What is interpretation? A cultural neurohermeneutic account

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Abstract: This essay answers the question: what is interpretation? It does so by proposing that interpretation involves certain brain operations. These utilize perceptual and procedural culture stored in neural networks. The parts of the brain performing interpretation are said to constitute a cultural neurohermenetic system, hypothesized to function according to an interpretive hierarchy. It is argued that such an approach has two benefits. The first of these is to provide a non-socio-biological, non-reductionist way of analyzing interactions between culture and biology. The second benefit is to provide conceptual tools for explaining how the micro-realm within individuals (I-space) makes connections in the macro-realm (E-space) of events in social forms. Conceptualization of such connections forms a basis for a variety of social analysis termed complex string being theory.

Keywords: interpretation, culture, brain, interpretive hierarchy, string being theory

This text concerns a recent swerve in social and cultural studies. Since the 1970s, many practitioners of social and cultural thought have taken an 'interpretive turn' to hermeneutics (Geertz 1983). The position argued in this article has two parts. First, my argument seeks to answer a question that lies behind hermeneutic practice: what is interpretation? The response given is that interpretation is the brain, a structure of structures, operating reflexively to analyze individuals' lived being in the past to produce their future being. So conceptualized the function of interpretation is to connect past with future human being, i.e., to string being together. The complex of structures in the brain doing this interpretation is theorized to be a cultural neurohermeneutic system. Implicit here is a novel ontological conception of the human condition as a place of the construction of string being. Second, the argument works to convince readers that neurohermenetics is a useful tool for an anthropology seeking collaboration between biological, social, and cultural analyses, thereby allowing more complex accounts of the human condition. My argument begins by answering the queries: what is a string being ontology and what biology is required to study it?

What Biology? What Ontology?

[B]iological and cultural life is a whole. (Boas 1938: 5)

Franz Boas created a holistic, four-field anthropology because he believed that in some manner human biology and culture were a 'whole'. Since the 1970s, Boasian anthropology has tended to fracture into its sub-disciplinary fields. There are a number of reasons for this. One is the rise, starting in the late 1960s, of socio-biology and evolutionary psychology. Both biologies tend to be different variants of genetic determinism. Both also tend to be reductionist (Rose and Rose 2001). Reductionism "is any doctrine that claims to reduce the apparently more sophisticated and complex to the less" (Flew 1976: 279). Socio-biology and evolutionary psychology are reductionist because social and cultural complexity are explained by genetic determinism, with evolutionary psychology exhibiting a hyper-Darwinist, or hyper-selectionist, form of this determinism. As Lewontin, Rose, and Kamin put it, individuals, societies, and cultures tend to be "governed by a chain of determinants that runs from the gene to the individual to the some of the behaviors of all individuals" (1984: 6). Lost is any sense of how the biological and the cultural might be a complex 'whole', and with this loss goes Boasian anthropology. Racism and defense of social inequality have been associated with at least some variants of this biological reductionism. Socio-biology and evolutionary psychology have been critiqued elsewhere.[1] These criticisms are weighty. However, my concern in this article is not that their explanations are faulty, but that what they chose not to explain includes realities that if investigated can account for how cultural and biological life are to some extent a 'whole'.

Socio-biology and evolutionary psychology ignore a key adaptation made by *Homo sapiens.* The creatures that went from prehominids on to *Homo sapiens* did not fancy claws, fangs, wings, poisons, electrical zappers, or other dew-dads to be stronger and more shocking. Rather, they got smarter by evolving bigger brains. This well-documented evolutionary sequence is called by Daniel Dennett the 'Great Encephalization' (1991: 190). The parts of the brain added were in association areas, especially in the frontal lobe, largely the prefrontal cortex, and their reciprocal neuronal connections with the limbic system. Enlargement of the left dorsolateral cortex, as well as associative areas in the occipital, temporal, and parietal regions allowed hominids to improve their probabilistic and deductive calculating capabilities, especially concerning perceptual and procedural implications of sensations. Addition of reciprocal neural networks between the enlarged prefrontal cortex and the limbic system facilitated coordination by the prefrontal cortex of emotion (produced in the limbic system) and various categorizations and their procedural implications (produced in the association areas). This made it possible to feel good about action your brain categorized as desirable, and bad about action categorized as undesirable. So a new type of brain had evolved which Dennett characterized as an 'anticipation' machine, whose "fundamental purpose is to produce the future" (ibid.: 177).

