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Human nature without a soul?

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Rapid developments in neuroscience over the past four decades continue to receive wide media attention. Each new reported advance points to ever tightening links between mind and brain. For many centuries, what is today called 'mind-talk' was familiar as 'soul-talk'. Since, for some, the possession of a soul is what makes us human, the challenges of cognitive neuroscience directly address this. This paper affords the non-specialist a brief overview of some of the scientific evidence pointing to the ever tightening of the mind-brain links and explores its wider implications for our understanding of human nature. In particular it brings together the findings from so-called bottom-up research, in which we observe changes in behaviour and cognition resulting from experimental interventions in neural processes, with top-down research where we track changes in neural substrates accompanying habitual modes of cognition or behaviour. Further reflection alerts one to how the dualist views widely held by New Agers, some humanists and many religious people, contrast with the views of academic philosophers, theologians and biblical scholars, who agree in emphasizing the unity of the person.

Introduction and background

For more than two millennia, perhaps the most widely accepted answer to the question, 'what makes us human?' was that 'humans possess "a soul" '. It was this that distinguished us from the rest of creation. Noting this pervasive theme, that there is a separate part of us called 'a soul', no less a figure than the architect of much of the biology of the last half-century, Francis Crick[1] declared ' … The idea that man has a disembodied soul is as unnecessary as the old idea that there was a Life Force. This is in head-on contradiction to the religious beliefs of billions of human beings alive today. How will such a change be received?'

Writing a quarter of a century before Crick, another Nobel laureate, David Hubel[2], whose work with Torsten Wiesel ushered in a new era of neuroscientific research, had commented, 'fundamental changes in our view of the human brain

cannot but have profound effects on our view of ourselves and the world'. Scientific advances do indeed shape our assumptions about reality. All too often, however, when they appear in the media it is without the tentativeness of the original reporting.

According to Crick, it was the evidence from developments in cognitive neuroscience in particular that made necessary this radical shift in our ways of thinking about our nature in general and the soul in particular. The dualistic thinking that Crick targets is not, however, confined to the religious domain. It is widely represented in much popular literature and in the widespread interest in things like near-death experiences, the occult, and New Age beliefs.

When John Horgan[3], author of the provocatively titled book *The End of Science*, reviewed Owen Flanagan's recent book *The Problem of the Soul: Two Visions of Mind and How to Reconcile Them*, he suggested that Flanagan had addressed ' … what is arguably the major cultural question of our times: can the humanistic and even religious view of human nature be reconciled with science?'

A background of pervasive dualism

The notion that humans possess 'a soul' was typical of the thinking of major figures from the past such as Plato, Galen, Origen, Nemesius, Augustine (who held a modified Platonic view) and Descartes. Until relatively recently within the western world, the dominant cultural influences have been the religious ones. Concerning these, Leslie Stevenson[4] notes that, 'The theologians of the early church did begin to use ideas from Greek philosophy, and the conception of immaterial and immortal soul found its way into Christian thinking and has tended to stay there ever since'.

However, such views were not universal. In the late Middle Ages, St Thomas Aquinas made an impressive synthesis of Christian and Aristotelian ideas, which has since become Catholic orthodoxy. Stevenson writes that Aristotle (and those who followed him) believed that 'the human soul or mind should be understood not as a thing, but as a way of functioning or, more precisely 'a distinctive cluster of faculties including reasoning, which are fundamental to the human way of living and functioning'. 'It is surely better not to say that the soul pities, learns, or thinks,' observed Aristotle, 'but that the man does these with his soul' (de Anima 408b15). Thought of in this way, it does not make sense to talk of a soul or mind existing without a body for, says Stevenson, 'if there is no body (or at any rate no living body) then there can be no way that the body is functioning, for it is not functioning at all'. However, Aristotle curiously suggests, that 'there is something specially different about the human intellect, namely our faculty for purely theoretical thought'. This faculty, this kind of functioning, can exist separately from the body 'as the everlasting can from the perishable'(de Anima

413b26). 'Some of Aristotle's Islamic and Christian successors were happy to exploit this apparent backtracking in his philosophy of mind', notes Stevenson. Under Aristotle's influence 'Aquinas thus retained an element of Platonism, arguing that the soul has a separate existence until the resurrection, and that this helps to solve the problem of maintaining personal identity but at the cost of incurring all the problems associated with dualism. Similar strongly dualistic views are found in the writings of the Protestant reformation leaders such as John Calvin.

Dualistic views are also an intrinsic part of the beliefs circulating widely amongst *New Agers*. New-age[5] spirituality feeds off both the waning of communal religion and the advance of science. For *New-Agers*, you are a soul who inhabits a body and thus you are able to travel out of the body, read others minds and glimpse the future. Your soul may have inhabited another being and may again be incarnated in someone to come. At your body's death you will meet a gentle being of light (which has already been experienced by those near-death survivors whose spirits temporarily vacated their bodies). Dualism is thus a crucial component of such beliefs

From 'soul talk' to 'mind talk'

In the 17th and 18th centuries, philosophers' 'soul' talk had changed to 'mind' talk. Kenan Malik[6] wrote

> The difficulty in finding a common language in which to talk of the immortal soul and the body-machine led many 17th and 18th-century natural philosophers to speak increasingly of the 'mind' rather than of the 'soul'. The mind was not simply a synonym for the soul in a more mechanistic language. Rather, those aspects of the soul's relationship with a world that were amenable to naturalistic explanations – memory, perception, emotions and so on – were recast as problems of the mind. This transformation helped minimise conflict between theologians and natural philosophers: the soul eventually became the domain purely of theology, while natural philosophers developed the 'science of mind'. But it did not resolve the underlying problem of how to talk about an immaterial entity using a language developed for describing machines. It simply transformed the terms of that problem: *the question of how the transcendental soul acted upon the physical body became replaced by the question of how the immaterial mind could arise out of fleshy matter. It still remains a central question for the science of mind.*

However, as Stevenson[4] made clear and as we shall see later, the issues are not quite as straightforward as Malik suggests. As a broad generalization we may say that for the past two millennia the dominant view of soul–body or mind–brain relations was expressed in terms of some form of dualism. There were other views such as those of Aristotle, Spinoza and materialists such as Hobbes and de la

Mettrie. Nevertheless an overview of what contemporary psychology and neuroscience is reporting about mind–brain relations is directly relevant to our discussions here.

