Cognitive Consequences of Technology

Cognitive Science 10

Spring 2009

http://hci.ucsd.edu/10

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What is Cognition?

- The BIG questions of Cognitive Science

- How shall we explain or understand processes like thinking, reasoning, speaking, decision making, planning, behaving, operating technology and so on?

- How shall we explain the organization of human behavior at all levels of description?

What is technology?

- "The system by which a society provides its members with those things needed or desired." (Websters New World Dictionary of the American Language)

- Includes stuff, ways of interacting with stuff, and ways of interacting with other people.

Chimpanzee technology?

www.michaelnicknichols.com

jinrui.zool.kyoto-u.ac.jp/ ChimpHome/douguE.html

Hominid stone tool technology

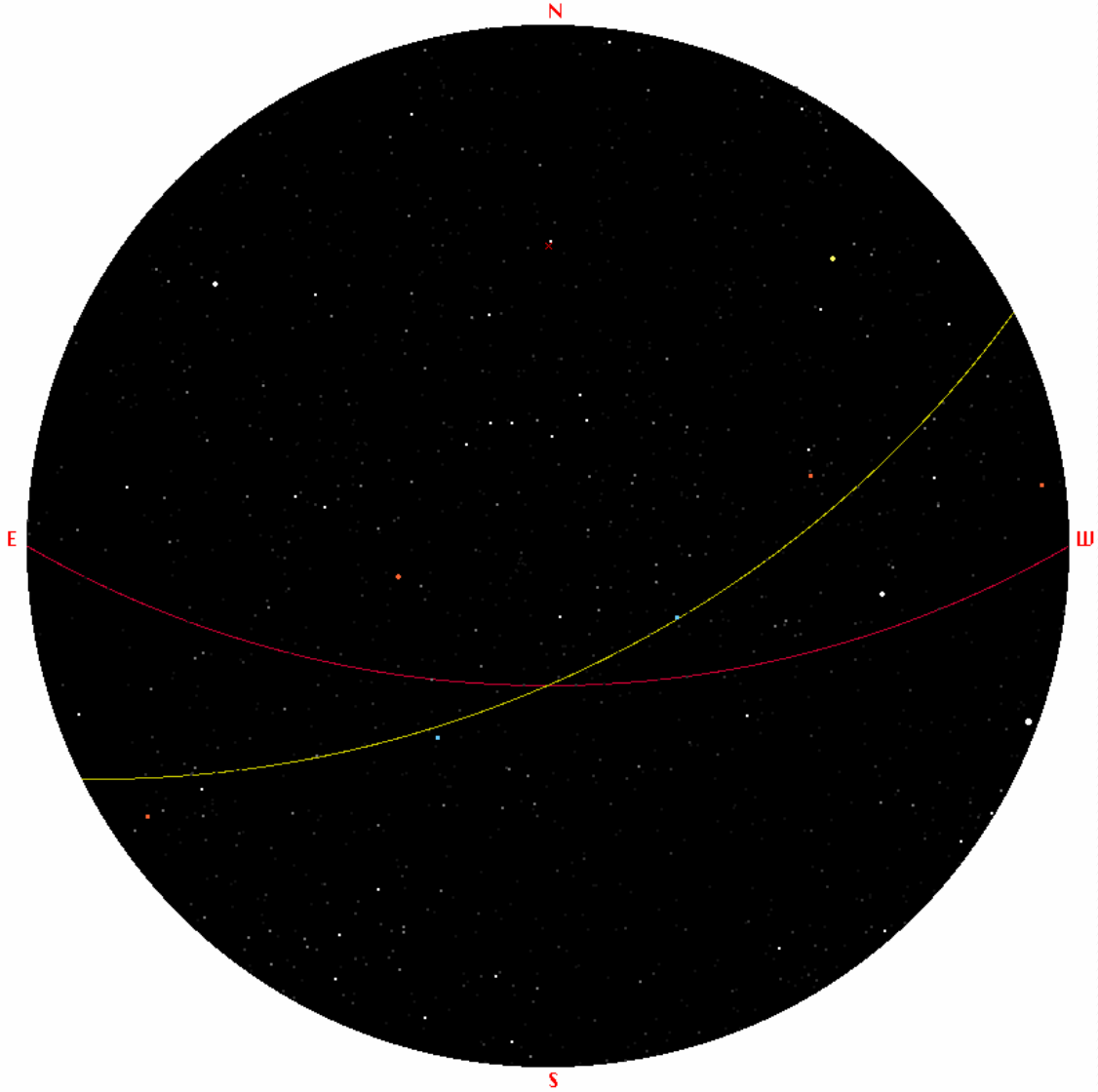
Oldowan choppers
2.5 Mybp

Acheulean hand axe
300,000 Ybp

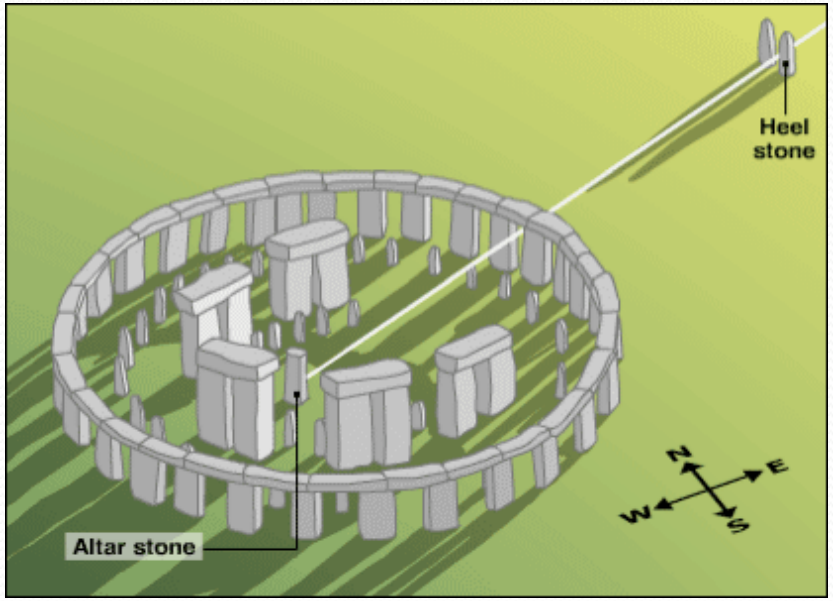
Material technology has a long history

- Stone age technology
  - Stone tools – 2.6mya until a few decades ago
  - Fire!, wooden implements, string, paint
- Metal work: copper, bronze, iron
- Agriculture
  - Cities, roads, dams
- Classic machines: transform mechanical force