I would go further and suggest that a brain which makes the future is also a reflexivity contraption. 'Reflexivity', according to Anthony Giddens's influential definition, is "the monitored character of the ongoing flow of social life" (1984: 3). The brain is a reflexivity contraption because its structures perform the monitoring of the 'ongoing flow of social life'. A particular social ontology is implied by the preceding. Ontology "aims at discovering a framework for understanding the kinds of things that constitute the world's structure" (Fetzer and Almeder 1993: 101). Social ontology in the framework being suggested is an 'ongoing flow' that undergoes 'monitoring'. The concepts of Exterior-space (E-space) and Interior-space (I-space) are introduced to assist with navigation in the 'ongoing flow'. 'E-space' denotes organizations of practices that are external to persons but which, in some way, impinge upon them. 'I-space' denotes the organization of structures in the brain that monitor, by reflecting on, events in E-space. The 'ongoing flow' is history. History in this optic is one damn E-space strung to another, with events in I-space doing the stringing. This is a social ontology where antecedent being (E-space) is strung to subsequent being (E-space) by intervening I-space, so that such being is literally string being.

It is essential in such ontology to learn how the brain in I-space strings antecedent to subsequent E-space. The brain in I-space, because it consists of interconnected neurons, may be considered a 'neurological' complex of structures. Further, when the brain monitors, or reflects upon, events in E-space, it comes to understand them, and understanding being is interpreting it. The reflexive brain is an interpretive neurological organ. This means that the brain's interpreting of events in E-space is literally a 'neurohermeneutic' process. So, in a string being ontology, the biology needed to clarify how events get connected is a neurohermeneutics; a hermeneutics of how everyday lives are actually lived in the here and now. Being intrigued by the selective pressures in hominid prehistory that possibly led to the evolution of certain genes, socio-biology and evolutionary psychology are oblivious to the realities of this ontology. The next section offers a foreword to a neurohermeneutic biology; an introduction that leads to culture and the notion of a cultural neurohermeneutic system (CNHS).

"Men's judgment is a function of … the brain"

The view that the brain is involved in interpretation is old. Baruch Spinoza in the seventeenth century remarked, "men's judgment is a function of the disposition of the brain" (in Changeux 1985: 201). Emmanuel Swedenbourg in the eighteenth century insisted, "the cortical substance imparts … understanding" (in Allman 1998: 28). What reason is there to believe that the brain 'imparts' understanding? A consideration of culture is necessary to respond to this question. Understanding involves culture, which, according to Steven Tyler, "consists of many semantic domains organized around numerous features of meaning" (1969: 359). Culture is a fiercely contested concept. Some wish to include in it learned behavior (Harris 1979). Others find it so vexed as to contemplate its jettisoning (Fox and King 2002). I wish to retain it. However, I have qualms about including learned behavior in the term. This is because if the term social refers to behavioral interactions, most of which are learned, then learned behavior is a social, not a cultural, phenomenon. How this is the case is explained below, and requires further explication of Tyler's notion of culture.

'Semantic domains' are systems of signs that involve cultural categories (hereafter simply categories). For example, any child can work in the semantic domain, or category, of 'animals' and interpret one furry thing as a 'kitty-cat' and another as a 'doggie'. 'Cats' and 'dogs' are categories within categories; with cats including everything from the domestic house pet to lions, and dogs including everything from the Mexican Chihuahua to mastiffs. When a three year old insists—"that is a kitty"—she is making an interpretation; and she could not do this unless she could think in terms of categories. Where are categories found?

Recent research in cognitive neuroscience by David Freedman and colleagues (2001) has sought places in the brain where the categories of 'cat' and 'dog' are represented. The term 'representation' is used literally here to mean the re-presenting of one reality as another. Freedman's team worked with monkeys to whom he presented images that were either 60, 80, or 100 percent 'dogs' or 'cats'. The different percentages of one animal or the other in the images were different variants of the categories 'cat' or 'dog'. The monkeys were adept at interpreting the difference between cats and dogs. If the image was 60, 80, or 100 percent some variant of a 'dog', the monkeys responded by indicating 'dog'. They responded 'cat' to a display of variants of 'cat'. When such interpretations were made neural activity was detected in particular regions of the prefrontal cortex; with one region being for 'cats' and another for 'dogs'. Strikingly, they found that 'dog' and 'cat' were represented at the level of single neurons. So regardless of whether the image was 60, 80, or 100 percent 'dog', if it was a damn 'dog', the same neuron indicated this. The situation was identical for the 'cat' neuron. Categories, then, are represented in monkey brains. Neurolinquistic research has located different places in human brains for verbal and numerical processing (Dehaene, Dehaene-Lambertz, and Cohen 1998: 195). If words and numbers express cultural categories, then, it is clear that culture is represented in the human brain. How culture might be hypothesized to function when interpretation occurs requires a model of how the different parts of the brain articulate.