From the academy to the market place

Scholars have long debated where precisely within the body/brain the soul/mind resides. The views of academia at any particular time filter down to the market place and are often expressed in contemporary literature. In the 1590s, William Shakespeare included in his plays at least three differing views of how the mind and body, or the soul and the body, were thought to be linked. In so doing he echoed the views of preceding millennia either that the mind and the body were linked in the cardiovascular system, or in the brain (the so-called encephalic view), or in the spaces in the brain (the so-called ventricular theory). Thus, he has Portia reflect on the alternatives in *The Merchant of Venice*[7] when she sings: 'Tell me where is fancy bred, or in the heart or in the head.' Sir John Falstaff, in *Henry IV*,[8] echoes these choices in attributing the king's apoplexy to 'a kind of sleeping in the blood' and then to a 'perturbation of the brain'. In *Love's Labour's Lost*, [9] the schoolmaster Holofernes expounds the ventricular theory when he proclaims that his gifts are 'begot in the ventricle of memory, nourished in the womb of the pia mater.'[9]

As Shakespeare popularized the views of the Academy in his day so, for example, does David Lodge[10] today when he writes amusingly and insightfully about contemporary academic life. He takes up the mind–body theme in his latest novel, *Thinks* … . Lodge has his central character, a senior professor in artificial intelligence, who focuses on the problems of consciousness, say: 'It is basically the old mind–body one bequeathed by Descartes. My graduate students call our Centre, 'The Mind–Body Shop'. We know the mind does not consist of some immaterial spook stuff, the ghost in the machine. But what does it consist of?'[10] What David Lodge's professor asks about the mind is reminiscent of some past discussions of the soul as well as some current ones about the mind and brain.

The pitfalls faced by scientists discussing mind and brain are all too evident. The sociobiologist E. O. Wilson[11] certainly did not endear himself to philosophers with his claim that 'the history of philosophy consists largely of failed models of the brain'. Kenan Malik turned the tables by suggesting that 'the history of the science of Man consists largely of failed philosophical theories'. Malik[6] urged that it was necessary to recognize that 'the separation of science and philosophy meant that scientists exploring the meaning of humanity can remain blind to the philosophical assumptions that animated their work, and at the same time pass off philosophical speculation as scientific fact'. He went on: 'Philosophers… debate the nature of human subjectivity without considering its

rootedness in biology… [whilst]… natural scientists consider the biological origins of humanity's special qualities without entering into discussion of human agency.' The result he believes is that two mutually hostile camps are created, 'one viewing Man from a purely naturalistic viewpoint, the other seeing him as an entirely cultural being'. Malik[6] concludes: 'Each is equally one-sided and equally flawed in its attempt to understand what makes us human'. Neither biological determinism nor social constructionism fit all the available evidence. We shall do our best to avoid such one-sidedness.

The current scene

During the second half of the last century, and in particular immediately after the Second World War, there was a reawakening of interest in the brain–behaviour relationship. Facing the task of rehabilitating thousands of servicemen with circumscribed gunshot wounds, research advanced rapidly. As sometimes happens in science, the outcome was not so much the discovery of new ideas but the rediscovery of old ones. In this case, the views of some of the 19th-century neurologists combined with the development of the new behavioural techniques of the experimental psychologists, gave the impetus to the development of neuropsychology.

The rapid development of cognitive neuroscience in recent years is generally attributed to the convergence of three previously relatively unrelated areas of scientific endeavour: experimental psychology, comparative neuropsychology, and brain imaging techniques. The cognitive revolution within experimental psychology freed it from earlier narrowly circumscribed behaviourist approaches to the understanding of mind and behaviour. Psychologists could talk freely about mental events and not simply about stimulus–response contingencies. The development of new experimental techniques enabled cognitive psychologists to fractionate psychological processes into their component parts; memory, for example, into long-term memory, working memory, and short term memory.

In comparative neuropsychology, techniques found useful in studying human remembering and perceiving were adapted and applied to the study of non-human primates. Exciting new findings came from studies of memory and visual perception in animals. Other psychologists, following the pioneering studies of Hubel and Wiesel with cats used single-cell recording techniques to study the neural underpinnings of perception in awake and alert monkeys. At the same time, there were exciting developments in brain imaging techniques, notably nuclear magnetic resonance, positron emission tomography and functional nuclear magnetic resonance scanning techniques. These latter, combined with cerebral blood flow studies, made possible the monitoring of brain activities occurring when specified mental tasks are performed by normal people.

It is important to set what follows in context. Because the focus is on findings from research in neuroscience, that does not mean that any claim is being made that explanations at these levels are to be regarded as the only or the most important accounts that can be given of the human person.

