Running head: SOCIOLOGY OF NEUROSCIENCE

Sociology of Neuroscience or Neurosociology?

Christian von Scheve
Freie Universitaet Berlin

9.315 words

ARTICLE IN PRESS IN
Pickersgill, M., van Keulen, I. (Eds.), *Sociological Reflections on the Neurosciences*. Advances in Medical Sociology, Vol. 13. Bingley: Emerald.

Correspondence
Christian von Scheve
Freie Universitaet Berlin
Institute of Sociology
Cluster of Excellence „Languages of Emotion“
Habelschwerdter Allee 45
D-14195 Berlin
Germany
Tel.: +49-30-838-57695
Fax: +49-30-838-52887
Email: scheve@zedat.fu-berlin.de

Abstract

A neuroscientific turn has been diagnosed in several disciplines, but sociology has not yet undertaken this turn. While other social science disciplines are engaging in a lively discussion with the 'new brain sciences' and have established extensive collaboration, exchange between neuroscience and sociology is almost absent. Besides a general scepticism towards "reductionist" explanations, this is largely due to sociology focusing on its traditional role as observer and critic of current developments in science. In this article, I will argue that this 'sociology of neuroscience' approach should be complemented by an increased attention to actual neuroscientific findings with respect to key theoretical concepts in sociology and social theory more generally. I will discuss how contemporary neuroscience research can assist in sharpening and empirically refining our understanding of a number of micro-sociological concepts that often elude investigation with more traditional social science methods. I will highlight the possible benefits and pitfalls of such endeavours by discussing the 'neurosociology' paradigm and sketch alternative ways of mutual engagement with the new brain sciences.

Introduction

A neuroscientific turn has been diagnosed in several disciplines, for example in economics, philosophy, anthropology, law, and psychology (e.g., Camerer, 2008; Churchland, 1989; Dominguez Duque et al., 2010). Although this turn is still confined to specialised disciplinary branches, its impact on major concepts and theoretical reasoning in these disciplines is already remarkable. The social sciences – and in particular sociology – have not yet undertaken this turn. At first glance, this is surprising, since the neurosciences – and most prominently the 'new brain sciences', such as social, cognitive, and affective neuroscience – have been investigating key concepts of sociological thought for quite some time; for example, cooperation, norms, and intersubjectivity. While other disciplines are more or less actively engaging in a lively discussion with these branches of neuroscience and have established collaboration on theoretical, empirical, and occasionally also institutional levels, mutual engagement or exchange between neuroscience and sociology is hard to find.

On closer inspection, this is less surprising, because the reasons for sociology's reluctance towards this kind of cooperation may be easily seen in sociologists' profound interest in an alternative form of rapprochement: its classical and important role as an observer and critic of current developments in science, technology, and society. This 'sociology of neuroscience' approach – only just emerging in institutionalized contexts, such as within the 'European Neuroscience and Society Network'[1] or the 'Critical Neuroscience'[2] initiative – is chiefly interested in examining the manifold implications and consequences of neuroscientific research on culture and society at large.

In this article, I will argue that the sociology of neuroscience perspective should be complemented by an increased and detailed attention to actual neuroscientific findings with respect to key theoretical concepts in sociology and social theory more generally. I will discuss how contemporary neuroscience research can assist in sharpening and empirically refining our understanding of a number of micro-sociological concepts that often elude investigation with more traditional methods, such as ethnographic observation, introspective self-reports, or interpretative and hermeneutic analyses.

This has recently been attempted, for instance, by David Franks (2010) and Warren TenHouten (1997, 1999), who have dubbed their approaches 'neurosociology'. Despite this somewhat unfortunate labelling, they do give clear and promising insights into how neuroscientific research might inform social theorizing. However, as I will illustrate, their work is to some extent prone to the same critique that shattered previous attempts of

[1] www.lse.ac.uk/collections/ENSN
[2] www.critical-neuroscience.org

incorporating biological mechanisms into models of sociological explanation. I will thus outline different ways for a sociological engagement with the neurosciences that potentially circumvent these problems and aims at combining the critical stance of the sociology of neuroscience with certain aims of the neurosociological paradigm.

The chapter is structured as follows: First, I will briefly illustrate current approaches in the sociology of neuroscience which broadly stand in the tradition of medical sociology, science and technology studies, and the sociology of science. I will put particular emphasis on those works relevant for a neurosociological perspective in that their critique is aimed at the sometimes careless and metaphorical use of social science concepts in neuroscientific research; for example, in the fields of social status, norms, or stratification. Second, I will discuss a number of promises and perils of recent neurosociological approaches and highlight their proneness to critique. By shifting attention from macro-social processes down to physiological levels of analysis and not justifying why – for sociological purposes – intermediate analyses, in particular social psychological, cannot do the trick (although they mostly can), the necessity to rely on neuroscientific data often remains unwarranted. Third, I will suggest two possible ways and strategies to concisely integrate findings from the neurosciences into sociological theory: one that makes explicit use of the findings of science and technology studies in the field of neuroscience research, and second one that is inspired by previous attempts to combine sociology and research on distributed artificial intelligence, calling for an *in situ* cooperation between neuroscience and sociology.

The sociology of neuroscience as sociology of science

The sociologies of medicine and science have, as yet, only little to say about current trends and developments in the neurosciences, and their social and cultural impact. A dedicated field of the sociology of neuroscience is just beginning to emerge. Traditionally, the sociology of science as part of the larger interdisciplinary endeavour of science and technology studies (STS) is concerned with the social and cultural embeddedness of the production of scientific knowledge and with its ramifications on various areas of society, for example institutions, politics, markets, organizations, and social relationships (Collins, 1983; Shapin, 1995; Hackett et al., 2007). In pursuing this agenda, STS usually employs well-established social science methods, such as discourse analysis, ethnographic observations, and interviews.

The majority of studies in the sociology of science seek to highlight the social construction of scientific knowledge and to dissect the conditions under which this knowledge

is produced (Knorr-Cetina, 1981; Lynch, 1993). Emphasis is commonly put on the social structures and processes that constitute scientific research; for example, research practices and politics, the organizational structure of research institutions, behaviour of corporate actors, research funding systems, and networks of researchers. These form the very basis of any kind of scientific knowledge. Hence, much of the research in STS is concerned not in the first place with the ontological status of certain research findings, but rather with the epistemological question of how findings are disseminated and regarded as objective truths (cf. Pickersgill, 2010).

In addition to investigating the production of scientific knowledge, sociology is also concerned with assessing the societal impact of this kind of knowledge. This line of enquiry is well-known with regard to scientific disciplines closely related to technological advances and innovations; for instance, biology, engineering, and information technology. Here, the focus is not primarily on the *production* of scientific knowledge, but on the *consequences* for a general, public understanding of the respective subject matters and their implications for policies, economies, and social relations. This encompasses, for example, genetics (Conrad 2000; Nerlich and Hellsten, 2004), psychopharmacology (Ehrenberg, 2009; Rose, 2003), nanotechnology (Burri, 2009; Kurath, 2009), and new media (May, 2002; Turkle, 1997).

