Reason, relativism and situated cognition

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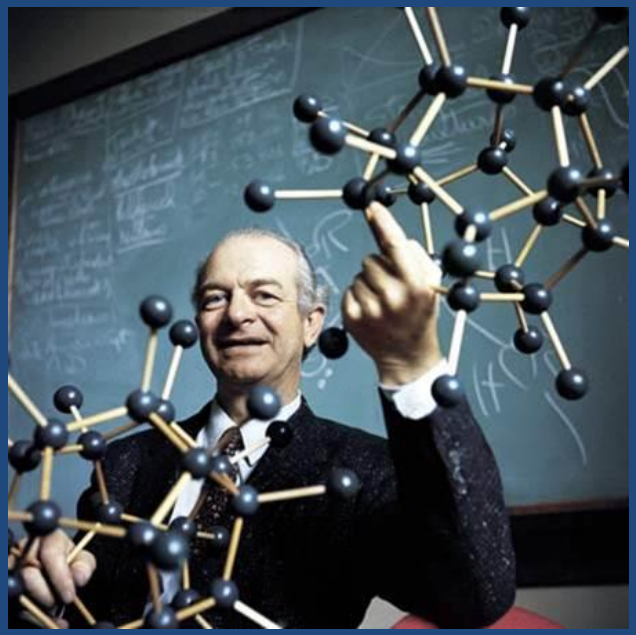
Introduction

- General theme: material culture in science
- Background: molecular models

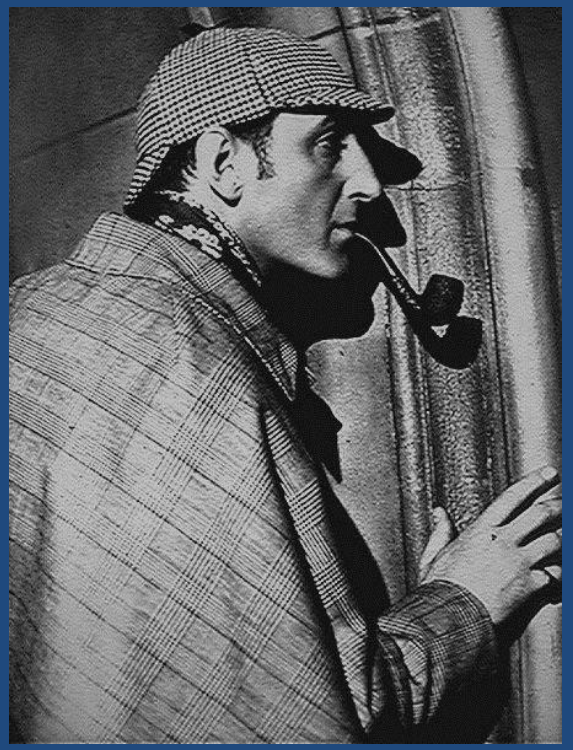


Linus Pauling

Carae Schrader Playing with a Doll at the Children's Hospital by Wallace Kirkland

Introduction

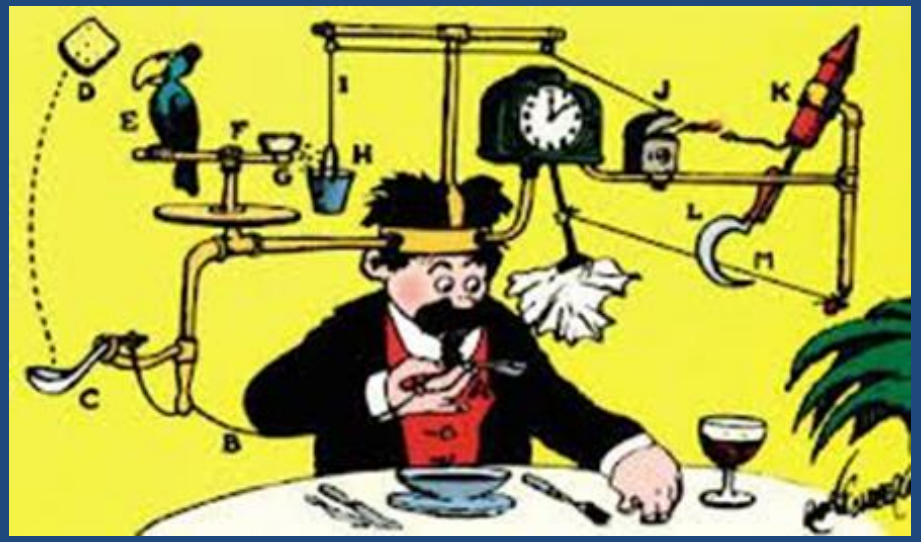
- New movements:
  - Cognition as s*ituated*, *embedded*, *embodied*, *distributed*…
- Common theme:
  - Cognition requires interaction of brain, body and environment
- *Extended cognition thesis*:
  - Cognition (and mind) ain't in the head!



