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Article

Neuroanthropology and the dialectical imperative

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Abstract

In this article, the ontology, epistemology and methodology of anthropology are questioned with the purpose of arguing for the possibility of a neuroanthropological approach capable of investigating the relationships between the neural, the experiential and the cultural. The author contends that the dichotomization of objects and subjects, objectivism and subjectivism, and explanation and understanding that characterizes anthropology is no longer viable and that a dialectical alternative is required that regards each member of these dyads as standing in a dependent relationship to one another. It is shown that this dialectical view ultimately calls for the investigation of the neural and mental dimensions of human activity as they are embedded in their cultural matrix. The discussion is substantiated by reference to debates around how to bridge the gap between the mental and the neural. The author draws on his experience in anthropology and imaging neuroscience to assess the process of knowledge generation in both fields with a view to showing that science and humanism are interdependent. Following from this, neuroanthropology, and anthropology more broadly, are characterized as having to oscillate between scientific humanism and humanistic scientism.

Keywords

dialectic, dichotomy, epistemology, explanation, neuroanthropology, objectivism
ontology, subjectivism, understanding

Introduction

Human activity has a neural substrate; human activity has a subjective, experiential quality; human activity has also a cultural dimension. Taken at face value, these statements are relatively uncontroversial. It should be unproblematic to acknowledge that, in order to more adequately comprehend the human condition, we could only benefit from investigating how these three domains interact. Neuroscientists have recently started to pay attention to the relationship between brain and culture,

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although the subjective dimension tends to be ignored. Efforts by anthropologists to address the interaction between brain, experience and culture have, on the other hand, been mainly ignored by their counterparts both in their own discipline and in neuroscience. The important contribution anthropology can make to this area, therefore, remains largely unrealized. In this paper, I will argue that the reason behind this state of affairs is the product of an unresolved contradiction at the heart of anthropological theory and practice that has its origins in Cartesian dualism. I will first draw on discussions around how to bridge the gap between the mental and the neural. I will also examine closely the process of knowledge generation in imaging neuroscience, based partly on my own experience doing research in this field,¹ and I will show that, in addition to its predominant scientific tactics, this area of research also depends on humanistic strategies that are discursively obscured but still very much an essential part of it. After advancing the arguments that: (1) the mental and the neural can, and have to, be conceived in terms of one another; (2) that the sciences and the humanities are interdependent; and (3) that it is by means of combining scientific and humanistic forms of enquiry that we can ultimately further our comprehension of the mental and the neural, I will argue that these two dimensions of human activity cannot adequately be accounted for without resort to the web in which that activity is embedded and from which it derives its meaning: culture. Anthropology, the study of cultural activity, is therefore called upon to make a decisive contribution by integrating the mental, the subjective and the cultural. In order to do this, I will contend that what is needed is an anthropology that takes seriously and incorporates the neural: a neural anthropology or, more briefly, neuroanthropology.

Dichotomy

There is an unresolved contradiction at the heart of anthropology. This contradiction divides the discipline right down the middle, not only between biological and sociocultural anthropologists (Whitehead, this issue) but, more fundamentally, between an anthropology that privileges a scientific orientation to its object of study, and an anthropology that subscribes to a humanistic approach to its subject(s) of study. The distinction between object and subject(s) above points to what a number of scholars (Levins and Lewontin 1985; Ricœur 1991; Bohman 1991; Latour 1993, 1999; Toren 1999; Reyna 2002; Searle 2004; Whitehead, this issue) have, in one way or another, recognized as a – perhaps *the* – core problem not only with anthropology but with Western formal enquiry about the world, socially and more broadly. This problem consists in the partition of the world into two distinct and ontologically independent domains: a domain of objects and a domain of subjects. This partition in the domain of being has entailed a separation in the domains of knowing, between objectivism and subjectivism; and in the domain of doing, between explanation and understanding, two different means of attaining knowledge about objects and subjects respectively.

As useful and successful as the divisions between objectivism and subjectivism and explanation and understanding have been in their respective domains, they have encountered serious limitations. In addressing this issue, I will follow Hazelrigg's (1986) account. On the one hand, subjectivists (also known as constructionists) have been charged with reducing the universe to consciousness and regarding phenomena as 'states of consciousness'. Constructionists are therefore accused of espousing a form of idealism. But if objectivists thought they could claim the grounds of materialism for themselves, constructionists have countered with the argument that objectivism is nothing but a form of idealist realism. We experience things from different perspectives at different times and yet we are predisposed to conceive of an object thus experienced as the same object rather than as different objects. On the basis of this, the objectivist concludes that objects exist independently from any point of view; that is, objects are thought to have an existence of their own. However, if objects exist independently of any perspective, it follows that they are seen from nowhere or from all possible viewpoints at the same time. And, because human perception is always directed from a point of view, objects perceived from nowhere or everywhere cannot be humanly perceived objects. Objects in themselves, with their primacy and autonomy, would therefore be invisible to humans and their existence could only be ideal. If the universe, as objectivists would have us think, 'is fully determined independently of consciousness, by what means can we ever consciously access its secrets?' In other words, if the universe 'is primary or logically prior', and if subjectivities, being not integral to the determination of the universe, are secondary, 'how then shall we know the world?' (Hazelrigg 1986: 7). How can we transcend this hermetic subjectivity to 'reach' the universe itself? On the other hand, if the contents of consciousness are only a function of the constitution of the objects of consciousness, if the meaning of statements can only be traced to the relationships between concepts, how can we ever claim that these contents of consciousness and meanings refer to anything at all? Of direct relevance to anthropology, what can be the basis of understanding across different conceptual systems and worldviews? Ultimately, what hope do individuals have of understanding each other?

Constructionists have been accused of inconsistency on these questions as they have been found trying to 'ground' subjectivity in an objective reality. Subjectivities are conceived as constitutive of their objects; simultaneously, these subjectivities are visualized as a product of existential conditions. However, these conditions are considered distinct from those subjectivities and are therefore envisaged as their 'base' (Hazelrigg 1986: 3). The 'objective grounding' of constructivism can be further appreciated in two procedures constructivists are forced to perform. In stating that an object can be perceived in this or that way from multiple perspectives, one is already assuming the self-identity of the object across those different perspectives. Second, the 'aboutness' of a statement, the condition of objects of being 'seen-as' (or perceived-as, thought-as, etc.) presupposes a distance between objects and the subjectivity doing the seeing. In response to this, Hazelrigg adds, 'the constructionist observer tries to stabilise the referent of his/her observational activity under the

heading 'a (putative) condition,' in order that he/she (and others) can have confidence in the agreement that what is defined 'as' an object 'is one and the same enduring thing for all who share in the agreement' (Hazelrigg 1986: 8).

