Cognitive Science 102A
Distributed Cognition

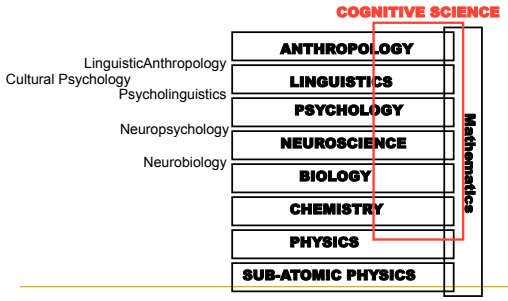
Professor Edwin Hutchins

http://hci.ucsd.edu/102a

What the course is about

- The BIG questions of Cognitive Science
- How shall we explain or understand processes like thinking, reasoning, speaking, decision making, planning, and so on?
- How did cognitive science get where it is?
- Where can cognitive science go from here?

Cognitive science as a slice of scientific cake



An interesting analogy

Anthropology : Psychology
as
Epidemiology : Pathology

(Dan Sperber, 1985; "Anthropology and Psychology: towards an epidemiology of representations.")

Cholera Outbreak in London 1854

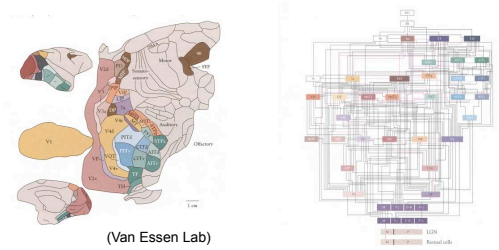
What is mind?

- 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

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 right?
- Is it the best approach?

The mind in the brain



(Van Essen Lab)

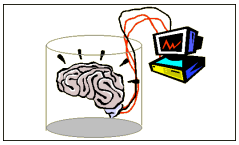
Understanding cognition is largely understanding the dynamic flow of information through the system

From a WA talk by Jochen Triesch 2003

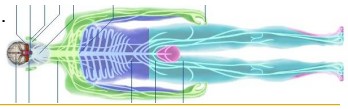
Disembodied Cognition?

Is the mind in the nervous system?

- A brain in a vat is a very poor model of the human cognitive system.
- The brain gets input from and sends output to other parts of the nervous system.



http://www.csus.edu/indiv/m/mccormickm/BrainsInAVat.html



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

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.
- The brain is a controller for body-world interaction

Photo: Edwin Hutchins, 2007

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

Mind in the interaction of the brain and body with a culturally constructed world

- Human life is lived in complex social environments that are filled with cultural artifacts.
- Our cognition and our mindfulness emerge from the interactions of our brains and bodies with this socio-cultural world.

Photo: Edwin Hutchins, 2003

The ingredients of a new kind of scientific investigation of cognition

- Theory:
  - Distributed Cognition
- Method:
  - Cognitive Ethnography (COGS 102B)
- Human activity systems:
  - Ship Navigation (CitW)
  - Science Laboratories
  - Commercial Aviation
  - … any other activity you can think of

Distributed Cognition

- Fundamental premise: Cognition, in all its forms, emerges from the interactions among the elements of complex systems.
- Cognitive Systems (units of analysis):
  - a neural circuit composed of interacting neurons
  - an area of the brain (e.g. V1 in visual cortex) composed of interacting neural circuits
  - a whole brain composed of interacting areas (multimodality)
  - a whole brain and a whole body in interaction
  - brain-body-world in interaction

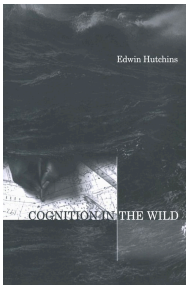
A hypothesis about human cognition

- High-level human cognition depends on interactions with culturally organized material and social structures.
  - Weak Dcog: Cognition is affected by or shaped by interactions with the material and social world.
    - Action *reveals* underlying cognitive processes
  - Strong Dcog: Some forms of human cognition are ***constituted*** in interactions of brain and body with material and social world.
    - Action *is* a form of cognition

Checking our progress

- The preferred unit of analysis for distributed cognition:
  - A. is the human brain
  - B. is the brain-body-world interaction system
  - C. is the brain-body-culturally-organized-world interaction system
  - D. depends on the question we want to answer