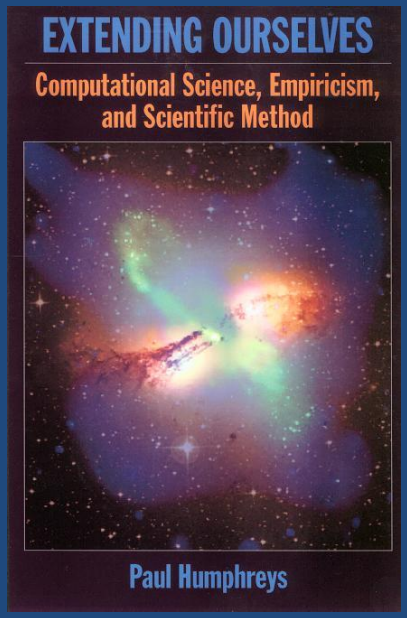
"I am a brain, Watson.
The rest of me is a mere appendix"

Introduction

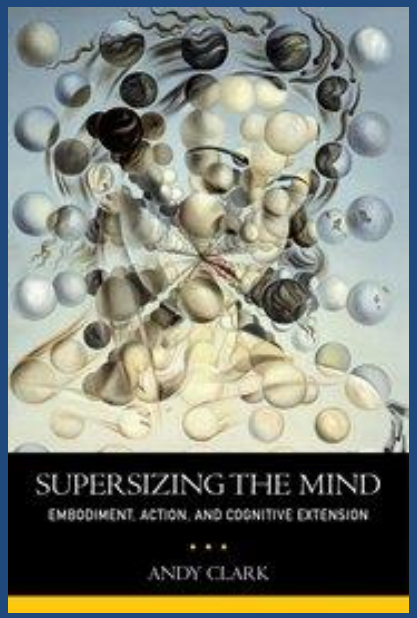
- 2 year project:
  Science as extended cognition: The role of material culture in scientific reasoning
- Today*:*
  - *Observation*
  - *Reasoning*
  - *Understanding*



Observation



- Scientific realists:
  - instruments 'extend' our senses
- *Extended mind thesis* (ExM):
  - Cognition extends beyond the brain and body



- Focus:
  - Observability and realist vs. constructive empiricist
  - Can realists draw on ExM?

Observation

- *Constructive empiricism:*

  *"*Science aims to give us theories which are empirically adequate; and acceptance of a theory involves a belief only that it is empirically adequate" (Van Fraassen*, 1980*)

- Observation as *unaided* perception
  - E.g. using a microscope is *not* an act of observation (*Scientific Representation*, 2008)

Observation

- The limits of observability:

  "The human organism is, from the point of view of physics, a certain kind of measuring apparatus. As such, it has certain inherent limitations – which will be described in detail in the final physics and biology. It is these limitations to which the 'able' in 'observable' refers – our limitations *qua* human beings." (Van Fraassen, 1980)

The Extended Mind

- A theory of perception?
- Cognition as *situated*, *embodied*, *embedded*…
- The *extended mind thesis* (ExM):
  - Clark and Chalmers (1998)
  - Also: Richard Menary, Mark Rowlands, Mike Wheeler, Robert Wilson, and others