Each of us is a complex system, simultaneously part of a larger social system and at the same time composed of smaller systems, which in turn are composed of ever smaller sub-systems. Any aspect of human behaviour and cognition we choose to investigate may be analysed at these different levels to begin to generate a fuller account of reality. Each level entails its own questions and calls for appropriate methods in order to answer them. Whilst the account given at each level may be complete within its own terms, that does not mean that by itself it constitutes a full account of the phenomena under investigation. Because at one level it is exhaustive does not mean it can claim to be exclusive. Each account complements the others. Take memory for example, neurologists and neuropsychologists study the cerebral localization of short term memory, working memory, episodic memory, and procedural memory, as well as the chemical codes and neural networks in which information is stored. Cognitive psychologists investigate memory in non-physical terms, as a partly automatic and partly effortful process of encoding, storing, and retrieving information. Social psychologists study how our moods and social experience affect our recall of past events. Recognizing the importance of these multiple levels of explanation does not entail adopting a reductionist position. That is not a necessary part of science. It may be a procedural device or it may be linked with materialist presuppositions held for other reasons. There are certainly great scientific benefits in the reductionist approach as a methodological stance and not a metaphysical one.

Illustrating the tightening mind–brain links

One of the more consistent findings of research capitalizing on the convergence of the three approaches outlined above has been how specific mental processes or even component parts of those processes appear to be tightly linked to particular regions or systems in the brain. Within those regions, moreover, there often emerged a further specificity indicating that certain columns of cells were involved when a particular aspect of the task was being performed.

Sensory processing as illustrated by research on neurophysiological, neuropsychological and clinical studies of face perception

From time to time over the past 50 years there have been occasional reports in the neurological literature of patients who, having suffered strokes, reported that they could no longer recognize individual human faces including their own. They

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could recognize dogs or cats or houses but not faces. With the advent of brain scanning techniques it became possible to identify areas of the brain which, when damaged, seemed to result in problems with face processing. There was already ample evidence of how visual signals arising from the face provide an abundance of social information about an individual's gender, age, familiarity, emotional state and potentially their intentions and their mental state.

Neuroethologists, having studied across many species the information gained by interpersonal face perception, pointed out that the primate face has evolved an elaborate system of facial musculature that helps in producing expressive facial movements. What also soon became clear was that the direction of gaze was of crucial importance. The eyes had of course long held a special interest to humans; they were said to be 'the window of the soul', and normally are one of the first points of contact between infants and their mothers.

Twenty years ago, following up an observation by Charles Gross at Princeton, researchers such as David Perrett[12,13] at St. Andrews, a leader in this field, used single cell recording techniques to discover that cells in monkeys' brains responded selectively to the sight of human faces. This was a surprising finding since, with further research, the specificity of the links between what the monkey was seeing, such as the identification of the faces, seemed to become stronger with every experiment. One important feature of any face was the direction of gaze of the eyes and the direction the head was pointing.

Cells that were responsively selective for faces were found in the superior temporal sulcus on the monkey's brain.[14] When the researchers changed the size of the faces these cells were not affected. However, if the individual features of the faces were scrambled, the responses of the cells reduced. There was a remarkable specificity in the cell responses to facial stimuli. More recently, Robin Edwards and David Perrett[15] have shown that colour is important and that colour and form are combined to specify the nature of the face. A green monkey activates cells less than a reddish brown monkey (the true colour). Perrett had earlier found, amongst other things, that changing head view – that is its horizontal orientation – had a dramatic effect on the activity of face responsive neurones. All this suggested to him that one of the key functions of these neurones may be to determine the direction of another's attention. Perrett proposed that the information provided by the eyes, the face and the body were each selectively processed by particular groups of neurones, all part of a processing hierarchy possibly for attention direction or social attention. Other researchers[13] demonstrated that this was only part of a larger system.

The results of this research with non-human primates have since been supported by human research using techniques such as event-related brain potentials or ERP's, functional magnetic resonance imaging or MRI and positron emission tomography or PET scans. There has also been a small amount of evidence from

patients suffering from very selective brain damage, which is consistent with the other research.

Personality and emotion

It is not only cognitive functions that have been localized. There is a long, although patchy, history within neurology that should have alerted us to the fact that with changes in the neural substrate we may observe changes in personality and in emotion. The best-known example is the case of Phineas Gage. Gage survived accidental damage to the frontal part of his brain, which transformed him overnight from a conscientious, reliable, dependable, hard-working pillar of society into an unreliable, boastful gambler, unable to devote himself for any length of time to any task. In short, as the result of selective brain damage, a reliable, morally upright, excellent character had become unreliable, morally irresponsible and a source of little good to the society within which he lived.

A series of similar cases, with damage to the same brain region resulting from disease and vascular accidents, have recently been documented by Antonio Damasio[16] and his colleagues. Cautious copy, however, never sells newspapers, so it is no surprise that the *Times*[17] of London, reporting Damasio's findings, came out with a large headline 'Brain damage can produce psychopaths'. One commentator on Damasio's patients wrote 'It's as if the moral compass of these people has been demagnetised, causing it to spin out of control' (de Waal)[18] and that 'What this incident teaches us is that conscience is not some disembodied concept that can be understood only on the basis of culture and religion'. Morality, he claimed, is as firmly grounded in neurobiology as anything else we do or are. De Waal observed how one capucin monkey will cooperate with another to help it get food.

Bottom-up and top-down

Most of the examples given so far are those in which changes have been made to neural substrates and observations have been made of subsequent changes in perception or cognition. This is sometimes labelled a bottom-up approach. Roger Sperry[19] urged equal attention to be paid to the role of cognition in modifying brain processes: this he labelled a top down effect. He wrote 'The new model adds downward to the traditional upward microdeterminism and is claimed to give science a conceptual framework that is more adequate, valid and comprehensive.'