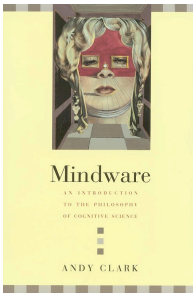
Cognition in the Wild (1995)



An extended case study of distributed cognition

- Examples from ship navigation
- How institutions think
- Where is computation/cognition/mind?
- Embodied cognition in cultural context
- Cognitive properties of groups
- Individual and institutional learning
- The costs of ignoring culture when studying cognition

Mindware (2001)

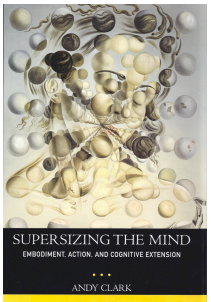


Andy Clark
Philosopher
of Cognitive Science

The development of cognitive science

- Andy Clark's combination history and critical reflection.
- Mindfulness as (some sort of) computation.
- Recent wrinkles
  - Embodiment
  - Robotics
  - Dynamics
  - Interaction with the material world

Supersizing the Mind (2008)



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How to Succeed in this Course

http://hci.ucsd.edu/102a/

TA Whitney Friedman

Basis of your Grade

	%
Plagiarism Tutorial	5
4 Written assignments @15 ea.	60
Midterm Exam	10
Final Exam	25
Total	100

Essay writing exercise topics

1. Meaning and space
2. Relations in a cognitive ecosystem
3. Features of socially distributed cognition
4. The principle of ecological assembly

The thinking/writing process

- Careful reading
- Additional research
- Note taking
- Drawing diagrams and sketches
- Outlining
- Writing/reflecting/re-writing
- Getting and giving constructive critical advice

Evaluation and self-evaluation

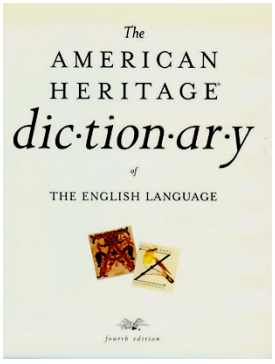
- Engage the ideas
- Stay on topic
- Successful expression
- Clarity
- Reflection on your own writing/thinking process

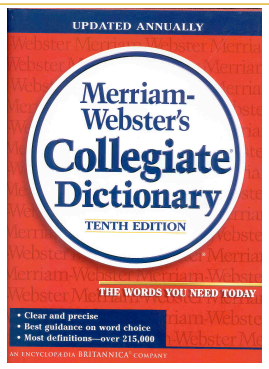
Do the Readings

- Keep up with the reading schedule
  - http://hci.ucsd.edu/102a/schedule.html
- Read carefully and critically
- Use the guidance provided on the class website
- THINK ABOUT WHAT YOU ARE READING!

Get a good Dictionary and use it

- Meanings
- Word choice
- Usage conventions
- Spelling
- Language is a social tool. Knowledge is power. Workout and get strong





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, texting, or web surfing in class
- If you don't understand something, ASK for clarification.
- You may take notes if you like. Remember, the lectures will be podcast, the slides will be posted on the course website, and AS lecture notes will be available.

Go to Discussion Section

- Discuss the readings and lectures
- Clarify issues
- Work on your essays
- Prepare for the midterm and final exam

Do the Assigned Work

- Start ahead of time
- Be sure you understand each assignment
- Make your essays easy to read and understand (consult the HowToEssay page of the course website).
- PROOFREAD! 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.
- Understand the concepts in the plagiarism tutorial.
- Do NOT look at your neighbor's paper during the exams.

Be Creative

- Learning can be fun.
- This course is about ideas, not the memorization of facts.
- Ideas never stand alone. They are always related to other ideas. Explore the world of ideas.

Appreciate the Challenge of Cognitive Science

- Many of the central questions in this field are still unanswered.
- Most of them relate directly to your daily life in some way. Be alert for connections to your own experience.
- You can do it!

For Tuesday

- Buy *Cognition in the Wild* and *Supersizing the Mind* (Both available at the bookstore)
- Review the material on the course web site: http://hci.ucsd.edu/102a/
- In particular, consult reading guidance for Tuesday's assignment on website schedule page
- Read these two papers (available on the website)
  - Mitch Resnick "Learning about life"
  - Edwin Hutchins, "Cognition, Distributed"

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