CHAPTER 3:
Guidelines, Principles, and Theories

Designing the User Interface:

Strategies for Effective Human-Computer Interaction

Sixth Edition

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Principles

- More fundamental, widely applicable, and enduring than guidelines
- Need more clarification
- Fundamental principles
  - Determine user's skill levels
  - Identify the tasks
- 5 primary interaction styles
- 8 golden rules of interface design
- Prevent errors
- Automation and human control

Determine user's skill levels

- "Know thy user"
- Age, gender, physical and cognitive abilities, education, cultural or ethnic background, training, motivation, goals and personality
- Design goals based on skill level
  - Novice or first-time users
  - Knowledgeable intermittent users
  - Expert frequent users
- Multi-layer designs

Identify the tasks

- Task Analysis usually involve long hours observing and interviewing users
- Decomposition of high-level tasks
- Relative task frequencies

	TASK				
Job Title	Query by Patient	Update Data	Query across Patients	Add Relations	Evaluate System
Nurse	**	**			
Physician	**	*			
Supervisor	*	*	**		
Appointment personnel	****				
Medical-record maintainer	**	**	*	*	
Clinical researcher			***		*
Database programmer		*	**	**	*

FIGURE 3.3

Frequency of Task By Job Title

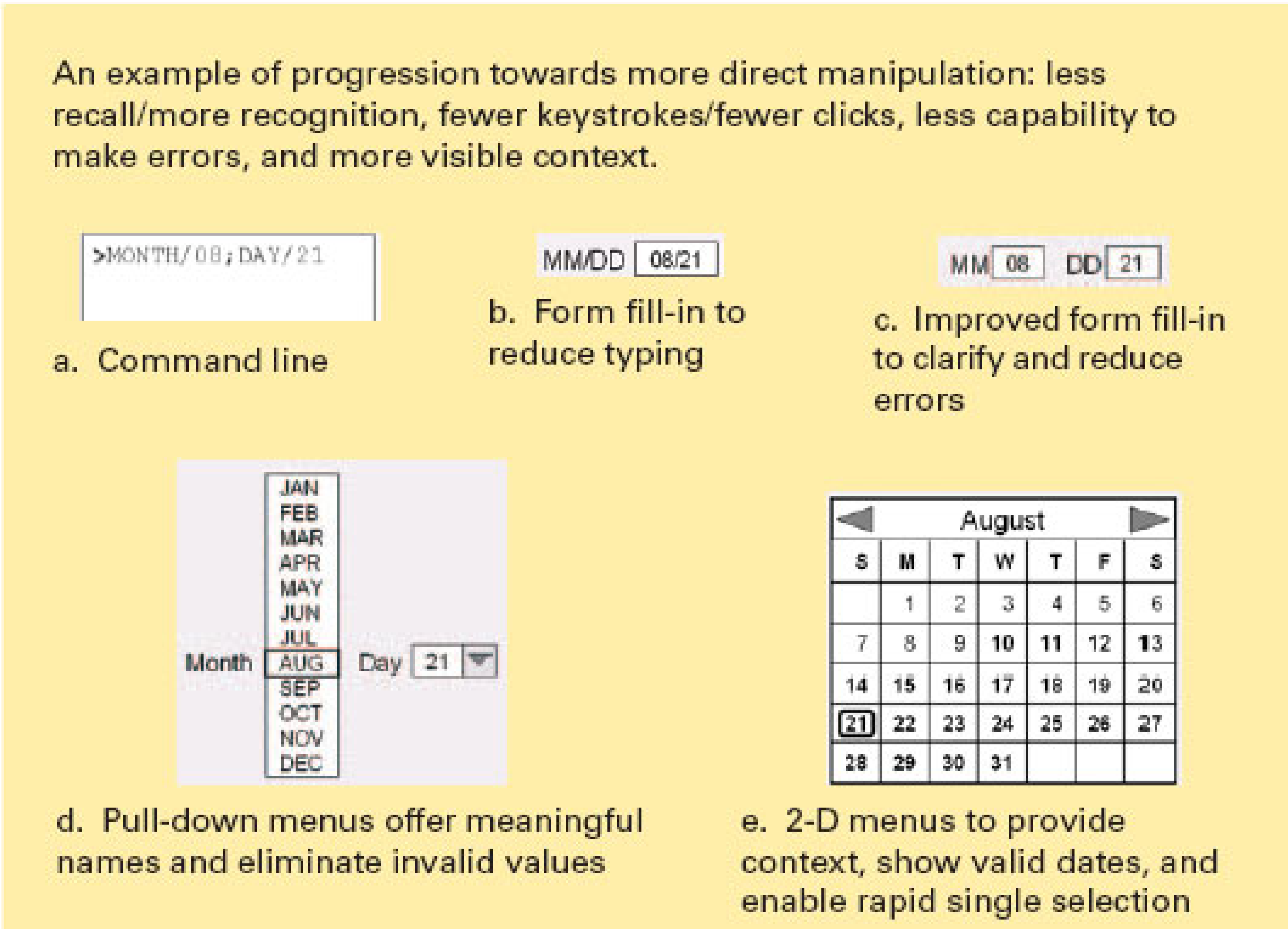
Hypothetical frequency-of-use of data for a medical clinic information system. Answering queries from appointment personnel about individual patients is the highest-frequency task (****), and lower-frequency use is shown with ***, **, or *.