  - Lever, wheel, screw, pulley
- Industrial revolution: Steam engines!
  - Mechanical power replaces animal power
- Information revolution
  - Messages in patterns of energy

Can you identify a constellation?



Building the regularities of the natural world into the structure of artifacts



Some Soft technologies

- Cultural practices:
  - Seeing the constellations
  - Domestication of plants and animals
  - Literacy and writing
- Ways of organizing group activity
  - Division of labor
  - Work schedules
  - Rituals (religious and otherwise)
- Institutions:
  - Legal system
  - University
  - Elections

Thinking about cognitive consequences

- Technology implies knowledge
  - To create it
  - To use it
- But! It is not so easy to infer that knowledge from the nature of finished products.

What is mind?

- What is special about minds (even your cat's mind) as opposed to inanimate objects?
- And what is special about human minds compared to other animal minds?
- Mindfulness is just matter…
  nicely orchestrated (Andy Clark, *Mindware*, 2001)

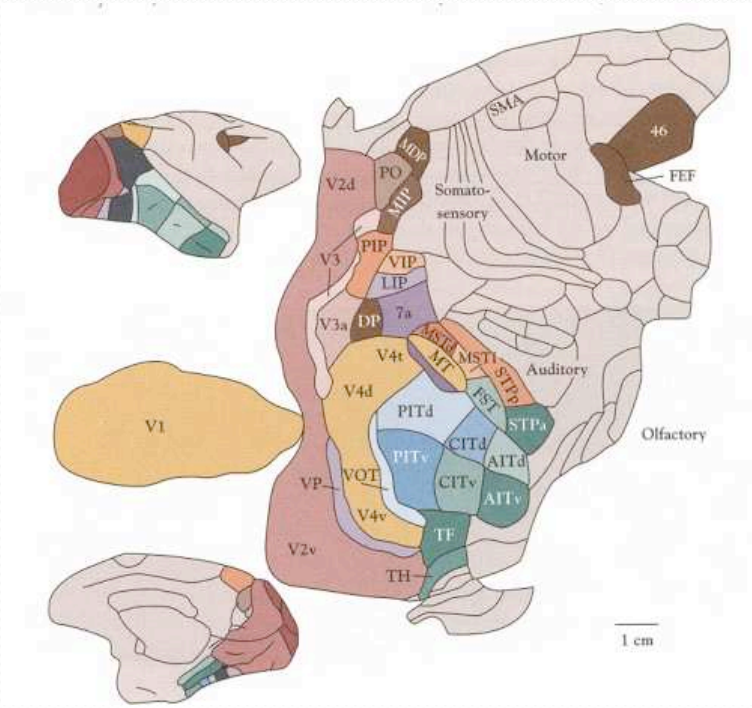
Where is the mind?

- Many cognitive scientists say that the mind is in the brain. Or they say that the mind is what the brain does.

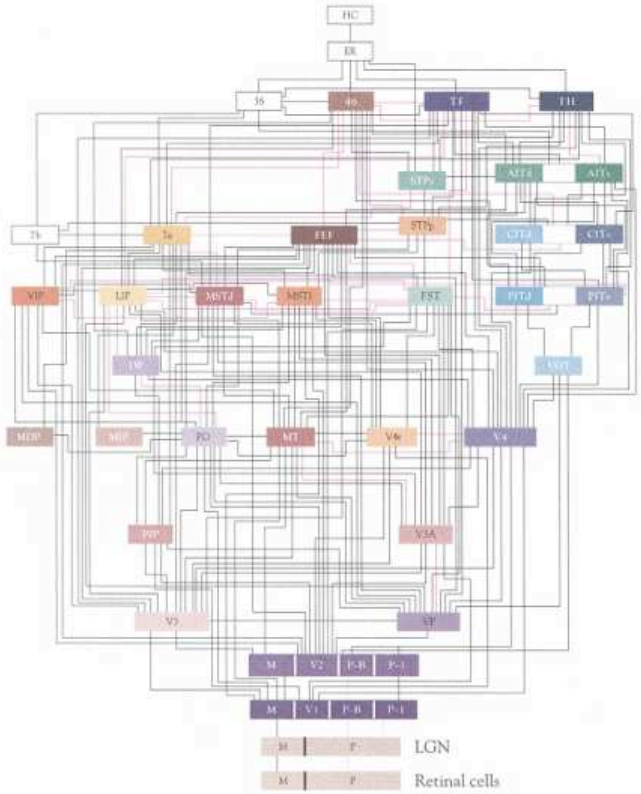
- Is this correct?

