

Integrating Social Science with Neuroscience: Potentials and Problems

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Abstract

New opportunities for systematic collaboration between neuroscience and social science have opened up in recent years, and some of the potentials and the problems that accompany them are explored with reference to Damasio's work. Systematic collaboration and integration might yield benefits for metatheoretical, theoretical and substantive inquiry, but will be impeded by language, conceptual and methodological problems. Strategies to facilitate collaboration are discussed, and it is concluded that methodological problems will be most difficult to resolve.

Keywords affective, embodiment, emotion, habitus, interdisciplinary, somatic marker

It seems fair to say that between neuroscience and social science there has been something of a history of mutual distrust, a reluctance within each discipline to engage constructively with the others' theories and research, and a lack of comprehension of each others' assumptions, methods, goals and findings. Disagreements over the meaning and character of phenomena such as psychopathology and intelligence (Parker *et al.*, 1995; Richardson, 2002), controversies over socio-biology and evolutionary psychology (H. Rose and Rose, 2001), and the 'science wars' prompted by the strong programme in science and technology studies (Gross and Levitt, 1994; Ross, 1996), all exemplify aspects of this troubled history. However, the recent emergence of new potentials from neuroscience, consequent upon the development and spread of imaging techniques and the accelerating accumulation of knowledge, has largely coincided with a growth of interest in social science in issues of the body, embodiment and affect. These simultaneous developments suggest that, in future, more systematic collaboration might be possible. With this in mind, this article begins to explore the potentials and problems that may accompany such an enterprise.

In social science there has in recent years been a renewed interest in 'the body' (e.g. Burkitt, 1999; Crossley, 2001; Shilling, 2003; Stam, 1998), an interest which may currently be spawning a related engagement with notions of emotion or 'affect' (Ahmed, 2004; Baerveldt and Voestermans, 2005). In social science the body is a vehicle for performance (Butler, 1993), the object of techniques and practices of discipline and self-regulation (Foucault, 1977), and

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the frequently unacknowledged ground of our being (Burkitt, 2003). In these works sociologists, social theorists, psychologists and others have engaged with issues such as mind–body dualism, the relationships between body, habit and identity, the nature of desire and emotion, the relationship between the body and language, and the ways in which bodies are realized or constituted in different regimes of thought (Crossley, 2001). Yet, in much of this work, the actual flesh and blood body, the body-brain system of neurones, hormones, glial cells, neurotransmitters, muscles, bones and skin, is largely absent. In its place appear relatively undifferentiated notions of the body as either the carrier of symbolic meanings, or as an object moulded by language and discourse (Nightingale, 1999). In other studies, the body is replaced by metaphorical concepts and processes produced through the application of psychoanalytic theories—so that instead of the actual body we have for example the id, the psychological representative of the body’s needs and desires. Indeed, social science engages with natural science work on the body primarily as an object of deconstruction, critique or study (within the sociology of scientific knowledge and science and technology studies). Consequently, for the most part social science fails to benefit from any constructive engagement with neuroscience, or indeed any of the other sciences of the body.

In neuroscience, the converse position holds and there is little adequate consideration of insights and evidence from the social sciences. Neuroscientists using fMRI, for example, have in recent years discovered empirical associations between activities of various kinds and the fine structure and activity of the brain. For example, research has shown that London taxi drivers have larger hippocampuses than members of the general population (Maguire *et al.*, 2000), that piano-players generate changes to the activity of the sensorimotor strip as a consequence of learning their instrument (Bangert and Altenmueller, 2003), and that just twelve weeks of talk and activity with a therapist produces measurable changes in patterns of brain activation (Wykes and Brammer, 2002). Taxi-driving, learning the piano and engaging in therapy are all activities with marked social dimensions, yet neuroscientists do not typically draw upon social science either to help them understand in more detail the activities and processes that generate associations with neural events, nor to better account for unexplained variance in their data and so strengthen their understanding of the brain processes occurring.

So it is likely that both social science and neuroscience could benefit from systematic and constructive engagement, but, like all interdisciplinary work (of which this is a particular instance), such engagement may be problematic. Interdisciplinary research is seen as more likely to be informed by values, more oriented toward real-world problems and more focused on wider societal benefits (Rhoten and Parker, 2004). At the same time, it is widely acknowledged as challenging (Brewer, 1999), since different disciplines have their own cultures, frames of reference, methods, objectives and languages; moreover, these challenges may adversely influence the career trajectories of individuals (Brewer, 1999; Rhoten and Parker, 2004). Bourdieu’s (1991) analysis of the fields and dispositions that demarcate the sciences also includes individuals, although in this case as the bearers of competencies implicitly designated as already appropriate for the constitution of science *per se*. Such individuals become legitimate authorities in the boundary disputes that inevitably occur as dynamic, shifting networks of power and interest play themselves out through the mediation of various kinds of disciplinary resource, practice and putative object. On this view, to be interdisciplinary is to be continually subject to boundary conflicts, a view supported by

Gieryn's (1983) historical analysis of the rhetoric of science. The boundaries between sciences are both symbolic and socio-structural: symbolic boundaries are used by some groups to enforce, maintain and legitimate socio-structural ones, and by others to reframe their meaning (Lamont and Molnar, 2002). The work of asserting and policing disciplinary boundaries is therefore bound up with the maintenance of hierarchy, which suggests that interdisciplinary research often needs to be 'seeded' by appropriate policy initiatives and directed funding strategies if it is to succeed (Metzger and Zare, 1999).

Before further discussing the potentials and problems of any engagement between neuroscience and social science, some cautionary points are necessary. First, although every effort has been made to provide balanced coverage, the author's background is predominantly in social psychology, and so inevitably this article leans towards the potentials and problems as they appear from this field. Second, neither social science nor neuroscience is homogeneous or monolithic, and it is of course impossible to address the whole of each discipline. This article's focus on exemplary aspects of each discipline fosters clarity and coherence, but necessarily generates omissions. Much of the focus is on how the *body* is open to social influence: this is appropriate, since it is probably the hardest case to make for the relevance of social science—'mental' states being clearly social (Vygotsky, 1962; Wertsch, 1991). Nevertheless, this focus necessarily de-emphasizes other perspectives, and so exceptions and challenges to some of the claims made here will always be possible. Third, the question of what it might mean to collaborate across these disciplines is an open one. Possibilities include simple dialogue, the exchange of ideas and findings and the sharing of concerns; the enrichment or completion of theoretical models by including notions and concepts from the other discipline; and empirical research programmes utilizing methods and designs acceptable to, and simultaneously rooted within, each discipline. Clearly, potentials and problems may arise and be configured somewhat differently at each of these different levels. Fourth, it follows that the present discussion is for the most part quite general: the goal is to open up an area for dialogue and debate by sketching some relevant concerns and issues, rather than attempt to prematurely resolve the debates that need to occur.