The insoluble conundrum between objectivism and subjectivism can thus be summarized this way: objectivism locks subjectivity away from the universe of objects, thus denying the possibility of knowledge of that universe; in response to this, constructivism reintroduces subjectivity as constitutive of that universe with two contradictory effects. On the one hand, it leads, from a different starting point, to the same consequence as objectivism: it renders the universe of objects forever out of reach; on the other hand, it ends up covertly attempting to ground subjectivities in a universe that is objective. We are left stuck in a loop.

In anthropology, critiques of objectivism and constructivism have followed similar lines. Let us briefly look at how these critiques have played out in the domain of participant observation, the defining research strategy of anthropologists, whether objectivists or constructionists. In objectivist anthropology, the emphasis has been on the direct witnessing of events by a trained professional as a requirement for a scientific anthropology. This privileges methodical observation as a research technique. The participating ethnographer is conceived as an objective observer participating in the life of the host community. Participation is, from this viewpoint, a means to an end, not an end in itself. The goal of participation is, pragmatically, 'to make it possible for the anthropologist to carry out research at all' (Holy 1984: 23). By necessity, if ethnographers want to study the way of life of people, they have to place themselves in their midst and interact with them, and establish personal and research relationships with them; in other words, they have to participate in the community's activities. In the objectivist tradition, ethnographers participate in order to observe, but participation itself, and the ethnographer by extension, are not considered to be part of what is observed.

From the constructivist point of view, in contrast, the social realm is not an objective world that can be accessed in a straightforward manner by means of the simple, unmediated observation of events. Human activity is seen as pregnant with meaning and meaning is not observable, but implicational (cf. Hastrup 1992). In order to pick up the meaning of activity, ethnographers, like the people they study, are required to consider each single action in terms of their own background knowledge and the immediate situation. Ethnographers are, therefore, bound to immerse themselves in the thick of the webs of meaning people spin; that is, in their cultures. However, constructivists would stress that ethnographers arrive at these encounters with webs of meaning of their own. Ethnographic fieldwork is thus mediated by the cultural lenses of both the researcher and the people under study, who, far from being passive observers and observed respectively, are engaged in a very active dialogue motivated by their own agendas and interests and framed by changing, usually asymmetrical, relationships of power (Geertz 1973; Dwyer 1977; Clifford 1986, 1988; Hastrup 1990, 1992). From this perspective, ethnography is the outcome of an intersubjective encounter where meanings are contested and negotiated.

While the constructivist perspective has allowed anthropologists to move beyond the naïve realism of the objectivist approach, adding a much-needed reflexive edge to their epistemology, it has also become trapped by the excesses of its own strong scepticism. This scepticism issues from the perspectivism and situatedness characteristic of constructivist, postmodern ethnography and takes several forms: rejection of the possibility of evaluating the adequacy of competing claims about social phenomena; the assumption of an incommensurability between cultural backgrounds which are conceived as horizons of meaning closed upon themselves; and the dismissal of ethnographers' interpretations of the meanings actors themselves ascribe to their own actions, automatically granting the latter privileged authority (Bohman 1991). All of this undermines the dialogic goals postmodern ethnography set for itself: dialogue is, effectively, unrealizable as interpretive social science amounts to 'a sort of ventriloquism or hermeneutically naïve process of reproducing meanings from "the native's point of view"' (Bohman 1991: 452). We are back right where we began: with something that looks very much like objectivist ethnography's goal of producing mirror-like accounts of social life. And the consequences run counter to the original spirit of much postmodern ethnography. It is worth quoting Bohman at length in this regard:

...seeming to endorse universal norms of dialogue, postmodernists leave us in a paradoxical position. They hold out an ideal of dialogue and human rights and yet then reject any defence of them as requiring objectionable transparency or ethnocentrism; they criticise the non-dialogical ethnographic interpretations and then argue that the asymmetrical conditions that operate in actual cross-cultural encounters in the end make dialogue politically and epistemologically irrelevant. (Bohman 1991: 453)

While Bohman acknowledges the contribution of postmodern ethnography in identifying the difficulties and responsibilities associated with interpretation and, I would add, representation, he charges this ethnographic tradition with morally and epistemologically dodging those very difficulties and responsibilities.

Dialectic

As the above discussion shows, the dichotomous separation of reality into the realm of objects and the realm of subjects has run its full course and has ultimately led us into a kind of intellectual blind alley. Some scholars have rejected this partition of reality with promising implications for overcoming the problems faced by objectivism and subjectivism, explanation and understanding (e.g. Ricœur 1991; Bohman 1993; Toren 1999; Reyna 2002; Hastrup 2004; Searle 2004). In this section, I will explore an alternative strategy to this dichotomization that, while retaining a distinction between object and subject, objectivism and subjectivism, and explanation and understanding, poses a dialectical relationship between each term of these dyads. This dialectical solution will be derived from a debate on

how to bridge the gap between neuroscience and philosophy and, ultimately, between the neural and the mental.

Varela and colleagues (1991) acknowledge the existence of two ways of knowing (which they refer to as the 'outer' and the 'inner' ways). For them, these ways of knowing issue from the fundamental circularity of experience. According to this circularity, first characterized by Merleau-Ponty, while the world is a projection of the subject, the subject is also a projection of the world. In other words, we

... reflect on a world that is not made, but found, and yet it is also our structure that enables us to reflect upon this world. Thus in reflection we find ourselves in a circle: we are in a world that seems to be there before reflection begins, but that world is not separate from us. (Varela et al. 1991: 3)

Varela and colleagues argue that, because of the circularity of experience, these ways of knowing are not opposed to each other. Instead, 'we continuously circulate back and forth between them' (Varela et al. 1991: xv). Thus, if we decide to investigate, say, our physical structure, then we must turn our attention toward 'the kinds of distinctions we draw in experience. . . Having attended to experience in this way, we can then turn back to enrich and revise our' theory of the physical structure, and so on (Varela et al. 1991: 54). The above argument suggests that rather than an objective or subjective epistemology, what is required is an epistemology that could be called interactive. In such an epistemology, the equation of knowledge is determined neither by objects nor subjects alone but by their interaction, the encounter between them.