Edward Hundert provides a simple tripartite brain model. He "divided the brain into input, central, and output systems" (1989: 201). Input systems are the areas that perform the tasks of sensing and perceiving. This includes, in the case of sight, the eyes that connect with the occipital lobe at the rear of the brain where the sensation of the external world is represented. Output systems are those areas that, upon receipt of information from the central system, perform the tasks of putting the body into action. They are the motor cortex and associated regions of the brain. However, it is a central system which is critical because this, according to Hundert, is where "the meaning of information" is established (ibid.: 201). Hundert locates the central system in the associational cortex.

Whether Hundert has very precisely specified this region of the brain is debatable, because cortical association areas are vast and complex. Less questionable is that these three systems attach with each other. Neurons from the input system connect with the central system which connects with the output system. Sensations from an antecedent E-space arrive via the input system. Meaning is interpreted in the central system and on the basis of this is made into discursive or practical action that re-enters a subsequent E-space via the output system. This means that the idea of a tripartite neurohermeneutic system is plausible, though at present little of its specifics are known. Let us allocate a role to culture in this system.

The ability to think categorically allows you to think categorically. It does not provide you with the 'content' of your categories. Forget any other categorical imperatives you may have heard about, the real categorical imperative is: *You cannot think categorically unless you have some specific cultural content.* Culture provides the particular categories by which sensation is interpreted and thereby classified as this or that, and culture is learned. This means that culture exists, in a way unimagined by Tyler, in a neuronal form (Reyna 2002) as memory which appears stored by the hippocampus (Fuster 1995). The term 'neuronal culture' will refer to neural memory networks that store the contents of different cultural categories. It is important to recognize that neuronal culture is learned and that the hippocampus, in ways that are far from completely understood, is responsible for this learning.

Neuronal culture includes both categorizations of 'what is' and procedures, or 'rules', for dealing with it. Elsewhere (Reyna 2002) categorizations of what is, are called 'perceptual', because they classify reality, and abstractions about reality, into different signs. Instructions for dealing with different perceptual cultural categories are said to be 'procedural'. Neuronal cultural systems, thus, have perceptual and procedural aspects. For example, among the Barma of Chad there is the cultural sign *kuin.* Perceptually mothers and mothers' sisters are classified as *kuin*. Procedurally *kuin* are shown *hormo* (respect). This is a neurohermeneutic system that runs on culture: at an antecedent time, E-space$_1$, a mother arrives in a daughter's hut. She is in the daughter's I-space interpreted as a *kuin,* and at a subsequent time in E-space$_2$, she is given *hormo.* This brings us back to the relationship between learned behavior, the social, and cultural. The daughter giving *hormo* to the mother is performing a learned, social behavior.

This social phenomenon, the subsequent event in E-space$_2$, is the result of a neurohermeneutic process in I-space that utilized learned culture. In this optic the learned behavior is not the culture but an effect of a process that uses culture. Let us generalize a bit from the preceding: E-space$_1$ has been connected with E-space$_2$ because cultural categorizations in the intervening I-space are used in the neurohermeneutic system to make interpretations based upon learned neuronal culture, giving humans the capacity to link antecedent with subsequent being; creating string being. The system allowing such connections is a cultural neurohermenetic system (CNHS) where:

Learned Cultural Categories + Tripartite Neurohermenuetic System = CNHS

This section has argued that the brain makes interpretations using culture. However, at present we know very little about this process. The following section suggests that the CNHS works as an interpretive hierarchy, and speculates upon the brain structures responsible for this hierarchy.