In a programmatic essay, Choudhury and associates (2009) sketch the way STS and the sociology of biomedical knowledge have so far engaged with the neurosciences, and with biotechnology more generally, and lay out avenues for a more systematic way to approach the new brain sciences from a “critical” (sociological) stance (for related discussions, see Beaulieu, 2002; Littlefield, 2010; Pickersgill 2009). For one, they highlight historical approaches to the neurosciences which help understand the formation of key concepts and practices, which are (also) used in contemporary neuroscience research. Analyses emphasizing this historical dimension primarily illuminate how the convergence of prevailing socio-cultural and technological conditions can lead to the formation of categorical distinctions between the ‘normal’ and the ‘pathological’, to the transformation of the subjective and qualitative dimensions of human life into quantifiable aspects of human neurophysiology, and to the treatment of scientific objectivity as a highly prized epistemic virtue (Choudhury et al. 2009, p. 66; see also Rose, 2010; Vidal, 2009). Choudhury and colleagues (ibid.) also emphasise that a historical perspective might dampen the often overstressed expectations attributed to the neurosciences and the public ‘hype’ surrounding them.

A second avenue for sociological investigations of neuroscientific practices is seen in the examination and assessment of scientific standards and the use of theoretical concepts and methods. Although this clearly is not the primary objective of social science inquiry but rather a basic necessity for any scientific discipline, it is no doubt promising to observe, document, and interpret how these debates emerge and are discussed in the neuroscience community (e.g., Logothetis, 2008). A good example for such an analysis is the discussion that was recently instigated by an article by Edward Vul and associates (2009) originally titled 'Voodoo Correlations in Social Neuroscience'. In this paper, Vul and co-workers heavily attacked a number of neuroscience colleagues for making false statistical inferences (Vul et al., 2009). From a sociological perspective, this debate is not so much interesting because of the statistical problem itself (i.e., non-independence errors, which are better known in the social sciences as selection-bias distortions), but for the social dynamics it created in the neuroscience community (cf. also Kriegeskorte et al., 2009). These dynamics can be estimated by the number and the tone of comments in scientific journals and the pressure most probably exhibited by the editors of the prestigious journal *Perspectives on Psychological Science* to rename the article from 'Voodoo Correlations in Social Neuroscience' to 'Puzzlingly High Correlations in fMRI Studies of Emotion, Personality, and Social Cognition'.

A similar discussion might be expected on other issues in functional magnetic resonance imaging; for example, that of reliability (Bennett and Miller, 2010). Also, the selection and composition of subject samples in current psychological and most of the existing neuroimaging studies are highly debated. For instance, Henrich and colleagues (2010a) aptly criticize that the usual subject pool for experimental studies is made up by "people from Western, educated, industrialized, rich and democratic (WEIRD) societies – and particularly American undergraduates – [which] are some of the most psychologically unusual people on Earth" (Henrich et al. 2010b, p. 29). In a commentary to this target article in the journal *Behavioral and Brain Sciences*, Chiao and Cheon (2010, p. 29) add that "within the field of psychology, 95% of psychological samples come from countries with only 12% of the world's population" and that "within the field of human neuroimaging, 90% of peer-reviewed neuroimaging studies come from Western countries (Chiao, 2009)" (cf. Arnett, 2008).

This line of inquiry is closely related to ethnographic field studies of neuroscientific research practice. As Choudhury and colleagues (2009) point out, the classical methods of STS provide an understanding of *how* neuroscience research is conducted in the laboratory and what the social systems and networks it is embedded in look like. Ethnographic

approaches provide insight into intra-disciplinary discourse, hegemonic thought structures and communities (e.g., Burnham and Johnson, 2005), forms of organization, management and funding, and the everyday practices of researchers and clinicians (Dumit, 2004; Joyce, 2008). In comparison to ethnographic analyses in other scientific fields (e.g., genetics or information technology), this methodological perspective seems equally promising in a neuroscience context, shedding light on how and why neuroscience comes to be seen by its practitioners not primarily as a *method* and *tool*, but as a comprehensive explanatory framework of human behaviour.

Most interesting in this context, and probably making up a great deal of the 'hype' surrounding the new brain sciences, are responses from the public and the media representations of neuroscience research. As has been shown in other areas of scientific inquiry – for example, in genome sequencing (Gerhards and Schäfer, 2009) – media representations of scientific findings and debates are the primary locus driving the public perception and understanding of this research (Schäfer, 2009). In a review, Racine and colleagues (2005) examine how neuroscience research is perceived by the "public eye", mostly conveyed through the mass media, and whether its applications, limitations and risks are properly communicated and received.

Other research has focused on the effects of the visualization of the brain on the credibility and believability of research results (McCabe and Castel, 2008; Weisberg et al., 2008). Scientists as well as the media suggest that the use of brain images (acquired, for example, through functional magnetic resonance imaging (fMRI) or other imaging techniques) to represent brain activity, "confers a great deal of scientific credibility to studies of cognition, and that these images are one of the primary reasons for public interest in fMRI research" (McCabe and Castel, 2008, p. 344). The alleged ability to precisely localize complex human cognitive capacities such as deception, belief, or moral reasoning seems to be highly attractive to the general public and the media which usually disseminates research findings (Dobbs, 2005; Dumit, 2004; Littlefield, 2009). Excessive reliance on brain images, however, tends to lead to an oversimplification of the issues at hand and media reports are thought to frequently misrepresent conclusions drawn in neuroimaging studies (Racine et al., 2006)

A further aspect of a "critical" engagement with the neurosciences which is highlighted by Choudhury and associates (2009) pertains to the economic dimensions of science. As with most other forms of research that produce knowledge which is easily marketable and applicable in a number of contexts, neuroscience is embedded into economic

structures of funding agencies, pharmaceutical corporations, medical service providers, technical equipment manufacturers, and so forth. It is no doubt highly interesting to investigate the constraints that are placed on neuroscience research by this complex combination of interests, but also to examine the possibilities that emerge from this constellation.

When reflecting upon these manifold dimensions of possible sociological engagement with the neurosciences, it is remarkable that one particular aspect of the new brain sciences seems to only play a minor role: its impact on the stocks of knowledge, theories, and concepts in the social sciences themselves. In contrast to other fields of research which are investigated by sociologists of medicine and of science (genetics, for example), neuroscience is special in that it partly seeks to provide answers to questions that the social sciences themselves have been asking for decades. This impact is only very sparsely reflected in sociological studies of the neurosciences. In contrast, it is exactly the kind of analysis whose impact seems to thrust current endeavours in the various emerging 'neuro-' disciplines in the humanities and parts of the social sciences, such as neuroanthropology, neuroeconomics, neurolaw, and neurophilosophy (see Johnson and Littlefield, this volume). This is, for example, reflected in recent workshops and conferences such as 'Neurocultures'[3] (Berlin 2009), 'Personhood in a Neurobiological Age'[4] (London 2010) or 'Neurosociety...What is it with the brain these days?'[5] (Oxford 2010).

Within sociology, these reflections mostly do not occur within STS, but rather in the fields of sociological theory and methods. In accordance with the discussion and adoption of neuroscience findings in other disciplines, this endeavour has been catchphrased 'neurosociology' (Franks, 2010). In the following section, I will discuss how the field of neurosociology is located in the lively and more general discussion on the place of 'biosocial' explanations in sociology, what it tries to accomplish, and how it can possibly profit from and complement works in science and technology studies focusing on the neurosciences.

Neurosociology as another 'Neuro-'Science?

