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## **Social Brains, Embodiment and Neuro-Interactionism**

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### ***By Way of Introduction***

One wouldn't know that bodies have brains from reading much of the body studies literature, and certainly not from reading the specifically sociological literature on the body and embodiment. This may call for a corrective by way of introduction. That is, in fact, what neurosociologists mean to do: introduce sociologists to the brain. Empirical knowledge of the brain is being employed by neuroscientists to make claims about human sociality. Neurosociologists are aiming to apply work on the 'social brain' to refine concepts about self, other and intersubjectivity. Interventions into social theory by way of the brain are also on offer. Neuroscience is being configured as a resource for sociology that will help to flesh out the body's materiality and ameliorate extreme social constructionism. In this chapter I consider one application of neurosociology, which I am naming 'neuro-interactionism,' that utilizes brain research on mirror neurons to materialize symbolic interactionist concepts of intersubjectivity. My aim is not simply to introduce uninitiated readers to neurosociology, but rather to highlight and raise questions about neurosociology's interventions into debates about the body and bioculture.

### ***Flesh Matters***

It was once possible to describe an impassable theoretical gulf between the material body and the discursive one. For a time, in the interdisciplinary field of 'body studies' – especially in the work influenced by feminism, poststructuralism, and queer theory – we treated the body as a sociological stage, a place where societies write up and enact cultural scripts. For example, many of us reading Judith Butler embraced a radical constructivism, wherein the physical body ('sex') was understood as the material stylization of culture ('gender') (Butler 1990, 1993; Chambers 2007). This discursive

framework heavily influenced two decades of writing on the body, and posited culture as doing just that, writing the body. Yet the dominant focus on performance, representation, iteration, and inscription of the body – even if these could be said in some way to make the body what it literally is – is no longer wholly satisfactory to many. The body is not only discursive but also fleshy and organic, and other disciplines, those outside of the humanities and social sciences, are empowered to take up its ontology. Such is the development of our own critiques that we are now in a position to ask: why is leaving the physical body wholly to other jurisdictions acceptable? The authority of hard science and medicine, the fields who seem to own the organic body, is difficult to overstate. Because they do not do enough to situate human bodies in social and cultural contexts, and because our own work is now appearing to be too de-fleshed, too ontologically skinny, it is no longer critically tolerable to leave the biological body entirely to them. What's more, in our own theoretical paradigms, we no longer accept strict divisions between organic and inorganic, between human and technology, between culture and biology (Davis and Morris, 2007). We are faced with the problem of the 'biocultural' (Davis 2008).

At the same time, it appears to be very difficult to invest in the organic body, especially aspects of the organic body we access primarily through the biological sciences, without losing our grip on cultural processes through which bodies can come to be meaningful. The debate I am invoking is familiar and has many versions. For example: Is there something elusory – under or before representation – about the body that provides some kind of foundation for action (Radley 1995), or are such claims simply unsupportable without recourse to essentializing biologism? What is Real, and can it be accessed in any meaningful way beyond knowing its representations (Colebrook 2000)? How is the body more than the constitutive outside of discourse? (Butler 1993). Can we ever know matters of fact about the body, or should we forgo them in favor of 'matters of concern,' as Bruno Latour (2004) has suggested? Does our exhaustive critical focus on the social construction of the body preclude acknowledging the existence of the body in-itself? Is there such a thing? If we treat biology as a social practice and an expert discourse, what do we do with its fleshy, meaty, moving, shaking, living – not to mention dying – bits? As Joan Fujimura (2006:50) asks, "how does one recognize and deal with the actions of biophysicalities... if they are always mediated by culture?" These questions make reference to empiricism and social constructionism, hard and soft science, the Real and the symbolic, and many other dichotomies, which in some writings have seemed like incredibly daunting if not impassable gulfs.

