion of a group of actions gives the operators the satisfaction of accomplishment, a sense of relief, the signal to drop contingency plans and options from their minds, and this indicates that the way ahead is clear to prepare for the next group of actions.

5. Offer simple error handling - As much as possible, design the system so the user will not make a serious error. If an error is made, the system should be able to detect it and offer simple, comprehensible mechanisms for handling the error.
6. Permit easy reversal of actions - This feature relieves anxiety, since the user knows That errors can be undone. Easy reversal of actions encourages exploration of unfamiliar options. The units of reversibility may be a single action, a data entry, or a complete group of actions.

7 Support internal locus of control - Experienced operators strongly desire the sense that they are in charge of the system and that the system responds to their actions. Design the system to make users the initiators of actions rather than the responders.

8 Reduce short-term memory load - The limitation of human information processing in short-term memory requires the displays to be kept simple, multiple page displays be consolidated, window-motion frequency be reduced, and sufficient training time be allotted for codes, mnemonics, and sequences of actions.

3.a. Describe Four pillars of UID?



User Interface Requirements

– Soliciting and clearly specifying user requirements is a major key to success in any development activity

– Laying out the user-interface requirements is part of the overall requirements development and management process

– User interface requirements describe system behavior

• Ethnographic Observation

– Identifying and observing the user community in action

– Discussed later

Guidelines documents and processes

Each project has different needs, but guidelines should be considered for:

• Words, icons, and graphics

– Terminology (objects and actions), abbreviations, and capitalization

– Character set, fonts, font sizes, and styles (bold, italic, underline)

– Icons, graphics, line thickness, and

– Use of color, backgrounds, highlighting, and blinking

• Screen-layout issues

– Menu selection, form fill-in, and dialog-box formats

– Wording of prompts, feedback, and error messages

– Justification, white space, and margins

– Data entry and display formats for items and lists

– Use and contents of headers and footers

• Input and output devices

– Keyboard, display, cursor control, and pointing devices

– Audible sounds, voice feedback, touch input, and other special devices
– Response time for a variety of tasks
• Action sequences
– Direct-manipulation clicking, dragging, dropping, and gestures
– Command syntax, semantics, and sequences
– Programmed function keys
– Error handling and recovery procedures
• Training
– Online help and tutorials
– Training and reference materials
– Command syntax, semantics, and sequences

3.b. i. Ethnography

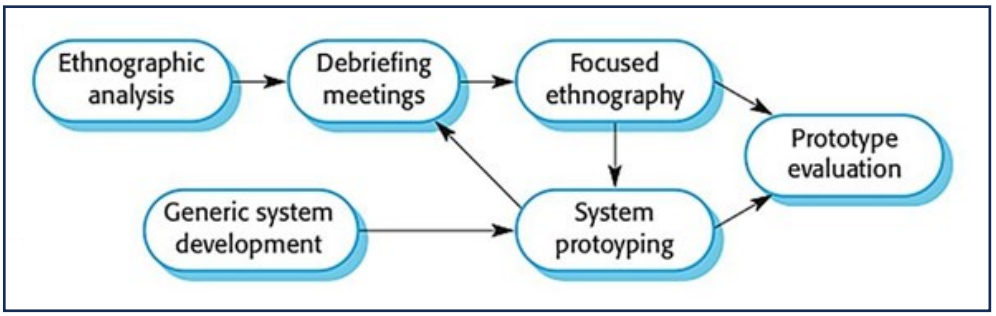
A social scientists spends a considerable time observing and analysing how people actually work.

People *do not have to explain* or articulate their work. *Social and organisational* factors of importance may be observed.

Ethnographic studies have shown that *work is usually richer* and more complex than suggested by simple system models.

Focused ethnography

- Developed in a project studying the **air traffic control** process
- Combines ethnography with prototyping
- Prototype development results in **unanswered questions** which focus the ethnographic analysis.
- The problem with ethnography is that it studies existing practices which may have some **historical basis which is no longer relevant**.