Critics of the various newly emerging 'neuro-' disciplines hold that the new brain sciences may still be too premature for their findings to turn theories and concepts of the more established social science and humanities disciplines on their heads, or even to be integrated into relevant disciplinary debates (cf. Abi-Rached, 2008; Rees and Rose, 2004; Reichertz and

[3] http://mediathek.mpiwg-berlin.mpg.de/mediathekPublic/neurocultures.html
[4] http://www.lse.ac.uk/collections/brainSelfSociety/personhood-in-a-neurobiological-age-symposium.htm
[5] http://www.sbs.ox.ac.uk/centres/insis/news/Pages/neurosociety.aspx

Zaboura, 2006; Rinaldi, 2009; Rose, 2006). Within sociology, this seems to stem from a long-standing reservation to incorporate findings from physiologically or biologically inspired disciplines into sociological theory (Dingwall et al., 2003). Primarily, it seems that the debates following Edward O. Wilson's (1975) *Sociobiology* in the 1970s and the prolonged fear of 'reductionism' or 'determinism' have led to a protracted disregard of discoveries in the life sciences at large (Alcock, 2001; Nielsen, 1994; Williams, 2009). This attitude might be traced back to Emile Durkheim's (1964) *Rules of Sociological Method* and his demand to explain the social through the social only. If, then, anything that is 'biological' is being conceptualized as *not* (also) social – which is quite often the case – then the use of biological or physiological principles obviously forbids itself for those sociologists closely sticking to Durkheim's claim. This also illustrates that sociologists usually regard 'biology' and 'culture' as two distinct antipodes, and those who wish to invoke 'cultural' principles in the explanation of social processes are required to let go of any biological explanations. As Freese and colleagues note,

> To many sociologists, 'biology' and the 'social' are locked in an explanatory zero-sum game in which any ground ceded to the former diminishes the value of sociology (and the need for sociologists) (Freese et al., 2003, p. 234).

Meanwhile, however, an increasing number of sociologists argue that this disregard of biological and physiological explanations is in fact counterproductive with respect to theoretical and empirical advancement in sociology, and the public standing of the discipline. Francoise Nielsen (1994), for instance, has aptly illustrated the ways in which 'sociobiological' reasoning can inform sociology. She highlights several evolutionary principles, such as different units of selection (gene, organism, and group), inclusive fitness, relatedness, and reciprocal altruism, and sketches how they might affect different areas of sociological inquiry: gender roles and collective action, for example.

More recently, Douglas Massey in a presidential address to the *American Sociological Association* argued that sociologists "have allowed the fact that we are social beings to obscure the biological foundations upon which our behavior ultimately rests" (Massey, 2002, p. 1; cf. Freese et al., 2003, p. 234). Similarly, Benton argues for a "re-alignment of the human social sciences with the life sciences" (Benton, 1991, p. 25) and Bury urges us "to rethink the relationship between sociology and the biological sciences" (Bury, 1997, p. 199; cf. Newton, 2003). The strongest claim for taking into account biological mechanisms in sociological reasoning and explanations is most probably made by Freese and associates, who illustrate how the "varying ways in which the specific materiality of the human actor – our

"biology" – can be asserted to be relevant toward understanding why we behave as we do or why human societies are organized as they are" (Freese et al., 2003, p. 234).

Freese and colleagues (2003) systematically track three broad areas in which research in the biological sciences can provide insights into genuinely sociological questions. First, they review research in evolutionary psychology and other evolutionary-minded sciences (e.g., human behavioural ecology). They highlight that human psychological capacities have been significantly shaped over vast timescales, compared to which modern societies occupy only a tiny fragment. Thus, much of our psychological capacities reflect adaptations to very different environments. Acknowledging this perspective, they argue, bears important implications for sociological research. Second, they illustrate how current research in genetics can be informative for sociological issues. In particular, they give detailed accounts of issues of heritability and gene-environment interactions which clearly show that – given specific genotype-phenotype linkages – the often articulated fears of genetic determinism are largely unwarranted. Third, Freese and colleagues (2003) review research on biomarkers and bioindicators, such as certain neurotransmitters and hormones, which are important for human social behaviour; for example, serotonin and testosterone. They emphasize that delineating the link between these indicators, the social environment, and social action is highly complex, and that most attempts at establishing the primacy of one over the other – either from the side of sociology or biology – have failed.

When looking at the history of sociological thought, it is almost surprising that taking note of these kinds of explanations is so contested in current debates. Take, for example, Pierre Bourdieu's concept of 'habitus', which extensively relies on the human body as an explanatory unit for examining social action and the emergence and reproduction of social structures (Bourdieu, 1977, 1990). Although the exact physiological processes and mechanisms that are in operation in bringing about the supposed effects remain opaque in Bourdieu's oeuvre, more recent theorizing has convincingly linked current research in the cognitive and biological sciences with Bourdieu's arguments. Lizardo (2005) has done this on the grounds of Piaget's views on embodiment and cognitive structures, and Pickel (2005) by decomposing the 'habitus' into four separate systems: brains, minds, social systems, and symbolic systems.

Similarly, there is a long tradition in sociology in referring to processes of *socialization* and *internalization* in explaining recurring patterns and practices of social action. Most of the extant works, however, concentrate on forms of cognitive socialization and internalization – most prominently Berger and Luckmann (1966) and later writings on the

sociology of knowledge and cognitive sociology (e.g., Zerubavel, 1997). This emphasis on mental and psychological process has led to a neglect of the physiological aspects of socialization and internalization. This is surprising, since Bourdieu's concept of the habitus already incorporated principles of physiological socialization (*hexis*). More recent approaches, however, tend to incorporate the body as a promising unit of sociological analyses, which is, for example, reflected in an increasing use of the concept of *embodiment* (Cregan, 2006; Ignatow, 2007; Newton, 2003).

These approaches reflect a dedicated sociological interest in the interactions between the social environment and humans' physiological parameters (i.e., in the 'social plasticity' of human physiology) – especially those which are relevant for social action. The timespan that is deemed relevant in these works is usually limited to the average lifetime of humans, which means it is strictly focused on *ontogenetic* development. There is no reason, however, not to extend these kinds of analyses from ontogenetic to phylogenetic development and to include evolutionary models of human behaviour – as, for instance, illustrated by Freese and colleagues (2003).

One of the most hotly debated interdisciplinary marriages is that of sociology and genetics. This is for a variety of reasons, of which two of the most striking are probably these: First, the mechanisms translating specific genetic predispositions into corresponding phenotypes are still largely unknown – that is, the degree to which genetic configurations actually impact behavioural outcomes is a matter of ongoing research and not yet fully understood (Freese, 2008). Second, most sociological engagement with genetics still seems to assume that the genetic makeup of individuals is largely *invariant* and does thus not allow accounting for any influences of culture and society on genetic behavioural dispositions. Accordingly, genetically informed explanations of social behaviour are often – as a matter of principle – disregarded as deterministic and reductionist (cf. Lippman, 1992; Nelkin and Lindee, 2004; Sloan, 2000). Such approaches tend to grant no room to interaction effects between environment and individual, as, for instance, in those theories referring to the habitus or socialization processes.