Many paths have been forged to get us over them. An abbreviated list here stands in for a very long one, since the problem of the 'biocultural' is becoming widely recognized as a primary one in the 21st century. Just take, for example: Nick Crossley's (1995) 'carnal sociology', rooted in Merleau-Ponty's work on perception, which considers the sociological subject as a living, perceiving and perceived body-subject; also take the expansive 'new empiricism' in cultural studies, which instead of perception looks at affect, as a preconscious bodily capacity for activation (Clough 2010; Watson 1998); critical sociomaterialism, which traces how materiality is not just represented but produced through practices like genetics (Fujimura 2006; see also Fausto-Sterling 2000); the corporeal turn in feminist philosophy, where the body is a material accomplishment, always in the process of 'becoming' (Grosz 1995); and the sociomedical study of

biopolitics, which looks not solely at how things like organs are understood, but also how they are literally cut up, moved around, and commodified (Lock 2001). The interface between the biological and the cultural – not simply the contest between them but their interaction or co-constitution – is now an urgent problem. We want to know bodily matter, and we want to know if, and how, knowing matter matters.

### ***The Biocultural Brain***

The brain is a hotspot of this problem of the biocultural. In the past two decades, the brain has become a space where people look to answer a huge range of questions, and even to shape the kinds of questions we ask, about ourselves. The stakes are high: at issue is our understanding of what it is to be human – to be gendered, sexed, social, moral, and so on. Also at stake: what kind of knowledge – cultural and sociological, empirical and scientific – is relevant. Over the past 20 years, neuroscience has become a dominant framework through which to understand mind, self and society; its explorations of the brain and its ability to depict it through imaging technologies have given enormous power to naturalist or biological perspectives in many disciplines. The brain is a very powerful symbol of physical reductionism. We have been hearing, over and again, “The mind is what the brain does” (Churchland 1996). And now, many people are looking to brain regions, neural networks, and molecular substrates to think about a wide range of topics once left to anthropology and sociology.

In contrast to a brute physical reductionism, however, a ‘new biology’ of the brain is being written that depicts the physical, organic brain in ways that suggest, to varying degrees, the role of culture in its very constitution. Recent developments in neuroscience give the brain not only a history (a story of its past on an evolutionary level) but also a historicity (a character of historical situatedness, on both an individual and cultural level). We are learning to think more deeply how the brain, and not just its representations, could be socially, culturally and temporally specific. Theories about the brain as plastic – as built through interaction with the environment and open to change throughout the lifespan – are seen by many as a bridge over the nature/culture divide. Plasticity refers to multiple processes of brain function and structure that result in new cells and the building of new neuronal networks, or multiple synaptic connections between neurons. While once thought to be restricted primarily to early in the lifecycle and to certain parts of the brain, neuroscientists now generally agree that plasticity applies to the whole brain and to later in life as well. Philosophers, theorists, psychologists, and cognitive scientists are investigating the brain’s situatedness and its plasticity as ontological features that could defy biological reductionism and make the brain a cultural object. The ‘new biology’ of neuroscience is even seen by some as material grounding for views of the self that are politically progressive – postmodern, plural, queer, unfixed, open to change, always unfolding, and even potentially liberatory (Malabou 2008; Wilson 2003; Clark 1998).

At the same time, neuroscience is not known for its contributions to progressive ideas about the subject, the body, or the mind, and it has not yet offered its own very complex views of the social, the historical, the situation, or the context. From the point of view of many sociologists and anthropologists, neuroscience is reductionist in the extreme, and is inherently anathema to sociological inquiry (Vidal 2011; Ehrenberg 2011; Martin 2000). The opening of the divide between brain and culture does not ensure that

mind, brain, body and self will be understood in richly cultural ways. Emily Martin, for example, argues that neuroscience constitutes a grave threat to understandings of the human as inherently social and cultural; she worries about a position in which the dyke between nature and culture has been breached, and all of what anthropologists call culture has drained through the hole and dissolved into the realm of neural networks (2000: 566).

Alain Ehrenberg agrees. What he calls the “strong program” of neuroscience links self and society to brain in a way that shrinks the outside – the social environment – to the level of the neuronal substrate. “Sociological description is subordinated to biological explanations to the point of becoming negligible, and the same applies to the psychological dimension” (2011: 120). This approach is highly individualist, and largely leaves the social, the intersubjective, and the institutional to functionalist and normative assumptions.

