

Why the earth is almost flat: Imaging and the death of cognitive psychology

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The first thing that struck me about Shallice and Cooper's (2011) brilliant (and beautiful) book is that the title is wrong: while actually called *The organisation of mind*, it should have been called *The organisation of brain*.

On page 187 I am charmingly called a flat-earther, presumably because of the sceptical position I have held about the current value of functional imaging to cognitive psychology, as described in papers such as Harley (2004a,b) and Loosemore and Harley (2010). I wish it to be publicly known that I do not believe the earth is flat. I have never said that the brain has nothing to do with the mind or that all brain imaging is a waste of time for psychologists. But I do believe that the horizon is a long way away, and that we need a good telescope to see the tops of the masts of just above it, and we can only infer what sort of ship is beneath the horizon from its mast.

There are of course only three possible positions about how mind and brain are related.

1. There is no relation. I find this position untenable, as one (literal) look at the brain would show. Kill the brain and you kill the mind. Not only that, the brain clearly has lots of different little bits in it that clearly do different things. But are they the things we think they're doing?
2. There is a nice simple mapping between the brain and the mind. Different bits of the brain support different psychological processes, and all we have to see is which bit of the mind lights up when we stimulate a bit of the brain, or vice versa. If we have a straightforward mapping between brain and mind, and an easily available methodology in the form of modern brain imaging techniques, we can easily tell us how the mind works by looking at how the brain works. It's this position to which I object. While there might be simple mappings (for the motor

cortex and early stages of visual processing, for example), in general the situation is more complicated.

3. And that is the third position, and one which I am amazed that the whole world does not hold: that the mapping between physical brain locations and processes and mental components and mind processes is a complicated one.

Perhaps everyone does believe (3). Then our only disagreement is how complicated is complicated: there's a continuum of beliefs here, from one extreme, that on the whole we can work out how the mind works from imaging, and generally it's going to be pretty easy to solve all the problems of cognitive psychology soon, to the far extreme that the mapping is so complicated that we are unlikely to be able to ever find out anything useful about cognition from brain pictures. Shallice and Cooper want to place me, in the form of Harley (2004a), and others such as Coltheart (2006) at the nasty pessimistic end. They themselves sing a happy, optimistic song, that yeah, things are a little tricky sometimes, but place themselves nearer to the easy end of the continuum.

So the issue is just how complicated is the brain-mind relationship, and just how are cognitive processes related to brain processes and locations? I love brain imaging; Shallice and Cooper is full of some beautiful pictures that are as good as any outstanding pieces of expressionist art.

The problem is that it is expressionist, and often more art than science. We are using psychological level concepts to explain brain-level processes (and vice versa). But of course they are different types of thing. So we must hope that our psychological level dissection of the mind corresponds in some way to the structure of the brain, but why should that be the case?

In particular the psychological level of theorisation uses language, and our psychological theories pretty much use folk psychology terminology: reasoning, morality, attention. (We give names to bits of the brain of course, but they are arbitrary.) I believe in a version of the Sapir-Whorf hypothesis (Harley, 2008) when it comes to psychological explanation: we talk about emotion, planning, memory, and attention, but just because we use these words, it does not mean that these are psychologically discrete entities, or *even exist as coherent mechanisms*. Our labels might look nothing like the psychological *subprocesses* involved in producing these entities. For example, attention has become reified to become a thing, rather than possibly the side-effect of orienting mechanisms. We talk about emotions called fear and anger, but these are complex sets of physiological and psychological responses that may not form a coherent entity - let imagers look for the correspondence of this complex, variable, perhaps even individual, state, across brain images. Some (perhaps most) imaging studies treat folk psychology categories as though they can be identified with discrete brain structures or pathways, and as such really are guilty of being the new phrenologists. Instead, though, the brain has evolved as a set of “kluges”, things added and put together, building on what has gone before, to solve specific problems in a changing environment (Marcus, 2008).

Let me give three examples. One concerns what we call executive processing. Now executive processing is nothing other than a convenient label for a set of processes to do with control. What are the actual processes involved in executive processing? At a low level they will be mechanisms such as exchanging two items in memory, mentally creating a plan (which it itself decomposable into simpler processes), switching plans (ditto), and examining our current state. The point is that we don't really know what we mean by “executive processing”, other than as an

umbrella term for a set of actual processes. It should be the job of cognitive psychology to work out what these processes really are (e.g. see Miyake et al., 2000, for one possible way forward). And that is why I like computational modelling so much: it forces us to be explicit about processes. Nature disposes, connectionism proposes.

The second example involves the hippocampus, discussed on p. 53. The hippocampus appears to serve two distinct functions: acting as a cognitive map, and involved in the storage of episodic memory. One strong possibility of course is that the hippocampus does indeed have two functions. But maybe we are looking at things the wrong way: we have easily available labels such as “cognitive map” and “episodic memory”, so we think those are the things we should explain. But at the true cognitive level, what we call the micro-cognitive level, a number of distinct processes might be involved. One suggestion I remember (unfortunately I cannot remember where) is that the hippocampus evolved as a structure that enables us to keep track of where food and danger lie in the world, thereby linking maps and episodes, but in a complex way.

A third example is emotion. We have some nice simple emotion words (surprise, disgust, anger, etc.) and even facial expressions that appear to correspond to these “basic” emotions, but the search for brain structures that correspond in any simple way has proved surprisingly complex to the point of elusive (see Ward, 2012, for a review). So again we might have to look at the level below emotion before imaging results make any sense.

Note that I am aware things might work the other way (too): our linguistic categories might be determined by our biology. We know this is true of colour names, at least in part (see Harley,

2008, 2010 for reviews). Similarly perhaps our biology determines some of the other folk psychology names we have. And I am not saying that imaging has no role to play here; in showing that processes previously thought to be unrelated share something, imaging can cast light on the cognitive micro-processes. But it's the micro-process that is of interest here, and that is usually ignored.

In summary, our language and thought may not divide up in the way in which the brain implements these processes. We are always going to need a psychological level of explanation to address folk psychology, and we will need a way of decomposing these folk concepts into cognitive micro-processes if imaging is to make any sense. I do not want to sound like some twenty-first century Luddite; I do not offer a council of despair, and I think computational modelling provides a way forward. Eventually psychology, modelling, and neuroscience will meet, providing converging evidence for a theory of mind, but a real integration is further away than Shallice and Cooper would like us to believe.

This book is an enormous piece of work; I am staggered at the level of scholarship. I am though nostalgic for the good old days of experimental psychology. I even yearn for a good old-fashioned lexical decision experiment that doesn't involve brain imaging (or eye-tracking). Cognitive psychology - the study of thought at the level of the mind - is being squeezed from beneath as ever larger portions of it fall under the surgeon's imager. Perhaps it is time to move on up. Perhaps I should become a sociologist.

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