Doing Good, Doing Bad, Doing Nothing

with Karl E. Peters and Barbara Whittaker-Johns, "Scientific and Religious Perspectives on Human Behavior: An Introduction"; William J. Shoemaker, "The Social Brain Network and Human Moral Behavior"; Ervin Staub, "The Roots and Prevention of Genocide and Related Mass Violence"; and Karl E. Peters, "Human Salvation in an Evolutionary World: An Exploration in Christian Naturalism"

THE SOCIAL BRAIN NETWORK AND HUMAN MORAL BEHAVIOR

by William J. Shoemaker

Abstract. The moral nature of humanity has been debated and discussed by philosophers, theologians, and others for centuries. Only recently have neuroscientists and neuropsychologists joined the conversation by publishing a number of studies using newer brain scanning techniques directed at regions of the brain related to social behavior. Is it possible to relate particular brain structures and functions to the behavior of people, deemed evil, who violate all the tenets of proper behavior laid down by ancient and holy texts, prohibiting lying, cheating, stealing, and murder? Is it possible that the recently discovered "mirror neurons" in the brain are the basis for empathy and that deficits in these brain cells lead to severe difficulty in relating socially to other people, including parents and siblings? What do we make of reports that the fusiform face area in the temporal lobe of the brain is specialized for the perception of faces and that defects in this region are seen regularly in individuals who are psychopathic.

Keywords: autism; limbic system; mirror neurons; moral behavior; morality; prefrontal cortex; prosopagnosia; psychopathology; social brain

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This paper discusses how the brain works in regard to moral and social behavior and how deficits in the brain contribute to people doing harmful things.

William J. Shoemaker is Associate Professor in the Department of Psychiatry at the University of Connecticut's School of Medicine. He can be contacted at MC 1410, University of Connecticut Health Center, 263 Farmington Avenue, Farmington, CT 06030-1410, USA; e-mail: Wshoemaker17@comcast.net.

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Moral Behavior and Social Behavior: Definition

Morality is a code of customs and values that guide social conduct of a given religion, group, or culture. Often referred to as "descriptive" morality, it codifies right and wrong for that group. Besides avoidance of harm to others, it specifies acceptance of authority, loyalty to the group, and appropriate behavior to secular and religious leaders (Haidt 2007; Mendez 2009).

According to Mario Mendez, "'Normative' morality is a universal code of moral actions and prohibitions held by all rational people, regardless of their society's or group's descriptive morality" (Mendez 2009). Normative morality deals predominantly with avoidance of harm and with fairness in social interactions, as well as other aspects of morality. It is normative morality that is the subject of recent neurobiological interest. This area of investigation brings together the fields of evolutionary psychology, social psychology, and cognitive neuroscience. These disciplines have long used the term "social" to describe the behaviors they study, thus, the term "social brain network." However, there is no question that the subject matter is identical to moral behavior.

Basic Limbic Emotions and Moral Emotions: More Definitions

The basic limbic emotions are those present in all mammals emanating from phylogenetically analogous brain structures collectively called the limbic system (MacLean 1989). These are fear, anger, disgust, sadness, and happiness; they function chiefly to promote the survival of the individual. The moral emotions, the product of the social brain network, arise later in development and evolution (Adolphs 2003). They are guilt, shame, embarrassment, jealousy, pride, and altruism; they function to regulate social behaviors, often in the long-term interest of a social group rather than the short-term interest of the individual person (Adolphs 2003). However, these brain systems should not be thought of as separate and distinct. The architecture of the social brain network maps onto the neural circuitry of the limbic system (Decety 2011), especially the amygdala and the insular cortex (see Table 1). When studied intensely and for a long period (usually in the field), one can view the complex social systems in lower animals. There is a phylogenetic progression from lower vertebrates to monkeys to apes on conflict resolution (deWaal 2000), cooperation and response to inequity (Brosnan 2011), rejection of unequal pay (in a laboratory setting) (Brosnan and deWaal 2003), compassion (Goetz et al. 2010), and ethics, aggression, and violence (deWaal 2004). Thus, the social brain network, so active and necessary for human and human culture, has been evolving for millennia.