- Requirements that are derived from the way that **people actually work** rather than the way which process definitions suggest that they ought to work.
- Requirements that are derived from **cooperation and awareness of other people's activities.**

Toolkit

Windowing System

Operating System

Expert Review and Usability testing

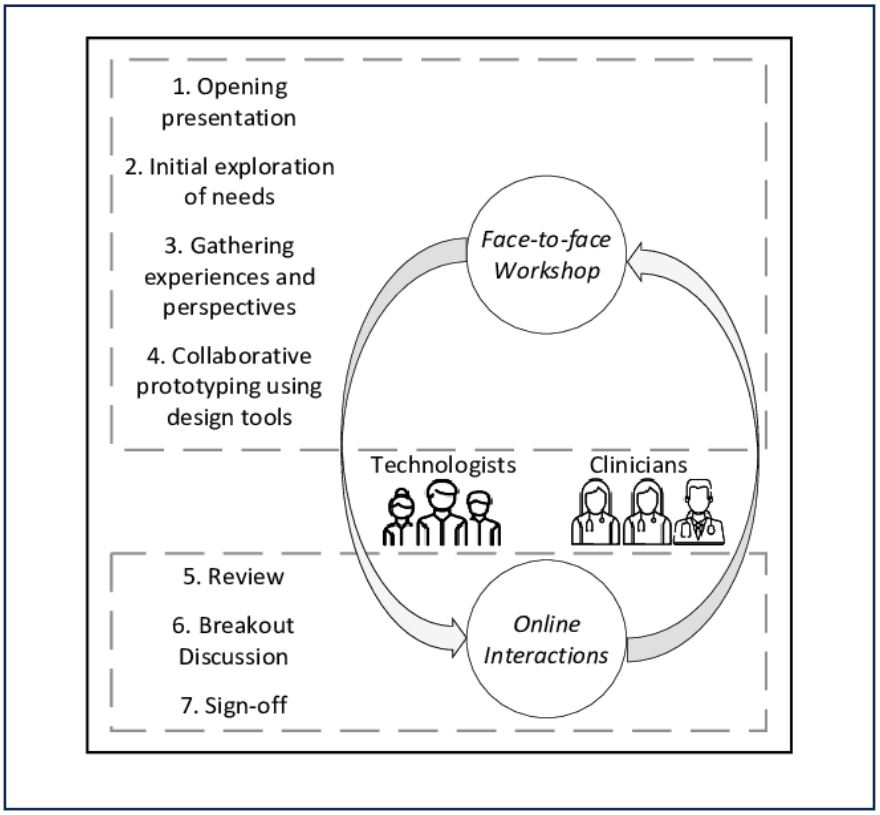
Interactive-System designers are now recognizing that they must carry out many *small* and some *large pilot tests* of system components before release to customers

ii. Participatory Design

- **More user involvement brings**

- Aims to actively involve users as members of the design team from the start of the design process
- Contrasts with experimental approaches where potential users are treated as passive subjects
- Why include users in the design team?
  - Because they are the experts in the 'work' activities the system is being designed to support
  - They can teach us a great deal about what the system should do then
  - PD is a mutual learning process

- More user involvement brings
  - More accurate information about tasks
  - More opportunity for users to influence design decisions
  - A sense of participation that builds users' ego investment in successful implementation
  - Potential for increased user acceptance of final system



4a. Social Impact

- Describe the new system and its benefits.
  - Convey the high level goals of the new system.
  - Identify the stakeholders.
  - Identify specific benefits
- Address concerns and potential barriers.
  - Anticipate changes in job functions and potential layoffs.
  - Address security and privacy issues.
  - Discuss accountability and responsibility for system misuse and failure.
  - Avoid potential biases.
  - Weigh individual rights vs. societal benefits.
  - Assess trade-offs between centralization and decentralization.
  - Preserve democratic principles.
  - Ensure diverse access.
  - promote simplicity and preserve what works.
- Outline the development process.
  - Present and estimated project schedule.
  - Propose process for making decisions.
  - Discuss expectations of how stakeholders will be involved.
  - Recognize needs for more staff, training, and hardware.
  - Propose plan for backups of data and equipment.
  - Outline plan for migrating to the new system.

