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
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.
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.
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")
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 each other
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?”
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).
"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)