

# Methods in Cognitive Science

CSCI 6402, EDUC 6504, LING 6200,  
PHIL 6310, PSYC 6200

Profs. Al Kim and Mike Eisenberg

T/R 5-6:15 Muenzinger D430

<http://l3d.cs.colorado.edu/~ctg/classes/issmeth08/IssMeth08.html>

**OBSERVAT. SIDERBAE**

berat: Iuppiter à sequenti occidua min. 5. hae verò à reliqua occidentaliori min. 3. erant omnes eiusdem proximè magnitudinis, satis conspicuae, & in eadem recta linea exquiritè secundum Zodiaci ductum.

Ori. \* ○ \* \* Occ.

Die decimaseptima H. 1. duae aderant Stellae, orientalis una à Ioue distans min. 3. occidentalis altera distans

Ori. \* ○ \* \* Occ.

min. 10. hae erat aliquanto minor orientali. Sed hora 6. orientalis proximior erat Ioui distabat nempe mi. 8. sec. 50. occidentalis verò remotior fuit, scilicet min. 12. Fuerunt in utraque observatione in eadem recta, & ambae satis exiguae, praesertim orientalis in secunda observatione.

Die 18. Ho. 1. tres aderant Stellae, quarum duae occidentales, orientalis verò una: distabat orientalis à Ioue

Ori. \* ○ \* \* Occ.

min. 3. Occidentalis proxima m. 2. occidentalior reliqua aberat à media m. 8. Omnes fuerunt in eadem recta ad vnguem, & eiusdem serè magnitudinis. At Hora 2. Stellae viciniores paribus à Ioue aberant interstitij: occidentalis enim aberat ipsa quoque m. 3. Sed Hora 6. quarta Stellula visa est inter orientaliorem & Iouem in tali configuratione. Orientalior distabat à sequenti m. 3. sequenti à Ioue

**RECENS HABITAE. 26**

Ioue m. 1. sec. 50. Iuppiter ab occidentali sequenti m. 3.

Ori. \* \* ○ \* \* Occ.

hae verò ab occidentaliori m. 7. erant serè aequales, orientalis tantum Ioui proxima reliquis erat paulo minor, erantque in eadem recta Eclipticae parallela.

Die 19. Ho. 6. m. 40. Stellae duae solummodo occiduae à Ioue conspicuae fuerunt satis magnae, & in eadem re-

Ori. ○ \* \* Occ.

cta cum Ioue ad vnguem, ac secundum Eclipticae ductum dispositae. Propinquior à Ioue distabat m. 7. hae verò ab occidentaliori m. 6.

Die 20. Nubilosum fuit coelum.

Die 21. Ho. 1. m. 30. Stellulae tres satis exiguae cernebantur in hac constitutione. Orientalis aberat à Ioue

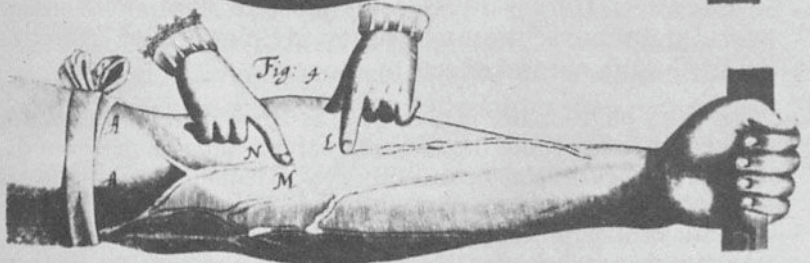
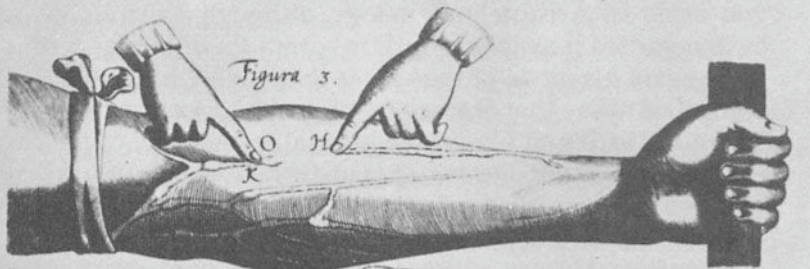
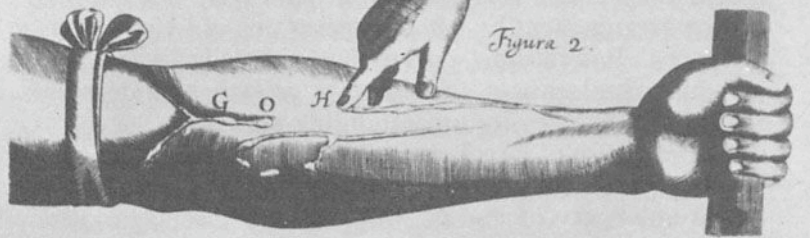
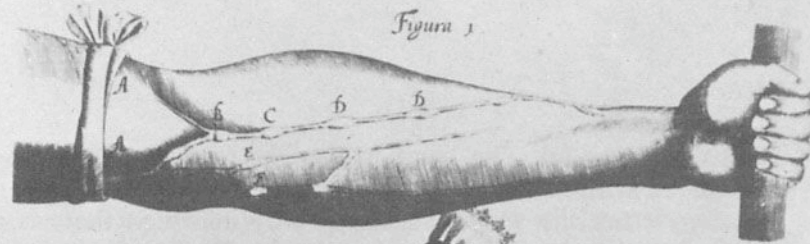
Ori. \* ○ \* \* Occ.