Yet, today, sociologists seriously engaging in genetically informed research have produced far richer and more sophisticated analyses than those so aptly critiqued by scholars like Dorothy Nelkin and Susan Lindee. They show, for example, that genetic differences might in fact be a major confounding factor in explanations relating individual outcomes to social environmental conditions, for instance education, income, or marriage (cf. Freese, 2008; Freese and Shostak, 2009). Accounting for genetic differences potentially also leads to

opposite findings: it might either support conclusions drawn from studies of the effects of social inequality or it might add distortion to existing conclusions and lower the explanatory power of the social environment in favour of behavioural predispositions (cf. Freese and Shostak, 2009). Moreover, current research in epigenetics seems to be particularly important to sociologists because it investigates the biochemical mechanisms responsible for the linkage between actual gene expression (the fundamental level at which phenotypes emerge from genotypes) and environmental conditions (Guo, 2008).

Neurosociology

It is within this ongoing discourse on the wedding of biological and sociological explanations where current neurosociological endeavours are situated, and many of the arguments that are exchanged over evolutionary reasoning or the usefulness of genetic information perfectly apply to the efforts to account for neuroscientific findings.

The term 'neurosociology' was first used by Bogen and colleagues (1972) and shortly after introduced into sociological discourse by TenHouten and Kaplan (1973). TenHouten (1999) then elaborated on the neurosociological paradigm as a reaction to the United States Congress's declaration of 1990s as the 'Decade of the Brain' and to the emerging field of 'social neuroscience' as a cooperation between neuroscience and social psychology seeking to establish the fundamentally social nature of the human brain (e.g., Cacioppo and Berntson, 1992; Cacioppo et al., 2000). Neurosociology, he states,

> takes the neural functioning and the mental life of the member of society as one level of reality, and in this sense requires a radically micro level of analysis. There is, in such a focus, no biological reductionism or determination, as we see for example in certain tendencies of sociobiology (TenHouten, 1997, p. 10).

In much the same way, David Franks has taken up research in the new brain sciences and sought to integrate it into sociological accounts of human social behaviour (Franks, 1999; Smith and Franks, 1999). In doing so, Franks emphasises the role of social psychology as a key bridging discipline between "ultra" micro-level analyses in the neurosciences and more macro-oriented social science reasoning. This position is best elaborated in his latest work (Franks, 2010), which at the same time can be seen as the most comprehensive outline of the neurosociological paradigm available to date.

Basically, TenHouten (1999) and Franks (2010) concur in arguing that the social sciences - and particularly sociology - would be well advised to take into account research in the new brain sciences, which allows an advancement and refinement of many classical micro-sociological concepts such as self, experience, mind, knowledge, thinking, and feeling. One reason for the sociological relevance of neuroscientific knowledge is seen in the focus of the 'new' brain sciences on the basic mechanisms of human (social) behaviour, instead of using neuroscience techniques as a means of undertaking medical research and diagnosis. By mostly combining experimental methodological approaches from the behavioural sciences with medical imaging (positron emission tomography (PET) or fMRI) and brain mapping techniques (e.g., electroencephalography (EEG) or magnetoencephalography (MEG)), these branches of neuroscience are supposed to provide insights into the foundations of human social behaviour and mental processes (Harmon-Jones and Beer, 2009).

The second reason advanced by proponents of the neurosociological paradigm is that research in the brain sciences has moved from investigating these processes in isolated individuals to examining actors engaged in social interactions or in activities immediately relevant for social interaction. This shift parallels earlier developments in psychology and the flourishing of social psychological research in areas broadly labelled social cognition, personality, and emotion. Hence, much of the neuroscience research cited in neurosociological approaches and with potential relevance for sociological issues comes from the specialized branches of social, cognitive, or affective neuroscience, whose mission statement is to combine "the tools of cognitive neuroscience with questions and theories from various social sciences including social psychology, economics, and political science" (Lieberman, 2007, p. 260; Adolphs, 1999, 2003). More recently and still largely unnoted in neurosociological works, neuroscience researchers started to extend this multi-faceted agenda to also include the domain of *culture* in their analyses and launched the field of *cultural neuroscience* (Chiao, 2009; Han and Northoff, 2008; though for a more critical analysis see Mateo et al, 2011). Cultural neuroscience seeks to investigate "cultural variation in psychological, neural and genomic processes as a means of articulating the bidirectional relationship of these processes and their emergent properties" and is "motivated by two intriguing questions of human nature: how do cultural traits (e.g. values, beliefs, practices) shape neurobiology (e.g. genetic and neural processes) and behaviour and how do neurobiological mechanisms (e.g. genetic and neural processes) facilitate the emergence and transmission of cultural traits" (Chiao et al, 2010, p. 356).

A third reason for the sociological relevance of neuroscience research is seen in neuroscientists highlighting the genuinely 'social nature' of the human brain. This reason is by far the most frequently and emphatically mentioned, for example by Franks (2010) and TenHouten (1999), although within the neuroscience literature it seems to have lost some of its prominence. The classic works discussed in this respect are Leslie Brothers' (1997) *Friday's Footprint* and Michael Gazzaniga's (1985) *The Social Brain.* Both emphasize the specialization of the human brain to process social information, its capacity to rapidly adapt to specific social and cultural environments, and its dependency on social context and embeddedness into social groups. In contrast to current debates in social cognitive neuroscience, these works tend to bring forward more evolutionarily minded arguments and hypothesize that the human brain evolved to cope with ecological problems related to cooperation, increasing group sizes, and complex social bonds and social structures (ibid.; also dubbed the "social brain hypothesis" of Dunbar, 2002). Exactly this perspective is taken by sociologist Jonathan Turner who integrates neuroscience evidence and evolutionary theory to explain the origins of human emotions (Turner, 2000).

In reviewing part of these neuroscience studies and paradigms, TenHouten (1999) as well as Franks (2010) state that their research hypotheses and results are directly adaptable to and relevant for the processes and mechanisms traditionally studied by sociologists. TenHouten, for example, refers to early sociologists such as Emile Durkheim, George H. Mead and Karl Mannheim, in whose theories the "human mind was seen as essential to societal organization" (TenHouten, 1999, p. 29). Thus, investigating the "mind" with various methodological approaches should yield substantial benefits for sociology. Concepts that reflect this position – for instance, collective conscience (Durkheim), mind and society (Mead), or social knowledge structures (Mannheim) – are foundational to many (modern) sociological paradigms, such as conceptions of the self, symbolic interactionism, and cognitive sociology.

Although the neurosociological perspective on the potential contributions of the neurosciences to social science research is fruitful and promising (von Scheve, 2009; von Scheve and von Lüde, 2005), it also bears a number of problems and pitfalls. Some of these can be readily identified by taking into account the manifold views expressed in the sociology of science and medicine.

One of the major pitfalls is that studies in social cognitive neuroscience often operate with concepts and terminologies borrowed from the social and behavioural sciences, in particular from sociology or social psychology (Dingwall et al., 2003). This is the case for

social norms, moral judgment, socio-economic status, social hierarchy, social status, social class, reciprocity, altruism, or empathy (cf. Lieberman, 2007). Regrettably, a substantial number neuroscientific studies tend to ignore decades of social science research on these concepts. In what follows, I will briefly outline one example.