Legal issue

- What material is eligible for copyright?
- Are copyrights or patents more appropriate for user interfaces?
- What constitutes copyright infringement(violation)?
- Should user interfaces be copyrighted?

4.b. Steps for development methodology

Stage 1: **D**evelop Product Concept
Stage 2: **R**esearch and Needs Analysis
Stage 3: **D**esign Concepts and Key Screen Prototype
Stage 4: **I**terative Design and Refinement
Stage 5: **I**mplement Software
Stage 6: **P**rovide Roll-Out Support

5.a. Expert Review Methods

- While *informal demos* to colleagues or *customers can provide some useful feedback,* more formal expert reviews have proven to be effective.

- Expert reviews entail one-half day to one week effort, although a lengthy training period may sometimes be required to explain the task domain or operational procedures.

- There are a variety of expert review methods to choose from:
  - Heuristic evaluation

The expert reviewers critique an interface to determine conformance with a short list of design heuristics, such as *the eight golden rules*

  - Guidelines review

The interface is checked for conformance with the organizational or other guidelines document.

  - Consistency inspection

Consistency inspection. The experts verify consistency across a family of inter faces, checking for
consistency of terminology, fonts, color schemes, layout, input and output formats

  - Cognitive walkthrough

Extensions to cover web-site navigation incorporate richer descriptions of users and their goals plus linguistic analysis programs to estimate the similarity of link labels and destinations

  - Formal usability inspection

The experts hold a courtroom-style meeting, with a moderator or judge, to present the interface and to discuss its merits and Weaknesses.

Expert reviews can be *scheduled* at several points in the development process when experts are available and when the design team is ready for feedback.

Different experts tend to find different problems in an interface, so *3-5 expert reviewers* can be highly productive, as can complementary usability testing.

5.b. Evaluation During Active Use

- A carefully designed and thoroughly tested system is a wonderful asset, but successful active use requires constant attention from .
  - dedicated managers,
    - user-services personnel,
    - and maintenance staff.
    - Perfection is not attainable, but percentage improvements are possible and are worth pursuing.
- Interviews and focus group discussions

- *Interviews with individual* users can be productive because the interviewer can pursue specific issues of concern.
- After a series of individual discussions, *group discussions* are valuable to ascertain the universality of comments.

- Continuous user-performance data logging
  - The software architecture should make it easy for system managers to collect data about the patterns of system usage, speed of user performance, rate of errors, or frequency of request for online assistance.

A major benefit of usage-frequency data is the guidance they provide to system maintainers in optimizing performance and reducing costs for all participants

- ❑ Online or telephone consultants
  - ❑ Online or telephone consultants are an extremely effective and personal way to provide assistance to users who are experiencing difficulties.
  - ❑ Many users feel reassured if they know there is a human being to whom they can turn when problems arise.
  - ❑ On some network systems, the consultants can monitor the user's computer and see the same displays that the user sees while maintaining telephone voice contact.
  - ❑ This service can be extremely reassuring; the users know that someone can walk them through the correct sequence of screens to complete their tasks.
- ❑ Online suggestion box or trouble reporting
  - ❑ *Electronic mail* can be employed to allow users to send messages to the maintainers or designers.
  - ❑ Such an online suggestion box encourages some users to make productive comments, since writing a letter may be seen as requiring too much effort.

6a. Usability testing

- The remarkable surprise was that usability testing not only speed up many projects but that it produced dramatic cost savings.
- Participants should be chosen to represent the intended user communities, with attention to background in *computing, experience* with the task, *motivation, education*, and *ability with the natural language used in the interface.*
- Participation should always be voluntary, and informed consent should be obtained.

