Design Guidelines and Multimedia

Interaction Description Tools

dialogs and scripts

Dialog: a sequence of information tokens exchanged between two or more agents
Script: a program which controls the exchange of tokens among agents

state transition diagram

a model which maps a token and a current state to a next state
Components:
- finite number of states
- set of transitions f(current state, token) -> next state
- special state: Start
- special state(s): End

object and process graphs/hierarchies

object-oriented inheritance systems
calling sequences (functional hierarchy)
parse trees
cause and effect chains

concept modeling (entity-relation graphs)

Entities: data which represents a single person, thing, concept, idea, or event (nouns)
Relations: associations between entities, including structure and organization, constraints, and invariants. Primary examples:
- IsSameAs (equivalence)
- IsA, Generalizes (typing)
- IsPartOf, Contains (hierarchy)
- IsMemberOf (sets)

grammars

Components:
- finite set of terminal symbols, representing semantic units
- finite set of non-terminal symbols, representing sub-trees
- set of production rules defining nonterminals

Standard form: *BNF* Example:
- <integer> ::= <digit> | <digit><digit>*
- <digit> ::= 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

context-free when nonterminal substitution has no dependency on adjacent nonterminals

rules, constraints, and inference

Components: a graph with two types of nodes
- slots: types and values for the attributes of an object
- rules: a transformation which generates a slot value from other slot values

Types of rules:
- upper or lower bound constraint
- enumeration of acceptable values constraint
- procedure invocation
- selection between several slot values
- function for calculating new slot value

multiple agents and communication models

shared memory: single records with regulated access
event handlers: continuous processes which respond to input events
event executive: process which prioritizes event handling (conflict resolution)
multithreaded dialogs
petri nets (information locations, synchronized transitions, arcs)

behavior modeling

task analysis: mapping the component steps/processes in a task
protocol analysis: mapping the component activities while doing a task
self-report: end user description and narration while doing a task
clinical diagnosis and remediation: single subject trouble shooting
controlled experiment: factoring the task into manipluated and measured variables

Visual Design (Mullet and Sano, Designing Visual Interfaces)

Elegance and simplicity

Qualities
- approachability, recognizability, immediacy, usability

Principles
- unity, refinement, fitness

Common errors
- clutter and visual noise
- interference between competing elements
- using explicit structure as a crutch
- belaboring the obvious
- overly literal translation
- excessive detail and embellishment
- gratuitous dimensionality

Techniques
- reduce a design to its essence
- regularize the elements of the design
- combine elements for maximum leverage

Scale, contrast, and proportion

Qualities
contrast, proportion, differentiation, emphasis, activity, interest
Principles
clarity, harmony, activity, restraint
Common errors
insufficient contrast
excessive contrast
visual interference
spatial tension
overextension
awkward dimensions
Techniques
squint test
establish perceptual layers
sharpen visual distinctions
integrate figure and ground

Organization and visual structure

Qualities
unity, integrity, readability, control
Principles
grouping, hierarchy, relationship, balance
Common errors
haphazard layout
conflicting symmetries
ambiguous internal relationships
aligning labels but not controls
alignment within but not across controls
false structure
excessive display density
all of the above
Techniques
use symmetry to ensure balance
use alignment to establish visual relationships
optical adjustment for human vision
shape the density with negative space

Module and program

Qualities
structure, predictability, efficiency
Principles
focus, flexibility, consistent application
Common errors
arbitrary component positions

arbitrary component dimensions
random window sizes and layouts
unrelated icon sizes and imagery
inconsistent control presentations
inconsistent visual language

Techniques

reinforce structure thorough repetition
establish modular units
create grid-based layout programs

Image and representation

Qualities

identification, expression, communication

Principles

immediacy, generality, cohesiveness, characterization, communicability

Common errors

misleading syntax
poorly integrated structure
dominant secondary elements
using type as image
using images for abstract concepts
images based on obscure allusions
culture or language dependencies
offensive or suggestive imagery

Techniques

selecting the right vehicle
refinement through progressive abstraction
coordination to ensure visual consistency

Style

Qualities

emotion, connection, context

Principles

distinctiveness, integrity, comprehensiveness, appropriateness

Common errors

unwarranted innovation
combining unrelated elements
partial fulfillment
internal and external inconsistency
incompatible concepts

Techniques

mastering a style
working across styles
extending and evolving a style

Cyberspace, Hypertext and the Web (R. Horn, Information Mapping)

Paper metaphors for hypertext

- library card catalogues
- footnotes
- cross-reference
- sticky notes
- commentaries
- indexes
- quotes
- anthologies

Computer metaphors for hypertext

- linked note cards
- popup notes
- linked screens or windows
- stretch text and outlines
- semantic nets
- branching stories
- relational databases
- simulations

Hypertext Links

- *system-supplied*
  - command and control pathways
  - table of contents
  - history tracking
  - automated profiling
- *user-created*
  - detours and shortcuts
  - notes, commentary, reminders
  - analogical links
  - new text
  - links to other knowledge bases
- *author-created*
  - links to prerequisite knowledge
  - hierarchical classification
  - chronological structures

Kinds of links

hierarchical	building a tree
keyword	building an array
referential	building a pointer list
cluster	building a struct