The Extended Mind

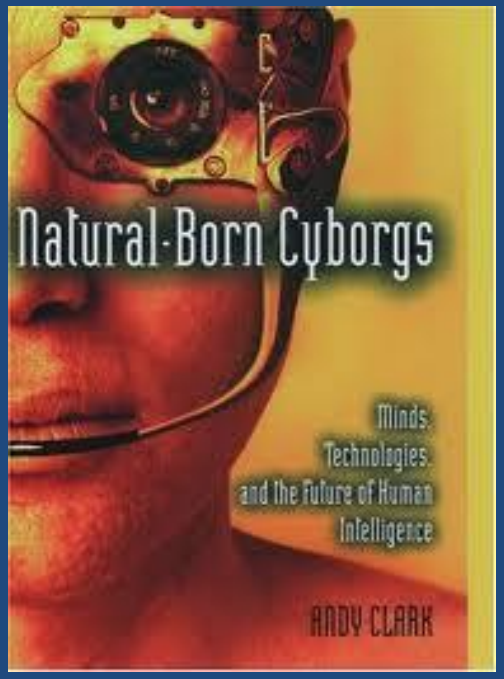
- Extended memory: Otto and Inga
- The *parity principle*:

  "If, as we confront some task, a part of the world functions as a process which, *were it done in the head*, we would have no hesitation in recognizing as part of the cognitive process, then that part of the world *is* (so we claim) part of the cognitive process." (Clark and Chalmers, 1998)

- "Veil of metabolic ignorance" (Clark 2008)

Extended perception

- *Natural-Born Cyborgs* (Clark):
  - cochlear implants
  - augmented reality goggles
  - telepresence devices
  - artificial vision systems
  - tactile visual sensory substitution



- The *extended perception argument*:
  - Instruments as part of scientists' perceptual systems

Extended perception

1. X is detectable using instrument Y (but not with unaided senses)
2. Under certain conditions, Y is part of the scientist's perceptual system
   a) If Y were inside the head of a Martian, it would count as part of its perceptual system
   b) (By parity principle) Y is part of the scientist's perceptual system
3. Therefore, *contra* Van Fraassen, X is observable

Classic arguments

- Grover Maxwell's "The Ontological Status of Theoretical Entities" (1962)
- No object is unobservable in principle:

  e.g. "suppose a human mutant is born who is able to "observe" ultraviolet radiation, or even X rays, in the same way we "observe" visible light" (Maxwell, 1962)

- Van Fraassen: '*observable'* means '*observable-to-us*'

Classic arguments

Maxwell

- Different perceptual systems are possible
- We might be mutants
- Limits of perception not epistemically relevant
- Empiricism as anthropocentric

Extended perception

- Different perceptual systems are actual
- We are cyborgs
- Limits of perception not limits of naked eye
- Empiricism as skullcentric

- *Empiricism for cyborgs*

Classic arguments

- Paul Churchland (1985):

  "[s]uppose a race of humanoid creatures each of whom is born with an electron microscope permanently in place over his left 'eye'. The scope is biologically constituted, let us suppose, and it projects its image onto a human-style retina, with the rest of their neurophysiology paralleling our own.

  Science tells us […] that virus particles [and] DNA strands […] count as observable entities for the humanoids described. The humanoids, at least, would be justified in so regarding them and in including them in their ontology.

Classic arguments

But we humans may not include such entities in our ontology, according to van Fraassen's position, since they are not observable with our unaided perceptual apparatus. We may not include such entities in our ontology *even though we can construct and even if we do construct electron microscopes of identical function, place them over our left eyes, and enjoy exactly the same microexperience as the humanoids*.

The difficulty for van Fraassen's position […] is that [it] requires that a humanoid and a scope-equipped human must embrace *different* epistemic attitudes toward the microworld, even though their causal connections to the world and their continuing experience of it be identical […]."
(Churchland, 1985)

Classic arguments

- Van Fraassen: Churchland conflates two different scenarios

  Scenario (1)

  - We accept humanoids as persons
  - What is observable-for-us changes

  Scenario (2)

  - We do not accept humanoids as persons
  - What is observable-for-us is unchanged
  - But then: Churchland begs the question