In a recent study, Chiao and associates (2009), following the 'cultural neuroscience' paradigm, report on the "neural basis of preference for human social hierarchy versus egalitarianism". Although "Marxist socialism" and "Rawlsian liberalism" are mentioned to set the stage for the social sciences (p. 174), this namedropping is irritating – if not misleading – because it also frames the possible interpretation of the study in a way that is neither supported by its deign, nor by its results. Apart from not considering the vast amount of social science research on social justice and social inequality, they frame the study in a way that lets readers expect a general (evolutionarily and biologically based) preference of social hierarchies over egalitarianism in humans. For example, they state that

> because of the near ubiquitous presence of social hierarchy across species and cultures, it is plausible that the human ability to successfully navigate hierarchical social interaction arises from adaptive mechanisms in the mind and brain that support the emergence and maintenance of social hierarchies within and across social groups (Chiao et al., 2009, p. 175)

In their findings, however, they only show that the neural correlates of processing pictures of people being either in pain or in neutral situations systematically vary with the degree of social dominance orientation (as assessed using a psychological scale) of the subjects watching these pictures. The conclusion Chiao and colleagues (2009, p. 174) draw – "that preference for hierarchical rather than egalitarian social relations varies as a function of neural responses within left anterior insula and anterior cingulate cortices" – is thus rather daring.

It is interesting to note that proponents of the neurosociological approach largely seem to be unaware of these obvious (and other) problems or think they do not deserve to be underscored. Yet, this might lead to an unfortunate and ultimately unreflexive use of neuroscience findings (and concepts) in neurosociological research and within sociology and the social sciences more generally. In the following section I will therefore discuss possible loopholes to circumvent these problems as well as strategies to put cooperation with the neurosciences on a sound and solid basis.

Neuroscience methods and sociological analysis

As the previous section has illustrated, the project of connecting neuroscience and sociology is fraught with ambivalences. On the one hand, an overenthusiastic and overly optimistic engagement with neuroscientific research – as is presently seen in some works following the neurosociological paradigm – can lead to an unreflexive use of neuroscience findings in social science research. This is problematic because it might foster the adoption of research results which are based on an application of social science concepts that is possibly incompatible with the use of these concepts in sociology and the social sciences. On the other hand, avoiding a neurosociologically-inspired engagement with the new brain sciences seems to forsake the potential benefits of neurologic findings to sociology – as aptly demonstrated by scholars such as Franks.

These problems can potentially have two consequences. First, they might be seen as reminders for social scientists who are interested in social cognitive neuroscience research to approach the respective results with caution. Above all, sociologists and social scientists should carefully scrutinize the concepts underlying neuroscientific studies and the interpretations drawn from this data. The recent debate on 'mirror neurons' is a case at hand. Here, social scientists obviously find it tempting to be served with a concept that seems to grant empirical support to the more classical (and at times rather opaque) notions of *empathy* or *intersubjectivity* and, more generally, to theories of social interaction and understanding, e.g. Mead's and Cooley's (cf. Franks, 2010, p. 85ff). A closer look at the relevant neuroscience literature, however, reveals that there are a number of problems in adapting mirror neuron research in a one-to-one fashion to social science concepts; for example, its still heavy reliance on single cell studies, animal studies, and motor behaviour (Iacoboni, 2009; Rizzolati and Craighero, 2004; cf. the excellent discussion in Zaboura, 2009).

Aside from the cautions and reflected engagement with social neuroscience, sociologists interested in this kind of research often overlook that those aspects of the findings in neuroscience studies that they deem most important for sociology have been demonstrated by, for instance, classical psychological studies long before. Much of the research discussed in publications sailing under the neurosociology flag has longstanding parallels in (developmental and social) psychological or (evolutionary) anthropological research, from which the basic behavioural results are well known and established. In these cases, knowledge of the neural substrates or correlates of certain phenomena and their localization in the human brain bears absolutely no added value for sociological investigations. All too often, social

scientists grant credit to the neurosciences where a look into standard psychology textbooks would have done the trick.

This is the case, again, for mirror neuron research. There is a large bulk of evidence in social psychology on the automatic and unconscious imitation and mimicking of a range of (rather complex) social behaviours (body posture, facial expression, etc.) that still awaits integration into sociological theory (e.g., Bargh, 1997; Bargh and Ferguson, 2000; cf. von Scheve, 2009). Incorporation of these results will most probably bear the same utility for the advancement of sociological theory as does neuroscience research – with the difference that classical psychological studies have been replicated several times more than current neuroscience paradigms.

Moreover, when accounting for neuroscientific evidence in sociological analyses, it should be clear – and made explicit – what kinds of conclusions can be drawn from the most widely used methods in social neuroscience (i.e., fMRI). This is a practice that is hardly followed neither by Franks (2010) nor by TenHouten (1999), for example. The majority of experimental social neuroscience paradigms using fMRI rely on *correlational* evidence, although the experimental designs often suggest – and are in fact interpreted as – strong *causal* inferences. Imaging analyses usually consist of computing differences in blood oxygen level-dependent (BOLD) signals between experimental baseline and target conditions. These differences are then typically correlated with other kinds of measures, such as behavioural or self-report data. The outcome of these paradigms is information on which brain regions reveal stronger patterns of activation (i.e., blood oxygen consumption) in the experimental target condition (as compared to the baseline condition) for specific groups of subjects (grouped according to individual differences measures).

Furthermore, the data is often interpreted by a process of reverse inference. This happens when researchers conclude that when a specific brain region is implicated in a specific task – and the same region has been shown to be active in some other task assessing a specific cognitive or affective ability before – this kind of cognitive or affective process is relevant for the task in question (cf. Poldrack, 2006, 2008). Stronger (causal) evidence is provided by lesion studies, which are comparably rare, or by studies using ‘artificial’ lesions induced by transcranial magnetic stimulation (TMS). Social scientists accounting for these conceptual and methodological issues in social neuroscience research and who engage thoughtfully with the neurosciences can thus be perfectly informed by the critiques of more mainstream sociology of medicine and science, and also by accounting for the critical

assessments of psychology and the neurosciences advanced by practitioners (e.g., Mateo et al., 2011; Vul et al., 2009; Henrich et al., 2010a).

Another path of engagement with the neurosciences might be found in a more cooperative stance towards the new brain sciences, without necessarily giving up 'traditional' sociological cautiousness. Sociologists might in fact find their ways into neuroscience laboratories and actively engage in cooperation with the neurosciences in an *in situ* context. Looking at the revival of experimental methods in sociology (e.g., Bohnet, 2009; Fehr and Gintis, 2007), this step is not as surprising as it may seem at first glance. Taking sociological experiments to the laboratory of course strips them of their immediate social context (loosing the advantages of field experiments), but nevertheless remains a promising and well established methodology.

The prospect of conducting sociological experiments in close cooperation with neuroscientists and neuroscientific methods then takes social cognitive neuroscience and related paradigms at 'face value', that is primarily as a (supplementary) *method* of conducting empirical research and a tool for generating sociological insight – not more, not less. It is of course crucial to be clear about the benefits of neurological evidence for the sociological question that is under investigation. If it were only the behavioural results sociologists were interested in, the experimental designs could well be conducted without the strong limitations and restrictions generated by the use of expensive technical equipment such as fMRI scanners and the constraints of laboratory settings. Knowledge of the neural correlates of different kinds of social behaviours in various contexts and situations might in fact be relevant for sociological reasoning when, for example, overt behaviour is hardly distinguishable across subjects or experimental conditions (e.g., habitual vs. intentional norm-compliance), introspection is problematic, when knowledge about the style of neural processing is of interest (e.g., cognitive vs. affective; controlled vs. automatic), or when processing 'side-effects' are crucial (e.g. the involvement of stress-related brain areas).