An interpretive hierarchy

Hierarchy has its levels, ascending or descending, in some order. An interpretive hierarchy ranks both the increasing involvement of different parts of the CNHS in interpretations as well as the increasing complexity of those interpretations. The function of such a hierarchy is to link subsequent action to antecedent events. Further, the different levels in the hierarchy, by adding more complete representation of the reality of antecedent events, eventually construct a desirable response to the events. Specifically, I recommend an interpretive hierarchy of four levels; those of reflex, sensational-world, life-world, and desire.

Reflex

Once, while walking in a parking lot next to a library—an absent minded professor, dimly lost in thought—something happened, and before I knew what, I had jumped a mile! When I returned to earth, I recognized that the car of a student racing for a scarce parking space had been bearing down on me. The student—grinning, delighted to have launched a professor—called out, "You OK?" I responded, "Yeah, you freaked me." There are certain interpretations of what is happening in the world that people make without being cognizant that they make them. I sensed something, was unaware of it, and suddenly I was making like a missile launch program; thereby connecting antecedent being, a car's motion, with a subsequent action, jumping.

The neurohermeneutic process involved in this form of interpretation involves the reception of stimuli of the present world, a car's motion, and transmission along the optic nerve to the lateral genticulate nucleus of the thalamus (Kandel, Schwartz, and Jessell 1991: 287). The thalamus is the part of the brain "in charge of receiving … information from the external world" and, then, relaying it to other parts of the brain for further processing (Goldberg 2001: 30). Relayed information goes along two neural pathways, one of which produces reflexes. The amygdala, important in emotion, regulates individuals' environmental interactions in situations where survival appears at risk (LeDoux 2002; Rolls 2005). One behavior it can provoke is flight. One of the neural pathways that relays information from E-space to the brain goes to the amygdala, the other to the sensory cortex. However, the stimuli along the thalamic-amygdala pathway arrive prior to those taking the scenic route in the thalamic-cortical pathway. So my amygdala had swung into operation sending information to various parts of my autonomic nervous system and leg muscles to jump before the sensory cortex functioned to represent 'car'.

Such reflexive interpretation involves subcortical neural pathways that take a 'direct thalamo-amygdala path' and, because this pathway bypasses the cortex, it is unable to benefit from cortical processing, which means that 'the amygdala' has only "a crude representation of the stimulus" (LeDoux 1996: 164). Perhaps, the term 'crude' is not helpful here. Really what is at issue is the amount of neuroanatomy involved in representation and a person's awareness of that representation. Reflexive interpretations occur without cortical involvement and without conscious representation of meaning. But the reality of that car was represented in my amygdala. So I wildly jumped without desiring it.

Sensational-world

A second level of interpretation roughly corresponds to sensation of the physical properties of a car without the recognition, 'car'! Such an interpretation has been made when an individual has represented the properties of a stimulus in her or his brain—what it looks, smells, and sounds like. The succession of such interpretations as individuals go about their daily affairs creates a particular representation of reality, a world of sensations, i.e., a 'sensational-world'. (A word on nomenclature: sensational representations will be placed between slashes, cultural signs between quotation marks. Thus a 'dog' is a cultural classification of the sensation /dog/.) What is the neurobiology of sensational-worlds?

It appears that the portion of the neurohermenetic process that leads to sensational-worlds begins at receptors with the reception of sound waves or other stimuli bearing information in E-space. These receptors transmit this information along different nerves to different parts of the thalamus. There it is further transmitted both to the amygdala and the sensory cortex. Sensational interpretation is concerned with what happens to the information that goes from the thalamus to the sensory cortex (Dowling 1998). Discussion of this cortex can be found in Kandel, Schwartz, and Jessell (1991: 326–529). Initially there is a unimodal processing of sensory stimuli in the primary sensory areas. 'Unimodal' here means that only a single sense—e.g., sight or sound—is represented; with hearing being processed in the primary auditory area of the temporal lobe, vision in the primary visual areas of the occipital lobe, smell in the primary olfactory area of the frontal lobe, and taste and touch in the primary somatosensory area of the parietal lobe. Then this unimodal memory information is transmitted to activate networks in areas of 'polymodal' memory, where sights are given sounds, smells, tastes, etc. These appear based in 'polysensory' convergence zones, at least some of which are in the prefrontal cortex. (Discussion of unimodal, polymodal, and polysensory areas in the association cortex can be found in Fuster 1989: 194.) Activation of the convergence zones seems to give a sensational-world interpretation its most complete representation in terms of its physical properties. So, sensational-worlds are interpretations that represent properties of being—visually, aurally, etc. These interpretations are not particularly goal oriented. There is little of desire in them. This is because they do not come with categorizations for regions of being, or procedures for what to do about them. This happens at the next, life-world level of interpretation.