The article is divided into two main parts. The section on potentials discusses some of the possibilities for integration and collaboration between neuroscience and social science, focusing on Damasio's work and showing how it yields opportunities for philosophical, theoretical and substantive integration. This is followed by a discussion of problems, which also takes Damasio's work as a frequent focus and is organized for analytical purposes into language, conceptual and methodological issues: although these are thoroughly intertwined, for the sake of analytical clarity they are treated separately here. The article concludes by discussing some strategies that might facilitate collaborative interdisciplinary work.

Potentials

Damasio's work, and in particular his three books *Descartes' error* (1994), *The feeling of what happens* (1999) and *Looking for Spinoza* (2003), provides the primary neuroscientific focus of these discussions. This may be seen as a somewhat unusual choice, given both the distinctiveness of his work and the existence of a new subdiscipline of 'social neuroscience'

which, at first glance, seems to offer a more obvious starting point. But social neuroscience is problematic precisely because it is already developing a partial view of the relationship between biological and social. For example, the opening section of Cacioppo and Berntson's (2005) introductory text on social neuroscience is titled 'The Brain Determines Social Behaviour'—strongly suggesting that foundational precedence has already been given to neuroscience, rather than any serious attempt being made to jointly explore social and neural influences. This impression is further reinforced in a short section at the end of the book, when, although it is eventually acknowledged that there are in fact *reciprocal* influences between the social and the brain, a strongly individualist emphasis is nevertheless maintained. The editors declare that social behaviour is not determined entirely by biology but then immediately qualify this by saying 'it does not necessarily follow that the person has no personal responsibility for having enacted this behaviour' (Cacioppo and Berntson, 2005: 241). This is an unusual statement in this context, more redolent of morality than science, and one that, from a social science perspective, merely glosses, rather than addresses, vital questions concerning the ontogenetic, constitutive relations between the biological, the personal and the social. Similarly, the new journal *Social Neuroscience* has so far published just one paper (out of 33) that focuses specifically on how the social influences the brain, rather than vice versa (Bianchi-Demichelli *et al.*, 2006).

In contrast, Damasio explicitly recognizes that social structures and relations have an influence upon brain systems. He adopts an explicitly Spinozist stance with regard to the relations between mind and body, individual and society, and so his work focuses on feeling and emotion in a way that situates them firmly within the social relations and cultural contexts that social scientists emphasize. In addition to neuroscience, he explicitly engages with culture, especially music and opera, and in his books he is not afraid of theorizing and making links between neuroscience and areas such as ethics and politics.

Partly because of these various engagements, Damasio's work has a slightly unusual status in neuroscience, and there are both critiques of and alternatives to his position. For example, Panksepp (2004) described Damasio's view of emotion as a cognitive one, for its emphasis on brain areas such as the prefrontal and cingulate cortices; for Panksepp (1998), emotion proper is generated by systems arising from the brainstem and the limbic area. Rolls (1999) is critical of Damasio's theory of how emotion and feeling play a part in decision-making, on the grounds that including the body in a feedback loop is simply too slow and hence, evolutionarily, unlikely to have arisen. Cognitivist alternatives to Damasio reinstate cognition and rationality as the core constituents of human mental functioning, minimizing the strong contributory role he gives to emotion and feeling and largely relegating them to the effects of evaluations (Lambie and Marcel, 2002). There are echoes here of the Zajonc–Lazarus debate concerning the possibility of affect-laden evaluations preceding, or occurring independently of, cognitive processing (Lazarus, 1982; Zajonc, 1980, 1984). Some of this dispute now appears to have been largely semantic (to do with broader or narrower definitions of cognition), and some may have arisen as a consequence of the existence of both 'high' and 'low' roads for the generation of emotion in the mammalian brain (Le Doux, 1999). It is unclear for the moment whether the distance between current cognitivist positions and Damasio's stance can be similarly reduced. To some extent, though, these concerns are indicative of the distance that Damasio has already travelled towards social science, by comparison even with other scholars currently publishing in

social neuroscience. His Spinozist stance, coupled with an explicit recognition of social influence, arguably make him the most social-science friendly of the major neuroscientists now writing: consequently, the problems encountered when trying to use his work in an integrative manner may be indicative of those likely to arise when *any* neuroscientist's work is used in this way.

Damasio's books comprise a trilogy addressing different aspects of experience. In *Descartes' error: Emotion, reason and the human brain* (1994), Damasio describes a brain system whereby 'social conventions and ethical rules' might be acquired and become part of our character. His 'somatic marker' hypothesis proposes that the ventro-medial sector of the frontal lobes is a vital node in this system. He has worked with 60 people with damage to this area (Damasio, 2002), all of whom display the same two consequences. First, their range of affect is greatly diminished; second, they are unable to decide effectively in social settings: even simple choices, such as which day some months hence to book a doctor's appointment, are problematic.

On the basis both of this 'double dissociation' and of evidence from neuro-anatomy, he proposes two things. First, that the ventro-medial sector is needed to enable feelings from the body to enter consciousness, and, second, that these feelings play an important part in everyday decision-making. Through experience we learn to classify some stimuli as positive and others as negative, and this learning includes a somatic component. When we are faced with decisions in the social world, body state profiles that were associated with similar previous experiences get reactivated, and serve to tag or 'mark' options with valences that either rule them in or out of consideration. Physiological states previously associated with positive or negative outcomes get reconstituted as feelings, *somatic markers* which stamp putative options with valences: 'When a negative somatic marker is juxtaposed to a particular future outcome the combination functions as an alarm bell. When a positive somatic marker is juxtaposed instead, it becomes a beacon of incentive' (Damasio, 1994: 174). Once somatic markers have effectively shaped our response sets in these ways, overtly 'rational' decision-making then occurs for the smaller set of remaining options.

