CHAPTER 5: Direct Manipulation and Virtual Environments

Examples of Direct-Manipulation Systems: Command line vs. display editors and word processors

WYSIWYG: what you see is what you get.

The advances of WYSIWYG word processors:

- ✓ Display a full page of text
- ✓ Show & control cursor action
- ✓ Display of the document
- ✓ Display of the results of an action immediately

Discussion of Direct Manipulation: Problems with direct manipulation

1. High-level flowcharts and database-schema can become confusing
2. The visual representation may be misleading
3. Designs may force valuable information off of the screen
4. Users must learn the graphical representations
5. Typing commands with the keyboard may be faster

Interface-Building Tools .Visual Thinking and Icons

* The visual nature of computers can challenge the first generation of hackers
* An icon is an image, picture, or symbol representing a concept
* Icon-specific guidelines

1. Represent the object or action in a familiar manner
2. Limit the number of different icons
3. Ensure a selected icon is visible from unselected icons
4. Make icons stand out from the background
5. Add detailed information
6. Design the movement animation
7. Explore combinations of icons to create new objects or actions
8. Consider three-dimensional icons

3D Interfaces: Features for effective 3D

- ✓ Use occlusion, shadows, perspective, and other 3D techniques
- ✓ Avoid unnecessary visual clutter
- ✓ Minimize the number of navigation steps
- ✓ Enable users to construct visual groups to support spatial recall.
- ✓ Organize groups of items in aligned structures to allow rapid visual search.
- ✓ Keep text readable
- ✓ Simplify user movement
- ✓ Prevent errors.
- ✓ Simplify object movement

Teleoperation

Two "parents": direct manipulation in personal computers and process control in complex environments

1. Physical operation is remote
2. Complicating factors in the architecture of remote environments:

✓ Incomplete feedback	✓ Unanticipated interferences
✓ Time delays 1.Transmission delays 2.Operation delays	✓ Feedback from multiple sources

Virtual and Augmented Reality: Virtual reality breaks the physical limitations of space and allow users to act as though they were somewhere else

- ❖ Augmented reality shows the real world with an overlay of additional overlay
- ❖ Situational awareness shows information about the real world that surrounds you by tracking your
- ❖ Movements in a computer model
- ❖ Augmented reality is an important variant
- ❖ Successful virtual environments depend on the smooth integration of:

1. Visual Display
2. Head position sensing
3. Hand-position sensing
4. Force feedback
5. Sound input and output
6. Cooperative and competitive virtual reality

WEEK 7-CHAPTER 7: Command and Natural Languages

The Basic Goals of Language Design

1. Precision
2. Speed in learning
3. Ease in writing and reading
4. Compactness
5. Simplicity to reduce errors
6. Ease of retention over time

Higher-Level Goals of Language Design

- Compatibility
- Flexibility
- Visual appeal
- Expressiveness to encourage creativity
- Close correspondence between reality and the notation

Functionality to Support User's Tasks. Users do wide range of work:

- ❖ text editing
- ❖ electronic mail
- ❖ financial management
- ❖ airline or hotel reservations
- ❖ inventory
- ❖ manufacturing process control
- ❖ Gaming

Designers should

- ✓ determine functionality of the system
- ✓ represent low-level interface syntax
- ✓ create a list of task actions and objects
- ✓ create a table of user communities and tasks
- ✓ evaluate destructive
- ✓ identify error conditions and prepare error messages
- ✓ allow shortcuts for expert users
- ✓ determine hierarchy of importance of user communities

Six Potential Abbreviation Strategies

1. **Simple truncation**
2. **Vowel drop with simple truncation**
3. **First and last letter**
4. **Phonics: Focus attention on the sound.**
5. **First letter of each word in a phrase: Use with a hierarchical**
6. **Standard abbreviations from other contexts: Use familiar abbreviations.**

Natural Language in Computing

- ❖ **Natural-language interaction**
- ❖ **Text-database searching**
- ❖ **Natural-language text generation**
- ❖ **Adventure games and instructional systems**
- ❖ **Natural-language queries and question answering**

WEEK 9 CHAPTER 6: Menu Selection, Form Fill-In, and Dialog Boxes

The primary goal for menu, form fill-in, and dialog-box designers is to create a sensible, comprehensible, memorable, and convenient organization relevant to the user's task.