- Is it the whole story?
- Is it the best story?

The mind in the brain



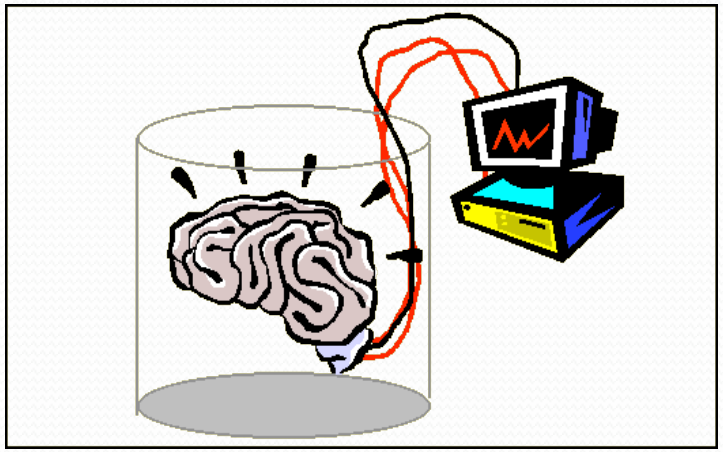
(Van Essen Lab)

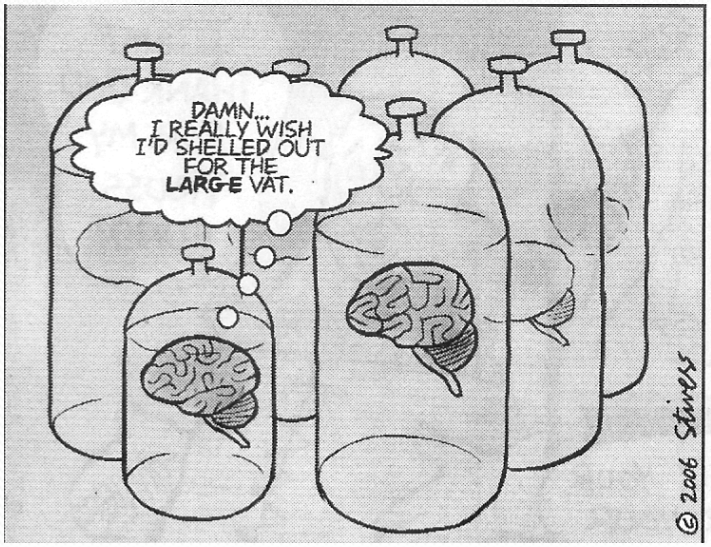


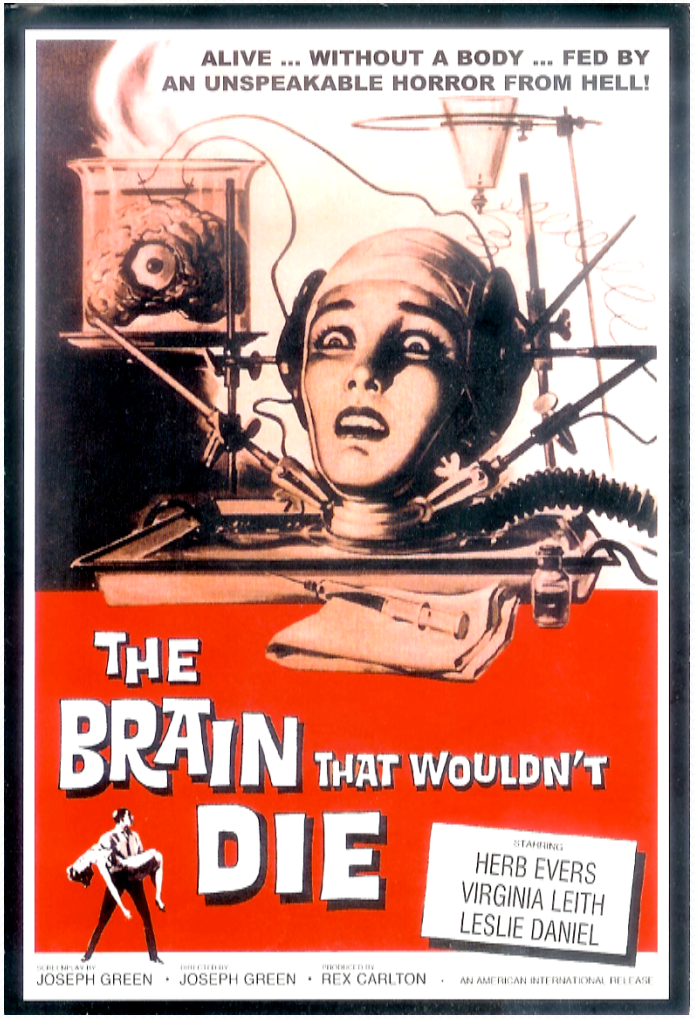
Understanding cognition is largely understanding the dynamic flow of information through the system

From a presentation by Jochen Triesch 2003

Could a brain in a vat really have a human mind?