Videotaping participants performing tasks is often valuable for later review and for showing designers or managers the problems that users encounter.

Field tests attempt to put new interfaces to work in realistic environments for a fixed trial period. Field tests can be made more fruitful if logging software is used to capture error, command, and help frequencies plus productivity measures.

Game designers pioneered the can-you-break-this approach to usability testing by providing energetic teenagers with the challenge of trying to beat new games

Destructive testing approach, in which the users try to find fatal(critical) flaws in the system, or otherwise to destroy it, has been used in other projects and should be considered seriously.

For all its success, usability testing does have at least two serious limitations:

It emphasizes first-time usage and has limited coverage of the interface features.

These and other concerns have led design teams to supplement usability testing with the varied forms of expert reviews.

6.b. Survey methods

- Written user surveys are a familiar,
  inexpensive and generally acceptable companion for
  usability tests and expert reviews.
- The keys to successful surveys are clear goals in advance and then development of focused items that help attain the goals.
- Survey goals can be tied to the components of the Objects and Action Interface model of interface design. Users could be asked for their subjective impressions about specific aspects of the interface such as the representation of:
  - task domain objects and actions
  - syntax of inputs and design of displays.
- Online surveys avoid the cost of printing and the extra effort needed for distribution and collection of paper forms.
  - Users background (age, gender, origins, education, income)
  - Experience with computers (specific applications or software packages, length of time, depth of knowledge)
  - Job responsibilities (decision-making influence, managerial roles, motivation)
  - Personality style (introvert vs. extrovert, risk taking vs. risk aversive, early vs. late adopter, systematic vs. opportunistic)
  - Reasons for not using an interface (inadequate services, too complex, too slow)
  - Familiarity with features (printing, macros, shortcuts, tutorials)
  - Feeling state after using an interface (confused vs. clear, frustrated vs. in-control, bored vs. excited).

7a. WYSIWYG

The Advantages ~

- Anyone can edit.
- Wikis are easy to use and learn.
- Wikis are instantaneous so there is no need to wait for a publisher to create a new edition or update information
- A rich text editor offers a what-you-see-is-what-you-get (WYSIWYG) interface, facilitating the formatting and layout of content.
- People located in different parts of the world can work on the same content.

- The wiki software keeps track of every edit made and it's a simple process to revert back to a previous version of a page.
- Non-technical users have access to the power of web publishing.
- The wiki has no predetermined structure – consequently it is a flexible tool which can be used for a wide range of applications.
- There are a wide range of open source software wiki's to choose from so licensing costs shouldn't be a barrier to installing an institutional wiki.
- Anyone can create web sites and put them online
- Create web sites quickly
- No prior programming knowledge required – no need to know what HTML code looks like
- Provide a platform to start learn HTML
- Easy
- Fast
- No special skills required.

~ The Disadvantages ~

- Anyone can edit so this may be too open for some applications, for example confidential documentation. However it is possible to regulate user access.
- Open to SPAM and vandalism if not managed properly. There are easy ways to restore a page and in the case of WikiEducator you must be logged in to edit pages so this reduces vandalism by automated spam bots.
- Requires Internet connectivity to collaborate, but technologies to produce print versions of articles are improving.
- The flexibility of a wiki's structure can mean that information becomes disorganised. As a wiki grows, the community must plan and administer the structure collaboratively.
- Messy code
- Depreciated code
- potentially arbitrary and redundant code (dependent on the editor)

7b. Direct Manipulation advantages and disadvantages.

