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13MCA355

Third Semester MCA Degree Examination, Dec.2016/Jan.2017
Principles of User Interface Design

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1 a. Discuss the various usability motivations for user interface design. **(10 Marks)**
b. Explain the guidelines for organizing the display. **(10 Marks)**

2 a. With a neat diagram, explain the four pillars of user interface development. **(10 Marks)**
b. Discuss the Guidelines for documents and process. **(10 Marks)**

3 a. Briefly explain the variety of expert Reviews methods in evaluating multiple designs. **(10 Marks)**
b. Explain the various types of usability testing. **(10 Marks)**

4 a. Explain the advantages of WYSIWYG word processor. **(10 Marks)**
b. Discuss about the combination of multiple menus. **(10 Marks)**

5 a. Discuss command Language strategies and structure. **(10 Marks)**
b. Briefly explain about Naming and abbreviations. **(10 Marks)**

6 a. List and explain the seven types of interaction task used for pointing devices. **(08 Marks)**
b. Write short notes on :
i) Keyboard Layout **(06 Marks)**
ii) Voice Information System. **(06 Marks)**

7 a. Explain the bases for preparing error messages. **(10 Marks)**
b. Write briefly about coordinating multiple windows supported by interface developers. **(10 Marks)**

8 a. Write the disadvantages of reading from display. **(06 Marks)**
b. Explain about shaping the content of the documentation. **(10 Marks)**
c. Write short notes on online documentation. **(04 Marks)**

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Third Semester MCA Degree Examination, Dec.2016/Jan.2017

Principles of User Interface Design

1. a. Discuss the various usability motivations for user interface design (10M)

1. Life-critical systems
    - Air traffic control, nuclear reactors, power utilities, police & fire dispatch systems
    - High costs, reliability and effectiveness are expected
    - Length training periods are acceptable provide error-free performance
    - Subject satisfaction is less an issue due to well motivated users Retention via frequent use and practice
2. Industrial and commercial uses
    - Banking, insurance, order entry, inventory management, reservation, billing, and point-of-sales systems
    - Lower cost may sacrifice reliability
    - Training is expensive, learning must be easy
    - 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
    - Word processing, electronic mail, computer conferencing, and video game systems
    - Choosing functionality is difficult because the population has a wide range of both novice and expert users
    - Competition cause the need for low cost
4. Exploratory, creative, and cooperative systems
    - Database, artist toolkits, statistical packages, and scientific modeling systems
    - Benchmarks are hard to describe due to the wide array of tasks
    - With these applications, the computer should "vanish" so that the user can be absorbed in their task domain
5. Sociotechnical systems
    - Designers have to take into consideration the diverse levels of expertise that users with different roles have.
    - 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

1 b. Explain the guidelines for organizing the display. (10M)

ans.

Smith and Mosier offer five high-level goals as part of their guidelines for data display.

1. Consistency of data display:
   During the design process, the terminology, abbreviations, formats, colors, capitalization, and so on should all be standardized and controlled by use of a written dictionary of these items.
2. Efficient information assimilation by the user:
   The format should be familiar to the operator and should be related to the tasks required to be performed with the data. This objective is served by rules for neat columns of data, left

justification for alphanumeric data, right justification of integers, proper spacing, appropriate measurement units and no of decimal digits.

3. Minimal memory load on the user:
   Users should not be required to remember information from one screen for use on another screen. Tasks should b arranged s.t completion occurs with few actions , minimizing the chance of forgetting to perform a step. Labels and common formats hould be provided for novice or intermittent users.
4. Compatibility of data display with data entry:
   The format of display of display information should be linked clearly to the format of the data entry. Where possible and appropriate, the output fields should also act as editable input fields.
5. Flexibility for user control of data display:
   Users should be able to get the information from the display in the form most convenient for the task on which they are working.

These objectives are useful starting point, but each project needs to expand these into application-specific and hardware-dependent standards and practices.

2 a. With a neat diagram , explain the four pillars of user interface development.(10M)

Ans

The four pillars can help user interface architects to turn good ideas into successful systems. They are not guaranteed to work, but experience has shown that each pillar can produce an order of magnitude speedup in the process and can facilitate the creation of excellent systems.