Life-world

It will be recalled, from the section on reflexes, that as soon as I was on the ground, I perceived that the /car/ was a 'car'. Once individuals have made the association—moving object, a 'car'—which is the classification of a present sensation with a perceptual sign in their neuronal cultural memory, then they have re-interpreted their sensational-world and are at a third level of interpretation. This level of interpretation occurs when the scanning of a memory neural network goes beyond sensory areas to retrieve cultural memories that have been associated with sensations. How and where it occurs is not clear, but it does occur.

Carl Wernicke, toward the end of the nineteenth century, published a classic paper concerning meaningful memory networks. He discovered an aphasia (a language disturbance) where persons could speak but not understand. This aphasia happened when a part of the cortex was damaged in the temporal lobe where it joins the parietal and occipital lobes. This region is today known as Wernicke's Area. It appeared to be the place where sensations were given words. Recent research, based upon novel brain imaging techniques, on the location of language in the brain has complicated this picture. Terrance Deacon, summarizing these studies, concludes that the 'brain structures' involved in 'linguistic symbols', i.e., cultural concepts, are "distributed across many areas" of the cortex (1997: 298). More specifically, he reports that "images of the working brain doing language show a hierarchic organization" (ibid.: 297). How this hierarchy works is still a matter of conjecture. Fuster (1997, 1998) has offered an influential associationist model of memory hierarchies that associate sensations with perceptual and procedural cultural concepts. A key to this model is the existence in neural memory networks of a hierarchy of associations of different sensations with increasingly abstract and general cultural notions. Further, Fuster believes that as these cultural notions become more abstract that the neural networks holding them "become broader and more widely dispersed, encroaching into progressively widely dispersed cortical domains" (Fuster 1997: 454).

An individual may be said to have doubly interpreted when both the sensational and life-world portions of a memory neural network have been activated, first in the sense of representing the physical properties of reality, and second in the sense of culturally representing the physical representation. Reality is 'organized' during this re-interpretation in the sense that it is given meaning. The phrase 'given meaning' refers to that part of the neurohermeneutic process where the cultural memory networks are activated and retrieve the perceptual and procedural attributes of cultural signs associated with sensations.

Metaphorically, it might be imagined that the difference between these two types of interpretation resembles the difference between silent movies and talkies. In silent movies, without any script at the bottom of the screen or any music to help you, things just go on. It is not so clear what they mean. But in talkies, the words give meaning to things, and the images take on life. To appropriate, and alter, Edmund Husserl's term, this third level of interpretation provides people with what they feel is their "only real world, the one that is actually given through perception, that is ever experienced and experienceable—our everyday life-world" (1970: 49). Outside my window there is 'snow'. It is 'winter', a 'grey' day. These cultural re-representations are at the third level of interpretation and bestow meaning; and meaning gives life, i.e., it creates life-worlds. However, such interpretations, though they give person a life, do not tell them what to do with it; i.e., what they might desire to do. In order to grasp how this occurs, we need to imagine a fourth level of interpretation, that of desire.

Desire

You, a history professor, are at your Park Slope, Brooklyn house that you bought back in the 1960s, when you could still get them cheap because the 'Negroes', soon to be 'Blacks' and soon to be moved to Bedford Stuyvesant, were still there. It is a torpid, starry night. You are reading *Cat on a hot tin roof* while listening to the hallelujah chorus of Handel's *Messiah,* cranked up loud. Your life-world is 'hot', full of 'hallelujahs', 'night', and 'stars'—and perhaps 'night' and 'stars' are associated in your memory with Van Gogh's painting *Starry night.* All in all, as life-worlds go, pretty swell. Your telephone rings. Your department chair, Stella Paforma, regrets to inform you that your department has been eliminated as part of an exercise in 'resource allocation'. History is history. The bozos in leisure management are going to grow—BIGTIME! Reflexively, you cry out, "Stella".

