Dialogues in Philosophy, Mental and Neuro Sciences

Crossing Dialogues Association

DIALOGUES

Brain Network Commonality and the General Empirical Method

ANUJ RASTOGI
Institute of Medical Science
Collaborative Program in Neuroscience
University of Toronto (Canada)
Email: anuj.rastogi@mail.utoronto.ca

DIAL PHIL MENT NEURO SCI 2014; 7(2): 68-69

The Generalized Empirical Method (GEM) as outlined by Henman (2013) initially seems a cogent approach that should be adopted by cognitive neuroscientists. However, some weaknesses in the presumptions of this method in light of modern neuroscience research may challenge its validity. As I am currently working on mapping cerebral-cerebellar networks using fMRI, I am intrigued by the practical utility of the GEM in experimental work.

In defining numerous mental acts as basic elements of a theory of cognition, Henman (2013) asserts that a "detailed account of [these] mental acts increases the specification of locales and events in the brain" (p. 53). If the intention here is to specify distinct brain regions for distinct mental acts, then the assumption is being made that these brain regions uniquely sub-serve/mediate corresponding mental acts. In this sense, even if scans could "record different rates of synaptic activity" (Henman, 2013, p. 53) (which they actually cannot since metabolic measures of the fMRI signal reflect local field potentials instead of synaptic firing rates; see review by Ekstrom, 2010) or reveal combinations of brain regions, the problem of over specification remains. That is, it would be uneconomical and computationally demanding for the brain to delegate so many unique areas for specific mental acts.

Brain networks possess tremendous modularity and overlapping functional zones. For example, the Executive Network correlates with many tasks involving mental flexibility and working memory (Seeley et al., 2007). This network would correspond to more than one mental act as Henman (2013) has defined, such as "judgement" and "planning" (p. 51). If a supposition of the GEM relies on parcellating many brain areas for many mental acts, this would ignore commonality- a central principle in neuroscience. If this were the case, how would we organize such enormous amounts data in order to arrive at a parsimonious theory of cognition?

Collaboration among molecular biologists, psychologists, biochemists, and physicists is imperative for cognitive neuroscience to progress. Therefore, all independent lines of inquiry, from microscopy to large scale neuroimaging, must in one way or another *contribute* to a theory of thinking. Of course, brain scanning cannot solely explicate such a theory. For instance, understanding disordered thinking in schizophrenia is dependent on our understanding of the brain from these multiple lines of inquiry. Contrary to Henman's (2013) suggestion however, this does not mean that "more specific and detailed descriptions of cerebral activity" (p. 49) are needed. What is necessary at this point is a broader theoretical framework in which to contextualize the plethora of scattered data (Tandon, Nasrallah and Keshavan, 2009). Only then can effective and relevant therapeutic protocols develop.

Finally, brain network connectivity is extremely dynamic and experimenters must have *a priori* assumptions to obtain desired signals. This is true for statistical thresholding and resolutions in fMRI scans to select what to analyze and at what significance (Lindquist, 2008). As a result, the data of the scan is imbued with the data of the experimenter. The subjectivity of the experimenter and all his/her steps of contemplation about experimental design becomes an intrinsic quality in the objectivity of the scan data itself.

Henman's attempt at re-conceptualizing the modern approach to experimentation in cognitive neuroscience is commendable. I hope the concerns I have brought to bare will improve the GEM for further consideration, as it is interesting and not totally untenable. The GEM is at least trying to answer the question too many neuroscientists comfortably disregard: what can we really learn from scans anyways?

REFERENCES

Ekstrom A. (2010) How and when the fMRI BOLD signal relates to underlying neural activity: the danger in dissociation. Brain Res Brain Res Rev, 62:233-244.

Henman R. (2013) Can brain scanning and imaging techniques contribute to a theory of thinking? Dial Phil Ment Neuro Sci, 6:49-56.

Lindquist MA. (2008) The Statistical Analysis of fMRI Data. Stat Sci, 23:439-464.

Seeley WW, Menon V, Schatzberg AF, Keller J, Glover GH, Kenna H, Reiss AL, Greicius MD. (2007) Dissociable intrinsic connectivity networks for salience processing and executive control. J Neurosci, 27:2349-2356.

Tandon R, Nasrallah HA, Keshavan MS. (2009) Schizophrenia, "just the facts" 4: clinical features and conceptualization. Schizophr Res, 110:1-23.