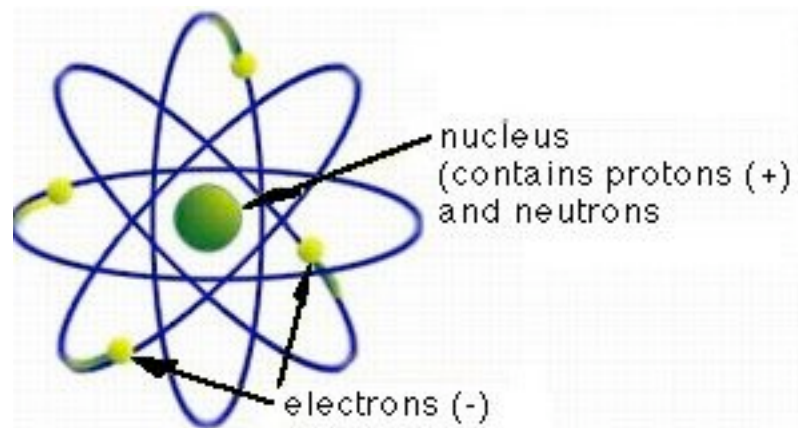
m. 2. Iuppiter ab occidentali sequente m. 3. hae verò ab occidentaliori m. 7. erant ad vnguem in eadem recta Eclipticae parallela.

Die 25. Ho. 1. m. 30. 4<sup>ta</sup> n<sup>ta</sup>m superioribus tribus noctibus coeli fuit nubibus obductum) tres apparuerunt Stel

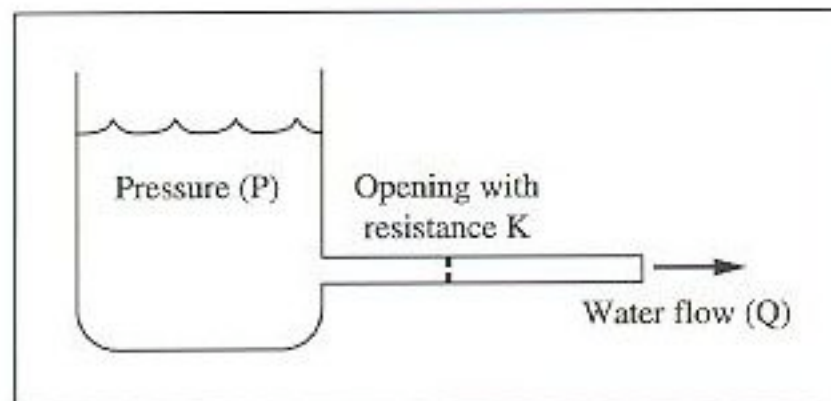
Ori. \* \* ○ \* \* Occ.