This brain system, which is the neural basis of 'gut feelings' and 'intuition', can also operate outside of conscious awareness to produce biases that we only notice (if at all) in retrospect. Although not in principle inaccessible to consciousness, this somatic guidance simply may not enter the limited capacity of awareness, especially in highly charged or complicated situations. This seems especially likely when somatic markers are replaced by their neural counterpart through the operation of what Damasio calls the 'as-if body' loop. When this happens, the somatosensory cortex is organized by the prefrontal cortices and amygdala into a simulacrum of the activity pattern that would have been induced had the body itself been engaged. Such loops cannot replicate precisely the feelings which would have ensued had full-blown somatic markers been engaged, but are advantageous because they greatly accelerate the guidance process. However, because these 'as-if body' loops are more subtle and fleeting, they are less likely to enter conscious awareness.

In Damasio's next book, *The feeling of what happens: Body, emotion and the making of consciousness* (1999), he sets out a theory of consciousness. He is explicit that this is not an attempt to solve the 'hard problem' of how brain mechanisms generate conscious experience (Chalmers, 1995), but rather an explication of how the brain generates 'a sense of self in the act of knowing'. So his focus is not on how qualia are produced, but—given that this

does occur—he focuses on how the brain produces a simultaneous awareness of person and world.

Damasio distinguishes between ‘core consciousness’ and ‘extended consciousness’ (although the consciousness we experience usually consists of both forms working together). Core consciousness is primary and non-verbal, consisting of feelingful images of the body and sensory images of the environment, and is a necessary precondition for extended consciousness. It is an immediate, ‘automatic’ awareness of one’s embodied state in the moment-by-moment flow of being in the world, generated as stimuli impinge upon the body-brain system. In neural terms, core consciousness is a second-order map. This in turn rests upon a first-order map that Damasio calls the proto-self, a dynamic representation of the body and its current state constantly updated in real time and rooted, evolutionarily, in the machinery of homeodynamics. The first-order map that Damasio calls the proto-self necessarily requires inputs generated by brainstem nuclei, the hypothalamus and the somatosensory cortices, while the second-order map of core consciousness also requires the superior colliculus, the thalamus and the cingulate (although Damasio is clear that multiple brain systems in many regions contribute to these processes, as they do to others). Changes to the proto-self may be caused either by internal body-brain changes or by external influences impinging upon the person. In either case, these changes generate a second-order map, the contents of which are *the experience of the body-brain system being changed*. So core consciousness is not the proto-self—it is the representation of changes in the proto-self, the *difference* between the proto-self in first one state and then a subsequent one. While we are awake these changes occur in a ceaseless flux, each following the other in rapid succession. Changes generate pulses of core consciousness, the contents of which are our fundamentally non-verbal awareness of the body-brain system in its state of dynamic equilibrium.

Extended consciousness, by contrast, is symbolic, representational, narrativized and discursive; it is both reliant upon and constructed through memory and symbols. It uses the uniquely human capacity for memory, representation and meta-representation, to generate webs of meaning and understanding within which to locate the ever-present flux of information supplied by core consciousness. The higher and frontal cortices, temporal areas and hippocampus are therefore important in the generation and successful continuation of basic extended consciousness functions such as language, memory encoding and recall. Thus, in extended consciousness, stimuli first registered in core consciousness very rapidly gain their full human meaning and significance, black marks on a white background become words on paper that carry a particular instruction or idea, such as the one you are contemplating as you read this. This happens (almost) immediately, as you process either incoming external stimuli or changes in your body-brain system: each generates a new pulse of core-consciousness which produces, in networks of spreading neural activation, a richly detailed, meaningful and fully human understanding of whatever has just occurred. Extended consciousness, then, requires extensive memory resources and the capacity for symbolic representation in order to produce the distinctively human capacity for reflection, questioning, analysis, understanding and meaning. Extended consciousness is secondary to, and parasitic upon, core consciousness. Changes to the body-brain system generate pulses of core consciousness, an immediate awareness of our embodied situation. These pulses activate other neural circuits, calling out language and memories which thoroughly endow these

embodied or sensory events with meaning. This means that it is possible to have core consciousness without extended consciousness, but not vice versa.

Damasio's third book is called *Looking for Spinoza: Joy, sorrow and the feeling brain* (2003). In many ways the least substantial of his books, this work foregrounds the role of feelings and emotions in everyday life, describes some of the brain pathways and mechanisms whereby they are produced, and offers some speculation about their role in maintaining social order. Damasio distinguishes between three different kinds of emotion. What he calls primary emotions are more-or-less hardwired, relatively invariant response modes called out as appropriate to incoming stimuli; he draws on the work of Ekman (1992) and others to explain these emotions. Then there are 'secondary emotions', responses that are enculturated rather than hardwired, such as shame, guilt and embarrassment. Damasio also identifies a broader, more subtle, continuous yet variable sense of the state of our bodies which he terms 'background emotion'. These three kinds of emotion are enabled by brain systems constituted across various 'triggering sites' that include the basal forebrain, the hypothalamus, the amygdalae, ventromedial prefrontal cortex and brainstem nuclei. Emotions do not necessarily get reflected upon in consciousness: although their influence is continuous and profound, it is frequently not the focus of our attention. When we do notice them it is typically as feelings, feedback from the body as it moves into a particular state profile. So emotions are body-brain states, whereas feelings are the phenomenological experience of those states.

Damasio carefully describes how the content of a feeling, for example feeling 'well', consists of much more than just thoughts or ideas. He observes that it also includes a comfortable skin temperature, easy and unconstricted breathing, little or no muscular tension, an absence of pain, an experience of the body as light and airy, yet simultaneously grounded, and perhaps a sense of the smooth, unified working of the body's various systems. These physical sensations merge seamlessly with a corresponding mental state, of which they are both reflective and constitutive: images have a sharp focus, and flow rapidly and effortlessly. Both the contents and the style of processing of these images are consonant with the pleasant feelings of the body, so that the whole is experienced as a satisfying unity wherein 'What you usually regard as "body" and as "mind" blended in harmony. Any conflicts now seemed abated. Any opposites now seemed less opposite' (Damasio, 2003: 84). Feelings, then, consist of perceptions of the body, perceptions of thoughts and themes, and perceptions of certain modes of thinking or styles of mental processing. We construct meta-representations of our own mental processes, noticing the rate, content and character of our own thought processes. These meta-representations sit alongside representations of the body, so that 'a feeling is the perception of the body along with the perception of a certain mode of thinking and of thoughts with certain themes' (Damasio, 2003: 86).