OAI model. The OAI model graphically represents the users' workplace using metaphors and let the users perform action(s) on the object. The sequence of work is to first select the object graphically (using mouse or other pointing device), and then performing an action on the selected object.
Shneiderman identified several attributes of this interaction style that make it superior to command-line interfaces:

- **Continuous representation of the object of interest**. Users can see visual representations of the objects that they can interact with. As soon as they perform an action, they can see its effects on the state of the system. For example, when moving a file using drag-and-drop, users can see the initial file displayed in the source folder, select it, and, as soon as the action was completed, they can see it disappear from the source and appear in the destination — an immediate confirmation that their action had the intended result. Thus, direct-manipulation UIs satisfy, by definition, the first usability heuristic: the visibility of the system status. In contrast, in a command-line interface, users usually must explicitly

check that their actions had indeed the intended result (for example, by listing the content of the destination directory).

- **Physical actions instead of complex syntax**. Actions are invoked physically via clicks, button presses, menu selections, and touch gestures. In the move-file example, drag-and-drop has a direct analog in the real world, so this implementation for the move action has the right signifiers and can be easily learned and remembered. In contrast, the command-line interface requires users to recall not only the name of the command ("mv"), but also the names of the objects involved (files and paths to the source and destination folders). Thus, unlike DM interfaces, command-line interfaces are based on recall instead of recognition and violate an important usability heuristic.
- **Continuous feedback and reversible, incremental actions**. Because of the visibility of the system state, it's easy to validate that each action caused the right result. Thus, when users make mistakes, they can see right away the cause of the mistake and they should be able to easily undo it. In contrast, with command-line interfaces, one single user command may have multiple components that can cause the error. For instance, in the example below, the name of the destination folder contains a typo "Measuring Usablty" instead of "Measuring Usability". The system simply assumed that the file name should be changed to "Measuring Usablty". If users check the destination folder, they will discover that there was a problem, but will have no way of knowing what caused it: did they use the wrong command, the wrong source filename, or the wrong destination?

The command contains a typo in the destination name. Users have no way of identifying this error and must do detective work to understand what went wrong.

This type of problem is familiar to everyone who has written a computer program. Finding a bug when there are variety of potential causes often takes more time than actually producing the code.

- **Rapid learning.** Because the objects of interest and the potential actions in the system are visually represented, users can use recognition instead of recall to see what they could do and select an operation most likely to fulfill their goal. They don't have to learn and remember complex syntax. Thus, although direct-manipulation interfaces may require some initial adjustment, the learning required is likely to be less substantial.

8a. Form fill-in

- Form Fillin
  - Appropriate when many fields of data must be entered:
    - Full complement of information is visible to user.
    - Display resembles familiar paper forms.
    - Few instructions are required for many types of entries.

- Users must be familiar with:
    - Keyboards
    - Use of TAB key or mouse to move the cursor
    - Error correction methods
    - Field-label meanings
    - Permissible field contents
    - Use of the ENTER and/or RETURN key.

- **Form-Fillin Design Guidelines**
    - Meaningful title
    - Comprehensible instructions
    - Logical grouping and sequencing of fields
    - Visually appealing layout of the form
    - Familiar field labels
    - Consistent terminology and abbreviations
    - Visible space and boundaries for data-entry fields
    - Convenient cursor movement
    - Error correction for individual characters and entire fields
    - Error prevention
    - Error messages for unacceptable values
    - Optional fields clearly marked
    - Explanatory messages for fields
    - Completion signal
- **Format-specific field**
    - **Coded fields**
        - Telephone numbers
        - Social-security numbers
        - Times
        - Dates
        - Dollar amounts (or other currency)
        -

8.b. Content Organization

- **Task-related grouping in tree organization**
    - **Create groups of logically similar items**
    - **Form groups that cover all possibilities**
    - **Make sure that items are nonoverlapping**
    - **Use familiar terminology, but ensure that items are distinct from one another**
- **Item Presentation Sequence**
    - **The order of items in the menu is important, and should take natural sequence into account when possible:**
        - **Time**
        - **Numeric ordering**
        - **Physical properties**

