Brain scanning and the single mind
Some of my friends have tried to convince me that I should finally quit meddling around with psychophysics and graduate to brain scanning. Start to solve real problems or really solve the problems I have an interest in! Brain scanning techniques are rapidly gaining popularity and many laboratories feel second rate when they can't offer suitable facilities. Owing to the high cost of such facilities there are complicated issues of politics and (social and scientific) status involved. Here I intend to address only the potential scientific merits of such methods. I say 'potential' because state-of-the-art equipment and methods—though intricate and expensive—still leave much to be desired. But suppose we're already in a more or less ideal situation, that is to say suppose we could obtain maps of human brain activity with good spatiotemporal resolution in realistic situations. What does this buy us?

There is no doubt that such methods will change the face of neurophysiology. In a way, neurophysiology is mainly about obtaining such maps. What is left to do is to develop descriptions that allow the prediction of such spatiotemporal distributions of electrochemical activity. For such theories one requires additional information on the micro level, much of which is already available, obtained with conventional techniques.

To my mind the same cannot be said about the psychological issues, except for much of psychophysiology which I will bluntly group with neurophysiology for the moment. That is why I am not terribly interested to take up brain imaging methods myself, being primarily interested in matters of the mind. Of course I will follow the brain scanning work out of academic interest, much as I follow developments in physics and astronomy (that's where I came from). To put it bluntly: Since the mind isn't in the head anyway, what use is it for me to peer into the brain? I believe that many people who use brain scanning methods to get a handle on problems of psychology erroneously locate the mind in the head.

Of course, I, too, believe with them that the mind is a natural phenomenon—to wit, a biological phenomenon. Yet I'm not saying that the mind is generated by the brain or is an “emergent property of brain activity” or something like that. If this were true one might consider abolishing psychology for a while, since neurophysiology, using brain scanning techniques say, will eventually solve all of the problems in its stride. Psychology might perhaps be tolerated as a sloppy, or 'coarse-grained', way of talking neurophysiology. This can actually be quite useful, like thermodynamics is a coarse-grained way of talking (in terms of suitable averages) about myriads of interacting molecules, but it is of a derived, not a fundamental usefulness. The very idea appears ludicrous to me. The mind is far from being a product of the brain. It derives from the interaction of the embodied brain and the world. Brains without evolutionary history are inconceivable and functional brains without constant interaction with the world are equally inconceivable. As we know, brains that are left to ‘freewheel’ for a relatively short time (sensory deprivation) quickly become dysfunctional. The mind is a natural, that is biological, product of the constant interaction of the embodied brain with the world, a dense nexus of largely circular processes.

Mental entities such as thoughts, beliefs, fears, perceptions, and the like are predominantly about the world or—as philosophers have been saying since Franz Brentano (1874)—are ‘intentional’. Since the term ‘intentionality’ is an awkward one in English (the original German doesn’t suffer from this), I'll use ‘about-the-worldness’ here.
When I see a tree, this is a *perception* if there really is the tree in front of me that causes me to perceive it, and I (quite automatically) take this to be the case. Thus perceptions aren’t in the head either (figure 1). Perceptions are perceptions because they have *meaning* and that meaning can’t be traced to the head. That is why brain scanning yields information about the causal relations in the brain but will never reveal any meaning. All one may hope to get is syntax and even that is idle hope. Brain activity is more like a footprint on the beach than like printed letters on the page. Strictly speaking, even the syntax has to be imposed from the outside as it were. To expect brain scanning to reveal anything about perceptions is like to expect a magnifier to reveal the meaning of a text. Sure, the magnifier would let you see the ragged edges of the printed letters better, but the meaning isn’t in the letters. The meaning of a text is not to be found between the covers of the book. These matters are nicely and to my mind definitively dealt with by Searle (1980) in his well known ‘Chinese room argument’. Searle grants too much to the ‘Chinese room machine’ though in that it lacks not just a semantics, but even a syntax.

So perhaps one should brain scan and correlate the results with the physical structure of the scene in front of the observer. Surely, that should reveal the nature of perceptions! Not really. For all you know, the observer might be a cleverly constructed human replica, or a zombie. How do you know it perceives *anything*, even granted that its brain activity can’t be distinguished from mine, scanned under similar circumstances? The only way to figure this out is to ascertain that the observer obtains some meaning from the exposure to structured electromagnetic fields, what I would be prepared to consider ‘vision’ in the case of myself. And the only way to find out whether meaning has been obtained is to ascertain that the exposure to the field of radiation has changed the potential behaviour of the observer. *Actual* behaviour will, of course, be exhibited by any well-constructed robot, even the circuits that guard elevator doors can’t be denied it. *Potential* behaviour is more interesting because it doesn’t merely depend on the stimulation. It depends also on the state of the observer. Roughly put, perceptions can be put to infinitely many uses and can ultimately play a key role in very diverse behaviours. It is exactly because they have a meaning, they represent knowledge about the current state of the world. For instance, one option open to the observer is not to act at all, but simply to wait and see. Then there is no overt behaviour to be recorded, but nevertheless the perceptions are still there, just as when the observer had decided to grab the object in front of it say. The existence of perceptions in this case can be proved because their nature will show up in consequent behaviour. That is why potential, not actual, behaviour is what counts here. In this sense perceptions have nothing to do with actions, that is *particular* actions. [This crucial point is forcefully pushed by Dretschke (1997).] In another sense, actions, understood as goal-directed behaviour, are often elicited and guided by perceptions, of course.
But how can one hope to get a handle on 'potential behaviour' when evidently only actual behaviour can be recorded? Is it a scientific concept at all? Of course it is. We all record potential behaviour when we assign our subjects arbitrary tasks in psychophysical experiments. The result of the experiment should be independent of the actual task. Examples of such tasks are the familiar "hit this or that button", "say yes or no", "raise left or right hand", and so forth in two-alternative forced-choice experiments. If the nature of the actual task turns out not to matter, we study perception because we record the potential behaviour (invariant over tasks); if it does, we study mere sensorimotor loops, reflexive behaviour, etc. Of course, this is only possible if one has a certain degree of control over the state of the observer. In human psychophysics this control is typically obtained through instruction, perhaps bought with some material reward. In animal experiments one uses such facts as that water deprivation typically motivates the animal to try to maximise its uptake of liquid. This necessity of acquiring control over the state of the subject makes true psychophysics only possible in cases where sufficient 'empathy' between the experimenter and the subject exists. The nature of the 'meaning' of perceptions is partly captured by Gibson's (1950) notion of 'affordances'. As an experimenter one needs to have some notion of the affordances of the stimuli, otherwise psychophysics becomes impossible and all that is left to do is to practice physiology.