We may summarize the evidence underlining the ever tightening links between brain and cognition by tracing out some examples taken from the bottom-up approach, moving up through the lower levels to the top levels of networks and systems, and then by noting top-down effects occurring at successively lower

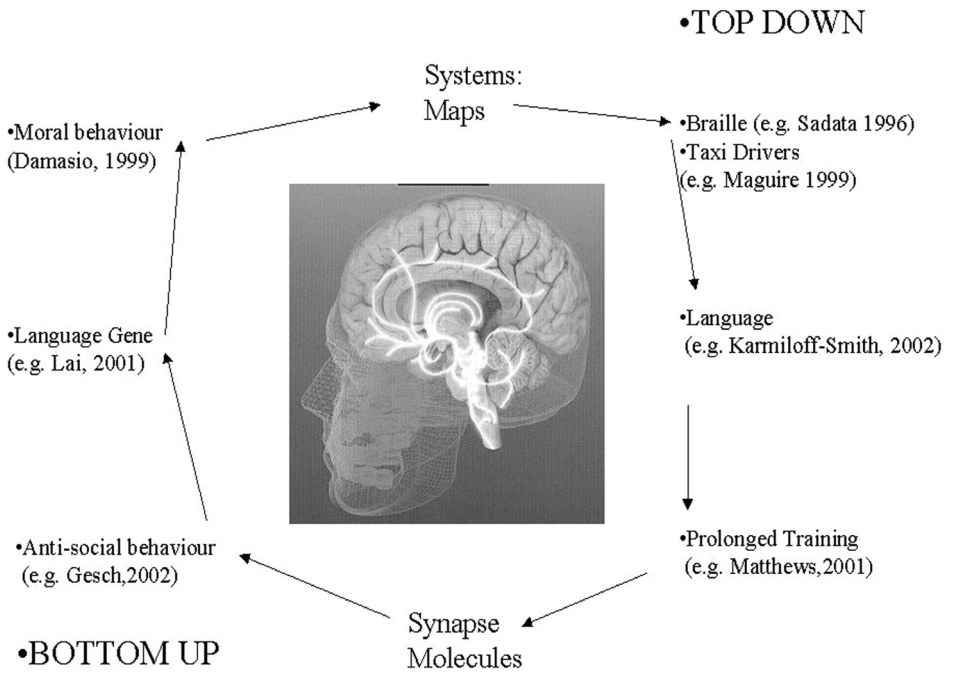

Figure 1. The interdependence of brain, cognition and behaviour.

levels. Figure 1 traces some of these effects using examples of research reported in the last few years.

Gesch[20] found that when prison inmates suffered a dietary reduction of vitamins, minerals and essential fatty acids their antisocial behaviour increased. Lai[21] and his colleagues identified a gene whose function is thought to be involved in the development of speech and language. Both these studies are clear 'bottom-up' phenomena.

Moving up from molecular levels to systems and maps in the brain we may refer back to Damasio's[16] (1999) studies cited above showing the effects of early brain injury on the moral behaviour of people in their late teens. Still at the level of systems and maps but now considering top-down effects, we recall that Sadata[22] studied people born blind and who had been taught Braille. Parts of their brains normally devoted to vision had been taken over by touch (see also the studies of Pascual-Leone and Torres).[23] These reports on humans were subsequently replicated in monkeys using single cell recording techniques.

Continuing with top-down effects in adulthood, consider another dramatic and widely reported top-down effect in the study of London taxi drivers by Maguire *et al.*[24] Licensed London taxi drivers are renowned for their extensive and detailed navigation experience. Maguire, studying structural MRI's of their brains,

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compared them with those of matched controls who did not drive taxis. They found that the posterior hippocampus of the taxi drivers was significantly larger than those of control subjects. Hippocampal volume also correlated with the amount of time spent as a taxi driver. They concluded, 'It seems that there is a capacity for local plastic change in the structure of the healthy adult human brain in response to environmental demands'. If the hippocampus is used extensively it changes shape and size and it is not a matter simply of the hippocampus being predetermined exclusively by genes.

With the rapid advances in studies of genes and human behaviour, which others have spoken about with special expertise, we are alerted to the increasing temptation to look for a one-to-one relationship between complex behaviours such as altruism, aggression and language on the one hand, and specific genes or locations in the brain on the other. Such a view has been given wide publicity by Steven Pinker[25] using data from adult neuropsychology and genetic disorders. However, other leading workers in the field such as Karmiloff-Smith[26] have argued that Pinker's interpretation of the data is flawed. She points out that it is based on a static model of the human brain, which ignores the complexities of gene expression and the dynamics of post-natal development. I agree with Karmiloff-Smith's critique. She has pointed out that '… understanding the complex pathways from gene-to-brain-to-cognitive processes-to-behaviour is like a detective story, in which seemingly unimportant clues early in development play a vital role in the final outcome'. She has argued that comments by scientists such as Steven Pinker[24] repeatedly supported assumptions that would imply a one-to-one relationship between specific genes and complex behaviours. Those of such a Nativist persuasion claim that human infants are born with genetically specified brains that contain specialised components, not only for low-level conceptual processes, but also for higher level cognitive modules such as language and face processing. She recognized that, at first blush, there are indeed a number of genetic disorders that seem to fit such a Nativist model. Dyslexia is one such disorder with a clear genetic component. Another is Williams Syndrome. Pinker has claimed this as the prime example of impaired and intact cognitive modules directly linked to genes. He compared another disorder, known as Specific Language Impairment or SLI with Williams Syndrome (WS) arguing that 'Overall, the genetic double dissociation is striking, suggesting that language is (both) a specialisation of the brain … . The genes of one group of children (SLI), impaired their grammar whilst sparing their intelligence; the genes of another group of children (WS) impaired their intelligence whilst sparing their grammar' (Pinker[25]). By contrast, Karmiloff-Smith argues that '… there is no one-to-one direct mapping between a specific gene and a cognitive-level outcome. Rather, there are many-to-many indirect mappings, with the regulation of gene expression

contributing to broad differences in developmental timing, the neuronal type, neuronal density, neuronal firing, neurotransmitter types and so on.'

She concluded that '… data from adult neuropsychology and genetic disorders cannot be used by Nativists to bolster claims about genetically specified, modular specialisations of the human brain. We need to understand how genes are expressed through development, because the major clue to genotype/phenotype relations turns out to be the very process of development itself'. This timely and well informed comment should be borne in mind whenever there is an attempt to deduce genetic determinism from research results in cognitive neuroscience.