In these three books, Damasio develops a way of thinking that combines neuroscience with the social realm, an approach that challenges abstract notions of cognition by highlighting its interdependence with body states and feelings. His fluid interweaving of experience in the social world with brain structures and processes, situated within a coherent and explicit philosophical framework, has numerous potentials for the social sciences.

At a metatheoretical level, Damasio's approach might inform efforts to transcend the dualisms that, in separating body from mind and individual from society, cause problems in social science theorizing (Burkitt, 1991, 1999). These dualisms are pervasive and

structuring influences upon the organization of academic knowledge, although their influence is frequently not acknowledged. This is partly because much work takes a predominantly empirical focus, within which such underlying conceptual questions rarely arise. More fundamentally, it is also because academic knowledge is *already* to a large degree fragmented and compartmentalized by these dualisms. For example neuroscience is separated from psychology, reflecting mind–body dualism; psychology in turn is separated from sociology, reflecting individual–society dualism. The issue is not that mind is the same as body, nor individual the same as society. The issue is that our typical ways of theorizing and researching make it difficult to see mind and body, for example, as anything other than incommensurable realms whose interaction is then difficult to conceptualize. Damasio’s way of thinking, by contrast, starts with the fundamental unity of mind and body (and hence, to some extent also, of individual and society) and so might allow these dualisms to be transcended or bridged. This may be especially valuable in interdisciplinary or multi-disciplinary work, where these problems become particularly visible.

At the level of specific theories, Damasio’s description of generic brain systems and processes whose content is largely open to social and environmental determination, facilitates integrative work with numerous social science perspectives. For example, in sociology the work of Bourdieu (1977), Elias (1978) and Young (1990) describes how ways of using and experiencing our bodies are moulded by culture, in line with the social positions that individuals occupy. Damasio’s somatic marker hypothesis may describe a specific mechanism whereby some of this embodied learning takes place, and by which it comes to be experienced phenomenologically (Cromby, 2005). In conjunction with his theory of consciousness, with its fluid interweaving of biological and social influences, it might facilitate greater understanding of how social influences both become part of our embodied character and are also relatively resistant to conscious efforts to change them. Such understandings would have implications for many activities, including research into the efficacy and benefits of psychotherapy and other interventions into the lives of distressed people (Smail, 2005).

Taking a substantive focus, Damasio’s ideas are already illuminating work in fields as diverse as economics, politics, personality theory, psychopathology, ethics and art. In both economics and politics, rational choice theory (e.g. Elster, 2004) is widely used to understand how individuals make decisions based upon what is effectively a cost–benefit analysis, and is used to generate models and predictions of consumer behaviour, voting preferences and suchlike. Damasio’s work highlights the contribution to such decisions of emotions and feelings acquired as a consequence of prior experience, and in so doing may explain at least some of the apparent irrationality of people’s *actual* choices (Bentley-Macleod, 2002). In the field of personality, Damasio’s work is making an impact through its associations with the emergent subdiscipline of neuropsychanalysis (Solms and Turnbull, 2002), which seeks to explicate the neural bases of psychodynamic concepts and processes. Similarly, in psychopathology, Damasio’s ideas have been invoked in the understanding of sexual and relationship problems (Hiller, 2005), as well in accounts of such psychopathological diagnoses as depression (Cromby, 2004), psychopathy (Schmitt *et al.*, 1999), obsessive-compulsive disorder and schizophrenia (Woody and Szechtman, 2000). Damasio’s engagement with the emotional, feelingful aspects of human life has also made his work relevant to studies of ethics, morality and the arts (Benson, 2001).

Problems

Despite these potentials, there are problems specifically related to any constructive collaboration between social science and neuroscience on the basis of Damasio's work. These problems are already at least immanent within the attempts at substantive integration described above; they will now be made explicit and described under separate categories to do with language, conceptual and methodological problems.

Language problems

The most obvious barrier to effective collaboration between social science and neuroscience is that of language; indeed, language issues may acquire a particular character and force for the many social scientists who take language as an object of study, as well as a medium of communication. The most basic kinds of issues likely to arise are that the meanings of terms change more or less subtly as we move from one discipline to another; that terms straightforward in one context are problematic, confused or inadequate in the other; or that the use of a given term in one context signifies connotations (for example theoretical allegiances or methodological proclivities) that are invisible or problematic in the other. These issues may fuel further confusions regarding, for example, the role of metaphor in theorizing and the distinctions between metaphors, analogies and homologies (S. Rose, 1997).

These problems can be illustrated with respect to Damasio's use of the term 'self'. For Damasio, this is a relatively unproblematic notion, referring to the more or less continuous sense we have of our own identities which, he claims, is biologically rooted 'in the ensemble of brain devices which continuously and *nonconsciously* maintain the body state within the narrow range and relative stability required for survival' (1999: 22). Yet for social scientists encountering his work, his frequent deployment of this term is likely to raise problems. 'Self' is a term troubled by issues such as the homunculus problem, and agency-structure and mind-body dualisms (Graham, 1993), located within a specific Western cultural and intellectual lineage, and freighted with moral and ethical implications (Taylor, 1989). Many social scientists agree that notions of self within Western culture are particularly individualistic, bounded and separate from both other persons and the material world (Geertz, 1973), and notions of self have been the subject of sustained and sometimes critical interrogation within the social sciences in recent years (Benson, 2001; Burkitt, 1991; Foucault, 1988; Gergen, 1991, 1997; Martin, 1988; Shotter and Gergen, 1989). Empirical evidence in support of these critiques includes anthropological and cross-cultural investigations demonstrating significant variation in notions of self between cultures (Heelas and Lock, 1981; Morris, 1994), and historical evidence showing that current Western notions of self first appeared somewhere between the eleventh and eighteenth centuries, depending on which particular conception is taken as the first exemplar (Logan, 1987). There is also evidence for variation in the constituent elements of the self, for example demonstrating the plasticity of personality characteristics across differing social contexts (Potter and Edwards, 1990) and showing historical variation in the relative prominence of emotions such as grief (Stearns and Knapp, 1996), shame and guilt (Demos, 1996). Consequently, 'self' means different things, not only to different social scientists, but within different traditions and communities: while for some it references some inner entity or substance (Craig, 1997; Robinson, 1991), for others it refers to the

putative outcome of a matrix of social forces that condition the legitimate ways of being human within a particular culture and epoch.