Research on perceptual illusions supports a view of knowledge as the combined product of the interaction between objects and subjects. In the case of bistable phenomena like the Necker cube, for example, awareness flips back and forth between seeing a cube as if from above, tilted to one side, or as if from below, tilted to the other side. Only one aspect of the cube is perceived at any given time. Similarly, in binocular rivalry, it has been shown, even among non-human primates, that conscious perception randomly oscillates between two contradictory pictures each of which is presented to one eye exclusively. While one picture is consciously perceived, the other one is suppressed. The illusion in this case is the vanishing act of either picture while suppressed by the other one. However, there is evidence that the brain is still registering both images. Activity has been recorded from neurons in a range of visual cortical areas of awake macaques trained to indicate which of the two pictures they are aware of at any given time (Logotetis 1998). These recordings have shown that neurons in early visual areas continue to respond to the perceptually suppressed picture. In contrast, a majority of neurons in area IT (a higher cortical area in the inferior temporal cortex) increase or decrease their activity depending on whether the picture is being perceived or suppressed. Another set of relevant perceptual illusions are those driven by contextual cues, like the Ponzo illusion where the

bottom of two bars looks shorter than the top bar (despite both being the same length) by virtue of the converging lines across which they are drawn. As the above examples illustrate, perceptual awareness clearly arises subjectively as a result of the brain making guesses and/or corrections about what it perceives based on its inner context (the history of the system and its current state, that is, its expectations) vis-à-vis its outer context (the relationships between the perceiver and the objects of perception). Perception and sensation are therefore not meant to be veridical but adaptive (Edelman 1987).

Ricœur (in Changeux and Ricœur 2000; see also Ricœur 1990, 1991) developed a similar argument to Varela and colleagues above but provided a fuller account of the actual procedures necessary to go back and forth from the ‘inner’ to the ‘outer’ ways of knowing. The French philosopher did this in the context of a discussion with a neuroscientist (Changeux) precisely on the relationship between the neural and the mental. According to Ricœur, the possibility of extending a bridge between what he refers to as the subjective and objective discourses about the body and, by extension, between understanding and explanation, rests in yet another possibility: the possibility of turning into objects, that is, of objectifying, the relations of lived experience. These relations are intentionality, meaning and communication.

Intentionality is the transcendental purpose of consciousness; that is, the condition or experience of being directed toward the world, of being outside oneself, of ‘being confronted by something that is not myself and therefore participating in an external world’ (Changeux and Ricœur 2000: 119–20). Meaning, in turn, crystallizes this ‘not myself’ into ‘something other’. Thus, the relation of meaning is the relation of otherness, which ‘obtains when something ‘applies to’ or ‘is applied to’’. Finally, the relation of communication corresponds to intersubjective understanding, which, crucially, involves that ‘we mutually understand that we understand the world together’ (Changeux and Ricœur 2000: 122). The relationships of lived experience represent steps in the process of objectification. This process has also been characterized by Ricœur as the detachment of meaning from its intended object or, more formally, the separation of the signified from the act of signifying.

The dialogue between the subjective and objective discourses about the body requires, however, a further objectification: the objectification of the relationships of lived experience themselves. By this means, subjective experience ‘becomes a doubly separate object that functions within a network of equally detached objects, within a system’ (Changeux and Ricœur 2000: 125). It is this double objectification that, according to Ricœur, allows us to talk about mental objects – in fact, of objects in general, which are the signifieds that have been detached from the act of signifying, floating signifieds. Mental objects conceived in this manner, as removed from the phenomenological field, can be, Ricœur argues, submitted to operations of explanation – in the special sense of a method of enquiry. Crucially, it is these mental objects, uprooted from experience, for which Ricœur considers it legitimate to find a neurological basis.

Changeux counters that mental objects only have meaning to the extent that they have meaning for a definite organism. Ricœur's answer to this is that, thanks precisely to the procedure of objectification, human beings can carry out the inverse operation. Thus, if objectification yields detached intentional objects it should also be possible to re-attach, to attribute those objects back to someone, a process referred to in analytic philosophy as ascription.

Based on the above, Ricœur puts forward an argument for the possibility of a dialogue between the neurological and the phenomenological. The author suggests that one can

... try to find a neurological basis for this [mental] object, constructed in three phases – intentionality, meaning, and communication... The bridge between these three moments of phenomenological experience and... neurological research resides in two subsequent operations: objectivation, which detaches the object of meaning from its experienced context, and attribution, which ascribes it to a subject capable of saying 'I,' 'you,' 'he,' 'she'. (Changeux and Ricœur 2000: 128)

This scheme corresponds, in Ricœur's own words, to the 'coordination between (experienced) understanding and (objective) explanation' (Changeux and Ricœur 2000: 126). The whole process can therefore be depicted in terms of a dialectic between objects and subjects, objectivism and subjectivism, and explanation and understanding. The original meaning of dialectic in Greek is to speak across. Thus, this is a dialogical model of the relationship between explanation and understanding in which both forms of intelligibility take turns to speak across in the following succession: understanding A → explanation → understanding B →. Understanding A consists in the determination of how particular transformations of experiences-to-mental-objects occur. In other words, this first moment of understanding is aimed at finding out how particular instances of these objects have been constituted and how they relate to the full field of experience from which they have been abstracted. Explanation then follows and is applied to objects as fully constituted in order to explore logical relationships between them and, in the present context, to find what have been called the neural correlates of experience and behaviour or what Ricœur refers to as the 'neurological basis for mental objects'. Lastly, understanding B is applied to the transformation of these objects and their entailments back into total experience. In other words, understanding B corresponds to tracking changes in understanding A after considering the implications of the results of the explanatory phase. The process, which can be called the understanding–explanation circle, is open-ended (as indicated by the arrow at the end), with new cycles of understanding and explanation to follow. We can also see that this circle, in which objects and subjects are ultimately and mutually constituted, is the expression of a dialectical imperative in the domains of being, knowing and doing. I would further add that understanding and explanation are two moments in the unfolding of a more encompassing form of intelligibility, which, for lack of a better word, we may call Comprehension.

