Notes on Psychology

Summary of design perspectives

Interface refers to the static look; interaction refers to the dynamic feel.

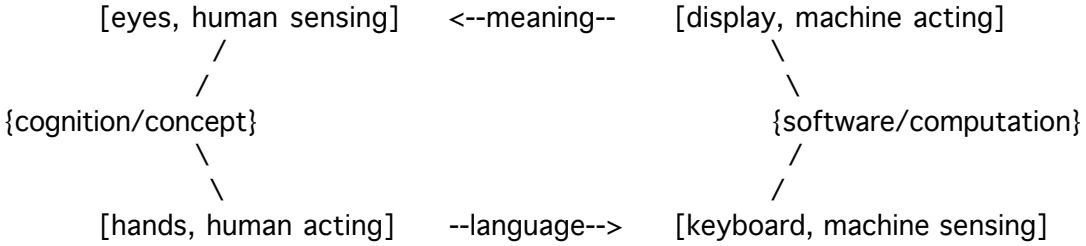
Machines are characterized by extreme similarity (replacability, predictability)
Humans are characterized by extreme uniqueness (individuality, unpredictability)
Therefore measure artifacts, but consult people.

Fundamental Principle of Design: Minimize cognitive load.
Fundamental Method of Design: Measure and modif

Generations of Interface

Year	*machine*	*substrate*	*access*	*interface*	*human activity*
1945-55	ENIAC	vacuum tube	knobs & dials	plugboard	plug wires, watch tubes
1955-65	PDP1	transistor	batch mode	countertop	punch cards, read print
1965-80	VAX	integrated circuit	timesharing	dumb terminal	type keys, read terminal
1980-90	68020	VLSI chip	menu	desktop	click mouse, watch monitor
1990-99	RISC	multimedia chip	multisensory	simulation	touch, talk, watch
2000!	parallel	array	whole body	movement	act naturally

A Simple Model of Human-Computer Interaction



Note: connections in human between sensing and acting are two-directional
connections in machine between sensing and acting are one-directional

Friendliness

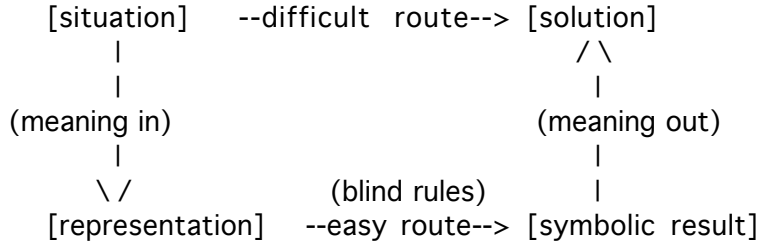
People use conceptual models to guide their actions.
These models are not necessarily symbolic or encoded.
Friendliness of an interface: the match between conceptual model and input options
common language from idea to human action to machine sensing
Friendliness of a software tool: the match between conceptual model and display output
common meaning from machine acting to human sensing to idea

Formalism

Computers use formal systems to guide their actions.
These models are necessarily symbolic and encoded.
A formal system:

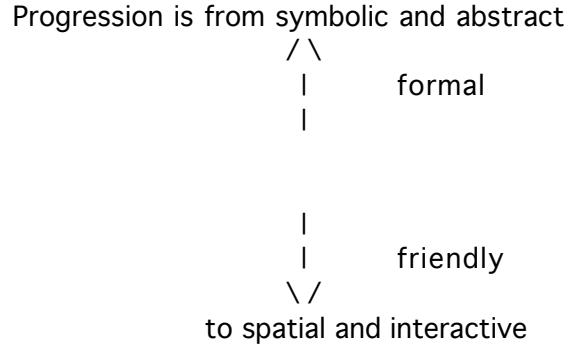
* a map between meaning and symbols that is invariant over symbol transformation
* what you do as machine input does not undermine your understanding of the output
* the software does not violate the user's model

Using a Formal System



Interaction Styles

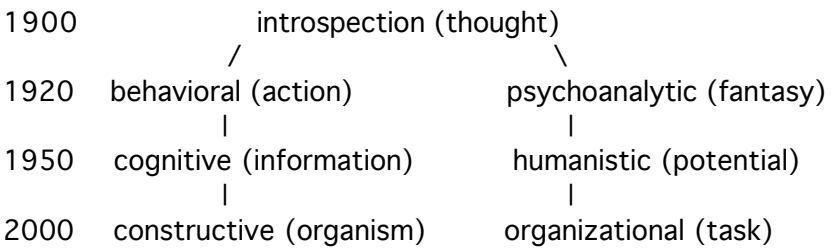
command line
programming language
semi-natural language
menu
forms
icons
windows
direct manipulation
graphical interaction
inclusion