The very idea of a 'zombie' makes little sense when the observer has been shown to perceive through arbitrary manipulation of its state. For then the states induced by an exposure to the field of radiation are really, that is to say empirically shown to be, about-the-world. Of course, we can never know 'how it feels like' to have such states to this observer because we can't get under its skin, but we have no valid reasons to deny it perceptions in the true sense of the word. The observer behaves in a certain way because it has seen certain things, and knows that the behaviour is likely to bring certain results about because it has seen these things. What else can one require? But notice that our conclusion that the observer behaves in a certain way because it has seen certain things, and knows that the behaviour is likely to bring certain results about because it has seen these things, doesn't depend in the least on how brain scans would look when collected during the process. Brain activity is at most part of mere particular action of the observer. Much of it is not even part of 'action' in the true sense of the word, like breathing or beating of the heart usually isn't. Thus, such data simply don't bear on the conclusion at all. Brain scanning and psychophysics are independent endeavours.

Thus I feel that there are valid reasons to pursue both neurophysiology (brain scanning) and psychophysics, but for quite different reasons. Neurophysiology reveals causal connections between brain states. It is not essentially different from the study of digestion (say), which reveals causal connections between the states of the stomach and the bowels as well as the concentrations of various chemical substances in the blood stream and so forth. Psychophysics reveals the structure of perceptions. Neurophysiology doesn't 'explain' the full ontology of perceptions for the simple reason that these are not to be found in the brain. In order to 'make sense' of the neurophysiology one needs psychophysics. For to 'make sense' of the data means to interpret them in terms of their about-the-worldness; for instance, to identify certain processes as 'visual' or certain areas as 'representing' monkey faces. Such interpretations require one to consider brain states as 'about' facts that relate to the world. This about-the-worldness is alien to neurophysiology proper, though. One conceptually switches to psychophysics, in the most simplistic case implicitly replacing the pushing of a button with the firing of an axon, say. But this only makes sense in the setting of psychophysics—I mean the potential action and all that. Without the psychophysics, neurophysiology can't be about the mind. There can be no meaning (semantics), not even a syntax.
Since behaviour depends on perception but is in no way *controlled* by perception (unlike reflexes or stereotypical, ‘instinctive’ behaviour), physiological processes cannot be expected to be determined by or determine perceptions. When I perceive a glass of water, I may drink it when thirsty or smash it when in a bad mood. I may bring about the smashing by kicking or throwing or some completely different action: the precise motor patterns are not tightly related to the perception, still less to the simultaneous—successive structure of retinal irradiances. Likewise, there is no logical reason to assume that perceptions will stand in a one-to-one relation to well-defined brain states. When brain scans look different from trial to trial, there is nothing to be worried about, at least not from the perspective of psychophysicists. The brain states are at best *actual*, not potential behaviour. Their precise structure is thus for a large part independent of which perception the observer may have. One expects more or less fixed patterns in peripheral parts of the brain, of course, and knowledge of these may be quite useful for the psychophysicist. In some cases satisfactory explanations of what’s in the mind can indeed be found, most clearly in cases where one explains what’s *not* in the mind because nothing is in the brain. For instance, when people without eyes turn out to be blind, a perfectly acceptable physiological explanation is not particularly hard to find.

The urge to look into the brain in order to find ‘fundamental causes’ of perceptual phenomena seems to be almost irresistible to most of my friends. This often surprises me, because most of these causes seem to me to lie in the world. Of course—in the final instance—even the brain itself is a product of the world, but here I mean ‘cause’ in a more immediate sense. Curiously, this is a highly neglected notion in current psychophysics. Here I once again sympathise with Gibson (1966) who looked upon ‘ecological optics’ as the major explanatory apparatus for (visual) perceptual facts. I am firmly convinced that forging a broad and quantitative ‘ecological physics’ of the human or animal biotopes is every bit as necessary a prerequisite for the understanding of human or animal perception as neurophysiology is. Even the development of neurophysiology itself [of the (conventional) kind that regularly borrows from psychophysics to forge stories to go with the recordings] will be (actually *is* already) seriously hampered by a lack of expertise in ecological physics.

In the final instance, one’s scientific preferences, I mean “what to do next”, are largely a matter of personal taste. Of course, it is fun and a challenge to put the new brain scanning technology to good use. The point I was making here is that one should not let this obscure one’s view of the larger picture. Psychophysicists should cheer up! There is no need to be envious of the scan crowd. Psychophysics is a valid endeavour in its own right and can never be rendered irrelevant by whatever progress in neurophysiology.

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