Transforming subjects into neuroimages

I will now show the working of the understanding–explanation circle as it operates in the context of brain imaging research. I will start by referring to the process of knowledge generation in a brain-imaging laboratory as described in Roepstorff's (2002) knowledge ethnography. Roepstorff carefully mapped the flow of people and information throughout the laboratory, observing what happens to them as they move from one 'processing' station to the next in the scripted journey that will ultimately yield scientific 'facts'. When participants first come into the laboratory, they are met by a researcher who gives them an overview of the scanning technique to be used (Positron Emission Tomography, PET, or Magnetic Resonance Imaging, MRI).² Participants are also briefed on the experimental paradigm and the particulars of the task to be performed (in the case of functional imaging). Once in the scanner, structural or functional images are acquired from participants, who are required to stay as still as possible. In functional imaging, participants are shown specific stimuli sequences and are required to respond to them in accordance with the task.

The scanners can detect with relatively high spatial and temporal precision metabolic changes in the brain, such as concentrations of radioactively-charged isotopes injected in the blood stream (in the case of PET) or differences in the density between oxygenated and de-oxygenated haemoglobin (for functional MRI). These metabolic measures are thought to be related to neural electrical activity considered, in turn, to sustain cognitive/behavioural functions associated with the performance of the experimental task. The precise temporal organization of the paradigm, i.e. the proper spatial and temporal coordination of 'minds, brains, and machines' (Roepstorff 2002: 161), yields data organized in time series that reflect the approximate time and place of activity in the brain (see Figure 1 in next section). The final step is the writing of articles, in which scientists present the rationale, hypotheses, data gathering and analysis techniques, and results of the experiment. They also discuss the relationship between the experimental task and the activations elicited by it in terms of the relevant body of knowledge already available in the field.

Roepstorff has suggested that the whole process of generation of scientific facts is arranged around two transformations. The first one 'is a transformation of the experimental subject into a mathematical object', the data time series referred to above. The point of departure of the second transformation is this mathematical object which is in turn converted into 'an objectively valid 'fact' about the brain activation resulting from the experiment' (Roepstorff 2002: 161). The second transformation involves, in the first place, two different procedures aimed at reducing 'locality, particularity and materiality while simultaneously gaining compatibility, standardisation and relative universality' (Roepstorff 2004: 1108). This consists of: the mathematical correction of movements of the head people make while in the scanner, which involves realigning each and every scan with the first scan; and the normalization of the brains of all participants by structurally matching them to a standard brain so as to create a comparable framework of coordinates whereby

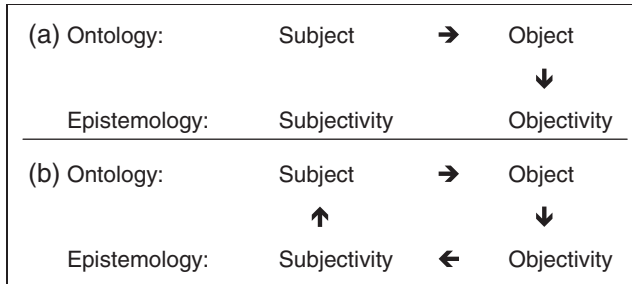


Figure 1. Functioning of a brain-imaging laboratory as one transformation spanning two binary oppositions: in the ontological domain, from subject to object; in the ontological domain across to the epistemological domain, from object to objectivity. Subjectivity is ignored. (Roepstorff 2002: 162) (b) Ontology-epistemology circle: Describes series of transformations between the binary oppositions in a). The circle depicts process whereby objects and subjects, objectivity and subjectivity are mutually constituted.

brain activations across subjects can be identified. These two treatments make it possible for the data to be treated as if they had been obtained from the same ideal brain. In addition to this, the central mathematical manipulation of the second transformation corresponds to statistically testing for differences in brain activation between the condition of interest and a control condition.

These two transformations, following Roepstorff, in effect correspond to a ‘transmutation’ of subjects into objectivities. Thus, the first transformation occurs at the ontological level: the transformation of subjects into data objects. The second transformation involves a shift from the ontological level to the epistemological level. Here, objects are transformed into objectivities, that is, knowledge about the world. These objectivities correspond to the maps of brain activation that tell us something about cause-effect relationships brought about by the experimental treatment. In this way, subjects have been transformed into neuroimages.

This knowledge ethnography of a brain-imaging laboratory illustrates the obvious explanatory nature of brain-imaging research manifest in its treatment of experimental subjects as ‘decomposable entities from which effects can be extracted through appropriate treatments’ (Knorr-Cetina in Roepstorff 2004: 1108); the exceedingly regularized role individuals agree to play as experimental subjects, which requires them to remain motionless in a very confined space while radioactive substances, strong magnetic fields and radio frequencies are administered to them; subjects having to follow a highly structured script that defines what stimuli they will be exposed to and when, and that tells them how to respond to it; the evening out of individual differences that goes hand in hand with the normalization of their brains; and, finally, the transformation of individuals into objects, and ultimately, objectivities. This process can be illustrated succinctly by the formula ‘subject → object → objectivity’ (Figure 1).

This formula makes more obvious an important attribute of the whole process: that the objective and the subjective are not closed to each other, that they are not

dichotomously separated. After all, the subject can be turned into objectivity. This opens up the interesting possibility that the opposite operation, turning objectivity back into a subject, is also possible.

The poetics of neuroscience

A central thesis of this paper is that understanding and explanation cannot be conceived of independently. And yet, the account of knowledge formation in brain imaging would appear to operate fully according to an explanatory paradigm bent on expunging any traces of subjectivity and wholly exclusive of understanding. The case of brain imaging can be easily considered a model of all other scientific undertakings, whether they have human beings as an object of study or not. In response to this, based on my direct experience of research in brain imaging, I would argue that, rather than being absent, subjects, subjectivity and understanding have been discursively obscured and marginalized in order to give the scientific process and its products an undeserving appearance of augmented validity. By this I do not wish to say that scientific enquiry is not valid. While I adhere to epistemological relativism, I do not share the strong scepticism of postmodernism. I favour pragmatism and fallibilism. I do not even oppose objectification and generalization (if the research problem at hand warrants it and if it is recognized that, while objectification is possible as an epistemic operation, it does not lead to the formation of knowledge with ontological objective reality). The point I want to make is rather that the whole process of knowledge generation, including scientific knowledge, is dependent on both explanation and understanding. It is the discursive practice of obscuring the contribution of understanding to the scientific process in order to artificially augment claims to validity and epistemic completeness which I object to. But if subjects, subjectivity and understanding do operate in neuroscience (and in all of science more broadly) where can they be found?