Single Menus

- **Binary Menus (**Mnemonic letters – Radio Buttons – Button Choice)
- **Multiple-item Menus**
- **Multiple-selection menus or check boxes**
- **Pull-down, pop-up, and toolbar menus**

Pull-down menus: Always available to the user by making selections on a top menu bar EX(Key board shortcuts - Toolbars, iconic menus, and palletes).Appear on a display in response to a check or tap with a pointing device.

- **Menus for long list (**Scrolling menus, combo boxes, and fisheye menus - Sliders and alpha sliders – Two-dimensional menus)
- **Embedded menus and hotlinks.** Allow users reading about people, place.

Combination of multiple menus

- **Menu Maps**
- **Linear menu sequences and simultaneous menus**
- **Tree-structured menus**
- **Acyclic and Cyclic Networks**

Linear: Guide the user through complex decision-making process (Ex: Wizards)
Simultaneous: Present multiple active menus at the same time and allows users to enter choices in any order.

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

Content Organization

1. **Task-related grouping in tree organization**
2. **Item Presentation Sequence**
3. **Menu layout**

- **Titles:** For single menus, use a simple descriptive title. For tree-structured menus, use the exact same words in the higher-level menu items as in the titles for the next lower-level menu)
- **Techniques**
- **Graphic layout and design**
- **Establish guidelines for consistency of at least these menu components:**
  - ❖ Titles
  - ❖ Item placement
  - ❖ Instructions
  - ❖ Status reports
  - ❖ Error messages

Fast Movement through Menus (Keyboard shortcuts)

Data Entry with Menus: Form Fill-in, Dialog Boxes, and Alternatives

- **Form Fill-in**
- **Format-specific field**
- **Novel design combining menus and direct manipulation**
- **Dialog Boxes**

a) Internal layout (Meaningful title-Standard buttons-Top-left to bottom-right sequencing)
b) External Relationship (Size small - Easy to make disappear - Clear how to complete/cancel)

Week10 CHAPTER 10: Quality of Service

Models of response-time impacts

- **Response time: The number of seconds it takes from the moment users initiate an activity until the computer presents results on the display.**
- **User think time: The number of seconds the user thinks before entering the next action.**
- **Designers of response times and display rates in HCI must consider:**

- **cost**
- **task complexity**
- **user expectations**
- **error handling procedures**
- **error rates**
- **speed of task performance**
- **complex interaction of technical feasibility**

- **Overall majority of users prefer rapid interactions**
  - **Lengthy response times (15 seconds) are detrimental to productivity**
  - **Rapid response times (1 second or less) are preferable, but can increase errors for complex tasks**
- **Display Rate**
- **Reading textual information from a screen**
- **Cognitive human performance**
- **Limitations of short-term and working memory**

- **Any cognitive model must emerge from an understanding of human problem-solving abilities**
- **Magic number seven - plus or minus two**
  - **The average person can rapidly recognize seven chunks of information at a time**
  - **This information can be held for 15 to 30 seconds in short-term memory**
  - **Size of the chunks depends on the person' s familiarity with the material**
- **Short-term memory and working memory are used in conjunction for processing information and problem solving**
  - **Short-term memory processes perceptual input**
  - **Working memory generates and implements solutions**
- **People learn to cope with complex problems by developing higher-level concepts using several lower-level concepts brought together into a single chunk**
- **Short term and working memory are highly volatile**
  - **Disruptions cause loss of memory**
  - **Delays require that memory be refreshed**

- **Source of errors**
- **Conditions for optimum problem solving**
  - **Longer response time causes uneasiness in the user because the penalty for error increases.**
  - **Shorter response time may cause the user to fail to comprehend the presented materials.**
  - **Progress indicators shorten perceived elapsed time and heighten.**