Compounding and perhaps illustrating these issues, there is in fact more than one notion of self at play in Damasio's work (van Ommen, 2005)—for example his 'proto-self', core self and extended self. These selves each have different characteristics, vary in the extent to which they are consciously experienced, and may be arrayed along a continuum from the biological to the social. It is nevertheless clear that, for Damasio, the phenomenological experience of self is necessarily produced by culture as well as by neural processes, and lacks the degrees of stability, insight, control and rationality that some social scientists have argued are erroneously attributed to Western persons (Henriques *et al.*, 1984). Indeed, Damasio's dual emphases on the dynamic and affectively driven character of the self may resonate with post-structuralist accounts of subjectivity that similarly accentuate the fluid, a-rational multiplicity of everyday experience. While this suggests that, for some purposes, language problems in this area might be resolved by simple clarification of and agreement over terminology, there nevertheless remains a gulf between any viable reading of Damasio and notions of the self portrayed in some relevant areas of social science. For example, in a study of treatments for Parkinson's Disease, Moriera and Palladino (2005) characterize the self as the contingent product of mutually supporting (or 'parasitic') regimes of 'truth' and 'hope'. Similarly, Nikolas Rose (2005) describes the ways in which the terminology and language of neuroscience are coming to inhabit our everyday ways of understanding our relationships, jobs and unhappinesses, such that we are now becoming 'neurochemical selves'. Such characterizations sit uncomfortably with Damasio's notion of an immanent, embodied self enabled by brainstem systems that manage homeodynamics, a discordance leading to the unsurprising suggestion that, all too often, disagreements over language may turn out to be mere vehicles for deeper, conceptual problems.

Conceptual problems

This part of the discussion focuses upon two issues likely to be of generic and fundamental relevance: first, how we conceptualize the influence of the social world; second, how we conceptualize the brain and its relationship to the rest of the organism.

Harré (2002) points to a divergence between the notions of social influence common in neuroscience and those common within many areas of social science. Although neither discipline is monolithic, within neuroscience there are strong tendencies toward a causal metaphysic. Within this way of thinking, outcomes (behaviours or states) are the endpoint of causal chains—albeit often very complicated ones, incorporating multiple feedback loops, parallel processes and decision-points. The causal metaphysic is a deterministic one: it presumes that if the initial state of the organism could be known, along with all of the inputs to it, then the later behaviours or states of the organism could be more or less reliably predicted.

This contrasts with much of social science, where what Harré calls a 'meaning/rule metaphysic' is more common. From this perspective, human behaviours and states are reflective of, and implicated within, dynamic structures of meaning. These do not act as causal influences: instead, they provide rules and guidelines toward which individuals orient, which they take up flexibly and apply creatively. Consequently, observed associations between social factors and the behaviour of individuals will always have an 'on balance' character

to them: social influence is normative, rather than deterministic. However, this does not mean that it is ephemeral or unimportant: rather, it reflects the actuality that social influence consists primarily of meanings and rules that guide individuals, rather than causal forces that determine or drive them.

Taking social psychology as his example, Harré demonstrates that confusion regarding the nature of social influence has led to many problems. Because many psychologists mistakenly imagine that social influence operates in a causal manner, they believe that their experiments control and isolate these influences, and that apparatus such as questionnaires measure them. In reality, Harré suggests that most social psychology experiments are merely analogues or models of real-world situations, rather than measures of them. A questionnaire is not a simple measure of some internal property of a person, its scores varying systematically in response to changes within the individual. In its administration, a questionnaire is a relatively restricted analogue or model of a more informal conversation. Consequently, its scores will reflect the shared rules for understanding the meaning of its terms, and the socially ordained autobiographical conventions that obtain for telling information to relative strangers within unusual situations: 'The results of the whole procedure, particularly the bringing out of correlations between types of questions and types of answers, are neither more nor less than expressions of narrative conventions and semantic rules governing the kind of conversation modelled' (Harré, 2002: 172).

Damasio's work bears an ambivalent relationship to these two contrasting metaphysical regimes. On the one hand, his 'somatic marker' hypothesis describes a neural system parasitic upon hardwired regulatory systems that achieve homeodynamic balance and maintain life, the substantive content of which is derived from experience of a particular social world:

Somatic markers are thus acquired by experience, under the control of an internal preference system and under the influence of an external set of circumstances which include not only entities and events with which the organism must interact, but also social conventions and ethical rules. (Damasio, 1994: 179)

In other words, Damasio seems to postulate a kind of 'social norming' system that might enable precisely the kind of flexible orientation towards social conventions, moral regimes and relational practices that Harré sees as important. On the other hand, however, Damasio—like the overwhelming majority of neuroscientists—conducts his empirical work primarily using experimental designs and variable models which presume a causal metaphysic (Davis and Rose, 2000); aspects of this issue will be discussed again in the section on methodological problems.

A second set of conceptual problems surrounds the issue of how we conceptualize the brain and its relationship to the rest of the organism of which it is a part. In this regard, Bennett and Hacker (2003) draw upon the later philosophy of Wittgenstein to analyse and critique the work of many contemporary neuroscientists, including Damasio. Mereology is the study of part-whole relationships, and central to their arguments is what they call the 'mereological fallacy': their term for a tendency they have observed amongst neuroscientists to ascribe psychological predicates, attributes, activities and characteristics to the brain. They provide detailed evidence and examples to illustrate their contention that neuroscientists frequently attribute to the brain psychological characteristics such as believing,

interpreting and guessing, which, logically, can only be attributed to persons—of whom the brain is but a part. As they put it:

It is not that as a matter of fact brains do not think, hypothesize and decide, see and hear, ask and answer questions; rather, it makes no sense to ascribe such predicates *or their negations* to the brain. The brain neither sees, *nor is it blind*—just as sticks and stones are not awake, *but they are not asleep either*. The brain does not hear, but it is not deaf, any more than trees are deaf. The brain makes no decisions, but nor is it indecisive. Only what *can* decide can be indecisive. So, too, the brain cannot be conscious; only the living creature whose brain it is can be conscious—or unconscious. *The brain is not a logically appropriate subject for psychological predicates.* (2003: 72, emphases in original)

Bennett and Hacker suggest that this tendency is a ‘mutant’ or ‘degenerate’ form of Cartesian dualism. Cartesian thinking applied psychological predicates to the mind, and only derivatively to the human being; current neuroscience simply applies them to the brain instead. In this sense it has the same logical structure as Cartesian dualism, although the specifics of its poles differ somewhat. It is vital to recognize that Bennett and Hacker’s critique is not an empirical one, but a logical, conceptual one: hence, no amount of additional empirical evidence concerning brain mechanisms or neural processes is likely to overcome the objections they raise.