Table 1. The Social Brain Network

Brain Region	Social Task Involved	Social Pathology
Inferior frontal cortex, including mirror neurons	Perceived similarity between the self and others; active during interactive social participation; responds during both observable action and intended action; responds during both behavioral and mental imitation.	Autism spectrum disorder (ASD) autism; Asperger's syndrome; also defective in antisocial personality disorder (AD) and psychopathy.
Fusiform gyrus of the temporal lobe (also known as the fusiform face area [FFA])	Mediates selective response to human faces; mediates social tasks such as recognition of identity and emotional expression of others (Baron-Cohen 1995).	Prosopagnosia; also defective in ASD and many cases of psychopathology.
Superior temporal sulcus (STS)	Processes socially relevant sensory information; sensitive to vocal and speech sounds, but not to other nonsocial sounds. Interacts with the FFA in processing motion and emotion of body, eyes, and face of others.	Figures prominently in studies of socially deviant behaviors.
Prefrontal cortex (PFC), including ventromedial PFC (vmPFC), orbital frontal cortex, and dorsolateral PFC (dlPFC)	Involved with motivation, reward, emotion processing, evaluation of ongoing behavior, and planning; it enables future events and consequences; also activated by tasks involving empathy, theory of mind, and discrimination of emotional expression.	Deficits in prefrontal cortex are the most common finding in antisocial personality and/or psychopathy diagnoses. This is the case for both acquired psychopathy from accidental lesions to the frontal brain (e.g., head impact on windshield in auto accident) and congenital psychopathy with no lesion present.
Amygdala (although considered part of the basic limbic system, the amygdala plays a major role in the social brain network)	Involved in rapid assessment of reward/punishment value. Receives sensory information from FFA and STS regarding emotional and motivational value.	Nearly all psychopaths have an aberrant connection between their vmPFC and their amygdala, accounting for their impaired decision-making (Motzkin et al. 2011).

Continued

Table 1. Continued

Brain Region	Social Task Involved	Social Pathology
	Therefore, functions in face processing, identification of emotion, perspective taking, social judgments, empathy, and threat detection.	
Insula; anterior insular cortex	The insula is what tells the individual how he/she is feeling. All subjective feelings pass through the insula (Craig 2002). Further, the insula is involved in the basic emotions of anger, sadness, and disgust, but is also involved in social emotions, especially social interactions and empathy (Jabbi and Keyers 2008; Lamm and Singer 2010; Loverno et al. 2009). The insula is also involved with feelings of inequity, playing a role in the neural coding of equity and efficiency (Hsu et al. 2008).	The insula shows aberrant activity in many pathologies, including failure to recognize faces, abnormal pain, or body sensations (Ostrowsky et al. 2002), increased anxiety (Stein et al. 2007), and feelings of aversion and disgust (Sarinopouls et al. 2010).
Anterior cingulate cortex (ACC)	The ACC has a more subtle effect on social behaviors. Decety (2011) suggests that the ACC is involved in the evaluation and regulation of emotions, as well as decision making. The subtle effects of ACC lesions in animals make delineating its function difficult. Nevertheless, Ortega et al. (2011) found that ACC-lesioned rats had difficulty coping with their emotional responses to a negative situation. Newman and McGaughty (2011) put lesioned animals in a social situation with difficult and reversal learning paradigms.	diPellegrino et al. (2007) tested 8 patients with focal lesions of their rostral ACC (rACC pts), 6 patients with lesions outside their frontal cortex (non-FC pts), and 11 healthy controls. Using tests of high and low conflicts, the non-FC patients and the controls reacted similarly to conflict test trials. The rACC patients displayed a failure to modify their performance to the contrasting tests. They were also slow in their reaction of all tests, indicating difficulty in regulating their cognitive control.

Continued

Table 1. Continued

Brain Region	Social Task Involved	Social Pathology
	They report that ACC-lesioned animals had difficulty with sustaining their responses in the face of distractions and had difficulty maintaining sustained attention.	Maia et al. (2008) published an interesting paper in which obsessive-compulsive disease patients (OCD) were tested using fMRI. They found that OCD patients, both adults and children, have hyperactivity of the ACC.

Portions of this table were adapted and compiled from Green and Haidt (2002), Mendez (2009), and Neuhaus et al. (2010).