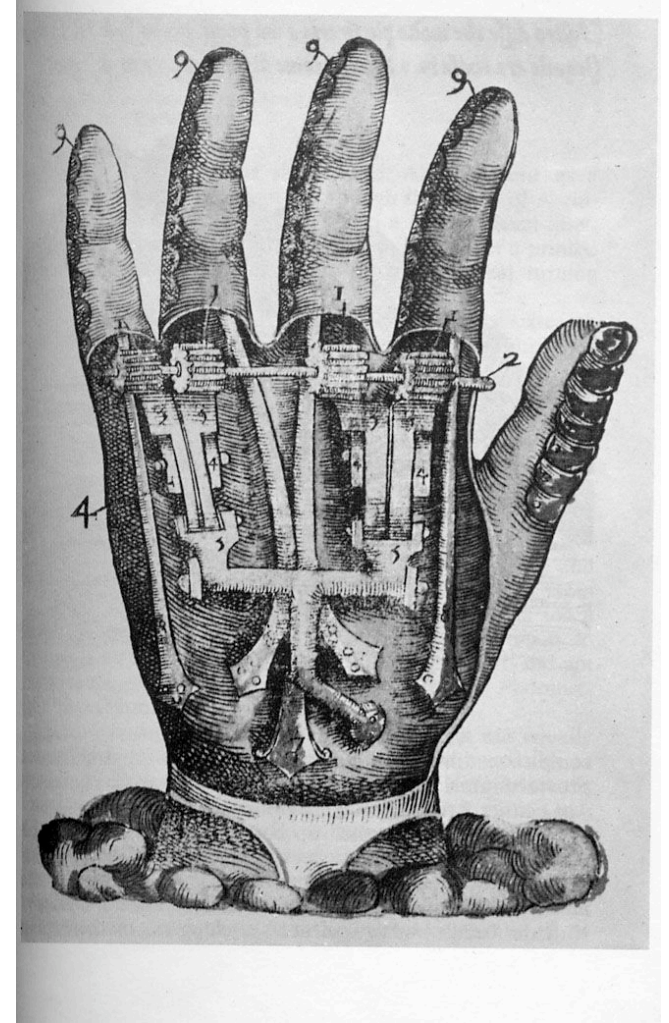
lae. Orientales duae, quarum distantia inter se, & à Ioue





$$Q = P/K = \text{Pressure/Resistance}$$





# Computational Metaphor

- A thematic continuation of machine-body metaphors in science...
- But with some features specific to the (then-) novel arrival of the digital computer
- A response to the (then-)reigning behaviorist tradition in American psychology

Suppose we take the following metaphor seriously:

*Software is to Hardware as Mind is to Brain*

What follows from this?...

- (a) We don't have to explain mind at the level of neuroscience
- (b) Mental representations (parse trees, symbols, rules, images) are as "real", and as worthy of study, as (say) algorithms in the realm of computer science
- (c) Functionalism: a resolution (sort of) of the mind-body problem

## **Before we go any further: What is “Functionalism”?**

*Functionalism* is generally summarized as the notion that mental states are characterized according to their causal roles in a system of mental states. In particular, it doesn't matter in what physical substance these states happen to be embodied. There is a resonance here with the notion of a computer program: it doesn't matter whether that program happens to be rewritten for a Macintosh or Cray or whatever--the essential program remains the same.

# A large metaphor suggests “sub-metaphors”

- New ways of thinking about: knowledge, learning, mental illness, among many other topics
- A way of thinking about the long-term debate between rationalism and empiricism
- Notions of “levels of description”

# New ways of thinking about “hard” or “easy” cognitive tasks

- Vision
- Language acquisition
- Problem solving/judgment
- Navigation
- “Common sense” reasoning

# And some other natural questions...

- Does the architecture of computers suggest anything helpful—beyond vague hand-waving generalities—about the human mind? For instance: how much is our understanding of human memory informed by what we know of computer memory?
- Even if we want to concentrate on understanding the brain (a step which we aren't sure is necessary), how much can we learn from computer simulations of neural or brain activity?