I see brain debates as important expressions of struggle over the body’s biocultural status. There are a range of up-takes of neuroscientific knowledges in sociology, anthropology, and other fields that respond to the challenges posed by the sciences of brain matter. Some of them take the material findings of brain science as foundational for our own fields of knowledge. Below I describe an example of ‘neurosociology,’ which attempts to use empirical findings about the brain to illuminate traditionally sociological problems. In particular, I consider an application of mirror neuron research to symbolic interactionism. This ‘neuro-interactionism’ aims to offer a more embodied, physiologically grounded version of intersubjectivity than is afforded by more symbolic approaches. I consider some of the implications of this move, including whether, and how, it fulfills its promise to materially ground or embody sociological approaches to the self and society.

### *Neurosociology*

The implications of neuroscience for sociology are just beginning to unfold. Some thinkers are drawn to the aspects of neuroscience which understand the brain in social terms and are rethinking sociality as informed by brain structures and processes. They insist that social sciences need the biological sciences to empirically ground their perspectives, and to bring the body back in to sociological theory. As Sean Watson puts it,

Sociologists have to learn to talk about the body itself. To do this they will have to know something about the body... The sciences of the brain, nervous system, and the rest of the body are progressing apace, and will continue to do so, with or without the blessing of sociologists. Evolutionary biology, evolutionary psychology, neuroscience, artificial intelligence; these are the sciences that are beginning to provide the lingua franca within which the popular consciousness develops its appreciation of the human condition. Sociology must defend its claim to this territory – but not by, again, trying to deny the existence of the body and its forces. The social constructionist theory is wrong; there is an outside to culture. Sociology can only retake this terrain by embracing the new languages of the body and its forces and making them its own... (1998: 23).

Neurosociologists argue that sociology is empirically irresponsible to the extent that it ignores the vast amount of information we are learning about the biological substrates of the mind and self, a point Doug Massey (2002) articulated in his Presidential Address to the American Sociological Association. But they stress that sociological issues can remain central in a neurosociological analysis, and that dearly held sociological beliefs are not necessarily under threat by neuroscience. Brain science is vast and varied, but some of it makes possible a less functionalist and more dynamic view of the brain and self than many outsiders suspect. Neurosociologists (and other social scientists adapting neuroscience for their own purposes) emphasize the ‘new biology’s’ vision of the brain as a social and embodied organ, and of mind as biologically given to be emotional, emergent and agentic (Connolly 2002). From this point of view, neuroscience offers the potential for contributing to a more deeply material conception of embodiment and for understanding the bio-logics of social and cultural inscription, or “how culture comes to inhabit a biological organism” (Watson 1998: 24).

David Franks’ (2010, 2002) account of neurosociology attempts to define the field and champions its significance for traditional sociological questions. Like Watson, Franks argues that ignoring empirical data about the nature of the human mind and its capacity for relations with others amounts to an ostrich-like putting of one’s head in the sand. What’s more, neuroscience needn’t be feared by those who see human beings as inherently and irreducibly social. Some of the findings of neuroscience not only confirm, but elaborate and enrich, sociological understandings about the intersubjectivity of the self. Franks takes pains to highlight brain ‘facts’ that point away from rigid biological determinism, strict individualism, and material reductionism. The human brain, he stresses, is biologically wired for social interaction.

To establish that neuroscience is actually conducive to and compatible with sociological thinking, Franks describes a number of findings, in addition to plasticity, which point to a social view of the brain. To briefly recite a few of them: First, from evolutionary biology, the suggestion that increased group reliance and interdependence are correlated with brain size (especially the size of the prefrontal cortex, the seat of ‘executive function’). Larger kin networks are linked to bigger PFC. Second, Franks cites research that identifies the brain’s “subsystem for social processing” (2010: 49; Brothers and Gazzaniga 1985; Brothers 1997). For example, alongside other areas and capacities, the Fusiform facial area found in the occipital lobe has been found to be responsible for identifying faces. Facial recognition is a social capacity that appears to take up dedicated neurological real estate. Third, Franks cites the work of Antonio Damasio on emotion, particularly his arguments that emotion is extremely important for brain function, including cognition, and that emotion is bodily and preconscious. Fourth, he describes mirror neurons, which are neurons that fire not only during one’s own bodily action, but also when one observes another’s same bodily action. Taken together, these characteristics (preconscious, embodied emotion, cognition as infused with emotion, neural mechanisms for interpersonal recognition, and in-built recognition of another’s actions as tied in some way to one’s own actions) suggest not rational, independent, disembodied actors but rather ones who are deeply embodied, affective, and intersubjective. The social brain is equated with a thoroughly sociological subject.

