The Language of Thought and the case against neurocomputational approaches – Thursday talk

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First, the neurocomputational approach

- Churchland & Sejnowski, ”Neural representation and neural computation”, *Philosophical Perspectives* 1990

Central ideas

- Reject top-down explanations of cognitive phenomena
- Co-evolutionary picture of interacting explanations instead
- Develop theories on the personal level in tandem with the sciences that study neural aspects of cognition

Aside: Personal and subpersonal levels

- The personal level deals with the thinking and acting person, while the subpersonal levels deal with cognitive activities ”below” that of the whole person. Marr’s theory of vision (Marr 1982) a typical example
- Suggested criteria:
  - Accessibility to consciousness
  - Cognitive penetrability
  - Inferential integration

How we study the brain

- Existing tools for studying the brain directly are not on the right level for studying cognition:
  - Imaging tools are too coarse (and slow)
  - Single-neuron studies are too narrow to explain how distributed patterns of activation over populations of neurons generate various types of cognitive activity

Central ideas, contd.

- Avoid this problem by using mathematical modelling to generate artificial neural networks that obey some of the general principles of the design and organization of the brain
- Now we can study how the various levels work and co-evolve together
- Artificial neural networks are especially good at pattern recognition

Central ideas contd.

- The only rules in the network that are explicitly coded are those regulating how activation is spread, and how mistakes are handled
- Representations in ANN:s are distributed over the units and their connections, not in discrete symbol structures
- If such distributed representations could exist in the brain, we get new ideas for handling PA:s

Result for the role and nature of PA:s

- Our common practice of specifying PA:s by giving sentences that specify their contents can turn out to be as inexact as giving a sentence to describe what an ANN knows (or ”knows”)

The Language of Thought (LoT)

- Representational, intentional, features are semantic: they are true or false about the world.
- So beliefs have their intentionality in virtue of properties shared with other semantically characterized items, sentences of public natural languages.

Linguistic in what sense?

- They are composed of parts and syntactically structured
- Their atomic parts refer to things and properties in the world
- Their meanings as wholes are determined by semantic properties of their parts together with the grammatical construction rules
- They have truth-conditions, determined by how the world is
- They have logical relations of entailment to eachother

The neurocomputational case against the LoT

- Certain cognitive tasks *couldn't* be accomplished in a computational fashion (not enough time)
- Anatomy: the brain is a parallel system
- Storage in nervous systems unlike storage in digital computers
- Certain tasks are easy for computers, hard for humans and vice versa

The neurocomputational case against the LoT contd.

- Nervous systems are plastic and change when we learn things
- ”The analogy between levels of description in a conventional computer … and levels of explanation in nervous systems may well be profoundly misleading.”
- How is animal and infant cognition accomplished without language?
- (Churchland & Sejnowski 1990:353ff)

”Why there still has to be a language of thought”, Fodor 1987

- ”But why … does it have to be a *language*?” (Fodor 1987:282)

Intentional Realism and LoT

- Agreement in the paper about IR:
- Psychological explanations need to postulate a network of causally related intentional states
- But what extra does the LoT give us – ”why does it have to be a *language*?”

LoT again

- What is claimed?
- PA-tokens are relations to symbol tokens
- The *objects* of intentional states are complex (all agree on this)
- LoT claims also that **mental states typically have constituent structure** (p. 283)
- So believing and desiring are typically structured states

Disagreement about cognitive architecture

- If mental states have constituent structure, this favours classicism over connectionism
- We need to compute in a language with transportable parts

Three reasons for believing in constituent structure

1. Methodological argument
2. Argument from psychological processes
3. Productivity and systematicity

Methodological argument

- Prefer theories that *minimize accidents*!

Only LoT theories can make it non-miraculous that there are certain connections between various aspects of behaviour. If there is no connection between thinking that *P* and thinking that *P & Q*, then this has to be mysterious

Argument from psychological processes

- Computational theories of mental processes (”the only game in town”) carry ontological commitments to mental state transitions, and this is not to be taken lightly
- ”(T)he cost of not having a Language of Thought is not having a theory of thinking” (292)
- Just appealing to ”Unknown Neurological Mechanisms” is no good:

Why would no theory be better?

- ”If you then ask her whether it’s not sort of unreasonable to prefer no psychology of thought to a computational psychology of thought, she affects a glacial silence.” (292)

Productivity and systematicity

- **Productivity:** there is a potential infinity of distinct belief-state types, hence belief must be combinatorially structured
- **Systematicity:** The ability to produce/understand some of the sentences is intrinsically connected to the ability to produce/understand many of the others.

Argument sketch

1. There's a certain property that linguistic capacities have in virtue of the fact that natural languages have a combinatorial semantics
2. Thought has this property too
3. So thought too must have a combinatorial semantics (293)

An argument from learning

- It is normally possible to learn part of a phrase without learning the rest (unless you're a tourist)

Restating the argument more carefully

- Linguistic capacities are systematic, because sentences have constituent structure
- Cognitive capacities are systematic too
- This must be because **thoughts** have constituent structure, too
- If thoughts have constituent structure, LoT is true

Why think that cognitive capacities **are** systematic?

- The function of language is to express thought, so cognitive capacities must be at least as systematic as linguistic capacities
- Not only language-users display systematic cognitive capacities. Rats learn stuff in a systematic way (296); pigeons solve disjunctive syllogism problems (if I remember correctly)

Fodor closing his argument

- ”The key to the nature of cognition is that mental processes preserve semantic properties of mental states; trains of thought, for example, are generally truth preserving, so if you start your thinking with true assumptions you will generally arrive at conclusions that are also true. **The central problem about the cognitive mind is to understand how this is so**.” (297)