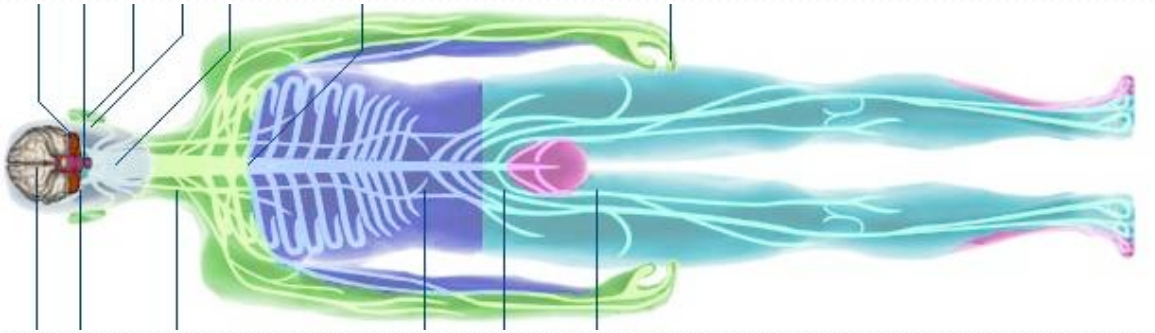






Is the mind in the nervous system?

- Is a brain in a vat really a good model of the human cognitive system?
- The brain gets input from and sends output to the central nervous system.
- Brains adapt to the bodies they find themselves in.



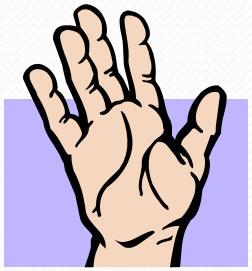
http://www.bbc.co.uk/science/humanbody/body/factfiles/nervous_anatomy.shtml

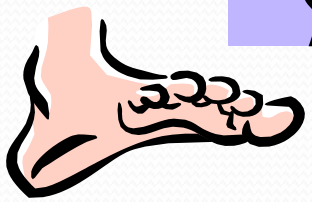
Perhaps we need to add the body to explain the mind

Consider two example situations

Situation 1: driving your car while having a conversation

Situation 2: reading out aloud while tapping your feet to the rhythm of some music





Same input/ouptut modules, yet different information flow!