### ***Mirror Neurons and Intersubjectivity***

Franks does not simply use neuroscience to validate sociology. His application of mirror neurons is a key example of how he thinks knowledge of brain processes, especially the literature on the ‘social brain,’ will have an impact on major sociological concepts. Mirror neuron research has been widely discussed as providing evidence that the human capacity for intersubjectivity is physiologically determined. There is still much debate about what mirror neurons do and how they are linked to human sociality. Nonetheless, Franks argues that this research can be used to refine (by embodying and biologizing) sociological theories of the self.

Mirror neurons are said to be found in the motor cortex as well as in other brain regions and fire both when an individual makes a motor action, and when she sees another performing the same action – thus they are sensorimotor neurons. They were first described in Giacomo Rizzolatti et al’s (1996) study of macaque monkeys; they were found through single-cell recordings in what is known as area F5 in the ventral premotor cortex. More recent research found mirror neurons in humans, at a ‘system’ level in fMRI imaging studies, lesion studies and TMS (transcranial magnetic stimulation) studies; preliminary observations of single-cell recordings on pre-surgical epilepsy patients have also been reported (Iacobini 2009). Mirror neurons are widely understood to be evolutionary adaptations (see Heyes 2010).

Mirror neurons in my brain might work like this: in my premotor cortex (for example), some of the neurons that fire when I pick up a banana would also be activated when I see you pick up a banana. Much is being made of this capacity for neural imitation; imitation is seen as a key part of the human ability to understand the other. But even more interesting than imitation is that some of the neurons (‘broadly congruent’ ones) that fire when I pick up a banana will also fire when I see you perform something different, but logically related or having the same goal as that action, like putting the banana to my mouth. Marco Iacobini (2009), on whose work Franks draws heavily, describes how these mirror neurons are shaped by experience such that they seem to make links between actions: “The properties of broadly congruent mirror neurons suggest that these cells provide a flexible coding of actions of self and others” (2009:). This flexibility is seen as an important capacity for social relations; it is, for Iacobini, an important property for successful social interactions because even though imitation is a pervasive phenomenon in humans, people do not imitate each other all the time but rather often perform coordinated, cooperative, complementary actions. Broadly congruent mirror neurons seem ideal cells to support cooperative behavior among people (2009: ).

Imitation is linked in social psychological theories to empathy. Iacobini cites these theories, but also finds biological evidence that mirror neurons are involved in human empathy. Especially significant is that mirror neurons also fire in response to facial expressions. That mirror neurons code for communicative actions is

especially important for the hypothesis that mirror neurons may facilitate our understanding of the emotions of other people, because the face is the body part that we use most often to express our own emotions (2009: 662).

We understand the other’s actions at a preconscious, neuronal level by experiencing them through the same mechanism as we do our own actions. In addition, through experiencing the other’s emotive expressions at a neuronal level we have some preconscious, bodily

experience of them. From fMRI studies and other evidence, Iacobini argues that the former may include a whole circuitry comprised of multiple brain regions and capacities, and the latter similarly engages a large neural network, not only mirror neurons but also the limbic system (triggering emotion) and the insula (midway between motor and sensory cortices).

Iacobini utilizes the flexibility of coding (learning) of mirror neurons to help him hypothesize fairly broadly that they are linked to understanding the other. Franks utilizes the theory of affordances formulated by James Gibson (1979) to elaborate the links between perception, neuronal imitation, and intersubjective experience. Affordances are the action possibilities, for me, of objects I perceive. In this theory, my perception of the world is filtered through the lens of its action possibilities. So my brain perceives not simply a banana, but a banana to be picked up or a banana to be eaten. Mirror neurons may help me to experience not only your actions but the action possibilities you find in the world. Franks describes mirror neurons as allowing us “to literally feel what others are feeling” (49), and to “literally experience in ourselves those actions that we see in others” (85), partly because actions are linked by affordances to intention.