In the citation for Karmiloff-Smith's award of this year's Latsis Prize by the European Science Foundation it was observed that 'Her research aimed to show that the brain is neither hardwired nor a blank slate, but that both genes and environment interact in complex ways and that the actual process of post-natal development plays a crucial role in this dynamic interaction.' Adding that this again 'highlights the fact that the adult neuropsychological model is inappropriate for explaining developmental disorders'.

At the level of synapses and molecules, we may recall the study by Keith Matthews[27] and his colleagues who showed that when rats were repeatedly subjected to neonatal maternal separation during the preweaning period, several of their brain neurotransmitter systems, including dopamine and serotonin, were systematically changed at adulthood. Collectively these studies indicate that experience changes the brain.

Finally we may consider a very recent elegantly designed study by O'Craven and Kanwisher[28] which beautifully illustrates how the 'Mind' selectively mobilises specific areas or systems in the brain. They showed that imagining faces or houses was linked to activity in two different brain areas. Seeing or even just thinking about faces activated the fusiform face area, whereas seeing or thinking about houses activated the parahippocampal area. The experimenters could actually 'read the minds' of their subjects by observing their brain activity. They could tell whether they were thinking about faces or houses by measuring the activity in the respective brain areas. This study also dramatically illustrates the rate of progress of research in cognitive neuroscience. O'Craven and Kanwisher, in their report quote a paper by Grabowski and Damasio[27] published in 1996 where they wrote 'the imaging of the neural correlates of single and discrete mental events, such as one image or one word, remains a most desirable dream'. O'Craven and Kanwisher[28] add 'That dream is now (2000) a reality'.

The need for a balanced account of each new exciting research finding is well exemplified by the work of Annette Karmiloff-Smith whose research has further underlined that the brain is neither hardwired nor a blank slate. Both genes and environment interact in complex ways and the actual process of post-natal development plays a crucial role in this dynamic interaction.

A continuing puzzle

How is it that with such similar basic brain architecture shared by humans and non-human primates their cognitive and cultural achievements are so different? Some neuroscientists have pointed to possible specific differences between monkeys and humans, which may have given rise to the great differences we observe today. David Milner[30] has speculated that, 'non-human primates may not have the cerebral equipment to later re-enact their perceptual experience, thereby providing the flexible mental furniture that is available to humans as a guide for their later actions. Our ability as humans not only to experience the visual world as a vivid moment-to-moment stream of consciousness, but also to be able to reconstruct and internally manipulate the contents of that experience "off line" may well be unique in the animal world. This has implications not only for internal cognition, but also for outward conduct.' Most recent research by Chris Baker at St. Andrews suggests, however, that it may be rather a matter of degree rather than an absolute difference.

Milner's claim may turn out to be correct and, if so, is part of the answer to the question, what makes us human? However it is salutary to remember the fate of a similar claim made some years ago by Tulving[31] that, '… as far as we know *members of no other species possess quite the same ability to experience* again now, in a different situation and perhaps a different form, happenings from the past, and know that the experience refers to an event that occurred at another time and in another place …' This refers to an ability labelled episodic memory. Commenting on Tulving's claim, Morris[32] observed that there are 'reasons for thinking that mammals may possess an "episodic-like" memory system even though Tulving's formal definition of episodic memory puts the concept outside the realm of experimental study in non-human species'. Whilst this sort of debate raises interesting and important issues *within* science about the use of animal models to investigate human cognitive abilities, there are no immediate ethical or moral issues at stake.

Human dignity, however, does not depend on human uniqueness based on episodic memory or the changed role of the superior temporal sulcus. To go down that road would be to repeat the errors of the past so nicely summarized by Passingham[33] when he noted in *The Human Primate* how man has always considered himself to be set apart from animals. He reminds us how the 19th-century anatomist Richard Owen on the basis of brain differences, put man in a separate sub-class, set apart from another sub-class containing all the other mammals. He called our sub-class the Archencephala or 'ruling brains', claiming that there were three structures unique to the human brain. T. H. Huxley convincingly refuted these claims, demonstrating that all three structures, including the hippocampus minor, could be seen in the brains of other primates.

Huxley was scornful of those who, as he put it, sought to 'base man's dignity upon his great toe', or those who thought 'we are lost if an Ape has a hippocampus minor'. Since it is the possession of 'a soul' which is the focus of our present discussions we may note in passing that others have sought to pin the uniqueness of humans on the possession of a soul, with the parallel assertion that animals do not have souls.

The search for how the quantum leap occurred making humans so different from animals continues. Some have suggested that what the physicists called a 'phase change' occurred at some point in brain evolution so that the same basic materials exhibited new properties. Oxygen and hydrogen in appropriate proportions and under specific conditions become a liquid with different properties from gases. Perhaps this is a useful analogy for what we shall eventually discover produced the remarkable changes between non-human and human primates.

Another possibility currently being widely canvassed suggests that the rise of modern Homo sapiens was crucially defined by our capacity for language (see Crow *et al*.[34]). It is argued that the key component of this language ability is focused in the left hemisphere of the human brain and a specific gene called *protocadhedrinXY* is postulated to play a crucial role in this language capacity. If so, it is this gene that can be said to define our species. On this view, the emergence of Homo sapiens was not a gradual or continuous process; instead there is the possibility that 100 000 to 150 000 years ago there was a jump that gave rise relatively abruptly to our species. Remembering that experiments with chimpanzees have claimed to demonstrate some capacity for language, we must conclude that the jury is still out on judging this recent proposal.