However, immediately your CNHS proceeds onto higher levels of the interpretive hierarchy. You scan the stimuli that are the chair's discourse. Your life-world alters. 'Hallelujah' is replaced by 'resource allocation', 'stars' by 'leisure management'. Now, you figure out what to do about this new life-world, and when you do, you are exercising your faculty of desire. In rage and fear you figure, "gotta get a new job". This combination of an intention 'get job', plus a spritzer of emotion, rage/fear, is desire. It is the fourth level of interpretation. Life-worlds organize sensations by giving them meaning. Desires organize life-worlds by providing understanding of what to do. It is as if you get a life.

Desires involve 'intentions', procedures concerning future action based upon what past procedural neuronal cultural memory instructs concerning present life-worlds. The phenomenologist Marcel Merleau-Ponty had anticipated this view, as far back as the 1940s, stating, "If behavior seems intentional it is because it is governed by certain pre-established nervous pathways such that I obtain the goal intended" ([1942] 1990: 7). (Intentions can be noted by placing them in double slashes. Thus, the historian whose Park Slope life-world was threatened as a result of the chair's information, formed the intention of //getting a job//.)

However, Merleau-Ponty had left something out. When you intend something, there always seems to be some emotion associated with it. That historian fiercely wanted a job, and his fierceness was a combination of the emotions of aggression and fear. Desires, then, are a fourth level of interpretation, where persons interpret their life-worlds to formulate intentional and emotional representations of what to do. When individuals possess such representations they might be said to achieve understanding of the meaning of their life-worlds.

A question might be posed: Is emotion or intention more important in desire? Elsewhere it is proposed that emotions select and reward intentions (Reyna 2002; Rolls 1999). To illustrate, recall that in the US the reality of being rich is positively rewarding. There are BMWs, grand estates in the countryside, gracious apartments on Park Avenue, getaways in Provence, Tuscany, and the Hamptons, blond trophy wives with taut bodies, muscular boy toys with slender hips, deferential servants, furs, designer clothing, booze and other drugs galore, art, restaurants, etc. Such a being people can feel good about. They intend to have it. So they spend time figuring out, i.e., reasoning, how to get it. They figure out how to get high paying jobs. They figure out how to invest in the market. They figure out how to get a place where real estate is appreciating. They feel good about these get rich schemes and together emotion plus intention are the great American desire of 'making it'; posing the question, how does the CNHS produce desires?

The anatomy of desire

The prefrontal cortex (PFC) appears to be crucial in doing the job. It is the place in the brain "where Plans can be retained temporarily when they are being formed, or transformed, or executed" (Miller, Galanter, and Pribram 1960: 207). This cortex, the most forward part of the brain, is more developed in humans than in other animals. It is known that "powers of reason and the experience of emotion decline together" with damage to the PFC (Damasio 1994: 54). The conjunction of reason and emotion was earlier termed desire. Thus a damaged PFC results in 'disrupted' desire (Pribram 1997: 361). Hence, the PFC seems the central place in the brain manufacturing desire.

Pribram has suggested that the PFC, like 'Caesar's Gaul' is "anatomically divided into three parts"(1997: 360). The first of these parts is the dorsolateral PFC. Studies indicate that this region performs "The nuts and bolts of thinking—holding ideas in mind and manipulating them" (Carter 1998: 195). Sequences of 'willed action' are generated here (Frith et al. 1991) as a result of 'assessing priorities' (Pribram 1997: 360). Exactly how this occurs is unclear, but the dorsolateral PFC is activated when a person selects "an item from memory to guide a response" (Rowe et al. 2000: 1656). The dorsolateral PFC probably operates by coordinating deductive and probabilistic reasoning. The former occurs in left regions of the dorsolateral PFC itself; the latter in occipital and parietal regions (Dehaene 1997; Osherson et al. 1998). The second part of prefrontal Gaul is the orbitofrontal PFC. While the dorsolateral PFC is connected with the hippocampus and its associated networks through the cingulate cortex, the orbitofrontal PFC "is connected to limbic systems structures concerned with emotion, reward, and punishment" (Leonard 1997: 145). These are 'core elements' of a 'circuit' that underlies 'emotion regulation' (Davidson, Putnam, and Larson 2000: 594). Further, the orbitofrontal PFC, among other things, seems involved in the "perception of novel relationships" (Krasnegor, Lyon, and Goldman-Rakic 1997: 1).

