

CHAPTER 3:

Guidelines, Principles, and Theories

Designing the User Interface: Strategies for Effective Human-Computer Interaction

Sixth Edition

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Theories

- Beyond the specifics of guidelines
- Principles are used to develop theories
- Some theories are descriptive
 - Explanatory
 - Prescriptive
 - Predictive
- Some theories are based on human capacity
 - Motor task
 - Perceptual
 - Cognitive

Explanatory and predictive theories

- **Explanatory theories:**
 - Observing behavior
 - Describing activity
 - Conceiving of designs
 - Comparing high-level concepts of two designs
 - Training
- **Predictive theories:**
 - Enable designers to compare proposed designs for execution time or error rates

Perceptual, cognitive, and motor tasks

- **Perceptual or cognitive subtasks theories**
 - Predicting reading times for free text, lists, or formatted displays
- **Motor-task performance times theories:**
 - Predicting keystroking or pointing times

Taxonomy (explanatory theory)

- Order on a complex set of phenomena
- Facilitate useful comparisons
- Organize a topic for newcomers
- Guide designers
- Indicate opportunities for novel products

Conceptual, semantic, syntactic, and lexical model

- Foley and van Dam* four-level approach
 - *Conceptual level:*
 - User's mental model of the interactive system
 - *Semantic level:*
 - Describes the meanings conveyed by the user's command input and by the computer's output display
 - *Syntactic level:*
 - Defines how the units (words) that convey semantics are assembled into a complete sentence that instructs the computer to perform a certain task
 - *Lexical level:*
 - Deals with device dependencies and with the precise mechanisms by which a user specifies the syntax
- Approach is convenient for designers
 - Top-down nature is easy to explain
 - Matches the software architecture
 - Allows for useful modularity during design

*Computer Graphics: Principles and Practice, Third Edition

Stages of action models

- Norman's seven stages of action
 1. Forming the goal
 2. Forming the intention
 3. Specifying the action
 4. Executing the action
 5. Perceiving the system state
 6. Interpreting the system state
 7. Evaluating the outcome
- Norman's contributions
 - Context of cycles of action and evaluation.
 - *Gulf of execution*: Mismatch between the user's intentions and the allowable actions
 - *Gulf of evaluation*: Mismatch between the system's representation and the user's expectations

Stages of action models (concluded)

- Four principles of good design
 - State and the action alternatives should be visible
 - Should be a good conceptual model with a consistent system image
 - Interface should include good mappings that reveal the relationships between stages
 - User should receive continuous feedback
- Four critical points where user failures can occur
 - Users can form an inadequate goal
 - Might not find the correct interface object because of an incomprehensible label or icon
 - May not know how to specify or execute a desired action
 - May receive inappropriate or misleading feedback

Consistency through grammars

Consistent user interface goal

- Definition is elusive – multiple levels sometimes in conflict
- Sometimes advantageous to be inconsistent

Consistent	Inconsistent A	Inconsistent B
delete/insert character	delete/insert character	delete/insert character
delete/insert word	remove/bring word	remove/insert word
delete/insert line	destroy/create line	delete/insert line
delete/insert paragraph	kill/birth paragraph	delete/insert paragraph

Inconsistent action verbs

- Take longer to learn, cause more errors, slow down users, and are harder for users to remember

Contextual theories

- **Micro-HCI Theories**

- Focus on measurable performance (such as speed and errors) on multiple standard tasks taking seconds or minutes in laboratory environments
 - Design-by-levels
 - Stages of action
 - Consistency

- **Macro-HCI Theories**

- Focus on case studies of user experience over weeks and months, in realistic usage contexts with rich social engagement
 - Contextual
 - Dynamic

Contextual theories (concluded)

- User actions are situated by time and place
 - You may not have time to deal with shortcuts or device dependent syntax (such as on mobile devices) when hurried
 - Physical space is important in ubiquitous, pervasive and embedded devices, e.g. a museum guide stating information about a nearby painting
- A taxonomy for mobile device application development could include:
 - Monitor and provide alerts, e.g. patient monitoring systems
 - Gather information
 - Participate in group collaboration
 - Locate and identify nearby object or site
 - Capture information about the object and share that information