Classic arguments

Churchland

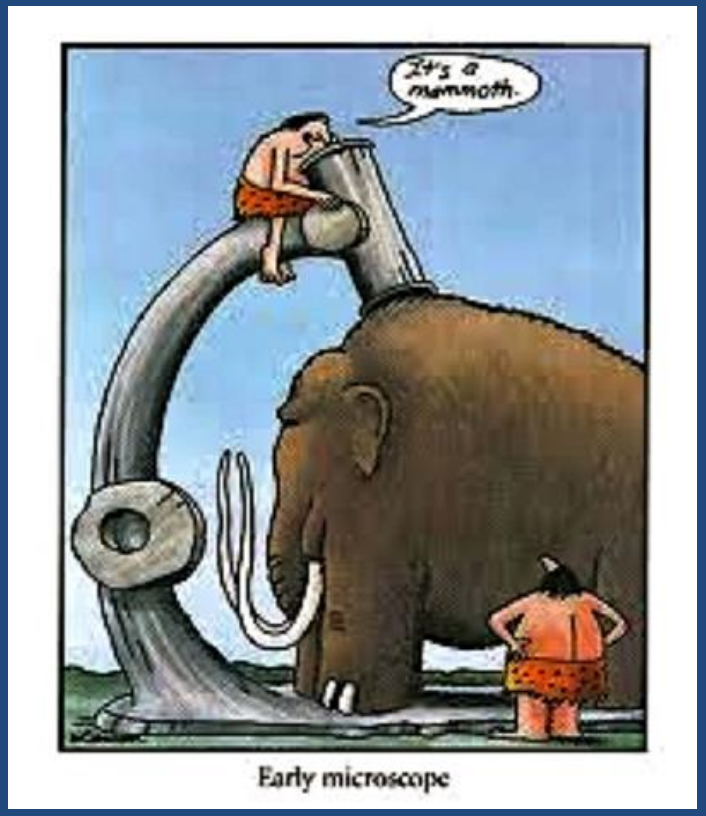
- It doesn't matter whether instrument is part of scientist's perceptual system
- Conflates scenario (1) and (2)
- Van Fraassen guilty of double standards

Extended perception

- Instrument is part of scientist's perceptual system
- Scenario (1) has already happened
- Van Fraassen guilty of cyborgphobia

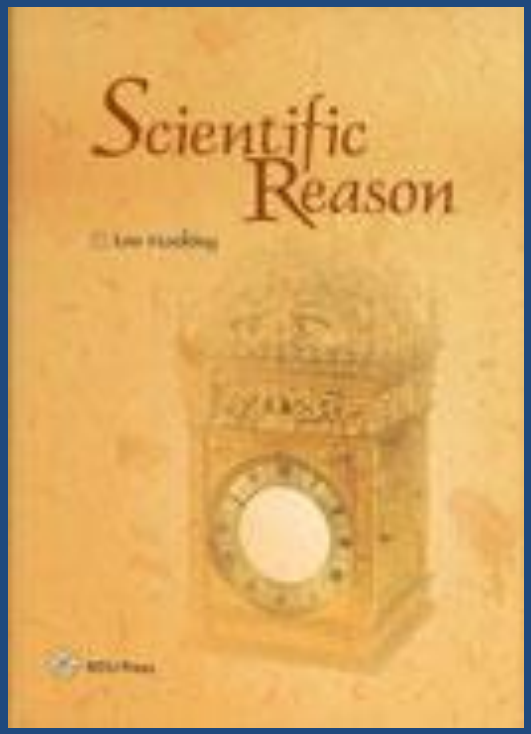
Summing up: observation

- Instruments as 'extensions' to the senses and the extended mind thesis
- *Empiricism for cyborgs:*
  - Differs from classic realist challenges to empiricism
  - Avoids Van Fraassen's responses to these challenges



Reasoning

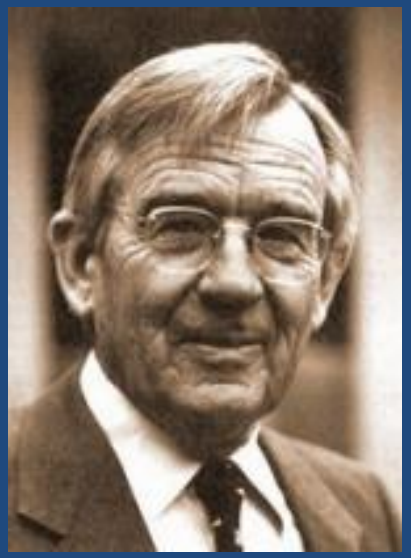
- Situated cognition and Ian Hacking's "styles of scientific reasoning"