From a talk by Jochen Triesch 2003

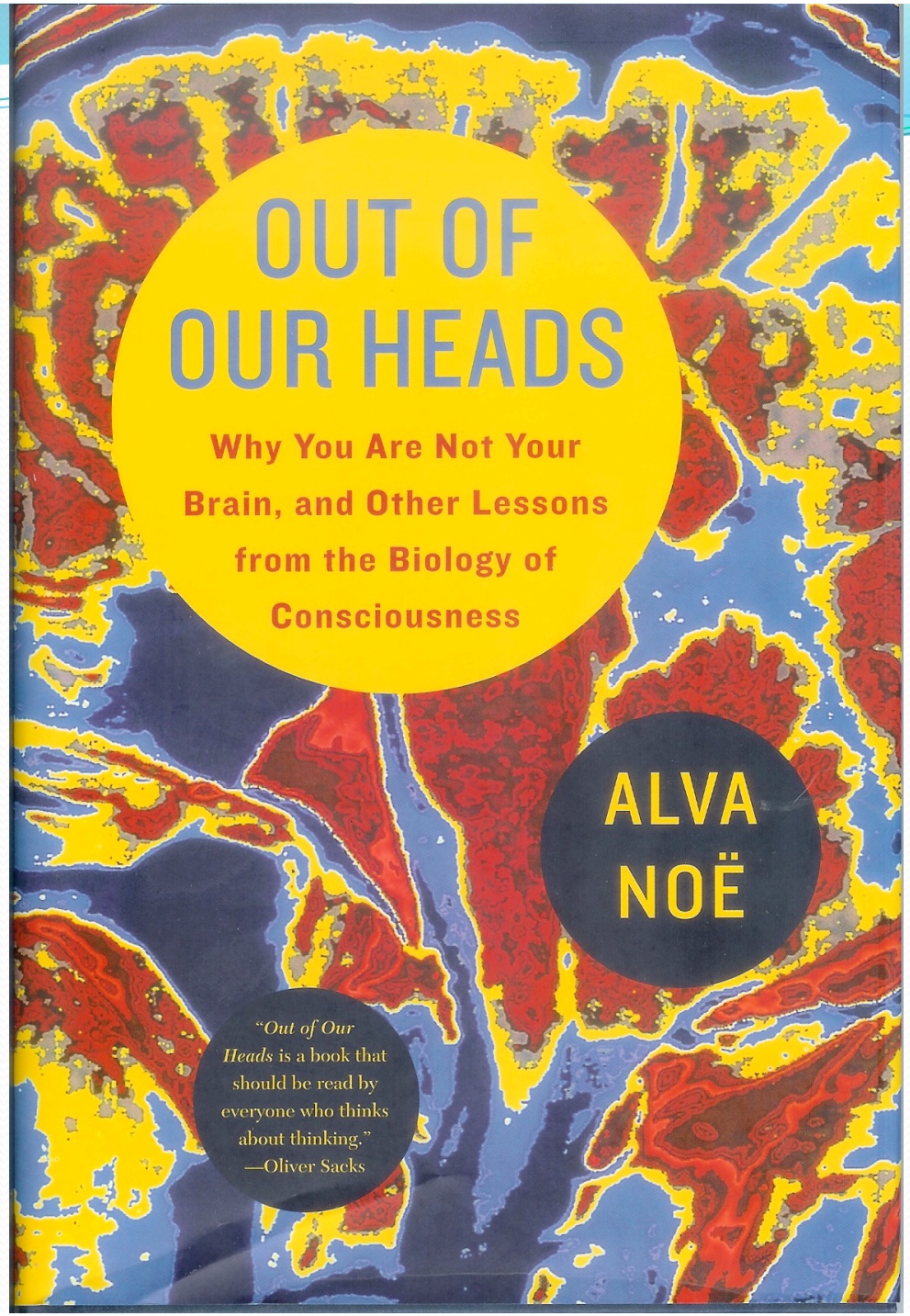
Understanding task structure

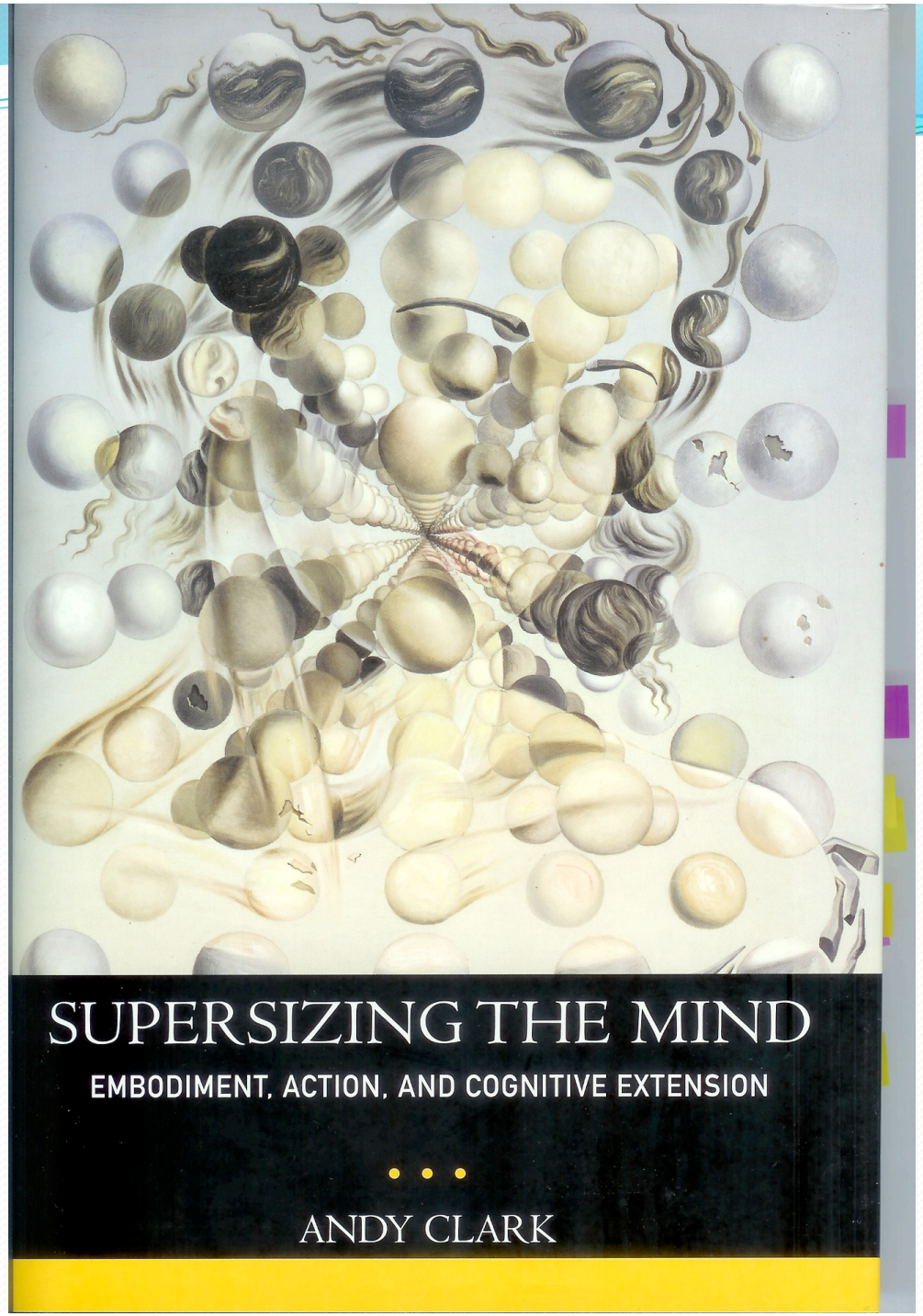
- The fact that different tasks organize the body and brain into different functional configurations is called the “functional systems” view.
- It means that the same internal brain/body processes can be organized to do a variety of tasks.
- There are almost always many functional system that can do any particular task.

The mind in the interaction of the body with the world

- The body is in a physical world, and the structure of that world interacts with the body and the nervous system and the brain to shape what we think and how we think.

Photo: Ron Church, *The Surfer's Journal* Volume 9, No. 4


OUT OF
OUR HEADS
Why You Are Not Your Brain, and Other Lessons from the Biology of Consciousness
ALVA NOË
"Out of Our Heads is a book that should be read by everyone who thinks about thinking."
—Oliver Sacks


SUPERSIZING THE MIND
EMBODIMENT, ACTION, AND COGNITIVE EXTENSION
ANDY CLARK

A lesson for designers

- This means that if we would like to design an environment for action or thinking, we must take into account not just the brain and body, but also the ways that brain, body, and environment interact.