Other conceptual paths, like phenomenology, have been forged to make the interpretive links from neuronal firing to empathy and intersubjectivity (Gallagher 2005, 2007). Regardless of the variety of these, mirror neuron research has been widely celebrated as a major breakthrough in understanding social behavior (eg, Blakeslee 2006). For Franks, the implications of mirror neurons include: first, that intersubjectivity has a strong physiological and neuronal substrate; second, that the human capacity to understand the other is at some level automatic and preconscious; and third, that the role of bodily experience is more prominent in social interaction than has been acknowledged in accounts emphasizing conscious, symbolic, language-based deliberations. Below I describe in more detail his use of mirror neuron research to refine key concepts of the development of a social self in symbolic interactionist theory.

### *Neuro-Interactionism*

For sociologists, it is wholly unsurprising that people have the capacity to understand the actions, emotions and intentions of others. But Franks suggests that neuronal mirroring, along with other brain capacities, offers a new way of explaining classic sociological ideas about intersubjectivity. In particular, G.H. Mead’s notion of role-taking is illuminated by mirror neuron research.

For Mead, taking the role of the other is essential for the creation of selfhood, which is intrinsically social. This first happens by way of a child’s role-playing, a practice which is “calling out in him the corresponding activities of the other person involved” (1934: 161). In *Mind, Self and Society* (1934), Mead describes taking the role of the other as a process rather than a capacity, an accomplishment of personal development in the context of socialization. Mead identified stages of children’s play that were steps toward a mature ability to understand oneself through the points of view of others. Eventually one is able to see herself through the lens of multiple specific others as well as that of a generalized other, comprised of an organized, normative system of symbolic meanings. For Mead, the self is not wholly a discursive construct, but it is shaped through the exchange of meanings, the gradual socialization process, and the

personal reflexivity born out of one's ability to situate herself in a larger framework of shared meanings.<sup>1</sup> Role-taking as a method of learning and enacting the meanings and perceptions of others is an essential part of the process of achieving self-consciousness, reflexivity, and selfhood.

If mirror neurons form part of a physiological substrate of social interaction, then they firmly root role-taking in biological processes. According to Franks, mirror neuron research can elaborate "how we reach across space to understand and penetrate each other's extra-sensory minds as tangible persons rather than intangible objects." We don't just observe other people's actions; we understand them, because through mirroring, he argues, "on a preobjective level they are our movements, too, and laced with similar intentions" (2010: ). The in-built capacity to take the role of the other, as 'mirroring,' is a phenomenon in which perception and action are coupled. Such coupling of perception of the other's action and one's own collapses the space he describes between minds.

Does this interpretation of mirror neurons confirm Mead's theory with biological evidence, or contest it? Franks sees the neuroscientific evidence as both supporting and 'refining' Mead's work. In mirror neuron research we get evidence that we do, at a biological level, what Mead says we do. As Franks and Iacobini have it, we are neuronally interactionist. But for Mead, role-taking is a representational matter. We are able to take the role of the other because we are able to generate meanings about what the other is doing, wants or intends, and we are able to use those narratives as tools for informing our own actions. This is a capacity that is developed over time through socialization and involves the exchange of meaningful (symbolic) communication. The process for Mead is not disembodied, because it depends upon a body-self's action in and engagement with the world, yet it is discursive, cultural, and linguistic.

A person is a personality because he belongs to a community, because he takes over the institutions of that community into his own conduct. He takes its language as a medium by which he gets his personality, and then through a process of taking the different roles that all the others furnish he comes to get the attitudes of all the members of the community... it is a structure of attitudes, then, which goes on to make up a self, as distinct from a group of habits (Mead 1934: 162).

By contrast, what neuroscientific evidence shows, according to Franks, is that taking the role of the other is, at some important level, automatic, written into the neural code. Taking the role of the other happens mechanically by experiencing the other's actions as our own at a physical, cellular level; we do not actually have to project a perspective (or attitude) onto another, as Mead suggested, and then back onto ourselves. Instead of a perspective coming from the outside (culture), an experience is coded from within as we perceive. As neuro-interactionism, symbolic interaction becomes less interactive, and even less symbolic.