The social brain network has only recently been described as a coherent brain system (see Figure 1). Early reports from studies of individuals with either frontal or prefrontal lobe damage demonstrated deficits in social behavior, yet they displayed normal functioning language, memory, and other cognitive skills (Anderson et al. 1999; Blair and Cipolatti 2000). Brain damage or lesions could be the result of cerebral stroke, brain tumors, or head trauma that damages brain tissue. The resulting damage from such lesions could affect any of the many brain functions. Only a small percentage of brain lesions would result in deficits in social behavior and not other functions.

What do we mean when we say “deficits in social behavior”? If the lesion is extensive, the individual’s resulting behavior may bring harm to another person, even a loved one, a situation that was unthinkable prior to the lesion. Often the lesions are small and result in behaviors such as inappropriate comments in social gatherings like church services, family dinners, club meetings, and so on. Frequently there is impulsiveness to the behavior that the individual cannot control. Often the aberrant behaviors have an overt sexual nature and produce embarrassment to the individual, friends, and family, or, worse, result in criminal arrest.

Because the social brain network is more fully developed in human and certain higher primates, it has been difficult to make progress in research using the usual laboratory animals. Nevertheless, as neurologists, psychiatrists, and neuropsychologists gathered information on patients with brain lesions that affected their social behavior and not other behaviors (Barrish et al. 2000; Shamsay-Tsoory et al. 2003), it appeared that social behaviors may have specialized regions within the brain.

There are also some genetic data to consider. People with the diagnosis of autism have severe impairments in social cognition and social behaviors,

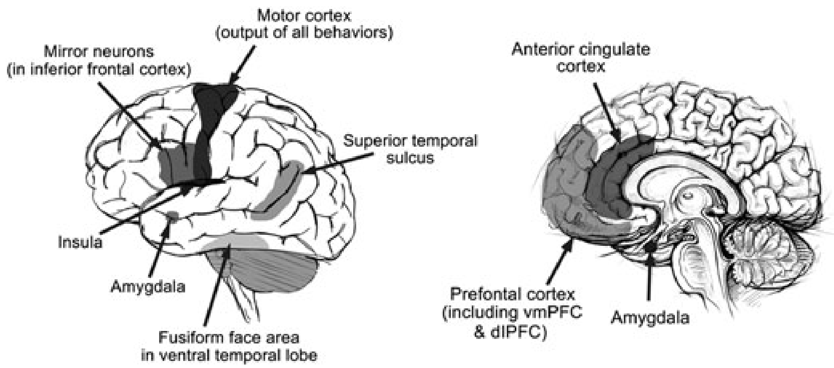

Figure 1. The Human Brain: Lateral View (left) and Saggital View (inner surface exposed, right). The amygdala cannot be seen with these views and its relative position is indicated within the depth of the tissue. The motor cortex is not part of the social brain network but is included for reference and because all behavior, social, and otherwise, must past through this region.

but many have intact general cognitive ability (Heavy et al. 2000; Klin 2000). Compare that with people who have Williams syndrome. These individuals have normal social behavior and social cognitive skills, but have deficits in spatial and other cognitions (Bellugi et al. 2000; Kamiloff-Smith et al. 1995). Similarly with individuals who have prosopagnosia; they show impairments in the perception of faces but preserved perception of nonsocial stimuli (Kanwisher 2000). Thus, again, it appears that social cognitions and social behaviors may be separated from other cognitive regions of the brain. This appearance became reality with the discovery of mirror neurons.

Mirror Neurons

In the mid-1990s, the Italian physiologist Giacomo Rizzolatti (di Pellegrino et al. 1992; Gallese et al. 1996) identified particular neurons in the inferior frontal cortex of primates (see Figure 1) that had unusual properties. These neurons would fire when the monkey picked up a piece of fruit to eat. They also fired when a caretaker picked up a piece of fruit to eat it. Over several years and a variety of experimental paradigms it became clear that this set of neurons fired for action intention, not only for its own action but for others as well—hence the name mirror neurons. No other neurons in the brain have these properties.