Trobriand Islands
Papua New Guinea

The technology of grass skirts

- Human life is lived in complex social environments that are filled with cultural artifacts.

Photo: Dona Hutchins, 1976

A cognitive problem

- During their lifetimes, people in all human societies enter into networks of obligation and credits.
- When a person dies, the accounts must be settled.
- This requires memory, computation, and validation.
- What technology can accomplish this task?
- The answer depends on how obligations and compensation are represented.

Trobriand Island Exchange Ritual

Photo: Edwin Hutchins, 1975

So what?

- Remembering as a community process.
- Social agreements create reality!
- The technology of grass skirts creates the symbols that are needed to make abstract obligations visible and to allow everyone to "see" that a debt has been settled.
- Cognitive ecology: the parts fit together. Computers will not help in Trobriand society, and the Trobriand system will not work in our society.
- A society that has relatively simple hard technology may have very sophisticated soft technology.

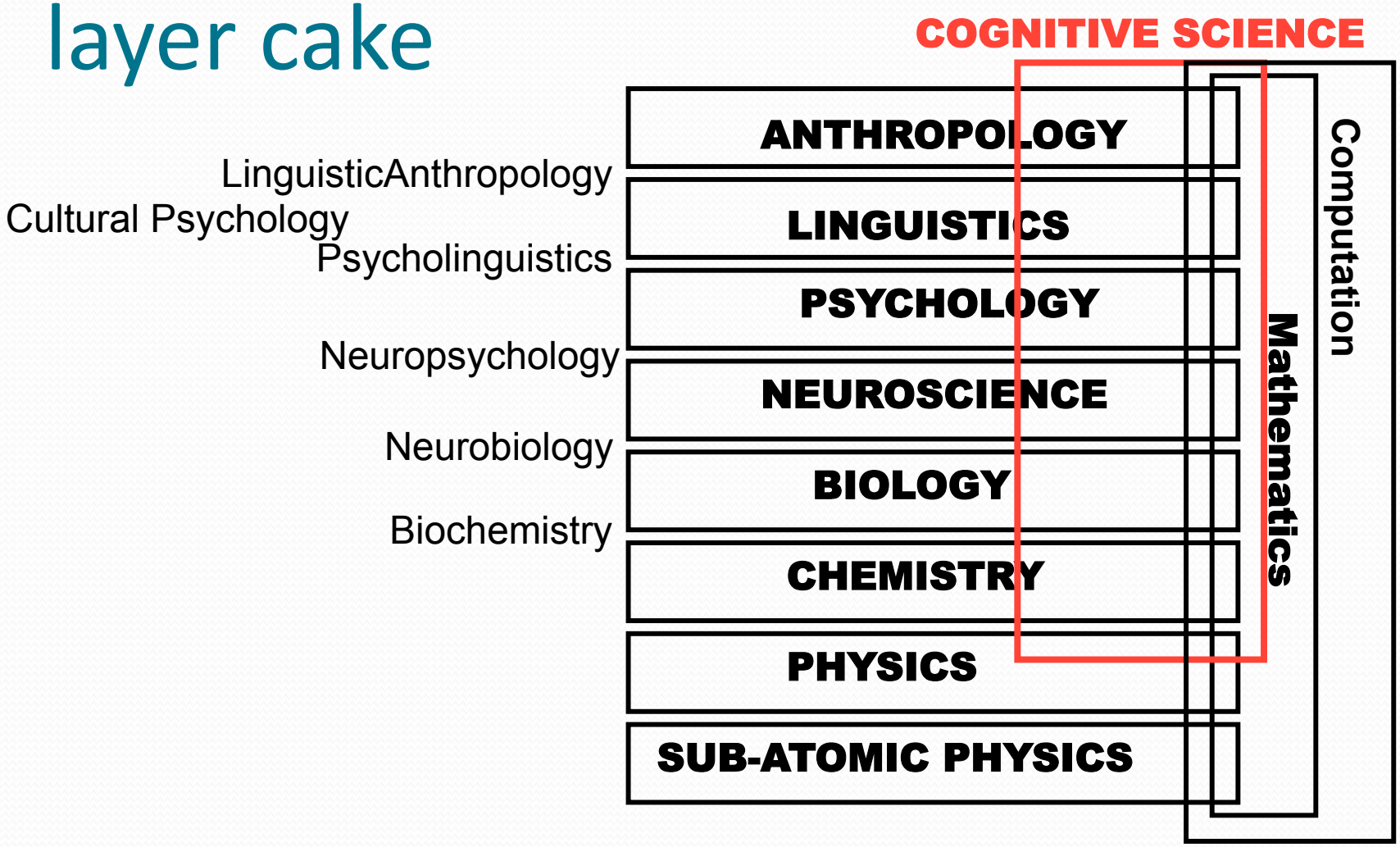
Our cognition and our mindfulness emerge from the interactions of our brains and bodies with this socio-cultural-technological world.

Photo: Edwin Hutchins, 2003

Human behavioral environments are culturally constructed

- The things with which we interact
- The ways of interacting with things
- The social categories of the people with whom we interact

Cognitive science in the scientific layer cake



Summary of the main idea

- Technology includes material objects and the cultural practices that organize interactions of people with objects and with other people.

