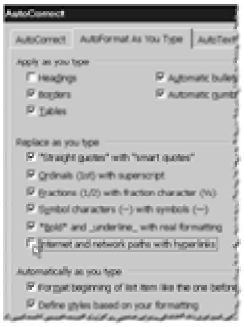
Cognitive Science and IT

From Computing to
Human Computer Interface

What is wrong with this?

Microsoft Office Assistant
presuming my aesthetic

What is wrong with this?



Microsoft Auto format
can anticipate my turn of thought

What is wrong with this?

Bad Web Page
requires me to work in the communication

Computing – in the beginning…

- Computer as mighty and mysterious idol
- Software Engineer as priest

- User presents task to programmer
- Programmer as program designer

Computing – then there was light…

- User gains direct access to computing applications
- The problem of teaching everybody (or every **mind**) how to operate a computer system
  - The coded command – **a memory load!!**
  - User friendly programs – **GUI: a shared mental model**
  - User centered design – **transportability of knowledge**
- Didn't happen overnight, and it owed a lot to studies of how minds work – and it still does!

Cognitive Sciences

- human information processing
  - attention
  - recognition
  - recall
  - learning
  - representation of knowledge
  - problem solving
  - decision making
  - reasoning

Associated Cognitive Sciences

- linguistics
  - turning ideas into words – Chomsky, Jackendoff
  - arranging words so that they put an appropriate mental model in the hearers mind
- computer sciences (yes, they have made contributions back to cognitive sciences)
  - automating cognitive tasks – Expert Systems
  - supporting human cognition – DSS, Knowledge Management
- neurosciences
  - brain imaging (what cognition looks like)
  - neurons and circuits (what thinking involves)
  - neural networks (how thinking is distributed in a mind)

Uses for Cognitive Science

- cognitive engineering
  - automating cognitive tasks – our job
  - human interaction with machines – our job
- education
  - information management – our job
  - problem solving skills – our job
- community
  - government-community interaction – our job
  - crime prevention/ forensics
- cognitive impairment
  - diagnosis and rehabilitation

Discoveries of cognitive science- a personal survey

My areas of research interest:

- organizational memory
- anthropology of thinking
- physiology of thinking processes
- analysis of how we think
- analysis of the raw material of thought

Some Cognitive Philosophies

- Deontologism
  - creative being as the source of ideas
- Descartes '*Cogito, ergo sum!'*
  - thinking as a fulcrum of life
- Hume
  - ideas absorbed into the mind from experiences & reflection
- Kant
  - personal knowledge vs. facts (declarative knowledge)
- Polanyi
  - expressible vs. inexpressible ideas (procedural knowledge)

Human cognition (or "Look What I Can Do!")

- Represent knowledge in the mind
- Represent knowledge about that knowledge (I know that I know things)
- Ability to:
  - form personal representations (ideas)
  - compare one idea with another
  - perceive causal relationships between things (and ideas) in the world
- Represent needs, motives and desires of ourselves (and others!)
- Perceive a self identity (perceive a difference between ourselves and all others in the world).

Cog Sci to IT

SOCIOLOGY

- PSYCHOLOGY
- COGNITIVE PSYCHOLOGY
- INFORMATION SYSTEMS SCIENCES
  - DECISION SUPPORT SYSTEMS
  - EXECUTIVE INFORMATION SYSTEMS
  - EXPERT SYSTEMS
  - USER CENTERED APPLICATIONS (OFFICE)

ideas-

sharing thoughts is not easy

- pre - language
  - married to words
- inexact
  - multi dimensional
  - muti-type
- unconscious and conscious
  - must be brought to mind
  - raw material of cognition
- My ideas won't exactly match yours

see Chomsky, Jackendoff, Dennett

Concepts-

shared thoughts

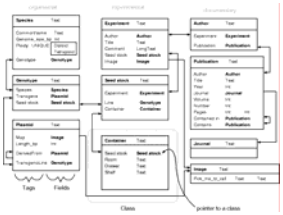
- taught & learned by us
  - reflect our adolescent culture
  - substance of formal education
- classify & order ideas
  - generalize them
  - consolidate them

  (under broad umbrella names)
  - model them
  - simplify (?) them
- common sense
  - common understanding

Piaget, Hallpike, Brown

Cognitive strategies-

things we use to help us think



- formula
- schema
- scripts
- techniques
- mental grammars – how to put an idea together
  (Jackendoff & Chomsky)

- We learn them early and use them without thinking

Aides-memoires-

prosthetic memory

source of the knowledge rather than the knowledge itself

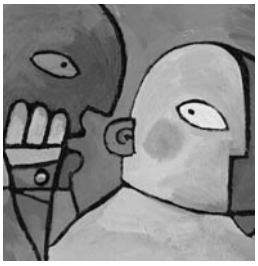
- index
- catalog
- glossary
- post-it-note

- we use them constantly to lighten the cognitive load

Communication-

putting a thought in someone else's mind

- remove complexity of ideas
  - symbolize
  - illustrate
  - wysiwyg
  - feedback
  - consistency



Human-Computer Interface design

- using a foreign interface
  - US terms and concepts
- straight-jacketing the user
  - Only one way to carry out a function
- violating the user's mental model
  - When I change data in one place it remains unaltered in another
- making the user remember
  - rather than have the system provide the information
- not providing feedback
  - Is the program running or frozen???

Some references

- Ray Jackendoff
  - Patterns in the Mind: language and human nature. 1994. Basic Books.
  - mental grammar – Naom Chomsky
  - language and the brain
  - language as a window on thought

Some references

- Christopher Hallpike
  - The foundations of primitive thought. 1979. Oxford: Clarendon Press
  - Universal human concepts
  - Development of thought - Piaget
  - cognitive strategies – techniques for thinking

Some references

- Daniel Dennett
  - Consciousness Explained. 1991. Boston: Little, Brown and Company
  - bringing things to consciousness from our store of ideas

Some references

- Donald Norman
  - The Psychology of Everyday Things. 1998. Basic Books.
  - Knowledge in the Head and in the World
  - User –Centered Design

Some references

- Harold Thimbleby
  - User Interface Design. 1990. Addison Wesley.
  - An examination of interactive systems from the standpoint of both the designer and the user, featuring a survey of the issues, problems, and methods of user interface design, and numerous case studies illustrating the practical and creative design issues involved in building interactive systems.

Some references

- Alan Cooper
  - About Face: the essentials of User Interface v

Some references

- Alan Cooper
  - About Face: the essentials of user interface design. 1995. IDG Books Worldwide, Inc.
  - Father of Visual Basic (GUI Programming Language)