## **Gardner's representative features of "classical" cognitive science (as of the mid-1980's):**

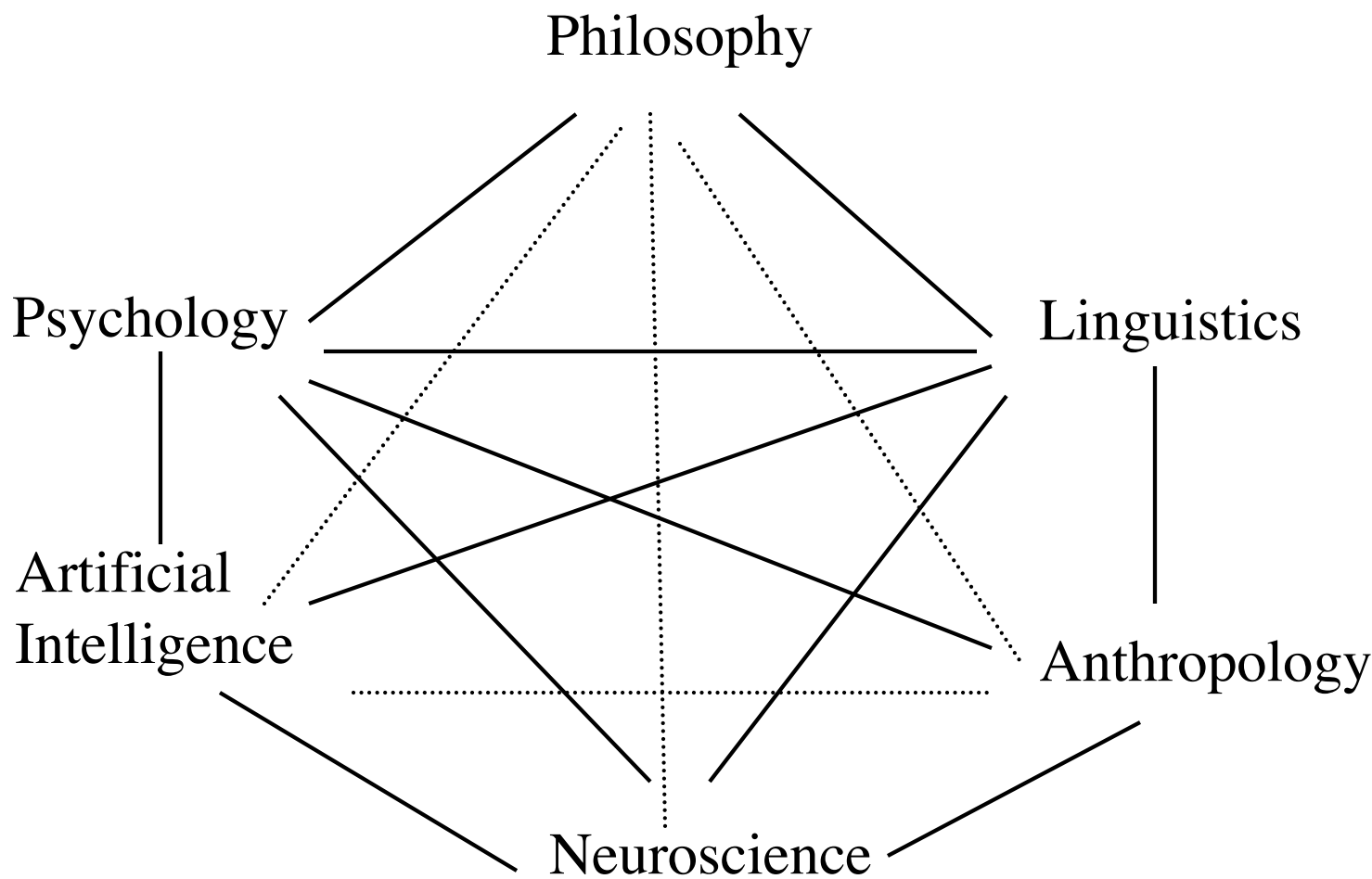
The *computational metaphor* of mind

*Mental representations* as an object of study

A relative de-emphasis on topics like *emotion, culture, sociology*

A strong tendency toward *interdisciplinary work*

Interest and origins in *classical Western philosophy*



# Some Early Problems with the Computational Metaphor

- The issue of consciousness
- Intentionality: how symbols get their meaning
- Difficulty of matching computational insights with medical phenomena (e.g., blindsight, hemispheric neglect, the “tip-of-the-tongue” phenomenon)
- Surprising difficulty of dealing with a variety of tasks, including (notably but not uniquely) common-sense reasoning

Jane was invited to Jack's birthday party.

She wondered if he would like a kite.

She went to her room and shook her piggy bank.

It made no sound.

# “Challenges” to the Computational Metaphor

- Evolutionary psychology
- Embodied cognition
- Cognitive neuroscience
- Game theory and reasoning beyond the individual mind

# For Thursday:

- Reading assignment for Thursday: papers by Turing and Searle
- Readings are linked to class website (password protected)