Before answering this question I will first refer to the case of general hermeneutics where the interdependence between explanation and understanding was clearly illustrated by Ricœur (1990). According to Ricœur, general hermeneutics can be regarded as comprising two variants: hermeneutics proper and semiotics. Hermeneutics is concerned at its base with human activity. At this first level, understanding consists in grasping what a particular action is, in being able to conceive of it as that something that causes something else to happen rather than just occur on its own. It is the recognition of a given behaviour as the doing or trying to do something by an agent; in other words, understanding in this instance is the intuition of agency. However, such an understanding leaves unanswered the question 'why'; in other words, understanding an action does not say anything about the purpose of the action. Providing the reasons for an action is what (teleological) explanation is all about. In Ricœur's words, 'an explanation in terms of reasons is thus a development of that understanding' (Ricœur 1990: 121).

At the second level, the level of everyday narration, where understanding consists in the generation of imaginative schemas aimed at accounting for segments of

activity larger than immediate action, explanation gets grafted onto understanding when accounting for motives and reasons, just as in the case of understanding at the level of action. In addition to this, owing to the ‘merely plausible character’ of the aforementioned schemas, an argumentative process ‘where truth claims, denials, evidence, supporting testimony, and rebuttals’ is initiated (Ricoeur 1990: 123). It is this process which opens the door for different forms of explanation such as nomological explanation, causal explanation, reductive explanation and structural explanation.

However, these forms of explanation do not flourish and come to stand on their own as something distinct from understanding until the third threshold leading away from action is crossed. Understanding at this level, which is the level of literary narrative, has to do with the text as a closed field independent from the mind of the author; more precisely, it deals with the configurative operations within a text, operations which produce emplotment. In other words, understanding in this context is the grasping of the plot as an emergent dynamic whole, the integrity and identity of which lies beyond the simple additive effects of the linear chronology of the narrative. It is at this point that the narrative itself, twice removed from all extra-linguistic reality, can become the object of analysis; as such, it comes to be ‘taken as an ordered system of symbols’ (Ricoeur 1990: 125). Analysis (rather than interpretation), in this context, consists in identifying ‘the composition procedures by which the signs get arranged into sentences, which are primarily statements about actions, and by which these action statements get ordered into well-structured series’ (Ricoeur 1990: 125).

We have now fully crossed the final threshold away from action, which, together with the other two thresholds, can alternatively be seen as actually paving the way toward the emergence of explanation as a form of intelligibility truly distinct from understanding. We are now in the realm of textual semiotics, of literary criticism, where the task is no longer to reactivate the act that structures the text, as is the case for hermeneutics, but to ‘describe the structures that issue from this act in terms of their own objectivity’ (Ricoeur 1990: 126). It is here that explanation can really assume any of its guises, such as nomological, generalizing, causal, etc.

From the above account, it is clear that explanation, as a distinct form of intelligibility, is not independent from understanding. The structures it deals with are clearly drawn from the background in which they are embedded and it is by virtue of this background and those structures’ history within it that they make sense at all. It is in fact in function of this background that these structures have to be understood, before they can be detached from it. Ricoeur was fully aware of this and was careful to indicate that, in the context of textual semiotics, explanation, as an autonomous, distinct and fully constituted form of intelligibility, ‘is guided behind the scene by our narrative comprehension’ (Ricoeur 1990: 129).

The same can be said to apply to the imaging of brain function and any other domains of enquiry (including anthropology; see below). In the first place,

subjectivity may be absent from the ‘subject → object → objectivity’ formula of experimental knowledge production but, according to Roepstorff, subjectivity is not absent from the wider epistemic culture. However, subjectivity is assigned a negative value and there are very few ways ‘to take seriously the actual experiences of the subjects during the experiment’ (Roepstorff 2002: 163). If those experiences were taken seriously and were incorporated into the ‘subject → object → objectivity’ scheme, I would suggest it would be possible to close the circle between the ontological and epistemological planes by means of transforming objectivity into subjectivity and then ascribing this subjectivity to a subject (see Figure 1B). The scheme modified this way, ‘subject → object → objectivity → subjectivity → subject →’, opens the possibility to show how those objects and objectivities emerge from and ultimately fuse back with the background of experience, in what can be referred to as an ontology-epistemology circle, in much the same way as described by Ricœur’s process of objectification and ascription.

I would furthermore suggest that brain-imaging experiments (and any other experiments) are embedded in this circle. However, at the level of epistemic culture the circle is not completed in a formal, institutionalized manner. The circle is informally closed by participants in the experiment (and the general public, not to mention policy-makers) who (may) read the results of the experiment and attempt to incorporate them into the interpretation of their own experiences and (may) use them to guide their own behaviour and decisions. The same can be said to apply to experimenters who, in addition, will use the insights derived from this interpretive process to formulate new questions that can be addressed experimentally.

Closely related to this last point is an issue linked to the deductive-inductive model of hypothesis testing, the inferential engine of science. Deduction is a procedure by means of which logically valid conclusions are derived from a rule and/or a case; in induction, it is the rule or generalization that is derived from specific instances. When testing hypotheses, predictions are deductively derived from hypotheses. The observation of separate instances of a prediction lends inductive support to the associated hypothesis. What is seldom considered in this model, however, is where hypotheses come from in the first place. By examining hypothesis generation I will show that scientific experimentation in neuroscience, and in fact in all of science, is completely dependent on subjective experience and understanding.

Hypothesis generation is an activity traditionally conceived to be ‘paradoxical, either illusory or obscure, implicit, and not analyzable’, not to mention irrational (Magnani 2001). However, there is a third modality of inference, introduced first by Peirce (1994), which accounts for the generation of hypotheses in a non-mysterious manner. Peirce called it abduction. In contrast to deduction and induction, abduction is an inferential procedure that uses background knowledge to yield conclusions at the same or higher level of generality from some datum of experience. In abductive inference, the relation between background knowledge and datum, on the one hand, and conclusion, on the other, is not of logical implication (as in deduction) but of contingent implication and plausibility vis-à-vis the context.

