Design Guidelines, Research Methodologies, Dialogs

Design guidelines:

Xerox Star innovations

- desktop metaphor
- direct manipulation
- property options
- wysiwyg
- generic commands
- consistency
- few modes
- extensive iterative prototyping

Norman's concepts for design analysis

affordance	properties which cue intuitive uses
constraints	properties which enforce intented uses and limit errors
conceptual model	the users' construction of understanding
mapping	the programs' construction of understanding
visibility	apparentness of the mapping
feedback	apparentness of the conceptual model

Usability guidelines [Nielsen, 1994]

- visibility of system status
- match between system and world
- user control and freedom
- consistency
- error prevention
- recognition rather than recall
- flexibility and ease of use
- aesthetic and minimalist design
- help recognition and recovery from errors
- help and documentation

Design question checklist [Norman, 1988]

How easily can you:

- determine the function of the device?
- tell what actions are possible?
- determine mapping from intention to physical movement?
- perform the action?
- tell if the system is in the desired state?
- determine the mapping from system state to interpretation?
- tell what state the system is in?

Measurement:

Types of measurement

existential	(indicative)	exists or not	
categorical	(nominal)	share some property	+ attribute
ranking	(ordinal)	put in order	+ less than
discrete	(interval)	relate to integers	+ equal steps
comparative	(ratio)	relate to fractions	+ parts and zero
continuous	(real)	relate to infinite	+ compactness
complex	(imaginary)	relate to model	+ i, other unit bases

Sources of variation in measurement

true differences being measured
true differences due to some other factor
transient personal factors
situational factors
variation in administration
sampling of items and experiences
lack of clarity of measurement instrument
mechanical factors
analysis errors

Types of reliability

stability over time, individual and population (test-retest)
equivalence over instruments (split-half)
power, relationship between sample size and size of difference

Types of validity

pragmatic	does it work
construct	does it match the abstract idea
face	does it look like it is expected to (self-evident)
concurrent	does it differentiate
predictive	does it replicate

Research methodologies:

Research steps [Selltiz et al, 62]

formulate problem
    concepts and theory, working definitions, results from other studies
design study
    exploratory, descriptive, causal, before-after
collect data
analyze data
interpret results of analysis

Research strategies [McGrath, 1994]

theoretical
    formal theory

- computer simulation
- experimental
  - laboratory experiment
  - experimental simulation
- field
  - field experiment
  - field study
- respondent
  - sample survey
  - judgment study

Experimental measurement techniques [McGrath, 1994]

- self reports
- trace measures
- observations by a visible observer
- observations by a hidden observer
- public archival records
- private archival records

Data collection methods [Selltiz et al, 62]

- unstructured observation
- structured observation
- interview
- questionnaire
- projective methods
- structured disguised tests
- statistical records
- personal documents
- mass communications
- rating scales
- questions which form scales

Case study techniques

- visual specifications
- iterative design
- rapid prototyping
- behavioral analysis
- empirical evaluation

Evaluation strategies

- heuristic with usability guidelines
- cognitive walkthrough
- usability testing
- usability engineering and metrics
- controlled experiment

Interaction evaluation tools

- state transition diagrams
- statistical analysis of random samples of behavior

exhaustive tracking
protocol analysis
clinical diagnosis and remediation
controlled experiment

Modeling with Graphs

Creating and Obscuring (Winograd)
- When we construct a software tool (or a mathematical model),
- we create within our world-view:
  - a particular collection of representations
  - a blindness to everything not expressible by those representations

Putnam and Functionalism
- Functionalism: the mind is functionally equivalent to a computer
- Putnam invents (1960), then repudiates (1990)
- Why functionalism is false
  - meaning is holistic (requiring even the non-represented aspects of a situation)
  - meaning is normative (defined by context and by negotiation)
  - concepts depend on evolution (defined in historical context and always evolving)
- Basically, mental states (definable shared cognitive objects) do not exist.

State transition model
- initial state
- final state
- decision points
- rule base for decisions
- problem space is all transitions from initial to final states

Central issues for the meaning of graphs
- formal or intuitive (mathematical or mystical)
- tokens or images
- open or closed system

in/out	perturbation
representational	non-representational
functional	autonomous
formed from outside	formed from inside
integrate languages	maintain organization

- what is a node and what is a link
- what do types of nodes and links mean
- what does connectivity mean
- what is static, what is process
- what is transmitted or exchanged
- what do labels mean

Dialogue

Qualities of a conversational interaction (Nickerson)

- bidirectionality
- mixed initiative
- apparentness of who is in control
- rules for transfer of control
- sense of presence
- nonverbal communication
- intolerance of silence
- helical structure
- characteristic time scale
- wide bandwidth
- informal language
- shared situational context
- common world knowledge
- shared special knowledge
- common history
- peer status of participants

Functions of a dialog manager

- receive and interpret input signals
- filter input errors, provide debugging feedback
- initiate error correction
- negotiate between user and computation about meaning of input (accommodate)
- integrate input into internal representation (assimilate)
- bypass computational levels for efficiency and clarity
- provide explanation, advice, help, justification.

Suchman's description of human-computer interaction

- contingent on unique circumstances which cannot anticipated
- activity is always concrete and embodied
- actions are never planned but are triggered by particular concrete circumstances
- representation cannot form a basis for interaction
- interaction means mutual intelligibility and shared understanding
- representation occurs when transparent activity becomes opaque
- language is indexical, shared meaning is contextual, understanding is collaborative