Rolls has suggested that the orbitofrontal PFC does the 'decoding' of "reinforcement contingencies in the environment" (2005: 140). When realities are rewarding the orbitofrontal cortex is involved in representing them with pleasant feelings, and when other realities are punishing the orbitofrontal cortex is involved in representing them with unpleasant feelings. So perhaps, as the orbitofrontal PFC makes these representations it emotionally orients a person that there is a 'good' or 'bad' reality out there that the dorsolateral PFC needs to think about. The third part of prefrontal Gaul is the ventromedial PFC. This region "integrates the functions" of the other two cortices with neural networks in "the rest of the brain" (Pribram 1997: 360).

Finally, disturbing Pribram's Gallic trope is research concerning the anterior cingulate cortex, just beneath the ventromedial region. Studies of this region suggest that it plays both a "prominent role in executive control of cognition" (Carter et al. 1998: 747f.) and in 'emotion/feeling' (Damasio 1994: 71). One of the problems in understanding of the anterior cingulated cortex is to distinguish it from the dorsolateral PFC. Both regions tend to be activated at the same time. However, recent research suggests that the dorsolateral PFC functions to 'implement control' over action, while the anterior cingulated cortex works in the 'monitoring' of the 'performance' of action (MacDonald et al. 2000: 1835). It is the brain's "error detection and correction device" (Bush, Luu, and Posner 2000: 215). Perhaps, the brain evaluates here whether intended action is consistent with the rules of procedural culture.

What is hypothesized, then, is that the complex operations of the PFC establish desire and desire action. As Elkhonon Goldberg puts it, "The frontal lobes," by which he means largely the PFC, "endow the organism with the ability to create neural models of things as a prerequisite for making things happen, models of something that does not yet exist but which you want to bring into existence" (2001: 24). In our terms, the PFC, based upon sensations from some E-space, creates 'wants'. Wants are desires that provoke action in some subsequent E-space, thereby generating string being.

Three final caveats concerning the interpretive hierarchy need to be emphasized. First, the neuronal operations constructing the different levels of the interpretive hierarchy occur nearly simultaneously because of the speed of transmission of nervous signals. This means, even though investigators may be able to identify analytically different levels of an interpretive hierarchy, people actually living it may not be able to distinguish them. Quicker than the blink of an eye, once you sense something you give it cultural status and have desires about it. So sensational-world, life-world, and desires are apprehended as a single experiential laminate. Second, the neural operations which construct life-worlds and desire do so by retrieving neuronal culture, *something learned and not in the genes.* This means that anyone wishing to understand construction of life-worlds and desire needs to be concerned with how different groups in E-space produce and propagate spoken and written perceptual and procedural culture; and how the CNHS turns this E-space discursive culture into I-space neural culture. Third, the view that there is a CNHS and that it works according to an interpretive hierarchy is a theoretical model and, as is the case of any theory, it is subject to skepticism. There are an estimated 100 billion to 1000 billion neurons in the nervous system, with each neuron having on the order of 100 to 10,000 connections (Dowling 1998: 6). This is arguably the most complex structure in the universe, whose working we are just 'beginning' to grasp (Edelman 1992: xiii). Thus, there tends to be healthy skepticism of any theoretical model dealing with the brain.

However, three actualities encourage further research into the CNHS: firstly, humans make interpretations; secondly, interpretations result from brain operations; and thirdly, conscious interpretations (those of the sensational-world, the-life world, and of desire) involve a hierarchy of neurological operations running from recognition of sensation, to assigning meaning to sensation, and on to assigning desire to meaningful sensations. Thus, it seems sensible to continue validation of the theoretical stance that some CNHS working through some interpretive hierarchy is responsible for humans stringing being together (see Reyna 2004 for a discussion of how to perform such validation). Two final points are considered below: why is the preceding not a biological reductionism and what does a neurohermeneutic interpretation of interpretation imply for hermeneutic anthropological practice. This leads us to complexity.

Complexity

Bruce Kapferer has argued that "recent changes in state ideologies and practices—broadly glossed as neo-liberalism—appear to have opened the way for an intensification of reductionist positions" in anthropology and beyond (2004: 15). The socio-biology and evolutionary psychology discussed at the beginning of this paper are part of this trend. The string being ontology argued for replaces reductionism in favor of complexity. Complexity theory is a multidisciplinary approach from a number of disciplines in the natural, biological, and social sciences. In the latter disciplines the key sources are the systems theory of Walter Buckley (1967), the structural Marxism of Louis Althusser and Etienne Balibar (1970), and the chaos theory of Gleick (1987) or Stewart (1989).