Personal agency

When analysing human nature from the perspective of neuroscience it is all too easy to forget the primacy of the role of consciousness and of the cognitive agent in all that we do. As medical or basic scientists we are constantly aware of the risk of so focusing on each new discovery of how this or that aspect of cognition or behaviour is embodied in this or that region or system of the brain, that we give the impression that we are, after all, 'mere machines'. We just take it for granted that people recognize that it was someone's personal agency that produced the research. It was undertaken on someone's personal initiative and that someone had reflected long and hard on the results before writing them up, presenting them at a conference for peer scrutiny, and submitting them to a journal, all indicative of personal agency at work. Without this personal agency none of the work would have been done and without rational evaluation it would never have been appreciated!

It is certainly worth remembering that some of the scientists who have

contributed most over the past few decades to our understanding of the biological basis of cognition and behaviour are the self-same ones who have been at pains to alert us to the dangers of being oversimplistic in our understanding of the implications of their discoveries. Take, for example, three Nobel laureates' views on consciousness and personal agency. Sir John Eccles[35] cautioned 'let us be clear that for each of us the primary reality is our consciousness, everything else is derivative and has a second order quality. We have tremendous intellectual tasks in our efforts to understand baffling problems that lie right at the centre of a being'. Roger Sperry[36] wrote 'the new model adds a downward to the traditional upward microdeterminism and is claimed to give science a conceptual foundation that is more adequate, valid and comprehensive'. Gerald Edelman:[37] 'The evolutionary assumption implies that consciousness is efficacious – that it is not an epiphenomenon'. For all three, consciousness is primary, and it is part of the world and the reality with which we have to deal. This is a view endorsed by the mathematician Roger Penrose[38] who wrote that 'consciousness is the phenomenon whereby the universe's very existence is made known'. For none of them is there any place for a simplistic reductionism.

To recapitulate; first, we are only at the beginning of our understanding of the complex interrelations between what is happening at the levels of cognition and its neural substrates. Second, there is no simple pattern of when, and under what circumstances it is the top-down, cognitive, behavioural, environmental factors that are crucial and under what circumstances it is the built-in bottom-up, genetic, neurochemical factors that are dominant and which represent the determinants of any expressed cognitive capacity or behaviour.

Unity, interdependence and duality

The science presented points to the intimate relationships between mind, brain and behaviour. Some of these relationships were bottom-up and some were top-down. The emerging consensus is well summarised in the views of a neurologist, Antonio Damasio, and a psychiatrist, Robert Kendell.

Damasio[39] wrote, 'The distinction between diseases of "brain" and "mind", between "neurological" problems and "psychological" or "psychiatric" ones, is an unfortunate cultural inheritance that permeates society and medicine. It reflects a basic ignorance of the relation between brain and mind'. Robert Kendell,[40] past President of the Royal College of Psychiatrists in Britain, wrote, 'not only is the distinction between mental and physical ill founded and incompatible with contemporary understanding of disease, it is also damaging for the long -term interests of patients themselves'.

It is one thing to observe this consistent pattern of the intimate links between mind and brain, but it is an enduring problem to know how most appropriately

to conceptualize it. Some talk about a relationship of identity, some of interaction, others characterize it as a relationship of interdependence. Interdependence, at least, has the virtue of not going beyond the available evidence. Given this interdependence, how can we take proper account of the primacy of self-conscious human agency in modelling the relationship of mind and matter? We may project this concept of human agency on to the outside world in terms of an image of brain events or we may take the standpoint of the agent itself experiencing mental events. Many have suggested that these two are best seen as complementary descriptions and it is a distortion of reality to say that they are 'nothing but' the one or 'nothing but' the other. There is an intrinsic duality about the reality we have to deal with but this does not need to be seen as dualism of substances. We may regard mental activity and correlated brain activity as inner and outer aspects of one complex set of events that together constitute conscious human agency.[41] Two accounts can be written about such a complex set of events, the mental story and the brain story, and these demonstrate logical complementarity. In this way, the irreducible duality of human nature is given full weight, but it is a duality of aspect rather than a duality of substance.

Whilst the evidence from the so-called top-down effects may, in some instances, be helpfully described as showing *interaction*, nevertheless the warnings given by Roger Sperry about the inadequacies of this description should be taken seriously and for that reason I prefer *interdependence* to interaction. Interaction normally is used to describe causal relationships between events at the same level but here we are describing relationships between events at different levels. We have no idea how what happens in the mind and through habitual behaviour produces changes in the brain even though, as I have tried to show, there is lots of evidence that it does.

The evidence for interdependence is so widespread, one might almost say universal, in all the work that I have described, that it seems to be the way the world is. In other words we may provisionally describe it as intrinsic. At the same time, as many have pointed out, descriptions in terms of personal agency and at the level of cognitive processes cannot be reduced to descriptions at the level of neurotransmitters or synapses. In other words the interdependence we observe is best described as an irreducible intrinsic interdependence.

Conclusions

For more than two millennia most, but not all, of the major models of soul–body or mind–brain relations in the market place have leaned towards some form of dualism. In the past 200 years, however, the accumulating scientific evidence has pointed steadily – and in the last 40 years at an ever-accelerating pace – towards recognizing the intimate links between mind and brain. As research proceeds

simultaneously at several different levels from the molecular to the cognitive, the pictures of the mind/brain relations become very complex. The basic fact remains that, as far as we can see at present, when something happens in the mind something also happens in the brain. The cognitive happenings may not always be conscious, but may nonetheless be detectable using some of the subtle scientific techniques available today to brain scientists.