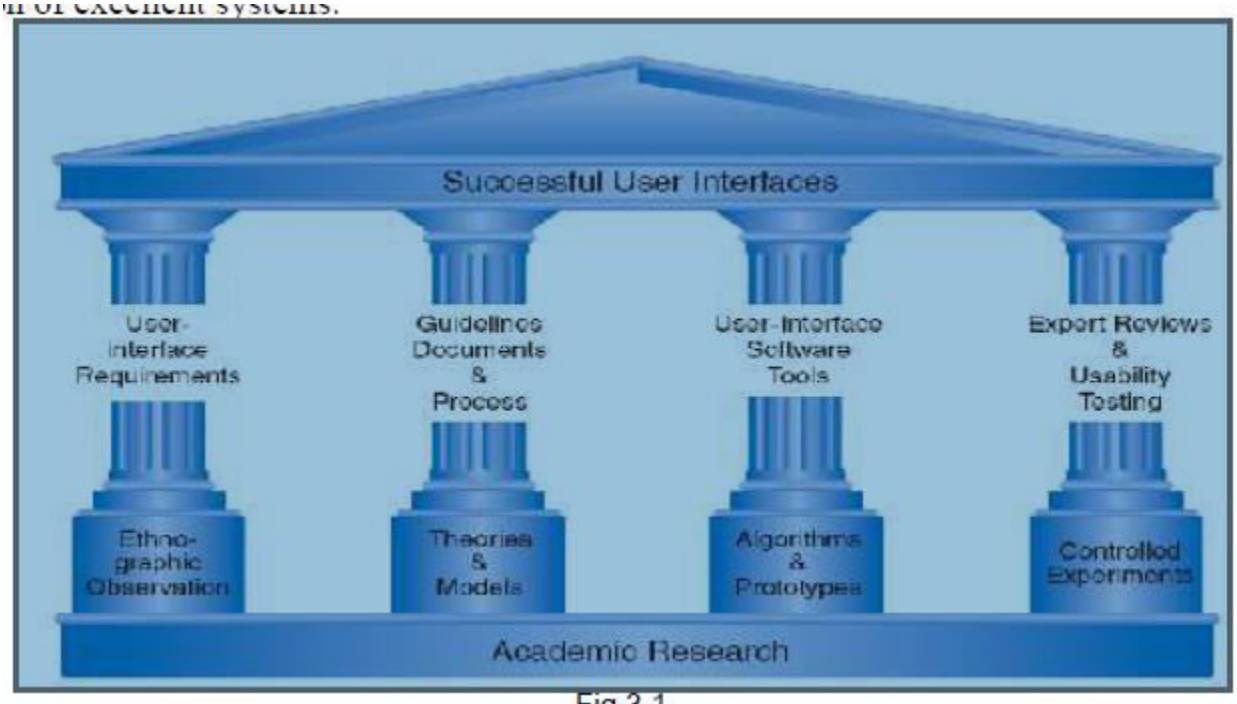


Fig 3.1

1.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

1.Guidelines documents and processes

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

Words and icons

- 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

2.User-interface software tools

- As the interactive systems are novel in many situations, users may not realize the implications of design decisions. Unfortunately, it is difficult, costly, and time consuming
- to make major changes to systems once those systems have been implemented. At an early stage, the customers and users can be given a realistic impression of what the final system will

look like The prototype of a menu system may have only one or two paths active, instead of the thousands of paths envisioned for the final system. For a form-fill in system, the prototype may simply show the fields but not actually process them.

- Prototypes have been developed with simple drawing or word-processing tools, but graphical design environments such as Macromedia's Director and Flash are widely used.

3.Expert reviews and usability testing

- Web-site designers now recognize that they must carry out many small and some large pilot tests of components before release to customers. In addition to a variety of expert review methods, tests with the intended users, surveys, and automated analysis tools are proving to be valuable. Procedures vary greatly depending on the goals of the usability study, the number of expected users, the dangers of errors, and the level of investment.

4. Development methodology

- Many software projects fail due to communication deficits between developers and clients/users (gap between business/user and IT/developer)
- These problems may be due to poor communication between developers and clients or between developers and their users.
- Successful developers use user-centered design which leads to systems that generate fewer problems during development and have lower maintenance costs.
- They are easier to learn, produce faster performance, reduce user errors substantially, and encourage users to explore features that go beyond the minimum required to get by.
- Software developers have learned that consistently following established development methodologies can help them meet budgets and schedules.
- Since software-engineering methodologies are effective in facilitating the software development process, they have not provided clear processes for studying the users, understanding their needs, and creating usable interfaces.
- Agile technologies and methodologies provide the room to be responsive to user-interface development and usability needs.
- These business-oriented approaches specify detailed deliverables for the various stages of design and incorporate cost/benefit and return-on-investment analyses to facilitate decision making.
- There are dozens of advertised development methods but the focus here is on rapid contextual design as in the below steps.

1. **Contextual Enquiry**
   Plan for, prepare and then conduct field interviews to observe and understand the work tasks being performed. Review business practices.
2. **Interpretation Sessions and work modeling**
   Hold team discussion to draw conclusions based on the conceptual inquiry, including gaining an understanding of the workflow processes in the organization as well as cultural and policy impacts.
3. **Model Consolidation and affinity diagram building**
   Present the data gathered to date from users and the interpretation and work modeling to a larger, targeted population to gain insight and concurrence.
4. **Persona development**
   Develop personas to represent the different user types within a targeted demographic that might use a site or product
5. **Visioning**
   Review and "walk" the consolidated data, sharing the personas created. The visioning session helps define how the system will streamline and transform the work of the users.