To illustrate how abduction works, consider Peirce's (2: 623) famous beanbag syllogism:

Major premise All the beans from this bag are white

Minor premise These beans are white

∴ Conclusion These beans are from this bag

In this example, the conclusion is not guaranteed by the premises. The beans can equally belong to 'this bag' or any number of other bags (or other types of packages or, in fact, none). However, the conclusion is plausible depending on our background knowledge and assumptions (for example, if the beans are next to the bag, or if there are no other bags of white beans close by). Furthermore, given contextual information, the conclusion can be considered to be justified and reasonable. Thus, while abduction is logically fallacious, it is not unreasonable or irrational.³

If the only logically valid arguments that can be made are those that proceed from the general to the particular, that is, by means of deduction, it follows that all generalizations (including scientific hypotheses) are logically invalid. In consequence, all generalizations have to be derived by means of abduction. For this reason, in Peirce's account, the total scientific process goes beyond the deductive-inductive cycle to include abductive inference, the creative engine of the process; the hypothesis-testing step is thus integrated into the prerequisite hypothesis-generating step.

It should be clear that abduction corresponds to understanding in terms of inferential modalities. In this way, just as abduction is guided and constrained by background knowledge, that is, contextual information, so too, in the context of general hermeneutics, for example, understanding the meaning of activity or texts can only be achieved vis-à-vis their context; just as abduction yields inferences at the same or higher levels of generality, so too understanding yields objects and meanings progressively detached from the relations of lived experience; and, just as deduction explicates and induction evaluates the inferential products of abduction, so too explanation gets grafted on to understanding at all levels of the hermeneutic process. Following from this, experimentation in neuroscience, as in all of science, has to be conceived of in a wider context of intelligibility wherein hypothesis-generation and, therefore, understanding (or abduction) play a necessary role.

Earlier, I argued that understanding not only precedes explanation but also follows it. I would suggest that in scientific practice understanding is also called forth after obtaining the results from the testing of hypotheses to consider their meaning, implications and import. This step has actually been institutionalized (although not as such) in the form of the discussion section in scientific papers. I regularly hear brain-imaging researchers refer to the discussion of results in terms of a 'story' that is put together in order to make sense of the results. It is this story that goes into the discussion section of scientific papers and which, more palpably,

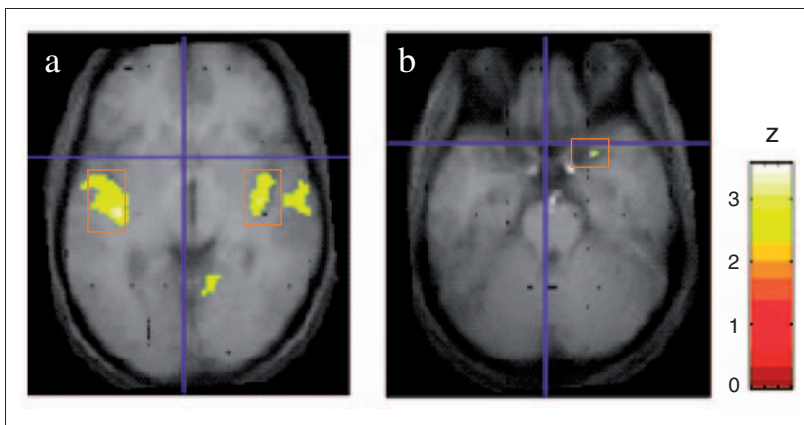


Figure 2. Brain activation associated with a theory of mind task for the comparison between US American and Japanese groups. Shown are maps of statistically significant activity ($p < .005$, uncorrected) superimposed on anatomical images in standard neural space viewed in cross-section in the transverse plane. Right and left hemispheres are visible; anterior portion of the brain is on the top of the image. (a) Increased activity in US American group as compared to Japanese group. Bilateral activity in the insula is highlighted in the orange squares; (b) increased activity in Japanese participants as compared to US American participants. Highlighted in the orange square is activity in right inferior frontal gyrus. Adapted from Kobayashi *et al.* (2006).

evidences the interpretive, hermeneutic nature of the discipline. An example from brain-imaging research will serve to illustrate this point.

In a fMRI study investigating differences in style of mental state attribution (or theory of mind) between US Americans and Japanese subjects, judgements of the mental states of others produced greater activation in the right insula, the bilateral temporoparietal junction (TPJ) and the right medial prefrontal cortex in US Americans compared to Japanese (see Figure 2). The latter showed greater brain activity in right ventro-frontal areas (Kobayashi *et al.* 2006). These results have been interpreted as evidencing two different styles of mental state attribution: first, a style, characteristic of US Americans, that requires the integration of sensory and emotional information as well as past experiences; and, second, a style, predominant in Japanese participants, that involves ‘feeling’ others’ emotions.

Interpretations such as this one are arrived at by inspecting not only the corpus of available behavioural studies on the topic at hand but also all those instances in which increased activity has been reported for the brain structures identified in a given study; that is, the background knowledge used to make sense of results. In the present example, interpretations of mental state attribution style in US Americans are based on previous findings implicating the insular cortex in processing emotional stimuli and the TPJ in integration of sensory and emotional information as well as past experiences. The Japanese attribution style is, on the other hand, inferred from the right ventro-frontal areas’ role in emotional processing and mentalizing tasks.

The abductive nature of the discussion of results in scientific papers is further evidenced in alternative interpretations of those results. In the present study, for example, the authors suggest that the ventro-frontal areas activated in Japanese participants can be taken to reflect Japanese culture's demands for response inhibition, as increased activity of these brain regions has been reported for working-memory inhibitory control.⁴ Finally, since this study involved adults only, the authors suggest new research involving children is necessary to determine how and when culture starts to affect mental state attribution styles.⁵

The present example clearly shows the interpretive component of neuroscience research. Not only neuroscientists make sense of results by putting them into the contexts of previous results and (abductively) finding likely explanations for the roles of the areas they identify as being more active for one condition in comparison to another one, but these interpretations may serve as the basis for new insights and hypotheses to be investigated and tested in future studies.⁶

There is one last instance I would like to briefly refer to in which research in neuroscience is transformed all the way back into subjects in a non-trivial manner. This is the case for clinical neurology and neuropsychology. In any clinical situation, a patient's symptoms are interpreted on the basis of three different sets of contextual information: the situation at hand, the clinician's knowledge regarding the symptoms and the patient's clinical history. Using this information clinicians are able to formulate a diagnosis, which has been repeatedly characterized as an abductive inferential procedure (for example, see Magnani 2001).⁷ Diagnosis is the applied end point of a process of enquiry that started long before and that led to using the lessons learned this way as tools to comprehend (and later treat) a particular subject, a patient. In this way, neuroimages (and other products of enquiry in neuroscience) have been transformed back into subjects.