Hacking on styles

- Alistair Crombie (1915-1996): *Styles of Scientific Thinking in the European Tradition (1994)*

1. The mathematical style
2. The hypothetical modelling style
3. The experimental style
4. The statistical style
5. The classificatory style
6. The historico-genetic style



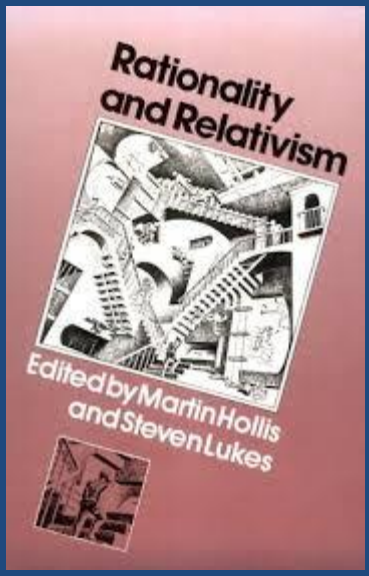
Hacking on styles

- Styles as “historical epistemology”
- With a style “new candidates for truth and falsehood may be brought into being” (Hacking, 1982)
- Why? Positivism – “the meaning of a sentence is its method of verification” (Schlick)
- “Thales discovered the continent of mathematics” (Althusser)

Hacking on styles

- "Language, Truth and Reason" (1982):

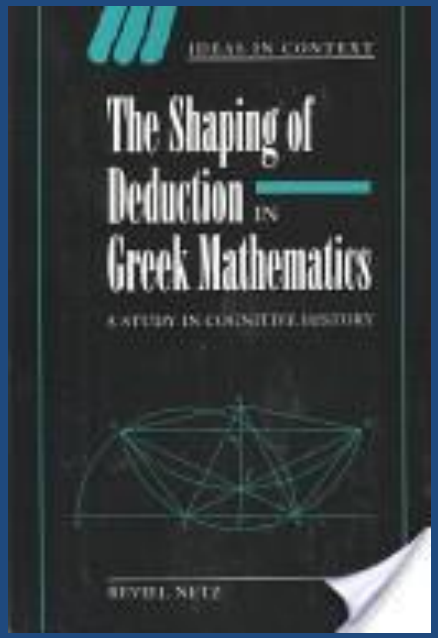
  "I want to pose a relativist question from the heartland of rationality"



- The worry:
  - Outside the style, claims are meaningless
  - So we can't know whether styles lead to the truth
  - We just have to jump in!
- Styles of reasoning are "self-authenticating"

Hacking on styles

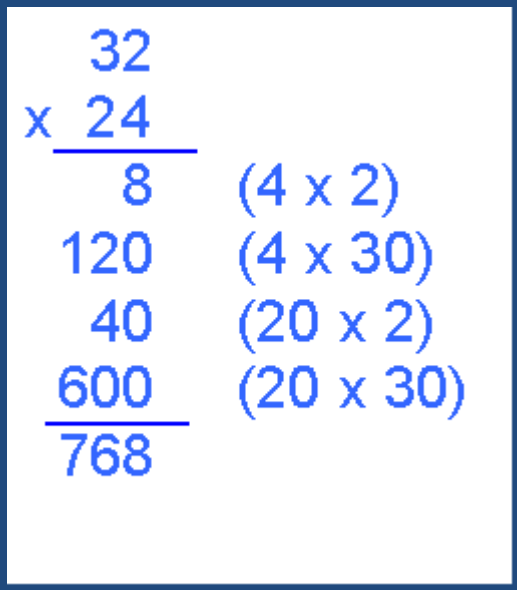
- Hacking (2012) calls for *cognitive history*
- Reviel Netz (1999) *The Shaping of Deduction in Greek Mathematics: A Study in Cognitive History*



"an attempt to understand how an organism with certain cognitive capacities developed sophisticated techniques of demonstrative proof in a corner of the Mediterranean 2400 years ago" (Hacking, 2012)