A very recent paper in *Trends in Cognitive Science*[42] nicely illustrates how today's widespread interest in linking brain with thought has extended into the domain of religious beliefs. The paper was entitled 'Religious thought and behaviour as by-products of brain function'. The tone of the paper implied that such research empties religious beliefs of any truth claims. A little reflection, however, and the remembrance of a paper published nine years ago in *Nature*[43] reporting a study of brain activity in chess playing might have helped avoid the tendentious title of the paper. No one, I think, concluded – following publication of the *Nature* paper – that chess playing and its endless intellectual challenge was nothing more than a 'by-product of brain function'! No doubt, another paper, after appropriate empirical research could be prepared entitled 'Scientific thought and behaviour as by-products of brain functions'. As scientists, however, we like to think that the truth or falsehood of any claims we make are not 'explained away' because we may be able to identify brain areas active when we are at work in our laboratories! The truth or falsehood of the content of the cognitive processes must in each case be judged by reference to the appropriate evidence.

We also noted that for those working in neuroscience what is labelled 'substance dualism' seems very difficult to defend. Which all leads back to the challenge offered by Francis Crick that on his interpretation of the evidence from neuroscience it would require 'billions of people alive today' to revise their understanding of human nature and this includes some humanists and many who hold some forms of religious beliefs. But did Crick overstate his case? I think the answer is yes and no!

Yes, if my impression is correct that a not insignificant minority of scholars best acquainted with the origins and content of Hebrew–Christian views of human nature would wish to dispute Crick's claim that they believe that we have 'a soul'. It seems that both Jewish and Christian textual and exegetical scholars are at pains to point out that the Hebrew–Christian view of the soul is not as straightforwardly dualist as widely believed. Keith Ward[44], for example, until recently Regius Professor of Divinity at Oxford, has argued that we need to recognize a great difference between *official* doctrines of the human soul and *popular* understandings of it. He accepts that the idea that the soul is a part of the human person, which can be disconnected from the body without any harm to the personality, is a widely held view. Ward concedes that in some of Plato's dialogues this view can be found and, moreover, because one of the most influential early Christian writers,

Augustine, was heavily influenced by Plato, it is assumed that Christians also believe that the soul is a spiritual substance distinct from the body. However, Ward claims that this is a misunderstanding of Christianity. Ward asserts that the Christian tradition, like the Jewish and Muslim traditions, starts at a different place. In Hebrew thought, the soul is the active principle of a living body. It is not a separate entity additional to the body. Ward has argued that the Hebrew and Aristotelian view of humans recognises that humans are fully and properly material objects but that their distinctiveness lies in their mental capacities of abstract thinking and responsibly free acting.

To Ward's views we may add other voices, such as the Old Testament scholar Lawson Stone,[45] who, when commenting on a passage in the book of Genesis often regarded as a proof text for the existence of a separate soul (Genesis chapter 2 verse 7), has noted that if (as he believes) 'dualisms have failed here, they forfeit their status as a privileged Christian view and scientific denials of dualism appear less controversial'. He goes on to comment 'if the immortality of the soul and hence dualism are essential to Christian thought then the Church should be bracing for an encounter with science far overshadowing debates about creation and evolution'. For Stone, however, the encounter with neuroscience should be read much more positively, demanding as it does a closer reading of the original texts. When this is done, the supposed religious requirement to embrace dualism, so he claims, disappears. In similar vein, the New Testament scholar Joel Green[46] reminds us that 'Jewish perspectives on life after death continued to embrace and view the human person as a psychosomatic unity', and thus typically they 'did not entail an expectation of the liberation of the immortal soul from the mortal body'. Green finds a similar view in his reading of the New Testament texts. He has written, 'a constellation of issues and concerns has coalesced in biblical studies over the last century with the result that theories of body–soul dualism are today difficult to ground in Scripture'.

It is perhaps significant that starting from theistic presuppositions, Jewish and Christian scholars are today re-emphasizing the need to avoid suggesting that human uniqueness resides in possessing this or that physical or psychological characteristic or in an immortal soul but rather grounding human uniqueness firmly in a unique divine calling and destiny.

For example, Colin Gunton[47] has written 'human difference from the rest of the creation does not lie in some absolute ontological distinction, but in an asymmetry of relation, and therefore a relative difference. As created beings, human persons are bound up closely with the fate of the rest of the material universe, as stewards rather than absolute lords.' And he adds, 'to be in the image of God is at once to be created as a particular kind of being – a person – and to be called to realise a certain destiny. The shape of the destiny is to be found in

God-given forms of human community and of human responsibility to the universe'.

Clearly the views of the academy have yet to reach the market place on this issue. To that extent surely Crick was correct and the debate will continue.

References

1. F. Crick (1994) *The Astonishing Hypothesis* (Simon and Schuster).
2. D. Hubel (1979) The brain, *Scientific American*, September, 45–53
3. J. Horgan (2002) Modern philosophy at its best. 24 July, Review of Flanagan O. *The Problem of the Soul: Two Visions of Mind and How to Reconcile Them.*
4. L. Stevenson and D. L. Haberman (2004) *Ten Theories of Human Nature*. 4th edn (New York, Oxford University Press).
5. D. Myers (2002) *Intuition: It's Powers and Perils* (New Haven: Yale University Press).
6. K. Malik (2000) *Man, Beast and Zombie* (London: Wiedenfeld and Nicholson).
7. W. Shakespeare, *The Merchant of Venice*, Act 3, scene 2.
8. W. Shakespeare, *Henry IV, Part 2*, Act 4, scene 2.
9. W. Shakespeare, *Love's Labour's Lost*, Act 4, scene 2.
10. D. Lodge (2001) *Thinks* (London: Secker and Warburg).
11. E. O. Wilson (2000) quoted in K. Malik (2000) *Man, Beast and Zombie* (London: Wiedenfeld and Nicholson)..
12. D. I. Perrett, M. W. Oram and E. Wachsmuth (1993) Understanding minds and expression from facial signals: studied at the brain cell level. In *IEEE International Workshop on Robot and Human Communication*, pp. 3–12.
13. N. J. Emery and D. I. Perrett (2000) How can studies of the monkey brain help us understand 'theory of mind' and autism in humans. In Baron-Cohen *et al*. (Eds) *Understanding Other Minds 2: Perspectives from Autism and Cognitive Neuroscience* (Oxford University Press).
14. P. Foldiak, D. Xiao, C. Keysers, R. Edwards and D. I. Perrett (2003) Rapid serial visual presentation for the determination of neural selectivity in area STAa. *Progress in Neurobiology*, **144,** 107–116.
15. R. Edwards, D. Xiao, C. Keysers, P. Foldiak, and D. I. Perrett (2003) Colour sensitivity of cells responsive to complex stimuli in the temporal cortex (R1), *J. Neurophysiol*, **90**, 1245–1256.
16. S. W. Anderson, A. Bechara, H. Damasio, D. Tranch and A. R. Damasio (1999) Impairment of social and moral behaviour related to early damage in human prefrontal cortex. *Nature Neuroscience*, **2**(11), 1032–1037.
17. *The Times* (1999) Brain damage can produce psychopaths, 19 October.
18. F. De Waal (1997) *Good Natured. The Origin of Right and Wrong in Humans and other Animals* (Harvard University Press), pp. 216–217.