6. **Storyboarding**
   The vision guides the detailed redesign of user tasks using pictures and graphs to describe the initial user-interface concepts, business rules, and automation and assumptions. Storyboarding defines and illustrates the "to be built" assumptions.
7. **User environment design**
   The single, coherent representation of the users and the work to be performed is expressed in the user environment design.
8. **Interview and evaluations with paper prototypes and mock-ups**
   Conduct interview and tests with actual users, beginning with paper prototypes and then moving onto higher-fidelity prototypes. Capturing the results of the interview aids in ensuring that the system will meet end-user requirements.

2.b Discuss the Guide lines for documents and process (10M)

Ans. Guidelines for documents and process

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

- 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

When preparing/working with guidelines always consider the 4Es:

- ***Education***: Provide training opportunities, give changes to discuss guideline.
- ***Enforcement***: Establish procedures that facilitate guidelines distribution and communication among stakeholders, establish procedures that ensure enforcement
- ***Exemption***: Allow for exemptions, install a process that allows for rapid adaptation if necessary.
- ***Enhancement***: Constantly improve/refine guidelines (where appropriate and possible without affecting the progress of the project too much)

3a. Briefly explain the variety of expert Reviews methods in evaluating multiple designs (10M)

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

• Heuristic evaluation. The expert reviewers critique an interface to determine conformance with a short list of design heuristics, such as the eight golden rules. It makes an enormous difference if the experts are familiar with the rules and are able to interpret and apply them.

• Guidelines review. The interface is checked for conformance with the organizational or other guidelines document. Because guidelines documents may contain a thousand items, it may take the expert reviewers some time to master the guidelines and days or weeks to review a large interface.

• Consistency inspection. The experts verify consistency across a family of interfaces, checking for consistency of terminology, fonts, colour schemes, layout, input and output formats, and so on within the interface as well as in the training materials and online help. Software tools can help automate the process, as well as produce concordances of words and abbreviations.

• Cognitive walkthrough. The experts simulate users walking through the interface to carry out typical tasks. High-frequency tasks are a starting point, but rare critical tasks, such as error recovery, also should be walked through. Some form of simulating the day in the life of the user should be part of the expert-review process. Cognitive walkthroughs were developed for interfaces that can be learned by exploratory browsing, but they are useful even for interfaces that require substantial training. An expert might try the walkthrough privately and explore the system, but there also should be a group meeting with designers, users, or managers to conduct the walkthrough and provoke discussion. 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. Design-team members may rebut the evidence about problems in an adversarial format. Formal usability inspections can be educational experiences for novice designers and managers, but they may take longer to prepare and more personnel to

carry out than do other types of review. 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.

- The number of expert reviews will depend on the magnitude of the project and on the amount of resources allocated.

3b. Explain the various types of usability testing.(10M)

- Usability testing comes in many different flovors and formats.
- The purpose of the test and the type of the data that is needed are important considerations
- The following is a list of the various types of usability testing. Testing can be performed using combinations of these methods as well

    - ***Paper mockups***. Early usability studies can be conducted using paper mock-ups of screen displays to assess user reactions to wording, layout, and sequencing. A test administrator plays the role of the computer by flipping the pages while asking a participant user to carry out typical tasks. This informal testing is inexpensive, rapid, and usually productive.

    - ***Discount usability testing.*** This quick-and-dirty approach to task analysis, prototype development, and testing has been widely influential because it lowered the barriers to newcomers. A controversial aspect is the recommendation to use only three to six test participants. Advocates point out that most serious problems are found with a few participants, enabling prompt revision and repeated testing, while critics hold that a broader subject pool is required to thoroughly test more complex systems. The formative evaluation identifies problems that guide redesign, while the summative evaluation provides evidence for product announcements("94% of our 120 testers completed their shopping tasks without assistance")and clarifies training needs ("with 4 minutes of instruction, every participant successfully programmed the videorecorder").

- ***Competitive usability testing.*** Competitive testing compares a new interface to previous versions or to similar products from competitors. This approach is close to a controlled experimental study, and staff must be careful to construct parallel sets of tasks and to counterbalance the order of presentation of the interfaces. Within-subjects designs seem the most powerful, because participants can make comparisons between the competing interfaces-fewer participants are needed, although each is needed for a longer time period.

- ***Universal usability testing***. This approach tests interfaces with highly diverse users, hardware, software platforms, and networks. When a wide range of international users is anticipated, such as for consumer electronics products, web-based information services, or e-government services, ambitious testing is necessary to clean up problems and thereby help ensure success. Trials with small and large displays, slow and fast networks, and a range of operating systems or Internet browsers will do much to raise the rate of customer success.

- ***Field tests and portable labs***. This testing method puts 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, as well as productivity measures. Portable usability laboratories with videotaping and logging facilities have been developed to support more thorough field testing.