Situated cognition

- Canonical example:
  - Rumelhart, McLelland et al. (1986) on long multiplication
  - Brain excels at pattern recognition
  - Logical reasoning accomplished by manipulating external, material symbols
- Wilson and Clark (2009):



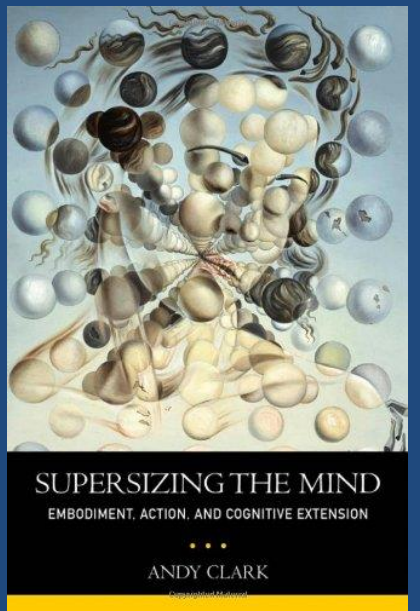
"the bulk of real-world problem solving, especially of the kinds apparently unique to our species, may be nothing but the play of representation and computation across these spectacularly transformative mixes of organismic and extranorganismic resources"

Situating styles

- General idea: styles of reasoning as practices involving cognitive tools
- Hacking: “thinking is too much in the head” and styles involve “the manipulative hand and the attentive eye”
- Netz: “Greek mathematical language was shaped by two tools: the lettered diagram and the mathematical language”

Situating styles

- New thoughts?
  - Kirsh (2010): external representations "allow us to think the previously unthinkable"
  - Houghton (1997): using external representations "we can represent things which, using our brains alone, we could not"
- Focus on Clark's "Material Symbols" and *Supersizing the Mind*



Situating styles

- What is the relationship between external material representations and human thought?
  - Translation views (e.g. Language of Thought)
  - Clark's "complementarity" view:

    "the actual material structures of public language (or sometimes their shallow "imagistic" internal representations) play a key and irreducible role" (Clark, 2006)

Situating styles

- Dehaene et al. (1999): mathematical cognition involves:
  1. Basic capacity to individuate small quantities
  2. Basic capacity for approximate reasoning
  3. Learnt capacity to use numerals as representing distinct quantities
- Clark:
  - No inner representation of 98
  - "There are 98 toys on the table" is a *hybrid thought*

Situating styles

- Recall Hacking on styles:
  - Styles open up new domains of knowledge by making new sentences candidates for truth-or-falsehood
  - Why? Positivist theories of meaning
- Situated view of styles:
  - Styles open up new domains of knowledge by making new (hybrid) thoughts thinkable
  - Why? Because new practices and cognitive tools provide new cognitive machinery

Situating styles

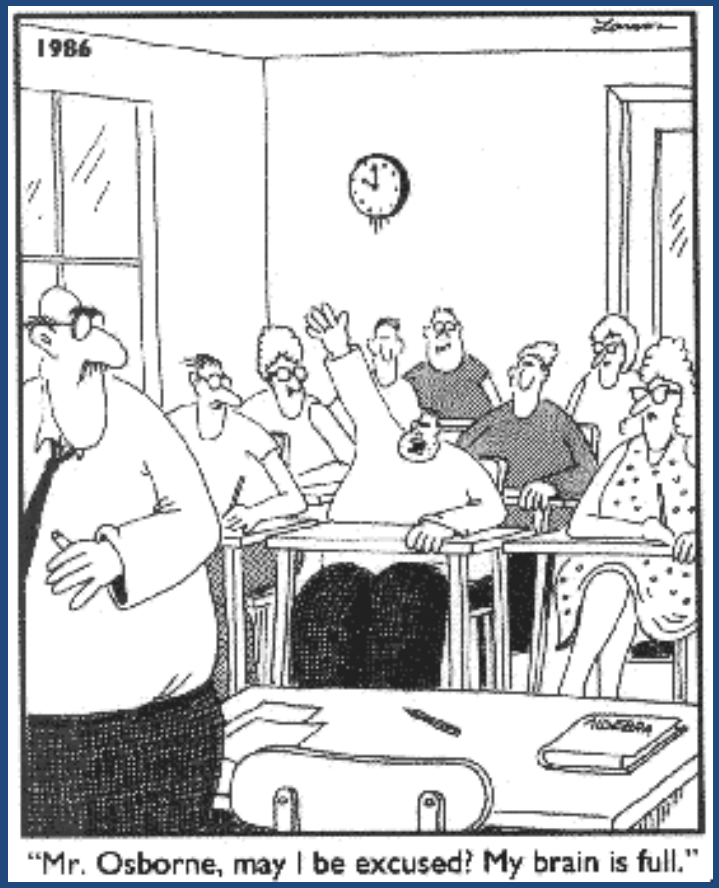
- Recall Hacking on relativism:
  - Outside the style, claims are meaningless
  - So we can't know whether styles lead to the truth
  - We just have to jump in!
- Situated cognition and relativism:
  - Outside the style, claims are unthinkable
  - So we can't know whether styles lead to the truth
  - We just have to (pick up the tools and) jump in!