Two canons guide complexity theory as it pertains to the human condition. The first canon is ontological. 'Complexity' is structures of structures, and in the case of people these are literally 'human being'. The second is epistemological. Reasonably 'full' knowledge of any complexity is approached when it is known how each structure in the whole operates; how it is articulated with other structures; and how its operation influences other structures in the complexity. The epistemic goal is to grasp the full complexity of a structure of structures and not to reduce one structure(s) operation to another's. A string being ontology argues for a particular type of complexity, one where there are structures in E-space that articulate with those in I-space that articulate with those in E-space, and on and on through history. The theoretical model of the CNHS, and its interpretive hierarchy, is a first cut at learning about this ontology by providing an account of how the structures in I-space operate.

It should be noted that the operation of the brain structures composing the CNHS is not reduced to the social or cultural demands operating in the articulated structures in E-space. The CNHS is connected with those forces, but it has its own 'autonomy'. This means the CNHS possesses its own way of functioning, giving it, as Goldberg states, "the ability to manipulate and recombine internal representations" and, thereby, "create new constructs" that may bring about "something that does not exist" but which, because of the "new constructs," is now desired and will come to exist (2001: 24f.). What does the study of the neurohermeneutics of the CNHS, as part of the larger analysis of the complexity of string being, imply for anthropologists who have taken the interpretive turn?

I believe a new partnership with biological anthropologists. This is to say that attempting to understand the CNHS complements, rather than competes, with existing cultural anthropological practice. The interpretive anthropologist should continue making interpretation, more complete if possible. These interpretations need to be systematically situated in space-time continuums. The interpretations should be presented as discursive accounts of what occurred in the I-space of an actor's brain in response to some event in E-space$_1$ that led the actor to do something in a certain way in a subsequent E-space$_2$: "First this happened to me, then I thought this, felt that, and so did what I did". In this way interpretive anthropologists will be discovering the sequences of E-space_I-space_E-space which constitute string being. However, the interpretive anthropologist will be working in joint venture with a new sort of biological anthropologist, a person we might call a cultural neuroscientist, whose job it will be to discover what neurohermeneutic operations occur when actors give different accounts of their thoughts and feelings.

Conclusion

What is interpretation? The answer this paper proposes is that interpretation is operations of a particular chunk of being, the CNHS. We possess only the barest knowledge of the organization and functioning of this structure—and the devil is in the details. So a new anthropological partnership—between cultural neuroscience and cultural anthropology—is proposed to fill in those details. Together this division of intellectual labor will seek a complex string being theory of how E-spaces are reciprocally connected with I-spaces, and in crafting such theory will contribute to realizing the Boasian goal of accounting for the cultural and biological as some 'whole'.

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Notes

1. There has been cross-disciplinary skepticism concerning socio-biology and evolutionary psychology. From the perspective of theoretical systems biology, Brian Goodwin (1994) disparages genetic determinism. Stephen Gould has attacked it as an evolutionary biologist (1996). Negative evaluations of socio-biology can be found in Sahlins (1976) from the vantage of cultural anthropology, in Montagu (1980) from that of physical anthropology, and from Leeds and Dusek (1981–1982) as well as Kitcher (1985) from that of philosophy. Rose and Rose offer a developmental biology critique of evolutionary psychology (2001). Anne Fausto-Sterling (2000) offers feminist criticism of evolutionary psychology from a developmental biology perspective. Panksepp and Panksepp (2000), neuroscientists, document the 'sins' of evolutionary psychology. Certain socio-biologists insist that humans are violent and criminal for genetic reasons. This gets capitalists and imperialists off the hot seat because violence and crime are not caused by their exploitation or oppression. Ferguson (2001) reveals the empirical non-support for such claims, at least as made by Napoleon Chagnon (1988). A hoary socio-biology canon is that intelligence is significantly a product of genes; with the corollary that the poor 'races' (usually a synonym for 'people of color') do not make the genetic grade for smartness. Lewontin, Rose, and Kamin (1984) counter Jensen's (1969) iteration of this view. Gould (1996) and Jacoby and Glauberman (1995) demolish the Herrnstein and Murray (1994) reiteration of it. Graves (2001) does the same on the latest Rushton (1995) re-reiteration.

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