The mirror neuron system has now been extensively explored and many of its properties described. It is a system that unifies action perception and action execution (Rizzolatti et al. 2009). It is responsible for the ability to learn by observing, one of the great attributes of humanity, and one that places humans far ahead of the lower animals. A later discovery was that a subset of mirror neurons had connections to the insula and the anterior cingulated cortex, part of the limbic system (Gallese et al. 2004; Singer 2006). Studies done with human subjects demonstrate that this aspect of the mirror mechanism is responsible for understanding the emotions of others (via facial expression or voice or body language) without higher-order cognitive mediation.

Mirror neurons appear to be a neuronal link to imitative behavior. Early descriptions of empathy referred to "inner imitation" of the actions of others. It is known through developmental studies that there is a link between imitative behavior and the development of social skills. Humans tend to imitate one another automatically when interacting socially (Chameleon Effect). Furthermore, the more people tend to imitate others, the more empathetic they tend to be. Thus, one way of empathizing is through the embodiment of the facial expressions and body postures of other people.

The Fusiform Face Area

One of the best studied aspects of the social brain is the visual processing of faces, because detection and recognition of faces is considered to be an important adaptation of social animals (Grossman and Johnson 2007; Johnson et al. 2005). As Nancy Kanwisher, a researcher at MIT puts it:

> Faces are among the most important visual stimuli we perceive, informing us not only about a person's identity, but also about their mood, sex, age, and direction of gaze. The ability to extract this information within a fraction of a second of viewing a face is important for normal social interactions and has probably played a critical role in the survival of our primate ancestors. Considerable evidence from behavioral, neuropsychological, and neurophysiological investigations supports the hypothesis that humans have specialized cognitive and neural mechanisms dedicated to the perception of faces. (Kanwisher and Yovel 2006)

Three cortical regions (the fusiform gyrus, the superior temporal sulcus, and the lateral occipital area) have been identified in neuroimaging studies as being face-sensitive areas (see Figure 1). That is, these regions of the brain are involved in encoding/detecting facial information. Interestingly, all three areas are considered to be within the social brain network. Of these, the fusiform face area (FFA) is more activated by faces than by houses, textures, and hands (Kanwisher et al. 1997).

Thus, two basic human social attributes, empathy and face recognition, have been localized to two cell groups embedded in the social brain network. With this information in hand, medical researchers began to look for diagnostic groups or other populations that might be deficient in empathy (mirror neurons) or in face recognition (fusiform face area).

Empathy, Autism, and the Mirror Neurons

The discovery of the mirror neurons was widely heralded, and, within a short time, the possible connection to autism was made. Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by a severe and pervasive impairment of reciprocal socialization, impairments in communication, and repetitive or unusual behaviors. One way to understand the symptoms of ASD is that there is a failure in the normal development of empathy. This contention has been put forth most eloquently by Simon Baron-Cohen in a number of articles (Baron-Cohen 2002, 2004; Baron-Cohen and Belmonte 2005) and books (Baron-Cohen 1995; Baron-Cohen et al. 1993). Subsequent fMRI studies of subjects with ASD compared to controls confirmed that children with autism had dysfunction of the mirror neurons in their cortex (Dapretto et al. 2006; Oberman et al. 2005). Other studies revealed abnormalities in the fusiform face area when autistic subjects were asked to identify faces (Hubl et al. 2003) and to determine the mood of people pictured in different emotional states (Critchley et al. 2000). In 2005, the Society of Neuroscience held a workshop on the developmental neurobiology of ASD and published a comprehensive summary of the presentations (DiCicco-Bloom et al. 2006) confirming the disruption of the brain structures involved in the social brain network in ASD.

Face Recognition, Prosopagnosia, and the Fusiform Face Area

Prosopagnosia is a rare condition involving a selective impairment in visual learning and face recognition. Until recently, most cases of prosopagnosia resulted from damage to the right hemisphere of the brain (De Renzi et al. 1994). However, there has been increasing recognition that many people have congenital prosopagnosia—that is, they are born with the defect in their brain without any known insult, traumatic, or toxic event (Behrmann and Avidan 2006; Kennerknecht et al. 2006). For those that acquired prosopagnosia following a brain lesion, it can be a terrible experience to have lost the ability to recognize faces, even those in their own family. However, those with congenital prosopagnosia do not realize what they lack, since they never had that ability. Congenital prosopagnosia individuals develop compensatory mechanisms throughout life; they use features such as hairlines, eyebrows, jewelry, and clothing to help them identify others.