In fact, this kind of 'proactive' interdisciplinary engagement has been suggested by sociologist Thomas Malsch (2001) in the context of research on distributed artificial intelligence (DAI). Malsch (2001) had observed a practice in DAI research which he called the "migration of metaphors", by which the semantic labels of social science concepts – for example, coordination, cooperation, or coalition formation – were 'imported' by DAI researchers to describe certain processes and mechanisms of distributed computational systems. However, in the process of adaptation many of the conceptual and theoretical assumptions remained fragmentary at best (cf. von Scheve and Moldt, 2004). This situation

would have been rather unproblematic, were it not that (a) DAI researchers tended to claim to make major contributions to a better understanding and a (theoretical) advancement of these social science concepts and that (b) social scientists, becoming aware of the sometimes rather flamboyant formulations, interpreted the neglect of the social science literature as ignorance rather than unawareness. Similar conclusions could be reached for social neuroscience research and sociology.

In the context of DAI research, Malsch (2001) argues that it would be unproductive to either simply dismiss this kind of research as premature or irrelevant, or to plainly accept and integrate it into sociological thinking. Rather, he proscribes active engagement in mutual dialogue and the careful assessment of the possibilities for sociologists to actively take part in these kinds of interdisciplinary endeavours and to use DAI techniques as new methodological tools. He termed this rapprochement *socionics* (Malsch, 2001). This argument seems perfectly valid for the linkage between neuroscience and sociology as well.

Conclusion

In this chapter I have discussed the possibilities of a sociological engagement with the neurosciences. Beginning from an observation that sociology and the social sciences more generally are restricted in their dealings with the neurosciences, I have illustrated approaches from two major sociological paradigms which are currently dealing with neuroscientific research. On the one hand, there is work in the sociology of biomedical knowledge. This strand of research engages with the new brain sciences in a way that sociology has investigated other areas of medicine and scientific research before: specifically, by examining the conditions of the production of knowledge, by delineating the economic motivations and constraints under which neuroscience research takes place, and by interrogating the social, cultural and political consequences that the new brain sciences and their findings have for society at large. I have argued that this ‘traditional’ form of investigation largely elides the possibilities that emerge from neuroscientific research for the advancement of key sociological concepts and theories.

On the other hand, these possibilities are outlined in great detail and partly utilised by current endeavours in sociology that have been referred to as ‘neurosociological’. Neurosociologists see themselves as working within a sub-discipline located at the interface of sociology, social psychology and the new brain sciences, and strive to integrate neuroscientific findings into sociological theory. Although work in this emerging tradition is, in principle, promising and fruitful for a better understanding of many concepts used to

explain social processes and behaviour, the adoption of neuroscientific theories and evidence tends to happen in a rather unreflexive fashion. I have shown that when integrating findings from the neurosciences, it is crucial to be aware of the perils and problems that are (a) inherent in social neuroscience studies and which (b) result from the at times problematic utilisation of social science concepts in these studies. Both remain unaccounted for in current neurosociological works. The first domain mainly relates to methodological specificities of imaging techniques, experimental designs, subject sample composition, and the kinds of inferences that can be drawn from neuroscience data. The second domain represents problems stemming from an incomplete (or unsophisticated) use of social science concepts in social neuroscience studies which limit the direct adaptability of these results to sociological theory.

Finally, I have discussed possible ways of engaging with the neurosciences that might help to circumvent the problems outlined above. One option is an engagement with the neurosciences that is inspired by the neurosociological paradigm, but which, at the same time, takes seriously the critiques characteristic in the sociology *of* neuroscience. A second – and more venturous – option is the *active* engagement that lies in actually conducting sociological studies using neuroscience *methods*. Referring to experimental methods that are well established in some branches of the social sciences, I have discussed the possibility of using imaging (and other neuroscience) techniques as an alternative methodological approach to empirical social research. I have highlighted parallels of this option with the *socionics* approach integrating sociology and DAI (distributed artificial intelligence).

Clearly, a sound sociological engagement with the neurosciences is needed in all of the three areas discussed in this article. First, to develop a scientifically grounded understanding of the impact of neuroscientific research on culture and society, the sociology of biomedical knowledge is without a doubt essential. Second, cautiously and critically accounting for neuroscientific findings can inform social theorizing and aid in developing and refining key sociological concepts. Finally, the active engagement in cooperative endeavours with researchers in social neuroscience may yield methodological advantages and lead to new, mostly micro-level insights into the physiological underpinnings and consequences of social structures, processes, and mechanisms.

References

Abi-Rached, J.M. (2008), "The implications of the new brain sciences", *EMBO Reports*, 9(12), pp. 1158-1162.

Adolphs, R. (1999), "Social cognition and the human brain", *Trends in Cognitive Sciences*, 3(12), pp. 469-479.

Adolphs, R. (2003), "Cognitive neuroscience of human social behaviour", *Nature Reviews Neuroscience*, 4, pp. 165-178.

Alcock, J. (2001), *The Triumph of Sociobiology*, Oxford University Press, New York.

Arnett, J.J. (2008), "The neglected 95%, Why American psychology needs to become less American", *American Psychologist*, 63, pp. 602-614.

Bargh, J.A. (1997), The Automaticity of Everyday Life, in Wyer, R.S. (Ed.), *The Automaticity of Everyday Life*, Erlbaum, Mahwah, NJ, pp. 1-61.

Bargh, J.A., Ferguson, M.L. (2000), Beyond Behaviorism: On the Automaticity of Higher Mental Processes, *Psychological Bulletin*, 126(6), pp. 925-945.

Beaulieu, A. (2002), "Images are not the (only) truth: Brain mapping, visual knowledge, and iconoclasm", *Science, Technology, & Human Values*, 27(1), pp. 53-86.

Bennett, C.M., Miller, M.B. (2010), "How reliable are the results from functional magnetic resonance imaging?", *Annals of the New York Academy of Sciences*, 1191, pp. 133-155.

Benton, T. (1991), "Biology and social science, Why the return of the repressed should be given a (cautious) welcome", *Sociology*, 25(1), pp. 1-29.

Berger, P.L., Luckmann, T. (1966), *The Social Construction of Reality*, Anchor, Garden City, NY.

Bourdieu, P. (1977), *Outline of a Theory of Practice*, Cambridge University Press, New York.

Bourdieu, P. (1990), *The Logic of Practice*, Polity Press, Cambridge.

Brothers, L. (1997), *Friday's Footprint. How society shapes the human mind*, Oxford University Press, New York.

Burnham, T. & Johnson, D.D.P. (2005), "The biological and evolutionary logic of human cooperation", *Analyse & Kritik*, 27, pp. 113-135.

Burri, R.V. (2009), "Coping with uncertainty: Assessing nanotechnologies in a citizen panel in Switzerland", *Public Understanding of Science*, 18(5), pp. 498-511.

Bogen, J.E., DeZure, R., TenHouten, W.D. und J.F. Marsch (1972), "The Other Side of the Brain, IV, The A/P Ratio", *Bulletin of the Los Angeles Neurological Societies*, 37(2), pp. 49-61.