Summary

– Users pick up the pace of the system to work more quickly with shorter response time

– Higher throughput of work demands more attention must be paid to minimizing the cost of delay of error recovery

Week11 CHAPTER 11: Balancing Function and Fashion

Error messages

• **Phrasing of error messages or diagnostic warnings is critical, especially when dealing with novices**		
• **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)**		
• **Specificity**	• **User-centered phrasing**	• **Appropriate physical format**
• **Development of effective messages**	• **Constructive guidance and positive tone**	

Display design

- **Effective display designs must provide all the necessary data in the proper sequence to carry out the task:**
- **Mullet and Sano's categories of design principles:**
  – **Elegance and Simplicity (unity, refinement and fitness)**
  – **Scale, Contrast, and Proportion (clarity, harmony, activity, and restraint)**
  – **Organization and Visual Structure (grouping, hierarchy, relationship, and balance)**
  – **Module and Program (focus, flexibility, and consistent application)**
  – **Image and Representation (immediacy, generality, cohesiveness, and characterization)**
  – **Style (distinctiveness, integrity, comprehensiveness, and appropriateness)**
- **Field layout**
  - Blank spaces and separate lines can distinguish fields.
  - Names in chronological order, alignment of dates, familiar date separators.
  - Labels are helpful for all but frequent users.
  - Distinguish labels from data with case, boldfacing, etc.
  - If boxes are available they can be used to make a more appealing display, but they consume screen space.
  - Specify the date format for international audiences
  - Other coding categories – background shading, color, and graphic icons
- **Empirical results**
  – structured form superior to narrative form
  – improving data labels, clustering related information, using appropriate indentation and underlining, aligning numeric values, and eliminating extraneous characters improves performance
  – performance times improve with fewer, denser displays for expert users
  – screen contents should contain only task-relevant information
  – consistent location, structure, and terminology across displays important
  – sequences of displays should be similar throughout the system for similar tasks
  – sequences of displays should be similar throughout the system for similar tasks
- **Display-complexity metrics**

Although knowledge of the users' tasks and abilities is key to designing effective screen displays, objective and automatable metrics of screen complexity are attractive aids

- **Tullis (1997) developed four task-independent metrics for alphanumeric displays:**

✓ **Overall Density** ✓ **Local Density** ✓ **Grouping** ✓ **Layout Complexity**

Web page design

Top Ten Mistakes

1. Burying information too deep in a web site
2. Overloading pages with too much material
3. Providing awkward or confusing navigation
4. Putting information in unexpected places on the page
5. Not making links obvious and clear
6. Presenting information in bad tables
7. Making text so small that many users cannot read it
8. Using color combinations for text that many users cannot read
9. Using bad forms
10. Hiding (or not providing) features that could help users

Window design

1) **Image browsing**

The design of image browsers should be governed by the users' tasks, which can be classified as follows:

- Image generation
- Navigation
- Open-ended exploration
- Monitoring
- Diagnostics
-

2) **Personal role management**

A role centered design emphasizes he users' takes rather than the applications and documents

- **Vision statement**
- **Set of documents**
- **Set of people**
- **Schedule**
- **Task hierarchy**

Color: Color can

• **Soothe or strike the eye**	• **Add accents to an uninteresting display**
• **Draw attention to warnings**	• **Emphasize the logical organization of information**
• **Facilitate subtle discriminations in complex displays**	• **Evoke string emotional reactions of joy, excitement, fear, or anger**

Guidelines of color

- **Use color conservatively**
- **Color can help in formatting**
- **Be consistent in color coding**
- **Design for monochrome first**
- **Limit the number and amount of colors**
- **Be alert to problems with color pairings**
- **Use color changes to indicate status changes**
- **Use color in graphic displays for greater information density**
- **Color coding should support the task**
- **Consider the needs of color-deficient users**
- **Color coding should appear with minimal user effort**
- **Color coding should be under user control**
- **Recognize the power of color to speed or slow tasks**
- **Be alert to common expectations about color codes**