In anthropology and other related disciplines, understanding is frequently invoked under the guise of a family of other terms that include poiesis, phronesis and poetic wisdom.⁸ Accordingly, some work in these fields has been cast in terms of poetics: the poetics of ethnography, cultural and social poetics, the poetics of imagining, the poetics of manhood or the poetics of modernity. In light of the discussion above, we should feel justified to say that neuroscience has a poetic dimension.

Neuroanthropology

In this paper, I have endeavoured to show that, no matter the domain of enquiry, objects and subjects, objectivity and subjectivity, and explanation and understanding, are not only always present but interdependent. I have attempted to show that the very possibility of enquiry hinges on this interdependence. I have developed the above argument by examining closely the case of the dialogue between the neurological and the phenomenological. This dialogue, which we may call neurophenomenological, is, however, not enough. It does not incorporate the definitional dimension of the human condition. Changeux (in Changeux and Ricœur 2000)

alludes to this additional dimension when he refers to what he calls a neuronal theory of context: a theory that deals with ‘the capacity of the human brain to communicate intentions, contexts, frameworks of thought’ (2000: 133).

At the base of Changeux’s neural theory of context is an inferential model of communication where the notion of relevance plays a major role (Sperber and Wilson 1986). In this model, in addition to the decodification of signals, the primary task individuals undertake is the determination (the inference) of the intentions of their counterparts. As each person forms a mental model of the intentions and emotions of the other, thus forming a shared framework of thought, they make use of information that is relevant to that framework. The model also operates beyond the realm of immediate interaction. For example, in Zola’s famous newspaper headline, ‘J’accuse’, the full meaning of the message can be appreciated only in the context of the Dreyfus affair. Thus, Changeux observes, Zola’s intended meaning will be grasped by those who share the relevant background knowledge. Anthropologists will immediately recognize that shared frameworks of thought are what they call culture. Changeux is therefore effectively calling for a neural theory of culture. Culture, anthropologists will agree, is the definitional dimension of the human condition. This is the reason why neurophenomenology is not enough: we require a cultural neurophenomenology.

A neural theory of culture is, however, not enough either. The dialectics immanent in the ontological and epistemological circles discussed in this paper also call for a cultural theory of the brain. What is required, therefore, is a theory of the experiential and neurobiological aspects of cultural activity. More than a theory, we need a whole approach suited to study these domains of the human condition. We need ethnographic methods in order to understand the meaning of human activity and we need neuroscience methods to study the neural underpinnings of human activity. Furthermore, we need these methods to explicitly enter into a dialectical relationship, a dialogue. Only this dialogue can lead to a neural theory of culture and a cultural theory of the brain. Such a dialogue can be called neuroanthropology, which can, by virtue of this very dialogue, be conceived both as a humanistic science and a scientific humanity.⁹

A central implication of the foregoing argument is that culture, as conceived in anthropology and other related disciplines, needs to be reconsidered in the light of neuroscience. It should be possible to approach culture from the perspective of the objective discourse of neurobiology, not only in terms of the brain mechanisms that allow human beings to share their experiences and how they evolved, but, crucially, in terms of a neurobiological description of those cultural experiences (and, more specifically, of the relationships of lived experience: intentionality, meaning and communication, all of which are cultural). Culture is therefore, from the perspective of the objective discourse about the body, a neurobiological phenomenon, not in the sense that it is genetically determined (on the contrary, culture is the way by means of which organisms transcend genetic constraints; cf. Whitehead, this issue) but in the sense that it runs on brains. In consonance with the argument advanced in this paper, Searle (1995) has written that the biology/culture dichotomy is an

elaboration of the more traditional Cartesian dualism. Just as subjective experience is a higher-level feature of the nervous system, we can similarly conceive of culture as a feature of biology at an even higher level. Thus, '[there] is no opposition between culture and biology;...culture is the form that biology takes' (Searle 1995: 227). Similarly, Toren proposes that 'we take seriously our understanding that body and mind, the biological and the cultural, the material and the ideal, are aspects of one another' (1999: 4). For Toren, human beings are 'biologically cultural and culturally biological' (Toren 1999: 5; see also, Latour 1993; in biology see Levins and Lewontin 1985, Ehrlich 2000, Richerson and Boyd 2005).¹⁰

Complementarily, the brain, as understood by the neurosciences, needs to be reimagined vis-à-vis anthropology as a culture-dependent, culture-ready organ (Whitehouse, this issue) and as having evolved to acquire culture. This shift has started to occur with the emergence of cultural neuroscience (e.g. Chiao 2009). From the perspective of this new field of study, the brain is no longer seen to be fully hard-wired but an incredibly plastic organ. Furthermore, there is mounting evidence that brain plasticity reflects cultural influences. Remarkably, the brain has been shown to change not only functionally but also structurally in response to these influences. And, as exemplified by the neural differences thought to be associated with mental state attribution styles in US Americans and Japanese, the brain seems also capable of handling the same problem deploying different strategies.¹¹

A question that could be raised at this point is: why is there a need for neuroanthropology when cultural neuroscience is already addressing issues of concern for neuroanthropology? My colleagues and I have dealt with this question in some detail (Domínguez et al. 2009a, 2009b). Here I will highlight the fact that cultural neuroscience operates exclusively in terms of explanation and shares the shortcomings of purely objectivistic disciplines. Neuroanthropology is necessary because, by integrating understanding and explanation (as well as research methods from anthropology and neuroscience; chiefly, but not only, participant observation and brain imaging), it will be in a better position to move back and forth between the neural, the phenomenal and the cultural domains.¹²

Final remarks: Dialectical anthropology

The possibility of neuroanthropology as depicted in this paper is predicated upon or entailed by the possibility of an anthropology that moves beyond the dichotomies of ontology, epistemology and method that have kept its humanistic and scientific halves apart. I am referring to an anthropology that takes the dialectical imperative seriously. I would argue that anthropology needs to assimilate the lessons of this imperative and reconfigure itself so as to, in general, recognize the interdependence between understanding and explanation and, more specifically, to differentially adjust the predominance of one or the other forms of intelligibility depending on the problem at hand. An anthropology conceived in such a way can be called dialectical anthropology.