- Cognition includes all forms of thinking, including those that happen in interaction with material stuff and in interactions among people.

- We see the cognitive consequences of technology in on-going human activity.

Tools for thinking about cognition

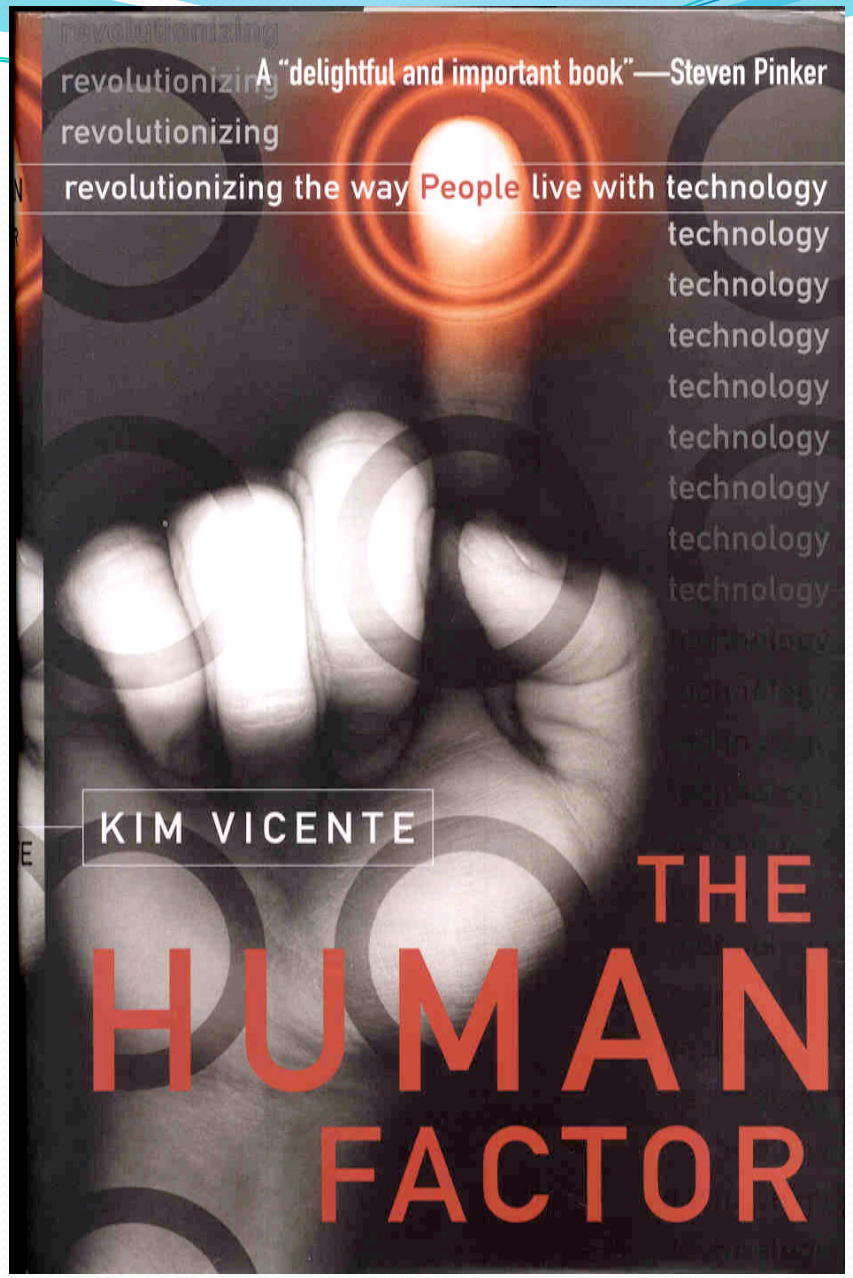
- Brain-body-world system
- The world for humans is culturally constructed
- Hard and soft technologies
- Technology ←→ Knowledge
- Functional systems analysis
  - Coordination of resources inside and outside
- Cognitive ecology
  - How elements of a cognitive ecosystem fit together

The Human Factor

by

Kim Vicente

Available in the UCSD bookstore



Elements of your grade

- 3 projects
  - Technology inventory (10 pts)
  - Interface evaluation (15 pts)
  - Cog. Consequences of Automotive Technology (30 pts)
- Plagiarism Quiz (5 pts)
  http://sshl.ucsd.edu/instruction/cogsci10
- Midterm Exam (15 pts)
- Final Exam (25 pts)
  - Tuesday June 9, 3:00 – 6:00 pm

- Total = 100 points

How to Succeed in this Course

Do the Readings

- Keep up with the reading schedule
- Read carefully and critically
- THINK ABOUT WHAT YOU ARE READING!