- ***Remote usability testing***. Since web-based applications are available internationally, it is tempting to conduct usability tests online, without incurring the complexity and cost of bringing participants to a lab. This makes it possible to have larger numbers of participants with more diverse backgrounds, and may add to the realism since participants do their tests in their own environments, using their own equipment.

- ***Can-you-break-this tests***. 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. This destructive testing approach, in which the users try to find fatal flaws in the system or otherwise destroy it, has been used in other projects and should be considered seriously.

4a. Explain the advantages of WYSIWYG word processor (10M)

Ans.

• *Users see a full page of text.* Showing 20 to 60 lines of text simultaneously gives the reader a clearer sense of context for each sentence, while permitting easier reading and scanning of the document. By contrast, working with the one line view offered by line editors is like seeing the world through a narrow cardboard tube. Modern displays can support two or more full pages of text, set side by side.

• *The document is seen as it will appear when printed.* Eliminating the clutter of formatting commands also simplifies reading and scanning of the document. Tables, lists, page breaks, skipped lines, section headings, centred text, and figures can be viewed in their final form. The annoyance and delay of debugging the format commands are almost eliminated because the errors are usually immediately apparent.

• *Cursor action is visible.* Seeing an arrow, underscore, or blinking box on the screen gives the operator a clear sense of where to focus attention and to apply action.

• *Cursor motion is natural.* Arrow keys or cursor-motion devices-such as a mouse, trackpad, or tablet-provide natural physical mechanisms for moving the cursor. This setup is in marked contrast to commands, such as UP

6,that require an operator to convert the physical action into a correct syntactic form that may be difficult to learn and hard to recall, and thus may be a source of frustrating errors.
• *Labelled icons make frequent actions rapid.* Most word processors have labelled icons in a toolbar for frequent actions. These buttons act as a permanent menu-selection display to remind users of the features and to enable rapid selection.
• *Immediate display of the results of all action.* When users press a button to move the cursor or centre text, the results are shown immediately on the screen. Deletions are apparent immediately: the character, word, or line is erased, and the remaining text is rearranged. Similarly, insertions or text movements are shown after each keystroke or function-key press. In contrast, with line editors, users must issue print or display commands to see the results of changes.
• *Rapid response and display.* Most display editors operate at high speed; a full page of text appears in a fraction of a second. This high display rate, coupled with short response time, produces a satisfying sense of power and speed. Cursors can be mewed quickly, large amounts of text can be scanned rapidly, and the results of actions can be shown almost instantaneously. Rapid response also reduces the need for additional commands and thereby simplifies design and learning.
• *Easily reversible actions.* When users enter text, they can repair an incorrect keystroke by merely backspacing and retyping. They can make simple changes by moving the cursor to the problem area and inserting or deleting characters, words, or lines. A useful design strategy is to include natural inverse actions for each action (for example, to increase or decrease type sizes). An alternative offered by many display editors is a simple undo action to return the text to the state that it was in before the previous action. Easy reversibility reduces user anxiety about making a mistake or destroying the file.

4b. Discuss about the combination of multiple menus.(10M)

Ans.

- Menus can be combined in linear series or presented simultaneously.

1 Linear menu sequences and simultaneous menus

- **Linear**
  - Guide the user through complex decision-making process.
  - E.g. cue cards or "Wizards"
  - Effective for novice users performing simple tasks
- **Simultaneous**
  - Present multiple active menus at the same time and allows users to enter choices in any order.

.2 Tree-structured menus

- Designers can form categories of similar items to create a tree structure
  - E.g., fonts, size style, spacing
- Fast retrieved if natural and comprehensive
- Use terminology from the task domain
- Expanding menus maintain the full context of each choice
  - E.g., Windows Explorer

.3 Menu maps

- Menu maps can help users stay oriented in a large menu tree
- Effective for providing overviews to minimize user disorientation.

.4 Acyclic and cyclic menu networks

- Useful for
- Social relationships
- Transportation routing
- Scientific-journal citations
- Can cause confusion and disorientation.

5a. Discuss command Language strategies and structure.(10M)

Ans. Strategies

- Several strategies for command organization have emerged. A unifying interface concept or metaphor aids learning, problem solving, and retention.

- Electronic-mail enthusiasts conduct lively discussions about the metaphoric merits of such task-related objects as file drawers, folders, documents, memos, notes, letters, or messages.
- The appropriate interface actions (CREATE, EDIT, COPY, MOVE, DELETE) and the choice of action pairs such as LOAD/SAVE (too much in the computer domain), READ/WRITE (acceptable for letters, but awkward for file drawers), or OPEN/CLOSE (acceptable for folders, but awkward for notes).