It may be tempting to believe that the issue here is primarily one of how we use language, and in fact reflects the kinds of misunderstandings alluded to in the previous section. But Bennett and Hacker provide examples of how the language that neuroscientists use shapes their reasoning, and is associated with conceptual errors regarding the presumed privacy of conscious experience and the nature of introspection. They also consider, and then reject on the basis of closely argued examples, the explanations that neuroscientists are simply using everyday terms in special, technical ways; that they are using psychological attributes as analogues to aid understanding; or that they are using psychological language metaphorically. For example, they take issue with the way that Blakemore (1990) explicitly defends the use of metaphor. Noting the extensive evidence that areas of the brain are organized into topographically arranged, causally connected systems, Blakemore says:

... it is hardly surprising that neurophysiologists and neuroanatomists have come to speak of the brain having *maps*, which are thought to play an essential part in the representation and interpretation of the world by the brain, just as the maps of an atlas do for the reader of them. (1990: 265)

Blakemore goes on to defend the use of metaphor in neuroscientific writing, rejecting the view that metaphors sow confusion. But Bennett and Hacker observe that whether confusion attaches to the metaphorical use of language depends on whether the author remembers that it is metaphorical, remembers the precise sense in which it is metaphorical, and—equally importantly—conveys the precision and limits of the metaphor to readers. Accordingly, they note that Blakemore’s refutation of the dangers of metaphors in fact falls prey to the very kinds of error they warn against. They note that when Blakemore talks of maps he must actually mean *mappings*, systematic configurations of cells firing in response

to a stimulus, and that such mappings cannot possibly function ‘just as the maps of an atlas do for the reader of them’. Cartographic maps depend for their intelligibility on shared conventions of mapping and rules of projection, which the artist applies in their drawing and the reader applies in their reading: but the brain cannot be said to be ‘reading’ a map in this sense, and does not know any conventions or projections. Moreover, the topographical arrangement of its cells is not organized in accordance with socially shared conventions, and—perhaps most vitally—‘the correlation between their firing and features of the perceptual field is not a conventional but a *causal* one’ (Bennett and Hacker, 2003: 80).

The mereological fallacy within neuroscience may cause problems for constructive integration with social science because it introduces forms of dualism, reification and biological reductionism. By treating the brain as though it has psychological characteristics, it seems at first glance that mind–body dualism is removed. But this appearance is merely superficial, as the continuing relevance of the ‘hard problem’ in fact illustrates. Indeed, this move simply pushes the problem of mind–body dualism ‘inside’ the brain, translating it into something that arises at the level of neurones and synapses, rather than at the level of minds and their corresponding bodies. Not only is dualism thereby reinstated; at the same time, its basis is moved deep within the organism, making social science contributions appear less relevant.

Reification becomes an issue because we humans use our bodies and material resources to organize, arrange and conduct our activities in social and collective ways. We have evolved shared traditions of symbolic representation and tool use, and ritualized practices which organize the activities vital for our own reproduction, survival and well-being. Because the entire body and its capacities are central to our understandings of these social and material practices, equating the brain with the organism mystifies or negates social scientific understandings of these dimensions of human life. While the brain is clearly a critical organ in their conduct, treating it as sole instigator and vehicle may lead to the reification of these collective representations, shared social practices and cultural tools—either as disembodied, cognitive processes or, alternatively, as synaptic or neural events.

Equating the brain with the organism is also, most obviously, a form of reductionism. It minimizes important qualitative distinctions between different kinds of brains (rats and humans, for example) and makes it easier to imagine that our analytical focus should be solely upon the biological, rather than also being concerned with social and material space and time. Humans are not simply brains, and so their activities cannot meaningfully be described in the language of nerve cells and their associated molecules. Even if we had a far more sophisticated knowledge than we do now of the relationships between brain events and processes and a human activity such as writing a signature, a complete explanation solely at the neural level would remain forever impossible because:

... no amount of neural knowledge would suffice to discriminate between writing one’s name, copying one’s name, practising one’s signature, forging a name, writing an autograph, signing a cheque, witnessing a will, signing a death warrant, and so on ... the differences between these are circumstance-dependent, functions not only of the individual’s intentions but also of the social and legal conventions that must obtain to make the having of such intentions and the performance of such actions possible. (Bennett and Hacker, 2003: 360)

Bennett and Hacker make numerous specific points concerning the ways in which the mereological fallacy plays itself out in Damasio's work, arguing that emotions need not be caused by mental images, are not about somatic changes and are independent of cognitive knowledge concerning causation. They also suggest that his somatic marker hypothesis is 'misconceived' because events in the world (an injustice, for example) rather than feelings are the source of our judgements concerning good and evil (see Bennett and Hacker, 2003: 213–216). While some of their objections can be refuted as either based upon partial readings or presupposing some kind of linguistic dominance (a tendency to which Wittgenstein's ideas are suited; see Parker, 1996), others are more telling. In particular, they challenge Damasio's claim that feelings are the first-person experience of somatic changes, whose meaning derives from their bodily character. From their Wittgensteinian position, the sources of experience are not within us, in some veiled inner life, but publicly available in the shared social world. Emotions and feelings are public events, called out in social interactions within which they are dynamic, variable and constitutive of the ongoing trajectories that emerge. Consequently, their meaning and character is derived from this ongoing social situation, and not from their somatic character: 'What makes the blushes blushes of shame rather than of embarrassment or of love, is not the "thought" or mental image, *if any*, that accompanies them, but the circumstances and the object of the emotion' (Bennett and Hacker, 2003: 213).