Neuro-interactionism implies that we must take physiology more seriously. Franks hopes in fact that knowledge of biological capacities and imperatives might improve social theory more broadly. Franks believes that neuroscientific evidence can be used to counter the 'excesses' of the linguistic turn in sociology, poststructuralist theory and cultural studies. He argues that poststructuralist theory overemphasizes language and semiotics; it depends too heavily on representation and meaning and does not allow for "real worlds... real actions... real consequences" (2010: 102). Neuroscientific frameworks



of embodied action support more pragmatic (action-oriented), less symbolic or linguistic views of the self and other.

The disembodied consensus model of intersubjectivity left over from Saussurian linguistics leaves out the shared experiences we gain from the impartial world of the motor actions which heeds neither prayers or social status. This shared experience of the way the physical world responds to our manipulative actions on it remains an important source of intersubjectivity (2002: ).

Neuroscientific knowledge of the brain's motor processes, coupled with a view of the world as filtered through its affordances or pragmatic possibilities, provides empirical grounding for a more action-oriented and biologically rooted notion of human sociality. It also provides fodder for a critique of social constructionist and poststructuralist understandings of the body and self.

### *Mirror Debates*

Below I describe a few scholars' objections to mirror neuron research as a way of raising questions about Franks' account of the social brain and the embodied self. These critiques focus on the interpretations of mirror neuron studies. But it is worth first mentioning that there are debates within neuroscience at the empirical level as well.<sup>2</sup> There is still much to learn about what mirror neurons do in humans, and what kinds of actions are actually mirrored (Turner 2007). There is disagreement on how much mirror neuron activity is actually discernable in human brains (Carmazza 2008). Mirror neurons in humans are located in areas significant for language, and experience (learning) may play a prominent role in mirror neuron activity – eg, neurons may be trained, and untrained (Iacobini 2002; Heyes 2010). Yet the mechanisms by which language and memory work with mirror neurons and social interaction are far from clear (Mahon and Carmazza 2008).

If for the purposes of this chapter we leave aside uncertainties over the empirical evidence for mirror neurons, the interpretations of the research still demand further reflection. Two very different critiques I describe below, coming out of philosophy and neuropsychology, raise doubts about Franks' use of mirror neurons to move symbolic interactionism toward biology and away from language. The first asks to what extent we can understand what mirror neurons do as truly communicative and social. The second accepts that mirror neurons perform social functions, but emphasizes that they are themselves the products of learning and thus of social experience.

Do mirror neurons actually participate in exchanging meanings from person to person? Do I really experience another's intentions or feelings through cellular-level imitation, simulation, or experience of her activity or emotive expression? Jessica Wahman (2008) articulates the fairly prevalent view that language is required for meaning, and that meaning is required for intersubjective experience. For Wahman, what mirror neurons do cannot be interpreted as an exchange of meaningful information about what the other experiences, intends, or feels. Instead, they enact a stimulus-response mechanism, which is a kind of signaling rather than communication of meaning. Signaling is indexical, transmitting information only about correlations, or a 'given state of affairs'. Meanings, on the other hand, depend upon language and are generated through symbolic exchange and through deliberations that are effortful. Shared meanings

are determined not solely by that which is observed (the sign), but also by the interpretative work of the observer. Wahman attributes to cognition our ability to translate felt response to a signal into something meaningful.<sup>3</sup> From her viewpoint, if our mirror neurons fire at the sight of another's smile, we have to add a layer of symbolic interpretation to that experience in order to have understanding of what the other is feeling. (A smile, for example, can express not simply happiness, joy, or openness, but also sarcasm or menace).

Wahman points out that our physiological responses to others' actions are not necessarily a reliable basis for knowing their intentions. In fact they may frequently be responsible for misattributions of others' intentions.

The automatic firing of sensorimotor neurons may serve as a condition for the possibility of this achievement [of communicating meaning]; but by itself, such activity not only falls short of shared meaning: it can stand in the way of it as well (178).