- **When cases have no task-related orderings, the designer must choose from such possibilities as:**
  - **Alphabetic sequence of terms**
  - **Grouping of related items**
  - **Most frequently used items first**
  - **Most important items first.**

Menu layout

- Use task semantics to organize menus (single, linear sequence, tree structure, acyclic and cyclic networks)
- Prefer broad–shallow to narrow–deep
- Show position by graphics, numbers, or titles
- Use items as titles for subtrees
- Group items meaningfully
- Sequence items meaningfully
- Use brief items, begin with the keyword
- Use consistent grammar, layout, terminology
- Allow type ahead, jump ahead, or other shortcuts
- Enable jumps to previous and main menu
- Consider online help; novel selection mechanisms; and optimal response time, display rate, screen size

9.a.i. Abbrivation

There is often a lack of consistency or obvious strategy for construction of command abbreviations.

Specificity	Versus	Generality
Infrequent, discriminating words	insert	delete
Frequent, discriminating words	add	remove
Infrequent, nondiscriminating words	amble	perceive
Frequent, nondiscriminating words	walk	view
General words (frequent, nondiscriminating)	alter	correct
Nondiscriminating nonwords (nonsense)	GAC	MIK
Discriminating nonwords (icons)	abc-adbc	abc-ab

ii. Guideline for Abbreviation

1. Simple truncation: The first, second, third, etc. letters of each command.
2. Vowel drop with simple truncation: Eliminate vowels and use some of what remains.
3. First and last letter: Since the first and last letters are highly visible, use them.

4. First letter of each word in a phrase: Use with a hierarchical design plan.
5. Standard abbreviations from other contexts: Use familiar abbreviations.
6. Phonics: Focus attention on the sound.

Ehrenreich and Porcu (1982) offer this set of guidelines:

- A *simple* primary rule should be used to generate abbreviations for most items; a *simple secondary rule* should be used for those items where there is a conflict.
- Abbreviations generated by the *secondary rule* should have a marker (for example, an asterisk) incorporated in them.
- The number of words abbreviated by the *secondary rule* should be kept to a minimum.
- Users should be *familiar with the rules* used to generate abbreviations.
- Truncation should be used because it is an easy rule for users to comprehend and remember. However, when it produces a large number of identical abbreviations for different words, adjustments must be found.
- Fixed-length abbreviations should be used in preference to variable-length ones.
- *Abbreviations should not be designed to incorporate endings (ING, ED, S).*
- Unless there is a *critical space problem*, abbreviations should not be used in messages generated by the computer and read by the user.

9.b. Pointing Devices

Pointing devices are applicable in six types of interaction tasks:

- 1. Select:
  - user chooses from a set of items.
  - used for traditional menu selection, identification of a file in a directory, or marking of a part in an automobile design.
- 2. Position:
  - user chooses a point in a one-, two-, three-, or higher-dimensional space
  - used to create a drawing, to place a new window, or to drag a block of text in a figure.
- 3. Orient:
  - user chooses a direction in a two-, three-, or higher-dimensional space.
  - direction may simply rotate a symbol on the screen, indicate a direction of motion for a space ship, or control the operation of a robot arm.
- 4. Path:
  - user rapidly performs a series of position and orient operations.
  - may be realized as a curving line in a drawing program, the instructions for a cloth cutting machine, or the route on a map.
- 5. Quantify:
  - user specifies a numeric value.
  - usually a one-dimensional selection of integer or real values to set parameters, such as the page number in a document, the velocity of a ship, or the amplitude of a sound.
- 6. Text:

  - user enters, moves, and edits text in a two-dimensional space. The
  - pointing device indicates the location of an insertion, deletion, or change.
  - more elaborate tasks, such as centering; margin setting; font sizes; highlighting, such as boldface or underscore; and page layout.