From a social science perspective, Damasio's treatment of emotions as body-related phenomena is especially troubling for the many tendencies which take language and its analysis as their primary focus. Following the 'turn to discourse' of the 1990s (Harré, 1992), these tendencies are present within cultural and media studies, social anthropology, human geography, sociology and psychology. For example, an approach called 'discursive psychology' (Edwards and Potter, 1992) focuses almost exclusively upon texts of various kinds, using detailed transcripts of conversations to represent social interactions. Empirical analyses then make visible the ways that social actors deploy linguistic resources and rhetorically organize and structure their talk, in order to do such things as mitigate or deny blamings, politely refuse invitations, or manage dilemmas of 'stake' wherein their own self-interest might be seen as problematic and so must be subtly discounted. Discursive psychology studies emotion categories and metaphors, and makes reference to Wittgenstein and ordinary language philosophy to 'rid us of too close an association between emotions and subjective mental or bodily experiences' (Edwards, 1999: 281). While it does not confuse emotion *per se* with talk of emotion, it does emphasize emotion talk in a way that leaves little space for the bodily aspects of emotions to be influential, significant or interesting. To the extent that other social science disciplines emphasize the linguistic and performative aspects of emotion, they are similarly likely to struggle with Damasio's conception. Thus, Bennett and Hacker seem to be pointing to a fundamental conceptual gap between notions of emotion extant in neuroscience and those prevalent in some areas of social science.

Methodological problems

This part of the discussion focuses upon problems associated with the practice, common in neuroscience, of comparing data across experimenter-defined groups using quantitative variables within controlled designs. This experimental practice all but typifies fMRI, PET

and other imaging studies in neuroscience and is the basis of the majority of Damasio's findings (some of his observations are derived from clinical work). Nevertheless, this practice makes a number of assumptions about the nature of its subject matter which, from some social science perspectives, may be problematic.

One set of problems concerns the typical assumption that social influences are relatively uniform, static or fixed in their character, and that they can be measured using single indicators or scales. For example, with regard to social class the assumption would be that people are uniformly working or middle class in their attitudes and behaviour, and indeed in their attitudes and behaviour with regard to all relevant objects and not just some. But in the social sciences class is a dense, troubled concept loaded with a variety of meanings, each freighted with the theoretical presuppositions of one or another school of thought (Joyce, 1995). This variety problematizes attempts at measuring class along a single scale, since any one indicator is likely to favour some definitions more than others. Moreover, social classes are notoriously heterogeneous, perhaps especially so in recent years (Hall and Jacques, 1989), and, as a consequence, measures of socio-economic status (SES) such as years in education or home ownership are increasingly used instead. However, it is possible that this translation from social class to SES loses something of the *meaning*, within both social theory and everyday life, of social class locations. With regard to the issue of meaning, Tolman (1994) observes that experimental designs can only adequately take account of influences that are immediately present and empirically tractable in the experimental situation, and that the meanings of class and their effects do not have this character. This echoes a more general point, which is that the treatment of biological and social variables side by side in experimental designs ignores the real, qualitative differences between biological and social influences. The recognition of these kinds of problems, and of the ways in which they can create falsely universal perspectives (rendering minority trends invisible, generating a falsely homogeneous view of social groups and an ahistorical notion of social change) has been one of the driving forces behind the spread of post-structuralist thinking in the social sciences. Post-structuralists emphasize the instability, fluidity and dynamism of the social world; they reject notions of fixity and origins and celebrate diversity, difference and the profusion of meaning. Accordingly, the deployment of tightly defined variables in controlled designs might be especially difficult to reconcile with the post-structuralist perspectives common in many social science disciplines.

A second set of problems connected with this experimental practice concerns its implicit presumption of a stance called methodological individualism: the presumption that the social world is merely the outcome of the aggregate of the actions and decisions of the individuals from whom it is constituted (Archer, 1995). Methodological individualism is flawed because it fails to recognize that once social collectivities and groups are formed, they have *emergent properties*, properties that are not features of any one individual taken in isolation but which feed forward and influence the likelihood of these groups (and the ideas or practices they favour) continuing to be influential or relevant. For example, the demographic constitution of a group is an emergent property influencing its future, since, if most of its members are past reproductive age, its influence will tend to decline. Similarly, different languages make some concepts and arguments more easily 'sayable'—and hence thinkable—than others. In interaction both with other social and material conditions and with the emergent properties of the demographic constitution of the population of its speakers, these

emergent properties of ‘sayability’ and ‘thinkability’ influence the likelihood that a language will proliferate. It is a typical requirement of experimental design in neuroscience (and elsewhere) that participants are randomly assigned to groups, but even where groups are selected (e.g. on the basis of a diagnosis) they are experimenter-constituted. Consequently, to the extent that groups are explored or compared at all within this methodology, they are typically groups without histories, demographics or collective cultural or material resources, that is, groups stripped of the very emergent properties that many social scientists would see as vitally important. Thus, this experimental practice implicitly endorses methodological individualism, because its groups are simply constituted from the aggregate or average scores of experimenter-allocated individuals. The sociohistorical constitution of groups and collectivities in everyday life, their dynamic interplay and evolution, and the emergent properties that flow from their constitution, are effectively eliminated from consideration.

The practicalities of rendering experience tractable in a controlled situation serve to both realize and amplify these problems, because once an experimental approach is already accepted as appropriate its precepts will then, inevitably, serve to organize activity. One consequence of this is that the logic of experimental design and its associated practices can effectively make somewhat invisible problems that social scientists might find troubling. For example, fMRI studies require participants to lie immobile in scanners that occlude their vision and surround them with noise, making it impossible for them to move spontaneously or interact naturalistically with others; consequently, participants can find the experience alienating and unsettling, and will be unable to ‘forget’ that they are taking part in an experiment. If social scientists object that this will influence their behaviour, their objection is likely to be countered by the claim that, since both experimental and control groups are subject to the same constraints, their influence is effectively cancelled out. Although this argument appears entirely reasonable within the logic of experimental work, it implicitly instantiates the claim that rigidly measured differences between experimenter-constituted groups obtained in highly artificial circumstances equate directly to actual social processes in everyday life, such that their measurement effectively stands for, and gains priority over, other forms of enquiry. Conversely, from a social perspective, problems may be generated rather than hidden because of the ease with which statistical significance can be conflated with lived significance, or because of slippage between the various to-be-negotiated meanings of ‘normal’ in everyday life and statistical notions of normality derived from sampling distributions.

