

Lecture 11

Part Two: Responding to the Respondents

Plan

- To try and understand *why* he doesn't accept the cases the respondents provide
 - Philosophical Objection
 - Empirical Objection
- We will then be in the position to consider:
 - Whether his challenge is fair
 - What (if anything) the take home message might be

Philosophical Objection

- Coltheart maintains the rival cognitive psychological theories must be '*otherwise plausible*'
- He defines 'otherwise plausible' as theories that have been seriously entertained by cognitive psychologists in print
 - This is to prevent degenerate theories
- Ta and Tb need to predict incompatible data in order to be rival theories
 - IF Ta THEN B1
 - IF Tb THEN NOT B1 (perhaps B2 instead)

Philosophical Objection

- Ta and Tb must predict incompatible neuroimaging data in order for it to be relevant for adjudicating between the two theories
 - IF Ta THEN N1
 - If Tb THEN NOT N1 (perhaps N2 instead)
- The data needs to be univocal (speak with one voice) so that we have clear support for either Ta or Tb and not both

Philosophical Objection

- But when people provide examples of the form:
 - IF Ta THEN N1
 - IF Tb THEN NOT N1 (perhaps N2 instead)
 - N1
 - Therefore support for Ta
- Coltheart maintains that these aren't theories about the mind, they are theories about the brain

Example

- Ta - Endogenous and exogenous attention are governed by a single cognitive system
- Tb - Endogenous and exogenous attention are governed by separate cognitive systems
- Imaging has revealed that endogenous attention activates a dorsal parietofrontal network whereas exogenous attention activates a ventral parietofrontal network
- This is taken as evidence that supports Tb over Ta

Philosophical Objection

- 'I think one can show that the two theories he considers are not psychological because nothing in his paper would be changed if he stated the two theories thus:
 - Ta - endogenous and exogenous attention are governed by a single brain system
 - Tb - endogenous and exogenous attention are governed by separate brain systems'
- They are not theories about cognitive systems they are theories about the brain

Philosophical Objection

- ‘...the theory that the process of rehearsal is cognitively independent of the process of speech production does not predict that different regions of the brain will be activated by these processes’
 - This might be because different cognitive processes can be trained on the same neural net (co-located), for instance

Philosophical Objection

- Coltheart's main objection to the respondents is that their cases fail because the neuroimaging data doesn't adjudicate between *cognitive psychological theories*
- In particular, he seems to maintain that cognitive psychological theories don't predict neural localization
- Insofar as respondents use theories that predict neural localization they are dismissed as failing to understand what he means by *cognitive psychological theory*

Philosophical Objection

- While Coltheart presents the claim as *empirical* (so that it is possible that there is a case that meets his challenge) his constraints seem to make it a *logical impossibility* that the challenge can be met
- While Coltheart presents the claim as restricted to *fMRI* the very same point would seem to apply to other neuroimaging techniques as well

Philosophical Objection

- One might be tempted to conclude ‘so much the worse for cognitive psychological theory!’
 - E.g., ‘If qualia can’t be studied by studying structure and function then so much the worse for qualia! If cognitive psychological processes can’t be studied by studying the brain then so much the worse for cognitive psychological processes!’
- In particular one might conclude that a BETTER theory would be answerable to more kinds of data (e.g., to alter the theory to predict and be answerable to neuroimaging data)

Empirical Objection

- ‘provided one makes the assumption that there is some “systematic mapping” from psychological function to brain structure, then functional neuroimaging data simply comprise another dependent variable, along with behavioral data, that can be used to distinguish between competing psychological theories (Henson, 2005, p. 194)’

Empirical Objection

- ‘I want to challenge this argument directly. I fully accept Henson’s assumption that there is some systematic mapping from psychological function to brain structure. Nevertheless, I’ll claim that no functional neuroimaging research to date has yielded data that can be used to distinguish between competing psychological theories’

Empirical Objection

- Coltheart thus grants that there is a systematic mapping from psychological function to neurological processes
- His other (empirical) objections to the examples provide clues as to why he isn't willing to regard cognitive psychological theories as being answerable to neuroimaging data

Empirical Objection

- It might not be enough to grant 'some systematic mapping'. It might be that there needs to be some specific mapping
- While Coltheart states he is *not* concerned with localization some of his specific responses question the legitimacy of the specific mappings that are relied on

Example

- Three theories of how number transcoding tasks such as reading aloud Arabic numerals are performed
 - Ta - transcodings always pass through semantic level
 - Tb - transcodings always bypass semantic
 - Tc - transcodings use both (with various factors biasing the route)
- Coltheart accepts these as rival cognitive theories

Example

- ‘The next step is to nominate the intraparietal sulcus (IPS) as a region of the brain that is activated when semantic tasks are being performed. Let’s accept this nomination, and measure IPS activation when people are performing number transcoding tasks. The predictions seem clear.’

Example

- The IPS is activated in tasks that don't require access to number semantics
- So it doesn't follow that Tb and Tc that there will be occasions when a number doesn't activate IPS
- Thus the findings that IPS is always activated when subjects perform a transcoding task is compatible with all three theories and can't be used to distinguish between them

Empirical Objection

- Similarly in response to another case Coltheart objects:
- ‘This reasoning required that covert shifting of attention and activation of the right posterior parietal region be *co-extensive*... Thus the claim that the sole function of this brain region is control of covert shifting of visual attention; unless that is so the reasoning about Ta and Tb does not follow’
- Research has shown that covert shifting of visual attention is *not* the sole function

Empirical Objection

- In 'Brain Imaging, Connectionism, and Cognitive Neuropsychology (2004)' Coltheart maintains 'I don't know of any examples in which there is current consensus as to the cerebral localization of any module of any cognitive system on the basis of cognitive neuroimaging data'
- He maintains that if we view cognitive processing as cascaded (rather than thresholded) and interactive (rather than purely feedforward) this poses 'grave difficulties for the use of imaging to discover the cerebral localization of cognitive modules'

What to Make of This

- It might turn out that there is a case in the existing literature that hasn't been unearthed yet...
- It might be that there are localizations accessible to fMRI that haven't been discovered yet (or that haven't been put to good use in adjudicating between cognitive psychological theories)
- It might turn out that fMRI is at the wrong grain to find the needed correlations between neuroscientific and psychological processes
- Or it might be that cognitive processes are multiply realized and distributed such that localization attempts will fail (denial of systematic mapping)

What to Make of This?

- Before I said it might be tempting to conclude ‘so much the worse for cognitive psychology’ if it was ruling neuroimaging data to be inadmissible by definition
- It would be especially tempting to conclude this if neuroimaging had been successful in finding neural correlates of cognitive psychological processes
- Insofar as neuroimaging hasn’t been successful in the search for correlates it is hard to see how the data is useful for theory adjudication, however!

What to Make of This?

- Until correlations / localizations are agreed upon...
- Why should cognitive psychologists look to neurological data for evidence relevant to their theories?