Text, Multimedia, and VR

Property	*text*	*multimedia*	*virtual environment*
access	sequential	parallel	experiential
space	1D	2D	nD
transfer	slow	fast	immediate
representation	abstract	pictorial	as-if-real
reference	indirect	graphic	interactive
display	static	dynamic	inclusive
metaphors	symbolic	iconic	natural

Schools of Psychology



Cognitive Science

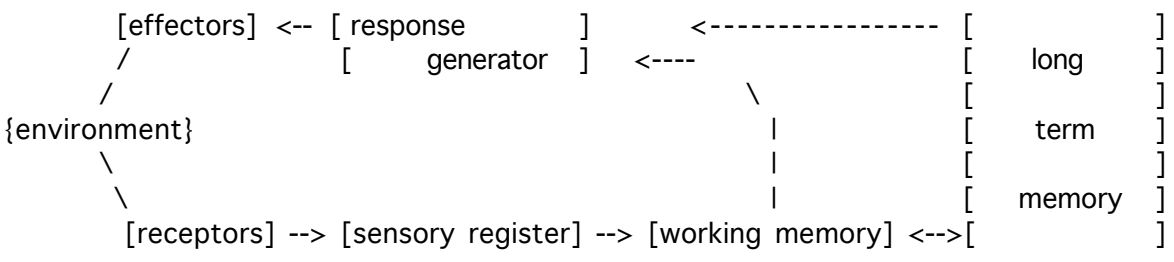
Cognition is information processing (not sensing, intuition, emotion, action, faith)

thinking	psychology
remembering	linguistics
understanding	neuroscience
learning	computer science
languaging	philosophy
perceiving	

Hilary Putnam

1960: the father of functionalism. The mind is functionally equivalent to a computer.
1990: Functionalism is completely false.
- Meaning is holistic
- Meaning is normative
- Concepts depend on evolution
- Mental states do not exist.

Information Processing Model of Human Cognition



The VR Paradigm Shift

from	We adapt to digital processes.
to	Digital processes adapt to us.
through	broader information interaction

activity within an environment, multiple models of intelligence
multiple sensory modalities, intelligence amplification (interactive problem solving)

Mechanical/information models

Old technology models embedded in new technology capabilities
mismatch of affordances

Cognitive/implementation models

Software design is toward cognitive not implementation model
so software engineers don't design
analogy to carpenters vs architects
    use hammer to buy a house

ask: what is goal of interaction
    how to make task easier
    how to hide implementation details
    usability is orthogonal to efficiency

Examples of
    calendar as single page of paper vs scroll
    tabs as mechanical rather than spatial
    trains and no moving camera in early film
    horseless carriage looks like carriage
    early tv as live radio

Shifts
    visual <- graphical
    user-centered <- machine-centered
    sensory <- silicon
    interactive <- symbolic

reduce cognitive complexity:
    vision is subconscious
    text is conscious

levels of human understanding
    perceive
    respond, recognize
    evaluate
    apply
    understand, analyze, synthesize

Models of computer

computer levels of architecture
    hierarchy of abstraction specification languages
        machine language specification
            vonNeumann tradeoff

circuit behavioral specification
hierarchy of realization specification languages

design model	abstract behavior
architecture model	abstract structure
performance model	abstract efficiency
correctness of behavior	functionality
efficiency of behavior	performance
actual behavior of physical circuit	reality

bit, word, instruction, program, message, application, user interface

Program levels, hierarchy

User interface: metaphoric system which makes design interface accessible to non-experts.

Design interface: hidden symbolic system which provide conceptual language for non-expert human to specify design abstractions.

Design abstraction: pure symbolic system which expresses a human objective

High-level programming language: symbolic system which closely models expert human models (math) and hides machine needs [Often math and algorithm are confused.]

Programming language: symbolic system which expresses assembly steps in human writable form. Does not cleanly differentiate between requirements of the human and those of the machine.

Assembly language: symbolic system which expresses machine language in process steps over specific logic function systems

Machine language: symbolic system which transfers low level machine instructions into processes within designed physical logic function systems

Logic function systems: physical system, integrated networks of gates

Gates: physical system represented by dnet graph format which has parens and pun components

Transistors: ignored physical system, assumed to be bundled in gates

Physiology

The *human sensorium*

cranial:	smell, see, taste, hear, motion, balance
integumentary:	touch, pressure, cold, heat, pain
muscular:	position, tension

Retinal variables
size, value, hue, orientation, texture, shape, position

Gestalts

proximity	... ...
similarity	..,,..,,..,,
continuity	- - - | - - -
closure	( ) ( )
area	(( ))
symmetry	<<<::.::>>>

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

Environments

qualities
partially observable
strongly parallel
apparently infinite
turns into an object when viewed from outside
coordination of interaction between contained entities
hierarchy of relative containment systems
holds global attributes
consistency (common time)
continuity (metric and origin of space)
linearity
flows and fluids
granularity
invariants (laws of the local universe)