- Designers often err by choosing a metaphor closer to machine domain than to the user's task domain.
    - **Simple command set**
        - Each command is chosen to carry out a single task. The number of commands match the number of tasks.
        - For small number of tasks, this can produce a system easy to learn and use.
        - E.g. the vi editor of Unix.
    - **Command plus arguments/options**
        - Follow each command by one or more arguments that indicate objects to be manipulated, e.g.
            - COPY FILEA, FILEB
            - DELETE FILEA
            - PRINT FILEA, FILEB, FILEC
        - Keyword labels for arguments are helpful for some users, e.g. COPY FROM=FILEA TO=FILEB.
        - Commands may also have options to indicate special cases, e.g.:
            - PRINT/3,HQ FILEA
            - PRINT (3, HQ) FILEA
            - PRINT FILEA -3, HQ

            to produce 3 copies of FILEA on the printer in the headquarters building.
        - Error rates and the need for extensive training increase with the number of possible options.
    - **Hierarchical command structure**
        - In the third option, the set of commands is organized into a tree structure, like a menu tree. The first level might be the command action, the second might be an object argument, and the third might be a destination argument:

Action	Object	Destination
CREATE	File	File
DISPLAY	Process	Local printer
REMOVE	Directory	Screen
COPY		Remote printer
MOVE		

Structure

- Human learning, problem solving, and memory are greatly facilitated by meaningful structure.
- Meaningful structure is beneficial for *task concepts*, and *syntactic* details of command languages.
- **Consistent argument ordering**: Several studies have shown that there are benefits associated with using a ***consistent*** order for arguments. For example, when presented

with commands with ***inconsistent*** and consistent argument ordering, users performed significantly faster with the consistent argument ordering.

Inconsistent	**order of argument**	**Consistent order of arguments**	
SEARCH	file no, message id	SEARCH	message id, file no
TRIM	message id, segment size	TRIM	message id, segment size
REPLACE	message id, code no	REPLACE	message id, code no
INVERT	group size, message id	INVERT	message id, group size

- **Symbol versus keywords:** Command structure affects performance

Symbol editor	Keyword editor
FIND: /TOOTH/; -1	BACKWARD TO "TOOTH"
LIST; 10	LIST 10 LINES
RS: / KO / , / OK/;*	CHANGE ALL "KO" TO "OK"

5b. Briefly explain about naming and abbreviations. (10M)

Ans.

Naming and Abbreviations

- There is often a lack of consistency or obvious strategy for construction of command abbreviations.
- Abbreviations, shortcut and function keys, special characters, and more fill the lexicon of knowledge intermittent to expert users.
- In Unix, such as mkdir (make directory), cd (change directory), ls (list directory)

.1 Specificity versus generality

- Names are important for learning, problem solving, and retention over time.
- When it contains only a few names, a command set is relatively easy to master;
- *Specific* terms can be more descriptive than general ones are, and if they are more distinctive, they may be more memorable. *General* terms may be more familiar and therefore easier to accept. Two weeks after a training session with 12 commands, subjects were more likely to recall and recognize the meanings of specific commands than those of general commands
- Two of the commands-the commands for inserting and deleting text-are shown here in all seven versions:

Infrequent, discriminating words	insert	delete
Frequent, discriminating words	add	remove
Infrequent, non discriminating words	amble	perceive
Frequent, non discriminating words	walk	view
General words (frequent, non discriminating)	alter	correct
Non discriminating non words (nonsense)	GAC	MIK
Discriminating non words (icons)	abc-adbc	abc-ab

- The "infrequent, discriminating" command set resulted in faster learning and superior recall than did other command sets. The general words were correlated with the lowest performance. The nonsense words did surprisingly well, supporting the possibility that, with small command sets, distinctive names are helpful even if they are not meaningful.

.2 Abbreviation strategies

- Even though command names should be meaningful for human learning, problem solving, and retention, they must satisfy another important criterion: They must be in harmony with the mechanism for expressing the commands to the computer.
- The phenomenon of preferring to use the full command name also apperred in our study of bibliographic retrieval.
- Novices preferred typing the full name, such as BROWSE or SELECT, rather than the tradition four-letter abbreviations BRWS or SLCT.
- Efforts have been made to find optimal abbreviation strategies.
- Here are six potential strategies

    - *Simple truncation*: The first, second, third, etc. letters of each command.
    - *Vowel drop with simple truncation:* Eliminate vowels and use some of what remains.
    - *First and last letter*: Since the first and last letters are highly visible, use them.
    - *First letter of each word in a phrase*: Use with a hierarchical design plan.
    - Standard abbreviations from other contexts: Use familiar abbreviations such as QTY for quantity, PRT for PRINT.
    - *Phonics*: Focus attention on the sound. For example, uses XQT for execute.

.3 Guidelines for using abbreviations

1. 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.
2. Abbreviations generated by the secondary rule should have a marker (for example, an asterisk) incorporated in them.
3. The number of words abbreviated by the secondary rule should be kept to a minimum.
4. Users should be familiar with the rules used to generate abbreviations.
5. 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.
6. Fixed-length abbreviations should be used in preference to variable-length ones.
7. Abbreviations should not be designed to incorporate endings (ING, ED, s).
8. Unless there is a critical space problem, abbreviations should not be used in messages generated by the computer and read by the user.