Choose an interaction style

- Direct manipulation
- Menu selection
- Form fill-in
- Command language
- Natural language

Advantages	Disadvantages
Direct manipulation	
Visually presents task concepts	May be hard to program
Allows easy learning	May require graphics display and pointing devices
Allows easy retention	
Allows errors to be avoided	
Encourages exploration	
Affords high subjective satisfaction	
Menu selection	
Shortens learning	Presents danger of many menus
Reduces keystrokes	May slow frequent users
Structures decision making	Consumes screen space
Permits use of dialog-management tools	Requires rapid display rate
Allows easy support of error handling	
Form fill-in	
Simplifies data entry	Consumes screen space
Requires modest training	
Gives convenient assistance	
Permits use of form-management tools	
Command language	
Flexible	Poor error handling
Appeals to "power" users	Requires substantial training and memorization
Supports user initiative	
Allows convenient creation of user-defined macros	
Natural language	
Relieves burden of learning syntax	Requires clarification dialog
	May not show context
	May require more keystrokes
	Unpredictable

Spectrum of directness



The 8 Golden Rules of Interface Design

1. Strive for consistency
2. Cater to universal usability
3. Offer informative feedback
4. Design dialogs to yield closure
5. Prevent errors
6. Permit easy reversal of actions
7. Keep users in control
8. Reduce short-term memory load

Prevent errors

- Make error messages specific, positive in tone, and constructive
- Mistakes and slips (Norman, 1983)
- Correct actions
  - Gray out inappropriate actions
  - Selection rather than freestyle typing
  - Automatic completion
- Complete sequences
  - Single abstract commands
  - Macros and subroutines

Automation and human control

Humans Generally Better	Machines Generally Better
• Sense-making from hearing, sight, touch, etc. • Detect familiar signals in noisy background • Draw on experience and adapt to situations • Select alternatives if original approach fails • Act in unanticipated situations • Apply principles to solve varied problems • Make subjective value-based judgments • Develop new solutions • Use information from external environment • Request help from other humans	• Sense stimuli outside human's range • Rapid consistent response for expected events • Retrieve detailed information accurately • Process data with anticipated patterns • Perform repetitive actions reliably • Perform several activities simultaneously • Maintain performance over time

Automation and human control (continued)

- Successful integration:
  - Users can avoid:
    - Routine, tedious, and error prone tasks
  - Users can concentrate on:
    - Making critical decisions, coping with unexpected situations, and planning future actions

Automation and human control (continued)

- Supervisory control needed to deal with real world open systems
  - e.g. air-traffic controllers with low frequency, but high consequences of failure
  - FAA: design should place the user in control and automate only to improve system performance, without reducing human involvement

Automation and human control (continued)

- Goals for autonomous agents
  - Knows user's likes and dislikes
  - Makes proper inferences
  - Responds to novel situations
  - Performs competently with little guidance
- Tool-like interfaces versus autonomous agents

Automation and human control (continued)

- User modeling for adaptive interfaces
  - keeps track of user performance
  - adapts behavior to suit user's needs
  - allows for automatically adapting system
    - response time, length of messages, density of feedback, content of menus, order of menu items, type of feedback, content of help screens
  - can be problematic
    - system may make surprising changes
    - user must pause to see what has happened
    - user may not be able to:
      - predict next change
      - interpret what has happened
      - restore system to previous state

Automation and human control (continued)

- Alternative to agents
  - user control, responsibility, accomplishment
  - expand use of control panels
    - style sheets for word processors
    - specification boxes of query facilities
    - information visualization tools

Automation and human control (concluded)

- Users employ control panels to set physical parameters, such as the cursor blinking speed or speaker volume, and to establish personal preferences such as time/date formats, color schemes, or the content of start menus.