Bohnet, I. (2009), "Experiments", in Hedström, P., Bearman, P. (Eds.), *The Oxford Handbook of Analytical Sociology*, Oxford University Press, New York, pp. 639-665.

Bury, M.R. (1997), *Health and Illness in a Changing Society*, Routledge, London.

Cacioppo, J., Berntson, G.G. (1992), "Social psychological contributions to the Decade of the Brain", *American Psychologist*, 47, pp. 1019-1028.

Cacioppo, J.T., Berntson, G.G., Sheridan, J.F., & McClintock, M.K. (2000), "Multilevel integrative analyses of human behavior, social neuroscience and the complementing nature of social and biological approaches", *Psychological Bulletin*, 126(6), pp. 829-843.

Camerer, C. (2008), "Neuroeconomics: Opening the Gray Box", *Neuron*, 60(3), pp. 416-419.

Chiao, J.Y. (2009), "Cultural neuroscience, A once and future discipline", *Progress in Brain Research*, 178, pp. 287-304.

Chiao, J.Y., Mathur, V. A., Harada, T., & Lipke, T. (2009), "Neural basis of preference for human social hierarchy versus egalitarianism", *Annals of the New York Academy of Sciences*, 1167, pp. 174-81.

Chiao, J.Y., Cheon, B.K. (2010), "The weirdest brains in the world. Commentary on Henrich, Heine, & Norenzayan, The Weirdest People in the World?", *Behavioral and Brain Sciences*, 33, pp. 28-30.

Chiao, J.Y., Hariri, A.R., Harada, T., Mano, Y., Sadato, N., Parrish, T. B., Iidaka, T. (2010), "Theory and methods in cultural neuroscience", *Social Cognitive and Affective Neuroscience*, 5(2-3), pp. 356-361.

Churchland, P.S. (1989), *Neurophilosophy. Toward a Unified Science of the Mind-Brain*, MIT Press, Cambridge, MA.

Collins, H.M. (1983), "The sociology of scientific knowledge, Studies of contemporary science", *Annual Review of Sociology*, 9, pp. 265-283.

Cregan, K. (2006), *The sociology of the body. Mapping the abstraction of embodiment*. Sage, London.

Conrad, P. (2000), *Sociological Perspectives on the New Genetics*, Blackwell, Malden, MA.

Dingwall, R., Nerlich, B., Hillyard, S. (2003), "Biological determinism and symbolic interaction: Hereditary streams and cultural roads", *Symbolic Interaction*, 26, 631-644.

Dobbs, D. (2005), "Fact or phrenology?", *Scientific American Mind*, 16, pp. 24-31.

Dominguez Duque, J.F., Turner, R., Lewis, E.D., Egan, G. (2010), "Neuroanthropology: a humanistic science for the study of the culture-brain nexus", *Social Cognitive and Affective Neuroscience*, 5(2-3), pp. 138-147.

Dumit, J. (2004), *Picturing personhood, Brain scans and biomedical identity*, Princeton University Press, Princeton, NJ.

Dunbar, R.I. (2002), "The Social Brain Hypothesis", in Cacioppo, J.T., Berntson, G.G., Adolphs, R., Carter, C.S., Davidson, R.J., McClintock, M.K., McEwen, B.S., Meaney, M.J., Schacter, D.L., Sternberg, E.M., Suomi, S.S., & S.E. Taylor (Eds.), *Foundations in Social Neuroscience*, MIT Press, Cambridge, MA, pp. 69-88.

Durkheim, E. (1964), *The Rules of Sociological Method*, Free Press, New York.

Ehrenberg, A. (2009), *Weariness of the Self, Diagnosing the History of Depression in the Contemporary Age*, McGill-Queen's University Press, Montreal.

Fehr, E., Gintis, H. (2007), "Human motivation and social cooperation: experimental and analytical foundations", *Annual Review of Sociology*, 33(1), pp. 43-64.Franks, D.D. (2010), *Neurosociology. The Nexus Between Neuroscience and Social Psychology*, Springer, New York.

Freese, J., Li, J.-C., Wade, L.D. (2003), "The potential relevances of biology to social inquiry", *Annual Review of Sociology*, 29, pp. 233-256.

Freese, J. (2008), "Genetics and the social science explanation of individual outcomes", *American Journal of Sociology*, 114, pp. S1-35.

Gazzaniga, M.S. (1985), *The Social Brain*, Basic Books, New York.

Gerhards, J., Schäfer, M.S. (2009), "Two normative models of science in public. Human genome sequencing in German and US print media", *Public Understanding of Science*, 18(4), pp. 437-451.

Guo, G. (2008), "Introduction to the Special Issue on Society and Genetics", *Sociological Methods and Research*, 37, pp. 159-163.

Hackett, E.J., Amsterdamska, O., Lynch, M. and J. Wajcman (Eds.)(2007), *The Handbook of Science and Technology Studies*. 3rd ed., MIT Press, Cambridge, MA.

Han, S., Northoff, G. (2008), "Culture-sensitive neural substrates of human cognition, A transcultural neuroimaging approach", *Nature Review Neuroscience*, 9, pp. 646-654.

Harmon-Jones, E., Beer, J.S. (Eds.) (2009), *Methods in Social Neuroscience*, Guilford, New York,

Henrich, J., Heine, S., Norenzayan, A. (2010a), "The Weirdest People in the World?", *Behavioral and Brain Sciences*, 33, pp. 61-83.

Henrich, J., Heine, S., Norenzayan, A. (2010b), "Most people are not WEIRD", *Nature*, 466, 29. DOI, 10.1038/466029a

Iacoboni, M. (2009), "Imitation, Empathy, and Mirror Neurons", *Annual Review of Psychology*, 60, pp. 653-670.

Ignatow, G. (2007), "Theories of Embodied Knowledge, New Directions for Cultural and Cognitive Sociology?", *Journal for the Theory of Social Behaviour*, 37(2), pp. 115-135.

Knorr-Cetina, K. (1981), *The Manufacture of Knowledge. An Essay on the Constructivist and contextual Nature of Science*, Pergamon, Oxford.

Kriegeskorte, N., Simmons, W.K., Bellgowan, P.S., Baker, C.I. (2009), "Circular analysis in systems neuroscience: The dangers of double dipping", *Nature Neuroscience*, 12, pp. 535-540.

Kurath, M. (2009), "Nanotechnology Governance: Accountability and Democracy in New Modes of Regulation and Deliberation", *Science, Technology & Innovation Studies*, 5(2), pp. 87-110.

Lieberman, M. D. (2007), "Social cognitive neuroscience, A review of core processes", *Annual Review of Psychology*, 58, pp. 259-289.

Lippman, A. (1992), "Led (astray) by genetic maps, the cartography of the human genome and health care", *Social Science Medicine*, 35, pp. 1469-1476.

Littlefield, M.M. (2009), "Constructing the Organ of Deceit: The Rhetoric of fMRI and Brain Fingerprinting in Post-9/11 America", *Science, Technology & Human Values*, 34, pp. 365-392.

Littlefield, M.M. (2010), "Matter for Thought: The Psychon in Neurology, Psychology and American Culture, 1927-1943", in Salisbury, L., Shail, A. (Eds.), *Neurology and Modernity*, Palgrave, New York, pp. 267-286.

Lizardo, O. (2005), "The Cognitive Origins of Bourdieu's Habitus", *Journal for the Theory of Social Behaviour*, 34(4), pp. 375-401.