19. R. W. Sperry (1994) American Psychological Association. A powerful paradigm made stronger. *Psychological Science Agenda* (September-October), pp. 10–12.
20. C. B. Gensch, S. M. Hammond, A. E. Hampson and M. J. Crowder (2002) Influence of supplementary vitamins, minerals and essential fatty acids on the antisocial behaviour of young adult prisoners. *British Journal of Psychiatry*, **181,** 22–28
21. C. S. L. Lai, S. E. Fisher, J. A. Hurst, F. Vargha-Khadem and A. P. Monaco (2001) A forkhead–domain gene is mutated in a severe speech and language disorder. *Nature*, **413**, 519–523
22. N. Sadato, A. Pascual-Leone, J. Grafman, V. Ibauez, M. P. Deiber, G. Dold and M. Hallett (1996) Activation of the primary visual cortex by Braille reading in blind subjects. *Nature*, 380, 526–528.
23. A. Pascual-Leone and F. Torres (1993) Plasticity of the sensori-motor cortex representation of the reading finger in Braille readers. *Brain*, **116**, pp. 39–52.
24. E. A. Maguire, D. G. Gadian, I. S. Johnsrude, C. D. Good, J. Ashburner, R. S. J. Frackowiak and C. Frith (2000) Navigation–related structural change in the hippocampi of taxi drivers. *Proceedings of the National Academy of Sciences*, pp. 4398–4403.
25. S. Pinker (1999) *Words and Rules: The Ingredients of Language* (London: Wiedenfeld and Nicholson).
26. A. Karmiloff-Smith (2002) *The Psychologist*, **15**(12) December.
27. K. Matthews, J. W. Dalley, C. Matthews, Tung Hu Tsai and T. W. Robbins (2001) Periodic Maternal separation of neonatal rats produces region and gender-specific effects on biogenic anime content in post-mortem adult brain. *Synapse*, **40**, 1–10.
28. K. M. O'Craven and N. Kinwasher (2000) Mental imagery of faces and places activates corresponding stimulus–specific brain regions. *Journal of Cognitive Neuroscience*, **12**, 1013–1023
29. T. J. Grabowski and A. R. Damasio (1996) Improving functional imaging techniques: the dream of a single image for a single mental event. *Proceedings of the National Academy of Sciences*, **93**, 14302–14303.
30. A. D. Milner (2000) Visual awareness and the primate brain. Paper at *Royal Society of Edinburgh Conference on Human Nature*.
31. L. Tulving (2000) quoted in R. G. M. Morris, Learning, memory and human nature: is episodic memory unique to humans? Paper at Royal Society of Edinburgh Conference on Human Nature, to be published.
32. R. G. M. Morris (2000) Learning, memory and human nature: is episodic memory unique to humans? Paper at Royal Society of Edinburgh Conference on Human Nature, to be published.
33. R. Passingham (1982) *The Human Primate* (Freeman).
34. T. J. Crow (Ed) (2003) *The Speciation of Modern Homo Sapiens* (Oxford: Oxford University Press).
35. J. C. Eccles (1989) *Evolution of the Brain: Creation of the Self* (London: Routledge), p. 327.

36. R. W. Sperry (1987) In R. L. Gregory (Ed), *The Oxford Companion to the Mind* (Oxford: Oxford University Press), pp. 164–165.
37. G. Edelman (1982) *Bright Air, Brilliant Fire: On the Matter of the Mind* (London: Penguin).
38. R. Penrose (1989) *The Emperor's New Mind* (Oxford: Oxford University Press).
39. A. Damasio (1994) *Descartes Error* (New York: Putnam).
40. R. E. Kendell (2001) The distinction between mental and physical illness. *British Journal of Psychiatry*, **178**, 490–493.
41. D. Mackay (1991) *Behind The Eye* (Oxford: Blackwell).
42. P. Boyer (2003) Religious thought and behaviour as by-products of brain function. *Trends in Cognitive Sciences*, **7**, 119–124.
43. P. Nichelli, J. Gradman, P. Pietrini, D. Always, J. C. Carton and R. Miletich (1994) Brain activity in chess playing. *Nature*, **369**.
44. K. Ward (2000) Human nature and the soul. Paper at Royal Society of Edinburgh Conference on Human Nature.
45. L. Stone (2004) Chapter 4 in *Losing Your Soul and Finding Yourself*, edited by J. Green (Abingdon Press, USA), forthcoming.
46. J. Green (2004) Chapter 7 in *Losing Your Soul and Finding Yourself*, edited by J. Green (Abingdon Press, USA), forthcoming.
47. C. Gunton (1997) *The Promise of Trinitarian Theology*, 2nd edn (T. and T. Clark).

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