Week12CHAPTER 8: Interaction Devices

❖ Keyboard Layouts

• **QWERTY layout:** put frequently used letter pairs far apart, thereby increasing finger travel distances

• **Dvorak layout:** reduces finger travel - it takes about 1 week of regular typing to make the switch

• **ABCDE style:** 26 letters of the alphabet laid out in alphabetical order nontypists will find it easier to locate the keys

Keys

- 1/2 inch square keys	- matte finish to reduce glare finger slippage
- 1/4 inch spacing between keys	- tactile and audible feedback important
- slight concave surface	- 40- to 125-gram force to activate
- 3 to 5 millimeters displacement	- key labels should be large, meaningful, permanent
- certain keys should be larger (e.g. ENTER, SHIFT, CTRL)	
- some keys require state indicator, such as lowered position or light indicator (e.g. CAPS LOCK)	
- some "home" keys may have additional features, such as deeper cavity or small raised dot, to help user locate their fingers properly (caution - no standard for this)	

• Function keys

- Users must either remember each key's function, identify them from the screen's display, or use a template over the keys in order to identify them properly
- can reduce number of keystrokes and errors
- meaning of each key can change with each application
- placement on keyboard can affect efficient use
- special-purpose displays often embed function keys in monitor bezel
- lights next to keys used to indicate availability of the function, or on/off status
- Typically simply labeled (F1, F2, etc) also have meaningful labels, such as CUT, COPY, etc.
- frequent movement between keyboard home position and mouse or function keys can be disruptive to use
- alternative is to use closer keys (e.g. ALT or CTRL) and one letter to indicate special function

• **Cursor movement keys**

- up, down, left, right
- some keyboards also provide diagonals
- best layout is natural positions
- inverted-T positioning allows users to place their middle three fingers in a way that reduces hand and finger movement
- cross arrangement better for novices than linear or box
- typically include typamatic (auto-repeat) feature
- important for form-fillin and direct manipulation
- other movements may be performed with other keys, such as TAB, ENTER, HOME, etc.

Keyboard and keypads for small devices

• Pens and touchscreens	• Cloth keyboards	• Soft keys
• Virtual keyboards	• Wireless or foldable keyboards	

Pointing Devices

Direct control devices (easy to learn and use, but hand may obscure display)

- Lightpen
- Touchscreen
- Stylus

Indirect control devices (take time to learn)

- Mouse
- Trackball
- Joystick
- Trackpoint
- Touchpad
- Graphics tablet

Non-standard devices and strategies (for special purposes)

- Multitouch tablets and displays
- Bimanual input
- Eye-trackers
- Sensors
- 3D trackers
- DataGloves
- Boom Chameleon
- Haptic feedback
- Foot controls
- Tangible user interfaces
- Digital paper

Criteria for success

- Speed and accuracy
- Efficacy for task
- Learning time
- Cost and reliability
- Size and weight

Novel devices

Foot controls	Handheld devices	Data Glove	Smart pens
Eye-tracking	Game controllers	Table top touch screens	Haptic feedback
Bimanual input	Multiple-degrees-of-freedom devices	Ubiquitous computing and tangible user interfaces	

Display technology

Monochrome displays	**Plasma panel**
RGB shadow-mask displays	**Light-emitting diodes (LEDs)**
Raster-scan cathode-ray tube (CRT)	**Electronic ink**
Liquid-crystal displays (LCDs)	**Braille displays**

WEEK 14 CHAPTER 9: Collaboration and Social Media Participation

Collaboration

Goals of Cooperation

1. Conference	2. Meeting and decision support	3. Electronic commerce
4. Telepresence	5. Structured work processes	6. Lecture or demo
7. Collaboratories	8. Tele-democracy	9. Focused partnerships
10. On-line communities		

Time/space matrix model of group-supported work