Discussion

It has been analytically helpful to separate out these three kinds of problem (language, conceptual and methodological) in order to trace their character and effects. However, we must now recall that they are in fact thoroughly intertwined, and that language, concepts and methods constitute self-insulating matrices of beliefs and practice whose interconnectedness makes it difficult to confine change to any one of their aspects. We must also remind ourselves that collaboration between disciplines will undoubtedly mean different things at different times, and so both the problems that arise and the kinds of compromises and

agreements that are formulated will be situated within particular local contexts that might problematize their transfer to other situations.

This already suggests that the most fundamental key to addressing these issues is constructive dialogue, discussion and debate between neuroscience and social science, and that only thorough, rounded consideration of issues and problems is likely to generate acceptable bases for systematic collaboration. At the same time, however, we must be careful to avoid romanticism. It is perhaps seductive and comforting to believe that if we all sit down together, talk and *listen*, change will inevitably come and new opportunities arise. But this would be to ignore the ways in which professional training, methodological expertise, conceptual understanding and linguistic orientations are not only intellectual tools. They are, at the same time, markers of status and power, intimately bound up with disciplinary structures and career pathways, and frequently oriented towards broader fields of ideological preference and power (Bourdieu, 1991) which, in practice, play themselves out around more mundane concerns such as gaining the trust and respect of others, obtaining access to funding, and personal career concerns related to employment, promotion and status (Brewer, 1999). Moreover, there is a wider context where research funding is both limited and discontinuous, competition is encouraged because of its perceived benefits, and the gulf between neuroscience and social science is underpinned by a material separation of interests into independently constituted fields, each with their own favoured theories, methods, journals, conferences and so on. Hence, we should not naively imagine that dialogue alone will resolve differences: nevertheless, if collaboration is to occur, dialogue is both essential and helpful, and so it is useful to identify strategies by which it might be facilitated.

One possible strategy involves differentiating clearly between brain processes and human processes by careful and deliberate use of language, for example by using one representational form to refer to brain processes, systems and states, and another to refer to human activities, experiences and states. Panksepp (1998) refers to the FEAR system in mammals, a collection of neuroanatomical circuits and neurochemical responses involved in generating responses of trepidation, freezing and flight. Relatedly, Panksepp also talks of *fear* as a human experience, but when he does this he always uses lower case letters. His strategy reflects both dissatisfaction with what he says are the limits of conventional language, and a principled attempt to minimize possible confusion by clearly distinguishing between brain systems (FEAR) and lived human experiences (*fear*). Similarly, Ullmann (1991) recommends that we distinguish between representation as human activity and representation* as something that brain systems do. Such distinctions may be difficult to sustain in practice and continual assertions of their relevance might prove irritating at times, but orientation towards them might nevertheless facilitate collaborative work.

Another more radical strategy is proposed by Harré (2002) as the basis for a 'hybrid' cognitive science that recognizes both the embodied and the social aspects of human being. He first of all suggests that we explicitly organize claims to knowledge within three grammars or realms of discourse. First, P or 'persons' grammar is reserved for the acts and capabilities of persons, it indexes the realm of social interaction, moral obligation, rights, duties, responsibilities and norms: the arena of fully human experience within which the effects of neural or brain mechanisms are not only felt and realized but also discussed, understood and researched. Second, O or 'organisms' grammar is reserved for aspects of

human life ‘that seem to fall outside the domain of well trained habit and the following of explicit rules’ (Harré, 2002: 149). It includes many capacities shared with higher animals, and refers to things our bodies enable or do for us, rather than things we intentionally choose or have learned to do. Third, M or ‘molecules’ grammar refers to the effects of molecules and molecular clusters such as neurotransmitters and hormones as they regulate, mediate and enable activities such as sleep, cognitive function, emotion, etc. Harré argues that each of these three grammars is a *necessary* way of speaking about human activity, since each contains different kinds of causality—causal effects, purposive organismic actions and intentional meaningful acts: ‘Mosquitoes act purposively but not intentionally, and so do babies. Acids act causally but neither purposively nor intentionally’ (Harré, 2002: 152).

Harré argues that by adopting these three grammars the mind–body problem, and hence many of the conceptual confusions arising between social science and neuroscience, might be ‘dissolved’. Rather than postulating two realms (mind and body) set contrastively against each other and constituted of entities and processes radically different in kind, Harré suggests that we instead examine the hybridity of P, O and M grammars and their necessary relatedness. He offers two principles to guide investigation of the relationships between these grammars. First, he proposes a ‘task/tool’ metaphor: human tasks defined in P grammar are materially enabled by embodied structures and neural processes that serve as tools, but which are meaningfully describable only in terms of O and M grammars. The second is through adopting a ‘taxonomic priority principle’ wherein ‘states, processes and structures of the P discourse exercise “taxonomic dominance” over the criteria of identity for neural states and processes ... that is, for the O and M discourses’ (Harré, 2002: 160–161). More simply put, we can only study the brain structures and neural processes that might enable a specific activity if the person studied can confidently be said to be engaged in that activity.

While these two strategies are solely linguistic and conceptual, they could facilitate both dialogue and the construction of mutually acceptable interpretations of findings. Moreover, the interdependence of methodology with language and concepts means that they may also seed practical benefits, especially if dialogue occurs at the earliest possible stages of collaboration: so for empirical work, it should begin before studies are planned and designed so that input from both disciplines can inform sampling, measurement, operationalization, the constitution of control groups and so on. From a different perspective, Steven Rose (1997) proposes a strategy with more immediate implications for the conduct of empirical research. His aim is to make biological research more systemic and less reductive by emphasizing ‘lifelines’ and so including the developmental trajectory of biological systems within their analysis. Consequently, he proposes replacing the troublesome opposition between ‘nature’ and ‘nurture’ with degrees of temporally organized plasticity and specificity, and the continual, dynamic, dialectical interpenetration of organisms and their environment:

The present instant of our, or any organism’s life, is simply inexplicable biologically if considered merely as a frozen moment of time. ... Each of our presents is shaped by and can only be understood by our pasts, our personal, unique, developmental history as an organism. (S. Rose, 1997: 157)

From this developmental perspective, Rose strongly challenges the extremes of neo-Darwinism and its concomitant genetic reductionism. Nevertheless, until the mathematical

and conceptual tools to handle the complexity of multiple interacting systems become available, even his progressive analysis recognizes a continuing need for reductionism at the level of methodology. This suggests that, for now at least, methodology is likely to remain the stumbling block in collaboration between social science and neuroscience, and might frequently be the fundamental terrain upon which deeper conceptual, meta-theoretical or ideological differences get played out.

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