.4 Command menus and keyboard shortcuts

- To relieve the burden of memorization of commands, some designers offer users brief prompts of available commands, in a format called a *command menu*. For example, the text-only web browser called lynx displays this prompt
  - H)elp O)ptions P)rint G)o M)ain screen Q)uit
    I=search [delete]=history list
- **Command-language guidelines.**

- Create explicit model of objects and actions.
- Choose meaningful, specific, distinctive names.
- Try to achieve hierarchical structure.
- Provide consistent structure (hierarchy, argument order, action-object).
- Support consistent abbreviation rules (prefer truncation to one letter).
- Offer frequent users the ability to create macros.
- Consider command menus on high-speed displays.
- Limit the number of commands and ways of accomplishing a task.

6a. List and explain the seven types of interaction task used for pointing devices. (8M)

Ans. 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.

6b. Write short notes on:

i) Keyboard Layout (6M)

- The Smithsonian Nation Museum of American History in Washington D.C. has a remarkable exhibit on the development of typewriter.
- At the middle of 19th century, many attempts were made to build typewriters.
- *Qwerty layout* was much suitable for finger travel distains, hence became the widespread standard.
- The development of electronic keyboards eliminated the mechanical problems of typewriters and led to the twentieth-century with new Dvorak layout. This could increase the typing rate of expert typists from about 150 words per minute to 200 words and reduced errors.
- The failure of this, is due to the effort required to learn a new, non-standarad interface.

- The Third keyboard layout is ABCDE style has 26 letters of English alphabet in order.
- Non-typists can easily locate letters. No advantage for ABCDE style, users with little QWERTY experience are eager to acquire but latter lost interest.
- Number pads are still controversial,
- Telephones use 1-2-3 keys on top row, but calculators place 7-8-9 keys on the top rows.
- Studies have shown the advantage of the telephone layout, but most keyboards use the calculator layout.
- Some researchers have recognized that the wrist and hand placement required for standard keyboards is awkward and have proposed ergonomic keyboard.

QWERTY layout

- 1870
- Christopher Latham Sholes
- good mechanical design and a clever placement of the letters that slowed down the users enough that key jamming was infrequent
- put frequently used letter pairs far apart, thereby increasing finger travel distances

Dvorak layout

- 1920
- reduces finger travel distances by at least one order of magnitude
- Acceptance has been slow despite the dedicated efforts of some devotees
- it takes about 1 week of regular typing to make the switch, but most users have been unwilling to invest the effort

ABCDE style

- 26 letters of the alphabet laid out in alphabetical order nontypists will find it easier to locate the keys

Additional keyboard issues

- IBM PC keyboard was widely criticized because of the placement of a few keys
    - backslash key where most typists expect SHIFT key
    - placement of several special characters near the ENTER key
- Number pad layout
- wrist and hand placement

ii) Voice Information System (6M)

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

7a. Explain the basis for preparing error messages. (10M)

Error Messages

- Error messages are key part of an overall interface design strategy of guidance for the user. The strategy should ensure integrated, coordinated error messages that are consistent across one or multiple applications.
- Avoid
  - imperious tone that condemns user
  - messages that are too generic (e.g. WHAT? or SYNTAX ERROR)
  - messages that are too obscure (e.g. FAC RJCT 004004400400)

.1 Specificity

- Messages that are too general make it difficult for the novice to know what has gone wrong. Simple and condemning messages are frustrating because they provide neither enough information about what has gone wrong nor the knowledge to set things right. The right amount of specificity therefore is important.

3 User-centered phrasing

Suggests user controls the interface, initializing more than responding

User should have control over amount of information system provides e.g. screen tips; a help button for context-sensitive help or an extensive online user manual

Telephone company, "We're sorry, but we are unable to complete your call as dialed. Please hang up, check your number, or consult the operator for assistance", versus "Illegal telephone number. Call aborted. Error number 583-2R6.9. Consult your user manual for further information.'

- **Appropriate physical format**

use uppercase-only messages for brief, serious warnings

avoid code numbers; if required, include at end of message

debate over best location of messages. E.g. Could be:

- near where problem arose
- placed in consistent position on bottom of screen
- near to, but not obscuring relevant information

Poor	Better
SYNTAX ERROR	Unmatched left parenthesis
ILLEGAL ENTRY	Type first letter: **S**end, **R**ead, or **D**rop
INVALID DATA	Days range from 1 to 31
BAD FILE NAME	File names must begin with a letter

11.2.2 Constructive guidance and positive tone

- Messages should, where possible, indicate what users should do to correct the problem.
- Unnecessarily hostile messages using violent terminology can disturb non-technical users:
  - FATAL ERROR, RUN ABORTED
  - CATASTROPHIC ERROR: LOGGED WITH OPERATOR
  - Negative terms such as ILLEGAL, ERROR, INVALID, BAD should be eliminated or used infrequently