Direct-control pointing devices

- lightpen
  - enabled users to point to a spot on a screen and to perform a select, position, or other task
  - it allows direct control by pointing to a spot on the display
  - incorporates a button for the user to press when the cursor is resting on the desired spot on the screen
  - lightpen has three disadvantages: users' hands obscured part of the screen, users had to remove their hands from the keyboard, and users had to pick up the lightpen
- Touchscreen
  - allows direct control touches on the screen using a finger
  - early designs were rightly criticized for causing fatigue, hand-obscuring-the-screen, hand-off-keyboard, imprecise pointing, and the eventual smudging of the display
  - lift-off strategy enables users to point at a single pixel
  - the users touch the surface
  - then see a cursor that they can drag around on the display
  - when the users are satisfied with the position, they lift their fingers off the display to activate
  - can produce varied displays to suit the task are fabricated integrally with display surfaces

    Tablet PCs and Mobile Devices:
- Natural to point on the LCD surface
- Stylus
- Keep context in view
- Pick up & put down stylus
- Gestures and handwriting recognition

10.a. Speech and auditory interfaces

- Speech recognition still does not match the fantasy of science fiction:
  - demands of user's working memory
  - background noise problematic
  - variations in user speech performance impacts effectiveness
  - most useful in specific applications, such as to benefit handicapped users
- Discrete word recognition
  - recognize individual words spoken by a specific person; can work with 90- to 98-percent reliability for 20 to 200 word vocabularies

  - Speaker-dependent training, in which the user repeats the full vocabulary once or twice
  - Speaker-independent systems are beginning to be reliable enough for certain commercial applications
  - been successful in enabling bedridden, paralyzed, or otherwise disabled people
  - also useful in applications with at least one of the following conditions:
    - speaker's hands are occupied
    - mobility is required
    - speaker's eyes are occupied
    - harsh or cramped conditions preclude use of keyboard
  - voice-controlled editor versus keyboard editor
    - lower task-completion rate
    - lower error rate
  - use can disrupt problem solving
- Continuous-speech recognition
  - Not generally available:
    - difficulty in recognizing boundaries between spoken words
    - normal speech patterns blur boundaries
    - many potentially useful applications if perfected
- Speech store and forward
  - Voice mail users can
    - receive messages
    - replay messages
    - reply to caller
    - forward messages to other users, delete messages
    - archive messages
- Systems are low cost and reliable.
- Voice information systems
  - Stored speech commonly used to provide information about tourist sites, government services, after-hours messages for organizations
  - Low cost
  - Voice prompts
  - Deep and complex menus frustrating
  - Slow pace of voice output, ephemeral nature of speech, scanning and searching problems
  - Voice mail
  - Handheld voice recorders
  - Audio books
  - Instructional systems
- Audio tones, audiolization, and music
  - Sound feedback can be important:
    - to confirm actions
    - offer warning

- for visually-impaired users
- music used to provide mood context, e.g. in games
- can provide unique opportunities for user, e.g. with simulating various musical instruments

10.b. Small and large display

- The display has become the primary source of feedback to the user from the computer
  - The display has many important features, including:
    - Physical dimensions (usually the diagonal dimension and depth)
    - Resolution (the number of pixels available)
    - Number of available colors, color correctness
    - Luminance, contrast, and glare
    - Power consumption
    - Refresh rates (sufficient to allow animation and video)
    - Cost and Reliability

  Usage characteristics distinguish displays:
    - Portability
    - Privacy
    - Saliency
    - Ubiquity
- Large displays
  - Informational wall displays
  - Interactive wall displays
  - Multiple desktop displays
- Heads-up and helmet mounted displays
  - A heads-up display can, for instance, project information on a partially silvered widescreen of an airplane or car
  - A helmet/head mounted display (HMD) moves the image with the user
  - 3D images
- Currently mobile devices used for brief tasks, except for game playing
- Optimize for repetitive tasks
- Custom designs to take advantage of every pixel
- DataLens allows compact overviews
- Web browsing difficult
- Okay for linear reading, but making comparisons can be difficult