Get a good Dictionary and use it

- Meanings
- Word choice
- Usage conventions ~~which matter~~ that matter
- Spelling
- Writing is one of our most powerful technologies. It has important cognitive consequences for authors, readers, and communities.
- This is your chance to workout and get strong

The

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of

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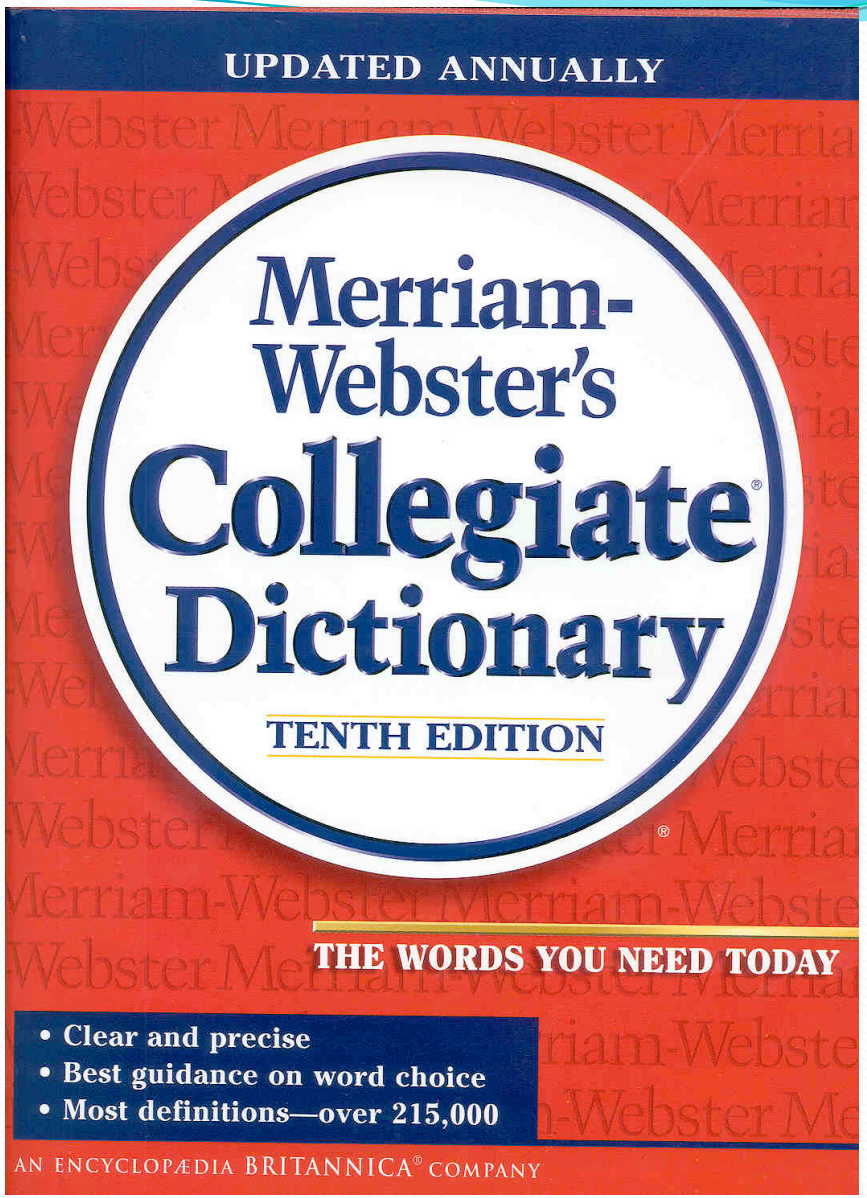
fourth edition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Spend some Time on the Course

- The registrar expects you to work 12 hours per week for a 4 unit course!

Come to Lecture Sessions

- Clean, sober, and awake
- Do NOT sleep in class
- Cell phones OFF!
- Be here. No IM or web surfing in class
- If you don't understand something, ASK for clarification.

Go to Section

- Discuss questions
- Clarify issues
- Get ideas for and help with your exercises
- Prepare for the quizzes and the final exam
- Pick up graded assignments

Do the Assigned Work

- Start ahead of time
- Be sure you understand each assignment
- Make your papers easy to read and understand
- PROOF READ! Check spelling and grammar
- Turn projects in ON TIME

Visit Office Hours

- We are here to help you
- You (or your parents) are paying for our time
- Explore ideas
- Clarify assignments

Do NOT attempt to CHEAT!

- Do your own work. You are encouraged to talk to other students about ideas, but do not "borrow" material from other students.
-
- You may use material created by others only if you give them credit. DO NOT present the work of others as if it were your own.
- Do NOT look at your neighbor's paper during the quizzes or exams.

Be Creative

- Learning should be fun.
- This course is about ideas, not the memorization of facts.
- Ideas never stand alone. They are always related to other ideas (in a cognitive ecosystem).
- Explore the world of ideas.

Exercise 1: Technology Inventory

(due in class Thursday, April 9)

- A. Make a list of the technologies found in your living space.

- For example, a house might contain the following technologies: printed matter (books, magazines, etc.), writing tools (paper, pencils, pens, stapler, post-it notes, checkbook, records in files, postage stamps, postage scale, address labels, envelopes), clocks, telephones, telephone answering machine, computer, modem, printer, audio system, musical instruments, electric lights, appliances, cameras, audio recorders, DVD player, calculators, bathroom scale, microscope, binoculars, television, indoor plumbing, water heater, mirrors, glass windows, doors, locks, air heater, paint, shelves, cd's, art (modern, classical, primitive), ...

Exercise 1: Technology Inventory

(due in class Thursday, April 9)

- B. Technologies never operate in isolation. They depend on other technologies in the local environment (in your home), and on other technologies outside the local environment (power grids, broadcast infrastructure, information and distribution networks, for example).
  1. Choose a set of the technologies you listed in part A that depend on each other for their use? Describe the relations among these technologies.
  2. Which technologies outside the local environment does the set you chose rely on?
  3. How is the use of these technologies embedded in larger socio-cultural systems?
- Your answer should be a maximum of 1500 words for part B.

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Enjoy the course!