Another feature of the prosopagnosia condition is the loss of determining the emotional state of a person from viewing that person's face. This deficit is indicative of the fact that the failure to recognize faces is not a memory defect (in fact, other aspects of memory and recognition are intact), but a defect in the social brain network. Recent studies using fMRI scanning have confirmed that individuals with congenital prosopagnosia have cellular losses in several regions of the social brain network, including the fusiform face area (Dinkeladin et al. 2011; Garrido et al. 2009).

Although individuals with autism or prosopagnosia have deficits in their social brain network, these individuals do not display a callous disregard for others, do not cause harm to others without showing remorse, and do not lead a socially deviant lifestyle with irresponsible and impulsive behaviors.

Antisocial Behavior and Moral Transgressions

There is a class of individuals that is typified by callous and impulsive antisocial behaviors. Many of them score low on empathy and have difficulty recognizing the emotion in people's faces. Further, these people demonstrate a willingness to intentionally commit moral transgressions against others (often violent) without guilt or remorse (Harenski et al. 2010). As can be imagined, such individuals come to the attention of criminal justice and mental health professionals. Despite the wide variety of portrayals of such "wild and crazy" individuals in novels, television, and movies, most sociopaths fit comfortably within a diagnosis of antisocial personality. Many of them also score high on the Hare Psychopathy Checklist (Hare 1991; Hare et al. 2000). The core abnormalities in individuals with these diagnoses are similar across cultures and national boundaries.

Deficits in the Social Brain Network of Psychopaths

A variety of techniques have been used to study the brains of psychopaths. Kent Kiehl, a leader in this field, began his studies using event-related potentials, which are recordings of the underlying brain activity made from the scalp, similar to a diagnostic electroencephalogram (EEG). Kiehl studied psychopathic and nonpsychopathic prison inmates for their pattern of brain activity during processing of semantic and affective verbal information. There were obvious differences between the groups (Kiehl et al. 1999a, 1999b). In a subsequent study, fMRI was used to visualize details of brain usage during processing of abstract emotional information. In this study, Kiehl et al. used three groups: imprisoned criminal psychopaths, prison inmates who are not psychopaths, and noncriminal control participants (Kiehl et al. 2001). The nonpsychopathic prison inmates and the noncriminal controls were identical in their brain patterns, whereas the psychopaths were quite different. This result shows that residing in a prison for a long period of time is not the cause of the brain differences. Kiehl interprets the differences in brain patterns as evidence of weakened input from limbic structures (Kiehl et al. 2001).

In a later review, Kiehl assessed the data from his own and other's work on brain changes seen in psychopathy (Kiehl 2006). The review proposed that the brain pattern changes were seen in orbital frontal cortex, insula, anterior and posterior cingulate, amygdala, parahippocampal gyrus (part of the temporal lobe), and the anterior superior temple gyrus. He termed these structures collectively as "the paralimbic system." These structures are essentially what we have termed the social brain network (see Table 1 and Figure 1).

Similar to the earlier discussion of acquired versus congenital prosopagnosia, there are brain lesions that can produce behavior that resembles psychopathy. In one study, nearly two-thirds of murderers had neurological diagnoses, including brain injuries, mental retardation, cerebral palsy, epilepsy, dementia, and others (Blake et al. 1995). Similar findings were reported by Wong et al. (1994). However, later researchers have been sensitive to this issue and with magnetic resonance equipment can scan each study participant for brain lesions and deformations before proceeding with the main study (Harenski et al. 2010; Muller et al. 2008).

A recent article used two different imaging techniques to examine more fully the brain connections in psychopaths (Motzkin et al. 2011). They reasoned that the two most compelling structures that show deficient activity from numerous studies are the amygdala and the ventromedial prefrontal cortex (vmPFC) (see Figure 1) (Blair 2007, 2008). Motzkin et al. employed two complementary imaging techniques to assess the structural and functional connectivity of vmPFC in psychopathic and nonpsychopathic criminals. They used diffusion tensor imaging to show that psychopaths have a reduced uncinate fasciculus, the primary white matter connection between vmPFC and anterior temporal lobe. They also used fMRI in the same subjects to show that psychopathy is associated with reduced functional connectivity between vmPFC and amygdala, as well as between vmPFC and medial parietal cortex. These results confirm that vmPFC connectivity is markedly diminished in psychopathy. This result fits nicely with the studies discussed next that show that vmPFC in psychopathy is deficient in the number of neurons.