- audio signals useful, but can be embarrassing - place under user control

- Development of effective messages
  - Messages should be evaluated by several people and tested with suitable participants
  - Messages should appear in user manuals and be given high visibility
  - Users may remember the one time when they had difficulties with a computer system rather than the 20 times when everything went well
- Recommendations
    - Increase attention to message design
    - Establish quality control
    - Develop guidelines
        - Have a positive tone
        - Be specific and address the problem in the user's terms
        - Place the users in control of the situation
        - Have a neat, consistent, and comprehensible format
    - Carry out usability test
    - Collect user performance data

7b. Write briefly about coordinating multiple windows supported by interface developers. (10M)

Ans

- Designers may break through to the next generation of window managers by developing coordinate windows, in which windows appear, change contents, and close as a direct result of user actions in the task domain
- Such sequences of actions can be established by designers, or by users with end-user programming tools
- A careful study of user tasks can lead to task-specific coordinations based on sequences of actions
- Important coordinations:
    1. **Synchronized Scrolling**: A simple coordination is synchronized scrolling, in which the scroll bar of one window is coupled to another scroll bar, and action on one scroll bar causes the other to scroll the associated window contents in parallel. This technique is useful for comparing two versions of a program or document. Synchronization might be on a line-for-line basis, on a proportional basis, or keyed to matching tokens in the two windows.

2. **Hierarchical browsing**. Coordinated windows can be used to support hierarchical browsing. For example, if one window contains a book's table of contents, selection of a chapter title by a pointing device should lead to the display, in an adjoining window, of the chapter contents. Hierarchical browsing was nicely integrated in Windows Explorer to allow users to browse hierarchical directories, in Outlook and in many other applications.

3. **Opening/closing of dependent windows**. An option on opening a window might be to simultaneously open dependent windows in a nearby and convenient location. For example, when users are browsing a program, if they open a main procedure, the dependent set of procedures could open up automatically.

4. **Saving/opening of window state.** A natural extension of saving a document or a set of preferences is to save the current state of the display, with all the windows and their contents. This feature might be implemented by the simple addition of a "Save screen as... " menu item to the "File" menu of actions.

5. **Tabbed browsing:** Browser tabs allow you to view multiple web pages in the same browser without the need to open a new browser session.

6. **Tiled windows:** Windows can automatically be resized and arranged so that they do not overlap each other.

7. **Ribbon interface:** The Microsoft office interface is designed to make it easier for users to find the features they need to get their work done.

8a. Write the disadvantages of reading from display (06M)

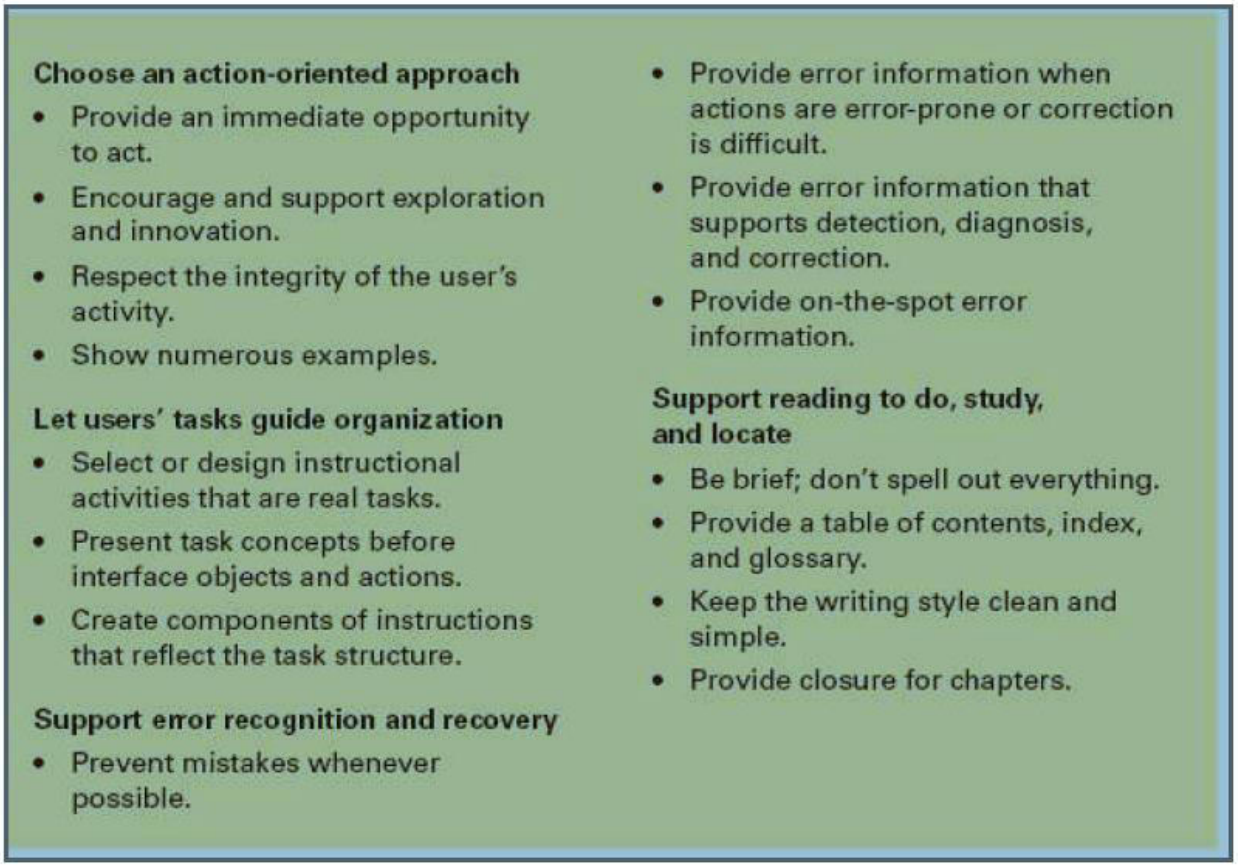
Potential Disadvantages in Reading from Displays:

- *Fonts* may be poor, especially on low-resolution displays. The dots composing the letters may be so large that each is visible, making users expend effort to recognize characters.
- *Low contrast* between the characters and the background and *fUZZY character boundaries* also can cause trouble.
- *Emitted light* from displays may be more difficult to read by than reflected light from paper
- *Small displays* require frequent *page turning;* issuing the page-turning commands is disruptive, and the page turns are unsettling, especially if they are slow and visually distracting.
- *Reading distance* is easily adjustable for paper, while most displays are *fixed* in place, and display *placement* may be too high for comfortable reading

- *Layout and formatting* can be problems-for example, improper margins, inappropriate line widths (35 to 55 characters is recommended)
- *Reduced hand and body motion* with fixed-position displays, as compared to paper, may be more fatiguing.
- *Unfamiliarity of displays* and the *anxiety* of navigating the text can increase stress.

8b. Explain about shaping the content of the documentation. (10M)

- Traditionally, training and reference material often written by junior member of development team
  - manuals were often poorly written
  - were not suited to the background of the users
  - were delayed or incomplete
  - were not tested adequately
- The benefits of well-designed manuals include shorter learning times, better user performance, increased user satisfaction, and few calls for support



Choose an action-oriented approach

- Provide an immediate opportunity to act.
- Encourage and support exploration and innovation.
- Respect the integrity of the user's activity.
- Show numerous examples.

Let users' tasks guide organization

- Select or design instructional activities that are real tasks.
- Present task concepts before interface objects and actions.
- Create components of instructions that reflect the task structure.

Support error recognition and recovery

- Prevent mistakes whenever possible.
- Provide error information when actions are error-prone or correction is difficult.
- Provide error information that supports detection, diagnosis, and correction.
- Provide on-the-spot error information.

Support reading to do, study, and locate

- Be brief; don't spell out everything.
- Provide a table of contents, index, and glossary.
- Keep the writing style clean and simple.
- Provide closure for chapters.

1 Towards minimal manuals

Minimal manuals encourage active involvement with hands-on experiences

Carroll's *guided exploration*

- choose an action-oriented approach
- anchor the tool in the task domain
- support error recognition and recovery
- support reading to do, study, and locate

- Show numerous well-chosen screen prints that demonstrate typical uses (*predictive model*)
- Table of contents and index required
- Glossaries for clarifying technical terms
- Appendices for error messages

2 Organization and writing style

Precise statement of educational objectives
Present concepts in a logical sequence with increasing order of difficulty
Ensure that each concept is used in subsequent sections
Avoid forward references
Construct sections with approximately equal amounts of new material
Need sufficient examples and complete sample sessions
Choice of words and phrases important
Style guides for organizations attempt to ensure consistency and high quality
Writing style should match users' reading ability

8c. Write short notes on online documentation. (4M)

- Online Manuals
    - Reproduction of printed manuals online
        - paper page layouts may not convert well
        - dealing with figures problematic
        - attractive if users have large enough display (full page)
        - close match between printed and online versions useful
- Enhanced by special online features
        - string search
        - multiple indices
        - multiple tables of contents
        - tables of figures
        - electronic bookmarks
        - electronic annotations
        - hypertext traversal
        - automatic history keeping
- Most effective if manuals redesigned to fit electronic medium to take advantage of
    - multiple windows
    - text highlighting
    - color

    - sound
    - animation
    - string search with relevance feedback
- Properly designed table of contents that can remain visible to side of text page vital
- Novices need tutorials
- Intermittent knowledgeable users can handle concise descriptions of interface syntax and semantics
- Keyword lists improved by clustering into meaningful categories