Wayfinding in cyberspace (these don't work very well)

show all connections
go back to the beginning
show history of behavior

Node sizes

one sentence
text of arbitrary size (article, monograph)
index card size
screen size
scroll of any length
variable record sizing
variable size, precisely and flexibly chunked

Information types

structure
concept
procedure
process
classification
principle
fact

Information Blocks

chunking	small, manageable hunks (blocks, maps)
relevance	one main point per chunk, based on purpose or function to reader
consistency	similar words, labels, formats, organization
labeling	label every chunk based on specific criteria

Common types of information blocks

analogy
block diagram
checklist
classification table
classification tree
comment
cycle chart
decision table
definition
description
diagram
example
fact
flow chart
flow diagram
formula
input-procedure-output
non-example
notation
objectives
outlines
parts-function table
parts table
prerequisite
principle
procedure table
purpose
rule
stage
synonym
theorem
when to use
worksheet

Types of hypertrail, path

- prerequisite
- classification
- chronological
  - sequence of events
  - storyline
  - natural development
- geographic
- project
- structural
- decision
- definition
- example

How readers behave

- novices stop reading too soon
- novices are mislead by superficial features
- novices rarely seek non-linear information
- readers construct a hierarchical mental representation
- readers remember the top level of information better
- readers depend on repetition of keywords

Reading cues

- hierarchical text organization
- explicit transitions
- sequence signals
- contrast and similarity cues
- pronouns as cohesiveness cues
- metaphors
- content schemas

Document titles

- just right: not too general, too specific, too long, too short
- common language for the intended audience
- itemize all possible readers and use lowest common denominator
- no cuteness or silliness
- no vague, mislabeled topic headers
- same words in contents, titles, pages, and references

Virtual Reality (W. & M. Bricken)

The VR Paradigm Shift

We adapt to digital processes ==> digital processes adapt to us.

The VR shift from formalism to friendliness

physiological naturalness	responsive to human physiology
cognitive ease	responsive to human thinking patterns
environmental familiarity	transparent, responsive, interactive
whole body involvement	multisensory interface
embedded functionality	task-oriented affordances
behavioral information	spatial and experiential information

Design Paradigm Shifts (M. Bricken, No Interface to Design)

Interface to inclusion
Mechanism to intuition
User to participant
Visual to multimodal
Metaphor to virtuality

Varieties of Meaning

physical semantics:
map between digital representation and activity in the physical world
virtual semantics:
map between digital representation and perceived virtual world activity
natural semantics:
hiding the digital layer, map between physical activity and virtual consequence

Component Technologies

behavior transducers	map behavior onto computation and back
inclusive computation	software for management of environments
intentional psychology	integrate information, cognition and behavior
experiential design	unifying inclusion and intention feels good

VR functional integration of

realtime operating systems
sensor fusion
dynamic adaptive control
distributive and parallel processing
dynamic database management
coordination and communication techniques
biological/environmental modeling
physical dynamics

arbitrary interactivity
physiological and cognitive modeling
design of experience

VR operating system requirements

realtime interactive programming
multiple participants
parallel decomposition model
distributed, heterogeneous processing
arbitrary i/o mappings

System-oriented programming extends oop

Every entity is an *autonomous operating system*, controlling its own
- attributes
- resources (memory, processes, i/o)
- communication
- timing

Entities follow *biological/environmental models*, using commands such as
- enter
- perceive
- react
- persist

Spaces and environments are first-class
- behavior is situated and contextual

Viewpoint transformations

turn head
fly (interactive, 3-space functional curve, constrained pathway)
jack into location (instantly transport)
ride vehicle
inhabit
grasp world
multiple concurrent views
projection (over dimensions, abstractions)

The Wand

A position sensor on a laser pointer. The virtual form changes with function.
Viewpoint control
- sight (attach ray to head orientation)
- move faster/slower
- jack (teleport)
- scale (travel in size)

Object manipulation
- grasp
- normal (make object perpendicular to ray)
- come (bring object to participant)
- connect (construct a port on the object)
- cut (the ray is a knife)

feel (tactile feedback ray)

Information gathering

identify pointed at object
measure distance
count/compute environmental complexity

Other uses

Draw	select
light (the ray is a flashlight beam)	baton (direct sound events)

Divergent Worlds

Physical reality

Experience is unique for each person.
We perceive only instances.
Matter dictates consensus.
We negotiate differences.

Virtual reality

Form is unique for each participant.
We perceive possibilities.
Choice dictates consensus.
We negotiate communality.

Multiple participant group space

build mutual context rather than global truth
each participant is unique
credibility rather than validity
comprehension rather than consistency
inconsistency maintenance and uniqueness enforcement

VR bumper stickers

Psychology is the Physics of VR.
Our body is our interface.
Computation is in your hands.
One experience is worth a trillion bits.
The virtual is more than real.
VR is the first empirical tool of metaphysics.

Issues

ownership	information wants to be free
ethics	how is access and behavior controlled
fluid self	our virtual body is ethereal
intoxication	cognitive remodeling and dreaming in polygons
consistency	unique, private, interpenetrating worlds
post-symbolism	semantics takes a back seat
embedded virtuality	enhanced sensorium and private filters
rights of programs	self-reference and autonomy
actual or virtual	the line is very fuzzy