Our internal experience, even in response to the stimulus of seeing another's action or emotion, may be an unreliable basis upon which to infer meaning about others. It is a joint, interpersonal achievement when we establish mutual or shared understanding. By this reasoning, mirror neurons, or even a whole neural network that includes the limbic system and the insula, cannot achieve something like empathy or intersubjectivity in the absence of language.

Cecelia Heyes (2010) begins with the opposite assumption: she accepts that mirror neurons do, indeed, facilitate social meanings. Yet she argues that experience and associative learning are much more crucial in generating mirror neuron activity than is allowed by many researchers, including Rizzolatti, who attributes mirror neurons to evolutionary adaptation. Heyes offers the alternative hypothesis that mirror neurons are "created by experience of observing and executing similar actions" (580).<sup>4</sup>

The associative hypothesis explains the matching property of mirror neurons with reference to the monkey's past experience. For example, whenever a monkey performs a grasping action with visual guidance, the activation of motor neurons (involved in the performance of grasping) and visual neurons (involved in the visual guidance of grasping) is correlated. Through associative learning, this correlated activation gives the grasping motor neurons additional, matching properties; they become mirror neurons, firing not only when grasping is executed, but also when it is observed.

An emphasis on learning and experience could explain: why pianists show more mirror neuron activity than non-pianists when watching a piano performance (pianists have more opportunity to develop mirroring); why mirror neurons can be trained and untrained (they are highly plastic); and why humans and monkeys exhibit different mirroring tendencies (different species are exposed to different kinds of experiences).

For our purposes, this is a significant matter: if the mirror neuron system is a product of associative learning, its contributions to social interaction must be developed from experiences of social interaction.

If the associative hypothesis is correct, mirror neurons not only support, but are supported by, human sociality. They come, not from evolution, but from sensorimotor experience, and much of this experience is obtained through

interaction with others. Therefore, the associative account implies that mirror neurons are a product, as well as a process, of social interaction (2010: 581).

For Wahman, mirror neurons, even as part of a system or neuronal network, do not accomplish the exchange of intersubjective meanings, experiences, or feelings. For Heyes, the evidence for a mirror neuron system is substantial, but evidence that it is an in-built, fixed mechanism shaped by evolutionary adaptation is not. Both of these theories raise issues for Franks' neuro-interactionism. Wahman's view simply denies the capacity of mirror neurons to accomplish the kinds of communicative exchanges Meadian theory describes as part of the development of the social self. Emily Martin's broad critique of neuroscientific reductionism resonates with this point of view; she fears any account of human subjects that is derived from less than fully cultural terms. She argues that "neuroreductionism could make social context seem to disappear despite its central focus on communication"; she fears that neuroscience could pose "subunits of individuals as the components of which groups are made" (2000: 584). One expects she would find the neuroscientific focus on mirror neurons worryingly reductionist, and its neuronal level of analysis of intersubjectivity depersonalized and acultural.

In Heyes' framework, the prospect of neuronal intersubjectivity is not so offensive. But in her account, mirror activations are not automatic, nor are they determined by the 'impartial' affordances of the physical world, to put it in Franks' terms. Instead, mirror neurons are developed through experience, in response to and in interaction with the social environment. This is, to my mind, a considerably different take on mirror neuron research than presented by Franks. Iacobini is open to Heyes' interpretation, but somewhat agnostic when choosing between this and an ideomotor framework (of which affordance theory is one). That in the associative sequence learning model "imitation is not based on dedicated functional (and neural) mechanisms" (2009:) but instead upon learned ones probably matters much more significantly for sociologists. I want to hope that such a view opens up the possibility of a less reductionist reading of mirror neurons.