Dialectical anthropology does not entail neglecting or denying the very real tensions and contradictions that exist between understanding and explanation. A case can be made that the capacity of the dialectical imperative to further our comprehension of the human condition and the world resides partly in the antagonism between these two forms of intelligibility. In addition, a dialectical anthropology is not to be conceived of in a totalizing or imperialist manner. It does not require nor demand all forms, sub-fields or even practitioners of anthropology to give equal weight to explanation and understanding in all instances of enquiry. All it asks is for practitioners of both persuasions to recognize the interdependence that ultimately exists between these forms of intelligibility and that it is this interdependence that is the basis of anthropological comprehension. Following from this, neuroanthropology is not meant to supersede and subsume anthropology or neuroscience. Instead, the amalgamation of these fields should be equivalent to an 'imbalancing act', to use Geertz's expression, whereby neuroanthropology is not only to provide new perspectives on human phenomena but also to unsettle the received wisdoms in both parent disciplines.

The circle of comprehension that issues from the dialectical imperative has been characterized in this paper as consisting of a never-ending, to-and-fro movement of intelligibility whereby objects and subjects are continuously constituted and pulled apart. For this reason, I would say that Lévi-Strauss's reflection that 'the ultimate goal of the human sciences' is 'not to constitute, but to dissolve man' (1966: 247) is half true. Following the dictates of the dialectical imperative, I would rather say that the ultimate goal of anthropology is indeed to constitute human beings in addition to dissolving them; not only this but, furthermore, to yet again reconstitute them only to dissolve them again and so on and so forth in a never-ending iteration that, despite the fact that it cannot exhaust our comprehension of ourselves and our place in the universe and cannot provide definitive, unambiguous answers on these matters, it can certainly enhance that comprehension.

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Several key ideas advanced in this paper were first essayed in my PhD thesis (Domínguez 2007). A more recent precursor to this paper was presented at the Workshop 'Cognitive Specializations of Nomadic Pastoralists', hosted by the Max Planck Institute for Social Anthropology, Halle, Germany in October 2009. I want to thank Kirill Istomin for his invitation and co-speakers and audience for their useful comments. I also want to thank Josephine Wright for useful discussions regarding the paper, for her help with issues of style and her assistance with proofreading the finished manuscript.

Notes

1. I am an anthropologist by training. However, since realizing the need for studying the relationship between the brain, experience and culture, I have also become involved in research in imaging neuroscience. My assessment of the process of knowledge generation in this field comes from my experience of being embedded in brain-imaging laboratories rather than from formal ethnographic fieldwork.

2. While the present discussion, following Roepstorff's ethnography, focuses on PET and MRI, the main argument applies more broadly to the whole field of neuroscience, with its vast array of research techniques (including, among others, additional imaging techniques such as magnetoencephalography and single positron emission computed tomography as well as electrophysiological techniques, drug manipulations, lesion studies, histological techniques, etc.) and subdisciplines (for example, developmental neuroscience, cognitive neuroscience, neuropsychology, clinical neuroscience, social neuroscience, molecular neuroscience).
3. Abduction can be considered the conceptual level equivalent of perception-as-guessing referred to earlier in the context of the discussion about perceptual illusions.
4. Single brain structures are commonly associated with many different functions. This places a heavy interpretive demand on researchers.
5. Kobayashi and colleagues have since investigated the development of mental state attribution styles in US Americans and Japanese children as revealed by distinct patterns of brain activity (2007).
6. Further confirmation of the identity between abduction and understanding is that abductive inference has been regarded as a model for the hermeneutic process (Ginzburg 1983; Eco 1994).
7. It is worth pointing out that Geertz (1973) likened interpretation of symbols in ethnography to diagnosis of symptoms in clinical practice.
8. *Poiesis* (ancient Greek): creative production; *phronesis* (ancient Greek): practical wisdom; poetic wisdom: as defined by Giambattista Vico, an experience-grounded wisdom.
9. My colleagues and I (Domínguez et al. 2009a, 2009b) have been developing a research methodology for neuroanthropology and exploring its applications. The papers by Robert Turner and Charles Whitehead in this issue also represent possible applications of a dialogue between anthropology and neuroscience. Other recent examples of this dialogue include R Turner (2001), Reyna (2002), Rilling (2008), Seligman and Kirmayer (2008), Brown and Seligman (2009) and Campbell and Garcia (2009). Earlier attempts at exploring culture-brain relationships or establishing a neuroanthropological discipline can be found in TenHouten (1976, 1992), d'Aquili et al. (1979), Laughlin et al. (1990), and V Turner (1983, 1985).
10. According to the conception of culture issuing from the dialectical imperative (Domínguez et al. 2009b), culture is at the same time a general/abstract entity and a particular/concrete one; it has a modal, inter-subjective, public, social and distributed dimension, but also a unique, individual, personal, private and psychological one; it is simultaneously a 'thing' and a 'process'; finally, culture is both real and constructed, or to put it in Latour's (1999) terms, culture is a *factish* (a fact and a fetish at the same time).
11. An important issue I do not have the space to properly address in this paper is agency. Individual agency may appear to have been squeezed out by the neural dimension, on one side, and the cultural dimension, on the other. However, the discussion has explicitly acknowledged the existence of three, rather than two, aspects of human activity: the neural, the subjective and the intersubjective or cultural. The subjective level, and therefore agency, should not be seen as squashed between two determinisms: neurobiological and cultural. Instead of explaining human activity in terms of its neural and cultural determinants, a neuroanthropological account of agency would strive to explore how

neural substrates and cultural influences not only constrain but, more fundamentally, serve as a vehicle for agents' expression of their will.

12. I am by no means discounting research in cultural neuroscience. According to the characterization my colleagues and I have made of neuroanthropology (Domínguez et al. 2009b), cultural neuroscience is considered an important component of the field. In neuroanthropology, research and analysis techniques from cultural (and more broadly, social) neuroscience are integrated into and embedded in ethnographic research.

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