Logothetis, N.K. (2008), "What we can do and cannot do with fMRI", *Nature*, 453, 869-878.

Lynch, M. (1993), *Scientific Practice and Ordinary Action, Ethnomethodology and Social Studies of Science*, Cambridge University Press, Cambridge, MA.

Malsch, T. (2001), "Naming the Unnamable, Socionics or the Sociological Turn of/to Distributed Artificial Intelligence", *Autonomous Agents and Multi-Agent Systems*, 4(3), pp. 155-186.

Mateo, M.M., Cabanis, M., Loebell, N.C.E., Krach, S. (2011), "Concerns About Cultural Neurosciences: A Critical Analysis", *Neuroscience and Biobehavioral Reviews*, doi:10.1016/j.neubiorev.2011.05.006

McCabe, D.P., Castel, A.D. (2008), "Seeing is believing, The effect of brain images on judgments of scientific reasoning", *Cognition*, 107, pp. 343-352.

May, C. (2002), *The information society. A Sceptical view*, Cambridge University Press, New York.

Massey, D.S. (2002), "A brief history of human society, the origin and role of emotion in social life", *American Sociological Review*, 67, pp. 1-29.

Nielsen F. (1994), "Sociobiology and sociology", *Annual Review of Sociology*, 20, pp. 267-303.

Nelkin, D., Lindee, M.S. (2004), *The DNA Mystique, The Gene as a Cultural Icon*, University of Michigan Press, Ann Arbor, MI.

Nerlich, B., Hellsten, I. (2004), „Genomics: Shifts in metaphorical landscape", *New Genetics and Society*, 23(3), 255-268.

Newton, T. (2003), "Truly embodied sociology, marrying the social and the biological?", *The Sociological Review*, 51(1), pp. 20-42.

Pickel, A. (2005), "The Habitus Process, A Biopsychosocial Conception", *Journal for the Theory of Social Behaviour*, 35(4), pp. 437-461.

Pickersgill, M. (2009), "Between Soma and Society: Neuroscience and the Ontology of Psychopathy", *BioSocieties*, 4(1), pp. 45-60.

Pickersgill, M.D. (2010), "Psyche, soma, and science studies: New directions in the sociology of mental health and illness", *Journal of Mental Health*, 19(4), pp. 382-392.

Poldrack, R. (2006), "Can cognitive processes be inferred from neuroimaging data?", *Trends in Cognitive Sciences*, 10(2), pp. 59-63.

Poldrack, R. (2008), The role of fMRI in cognitive neuroscience, where do we stand?", *Current Opinions in Neurobiology*, 18, pp. 223-227.

Racine, E., Bar-Ilan, O., & Illes, J. (2005), "fMRI in the public eye", *Nature Reviews Neuroscience*, 6, pp. 159-164.

Rees, D., Rose, S. (Eds) (2004), *The New Brain Sciences, Perils and Prospects*, Cambridge University Press, Cambridge.

Rinaldi, A. (2009), "Homo economicus?", *EMBO reports*, 10, pp. 823-826.

Rizzolati, G., Craighero, L. (2004), "The mirror-neuron system", *Annual Review of Neuroscience*, 27, pp. 169-192.

Reichertz, J., Zaboura, N. (Eds.) (2006), *Akteur Gehirn - oder das vermeintliche Ende des handelnden Subjekts, Eine Kontroverse* [The brain as social actor – or the alleged end of the acting subject. A controversy], VS-Verlag, Wiesbaden.

Rose, N. (2003), “Neurochemical selves”, *Society*, 41(1), pp. 46-59.

Rose, N. (2010), “Normality and pathology in a biomedical age”, in Carter, B., Charles, N. (Eds.), *Nature, Society and Environmental Crisis*, Wiley-Blackwell, Malden, MA, pp. 66-83.

Rose, S. (2006), *The Future of the Brain, The Promise and Perils of Tomorrow's Neuroscience*, Oxford University Press, New York.

Schäfer, M.S. (2009), “From public understanding to public engagement, A comparison of mass media coverage on different science issues”, *Science Communication*, 30(4), pp. 475-505.

von Scheve, C. (2009), *Emotionen und soziale Strukturen. Die affektiven Grundlagen sozialer Ordnung* [Emotion and social structures, The affective foundations of social order], Campus, Frankfurt am Main.

von Scheve, C., von Luede, R. (2005), “Emotion and social structures, Towards an interdisciplinary approach”, *Journal for the Theory of Social Behaviour*, 35(3), pp. 303-328.

von Scheve, C., Moldt, D. (2004), “Emotion, Theoretical investigations and Implications for Artificial Social Aggregates”, in Lindeman, G., Moldt, D., Paolucci, P. (Eds.), *Regulated agent-based social systems*, Springer, Berlin, pp. 189-209.

Shapin, S. (1995), “Here and everywhere, Sociology of scientific knowledge”, *Annual Review of Sociology*, 21, pp. 289–321.

Sloan, P.R. (2000), “Completing the tree of Descartes”, in Sloan, P.R. (Ed.), *Controlling Our Destinies, Historical, Philosophical, Ethical, and Theological Perspectives on the Human Genome Project*, University of Notre Dame Press, Notre Dame, IN, 1-25.

Smith, T.S., Franks, D.D. (1999), “Emergence, Reduction, and Levels of Analysis in the Neurosociological Paradigm”, in Franks, D.D., Smith, T.S. (Eds.), *Mind, Brain, and Society, Toward a Neurosociology of Emotion*, JAI Press, Greenwich, CT, pp. 3-16.

TenHouten, W.D. (1999), “Explorations in Neurosociological Theory”, In Franks, D.D., Smith, T.S. (Eds.), *Mind, Brain, and Society, Toward a Neurosociology of Emotion*, JAI Press, Greenwich, CT, pp. 41-80.

TenHouten, W. (1997), “Neurosciology”, *Journal of Social and Evolutionary Systems*, 20(1), pp. 7-37.

Turkle, S. (1997), *Life on the screen*, Simon & Schuster, New York.

Turner, J.H. (2000), *On the Origins of Human Emotions*, Stanford University Press, Stanford, CA.

Vul, E., Harris, C., Winkielman, P., Pashler, H. (2009), "Puzzlingly high correlations in fMRI studies of emotion, personality, and social cognition", *Perspectives on Psychological Science*, 4(3), pp. 274-290.

Weisberg, D.S., Keil, F.C., Goodstein, J., Rawson, E., Gray, J. (2008), "The seductive allure of neuroscience explanations", *Journal of Cognitive Neuroscience*, 20, pp. 470-477.

Williams, S.J. (2009), "A 'neurosociology' of emotion? Progress, problems and prospects", in Hopkins, D., Kleres, J., Flam, H., Kuzmics, H. (Eds.), *Theorizing Emotions*, Campus, Frankfurt, pp. 245-268.

Wilson, E.O. (1975), *Sociobiology*, Belknap, Cambridge, MA.

Zaboura, N. (2009), *Das empathische Gehirn. Spiegelneurone als Grundlage menschlicher Kommunikation* [The empathic brain, Mirror neurons as a foundation of human communication], VS, Wiesbaden.

Zerubavel, E. (1997), *Social Mindscapes*, Harvard University Press, Cambridge, MA.