### ***Conclusion: the Brain and Embodied Intersubjectivity***

David Franks, Sean Watson, Doug Massey and others have claimed that knowledge of the brain can give sociology and social theory a more embodied, material grasp of self and social life. Watson has explicitly argued that neuroscience can be utilized to solve a theoretical crisis that is the legacy of social constructionism: an ironically defleshed, immaterial, overly discursive appreciation of the body. Franks' use of brain research aims to provide biological grounding for sociology. His application of mirror neuron research to symbolic interactionism amounts to a neuro-interactionism, where the human capacity for social interaction is understood at the level of the neuron. According to mirror neuron research utilized by Franks, embodied events of imitation and empathy are facilitated at the level of the sensorimotor neuron and the neural network. Franks takes such events as biological evidence of the primacy of sociality in human life; further, he argues that they illuminate and biologize symbolic interactionist theories like 'taking the role of the other.' But for many neuroskeptics, the account of

intersubjectivity made possible in this research would be unacceptably narrow, reductionist and bounded. And as I noted earlier, the neuro-interactionist vision outlined by Franks is informed by an explicitly anti-linguistic, anti-cultural agenda.<sup>5</sup>

For me, Franks' neuro-interactionist account of the social brain raises two related questions. First, does framing social capacities as the automatic, physiologically determined responses of the brain actually help embody our understanding of self and social? Put another way, does this version of the social brain rescue us from the disembodied effects of social constructionism? I think perhaps not. The versions of both brain and embodiment employed here are unnecessarily fixed by evolution, universalized in response to a predictable, 'objective' physical world, and unjustifiably pitted against language. For example, even though mirror neuron research acknowledges possibly complex roles for language and memory, sensorimotor actions are framed as 'indifferent' and wholly neutral in relation to culture. Franks' evolutionary assumptions and his theoretical agenda close off the possibility of thinking about mirror neurons as participating in a flexible, embodied, engagement with the other, and of the brain as shaped by experience that is narrative, symbolic, and embodied. Thus his approach to neuroscience may not do very well in recovering the body for social theory; the body it would recover is one we could barely recognize as sociologically meaningful.

The highly skeptical responses to neuroscience by prominent scholars like Martin, however, may encourage a fatigued acceptance of the opposite vision: of bodies without physiologies, or physiologies so wholly inscribed by culture as to be rendered totally inaccessible if not materially meaningless. We may simply continue to ignore the brain because we are presented with such sociologically unsatisfying portraits of it. I believe the need for embodying social theory is pressing, and I agree with Watson (and, grudgingly, with Franks) that our working conceptions of the body in sociology are pretty empty of flesh and materiality. I also share Watson's concern that leaving the brain to the hard sciences eliminates any opportunities we might take for influencing how it appropriates sociological and anthropological concepts to extend its relevance beyond the brain. My second question, then, is whether there are other, more sociologically productive ways to take up mirror neuron research (and brain research more broadly). One hopeful point is that neuroscience is not monolithic, and in its cracks and fissures we might find spaces for creative intervention and interpretation.

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<sup>1</sup> Mead's pragmatism resists reducing the self to a construct of symbols; symbolic interactionism emphasizes practical engagement with the world. The capacity to engage with the world is embodied, prediscursive and biological, while the reflexivity upon which a self depends is social and interactive (Callero 2003).

<sup>2</sup> Franks' account doesn't even raise the question, implying that the evidence about mirror neurons is unassailable. It is true that sociologists are not well-equipped to critique neuroscientific methods, and thus a reluctance to adjudicate evidence and methodologies is understandable. But the strong critical work by anthropologists and sociologists such as Joseph Dummit (2004) and Rebecca Jordan-Young (2010) makes blind acceptance of brain science seem unreasonable.

<sup>3</sup> In cognitive science terms, this is an explicit version of simulation theory (Gallagher 2007).

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<sup>4</sup> Heyes distinguishes between associative learning, which “results from exposure to a relationship between two events,” and Hebbian learning, even though the two are similar. The former requires both contiguity (closeness in time of the events, which strengthens the association) and contingency (a predictive relationship between the events). Hebbian learning requires only contiguity (2010: 576). Iacobini (2009) notes the strong similarity between these two models.

<sup>5</sup> Iacobini states that the evidence from mirror neurons suggests that empathy and intersubjectivity do not come “our ideas and social codes,” but rather are “built bottom up from relatively simple mechanisms of action production and perception” (2009: 666-667). Franks believes that by taking seriously physiological processes in the brain, we can combat ‘extreme social constructionism.’