Summing up: reasoning

- Situating styles:
  - Collaborative framework for cognitive history
  - Naturalistic, psychological reading of styles and their philosophical implications
  - New problem of relativism?

Understanding

- A difficult case?
  - Understanding and the “aha feeling”
- Claim:
  - understanding isn’t (always) in the head



Understanding

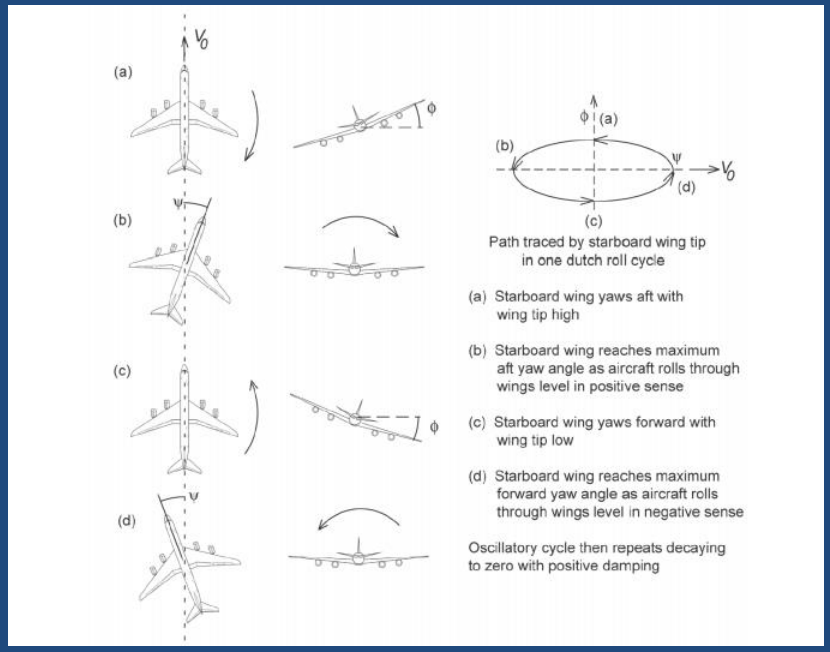
- What is the psychology of understanding?
  - E.g. Tom and Barbara: “Why do planes fly?”
  - Understanding as “seeing” or “grasping”

    “[a]n important difference between merely believing a bunch of true statements within subject matter M, and having understanding of M, is that one somehow sees the way things fit together. There is a pattern discerned within all the individual bits of information or knowledge’’ (Riggs, 2003)

Extended understanding

- E.g. Tom and Barbara: “Why do planes experience Dutch Roll?”

“[t]he Dutch roll mode is a classical damped oscillation in yaw […] which couples into roll and, to a lesser extent, into sideslip. The motion described by the Dutch roll mode is therefore a complex interaction between all three lateral-directional degrees of freedom. Its characteristics are described by the pair of complex roots in the characteristic polynomial” (*Aerospace Engineering Desk Reference*)



Summing up: understanding

- Understanding as a cognitive state
- This cognitive state can be realised by external, material devices
- Implications:
  - Subject of understanding
  - Psychology of understanding
  - Understanding and explanation
    - Cf. Kitcher: “internalization of the argument patterns”

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