Another technique that can be used in brain studies is voxel-based morphometry (VBM). Using a magnetic resonance imager, the technique allows for measurement of gray matter in specific brain regions. Unlike fMRI, which measures the metabolism or usage of brain regions, usually in response to a task, VBM makes measurements in the resting brain. VBM yields quantitative results of the amount of gray matter in a particular brain region. Gray matter is the sum of neuronal cell bodies and their axons and dendrites, the parts of the brain that do the communicative work. White matter refers to myelin, made of lipid layers synthesized by nonneural cells. Think of white matter as the insulation that surrounds the cables (axons). Both are important, but changes in gray matter connote changes in the number of neurons in a specific area. Individuals with degenerative brain diseases, like Alzheimer's, have losses in gray matter but not in white matter. Multiple sclerosis is a disease affecting white matter.

Muller et al. (2008) used VBM to look at the frontal cortex and the superior temporal gyrus in criminal psychopaths. They found significant volume loss in gray matter in psychopaths compared to controls in both frontal and temporal brain regions. All of the psychopathic patients used in this study had normal MR imaging, meaning no brain lesion was present. Raine et al. also used VBM to investigate 21 persons with antisocial personality disorder and found an 11% reduction in prefrontal gray matter (Raine et al. 2000). Similar results were also reported by de Oliveira-Souza et al. (2008). These results indicate that psychopaths not only are defective in how they process emotional information in their brains (fMRI results), but they also have less brain tissue in important areas of their brain compared to normals (VBM results).

However, the notion that less brain tissue in frontal cortex is the cause of psychopathy may be too simplistic. Yang et al. (2005) compared prefrontal gray matter in "unsuccessful" psychopaths (those who have been caught by authorities for crimes committed) to "successful" (uncaught) psychopaths. The caught psychopaths showed a reduction of 22 percent in frontal gray matter compared to the uncaught psychopaths. While the notion of "community psychopaths" may be unsettling to some, remember that in our criminal justice system, guilt is based on one's actions, not one's thoughts or desires. In a study of 203 corporate professionals, the underlying latent structure of psychopathy in a subsample was consistent with the model found in community and offender studies (Babiak et al. 2010). These uncaught psychopaths may not have broken any laws, or may have and not yet been caught. The difference in frontal gray matter reported by Yang et al. may account for the fact that this group is savvy enough to stay out of jail. They are walking around with a diagnosis of antisocial personality and have scored high on the psychopathy scale. More studies need to be carried out on this population of community psychopaths, using scanning techniques to test the processing of emotional information. Where it has been looked at, psychopathic attributes fall on a continuous scale in noninstitutionalized populations (Levinson et al. 1995).

SUMMARY

The study of moral behavior has been dominated for centuries by theories that emphasize the role of reasoning in the moral judgment of humanity. Morality-driven behaviors have traditionally been attributed to logically and verbally mediated processes, commonly referred to as moral reasoning and judgment (Garcia and Ostrosky-Solis 2006). Recently, converging lines of evidence from evolutionary biology, neuroscience, and cognitive psychology have shown that morality is grounded in the brain (Moll et al. 2003). The current model has the limbic system and the social brain network playing major roles in the everyday thoughts and actions concerned with moral (social) events and moral (social) judgments. This model can also provide a basis for interpreting the impairments of moral behavior seen in neuropsychiatric disorders. It appears fitting that emotions are the driving force behind the neurobiology of social interaction. As evolution proceeded toward living in larger social groups and increasing brain size, it seems natural that the parallel evolution of neural systems would call upon the emotional circuits of the brain to adapt to the newer conditions. It is the basic limbic system that allowed mammals to survive so long on the planet in the first place.

It is some comfort, at least to this observer, that the basic position of the social brain network is to provide empathy, rapid identification of mood and affect in others, a strong sense of fairness, as well as compassion, altruism, and love. The default position of humans from birth, when it is not interfered with by abuse or illness, is to be empathetic, social, and concerned about their fellow human being. Mendez (2009) has summed this up succinctly: "Humans have an innate moral sense."

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