HARDWIRED BEHAVIOR

WHAT NEUROSCIENCE REVEALS ABOUT MORALITY

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Neuroscience advances during the past few decades have been nothing short of astounding. Our notions about how the brain works and the relationship between mind and brain have been radically changed as we have come to understand how parts of the brain function to provide a wide range of human functions – from short- and long-term memory to the production of fear when certain areas of the brain (most particularly, the amygdala) are activated, and to how the brain's cognitive centers influence and are influenced by regions of the brain that produce emotions.

Many traditional notions of the "mind" as it reflects a dichotomy between mind and body are being revised. Evidence that the brain "makes" the mind is strengthening with indications that brain and mind are not two entirely different realms, but rather that the physical brain has the major role in creating and shaping our emotions and thinking.

With these ideas in mind, I began wondering about the impact of the brain on moral thinking. Because the brain is basic to decision making, it must play a powerful role in our thinking regarding moral issues, and consequently in the way we treat each other in our society to maintain order and uphold fairness, individual rights, and equity. Through my research on these issues as they involve a wide range of behavior, I learned that much thinking and some research have already gone into the impact of neuroscience on morality. Our view of morality has already been altered by new understanding

of brain biology, and at the rate that new discoveries are being made, that view will change even more in the future. With these changes will come the understanding that we can intervene at the most fundamental biological levels to affect moral development. Herein lies the primary dilemma posed by these new advances: The modifications in morality empowered by neuroscience will lead to hard choices on how we as a society want to handle these changes, how we want to deal with each other, and the untoward potential consequences of a biologically engineered morality.

Moral Precepts

When I started to think about the biology of morality, I cast around for a frame of reference, one that would help me convey how our culture identifies and classifies right and wrong. My first instinct was to look to religion; all religions have well-defined notions as to what is "good" and what is "evil," and with minor variations religions are in agreement about serious immoral acts. Murder, stealing another's property, and infidelity are forbidden by nearly all the world's religions. These notions of right and wrong have provided a set of rules for human conduct, particularly involving personal relationships, and form the infrastructure of a socially constructed system that exerts, at the very least, informal controls over individual behavior.

According to the Judeo-Christian tradition – which has been the foundation of social morality and laws in Western cultures – from as far back as Genesis humanity has been forced to confront evil. When Adam and Eve disobeyed God and fell from grace, this tradition holds, they changed the nature of Man. The Old and New Testaments caution us each to work every minute of our lives to be faithful to the integrity of our soul, which reflects God's wishes for goodness.

An important dimension of our grappling with our potential for "evil" is self-awareness. Of the ancient philosophers Socrates was reputed to be the first to espouse the value of "Know thyself" as a guiding principle, and over the centuries this "self-knowledge"

has not been limited to recognizing our desires and unique abilities. It has required searching within ourselves for knowledge of our "dark" side, our predisposition for evil. Worldly considerations and our emotions may lead us to the ways of "evil" but – theoretically at least, in the Socratic view – we can gain control over these tendencies by understanding our deepest feelings, passions, and needs.

To heed Socrates' advice in our day and age in culturally diverse societies is daunting, to say the least. I suggest that we examine instead the moral precepts developed as guides by humankind in the postclassical world. These precepts may have once been religion-specific, but today they apply generally to civilized societies and, despite their once religious pedigree, have a modern ring to them. They are in fact the moral values that we generally embrace – secular descriptions of our modern moral consensus.

The "moral" proscriptions on behavior appear in one section or another of the Old and New Testaments. In the Jewish faith, the Sixth through the Tenth Commandments, and in later Christianity's Seven Deadly Sins, certain behavior that we might term immoral for all human society is proscribed. The Deadly Sins is a listing believed to be the work of Saint John Cassian, a monk who lived in Egypt and France during the latter part of the fourth and early fifth centuries.[1] Cassian wrote two principal works of rules for governing the monastic life,[2] which included eight books devoted to what he called obstacles to perfection – impurity, covetousness, gluttony, anger, ennui, vainglory, pride, and dejection. Pope Saint Gregory (the Great), who lived from the middle of the sixth to the early part of the seventh century, has been credited with refining the list to the Seven Deadly Sins (or "capital vices").[3] His list was closer to the modern one and did not include some of the terms, like "ennui" or "dejection" (though "ennui" might be interpreted as distantly related to "sloth").

These moral precepts fundamental to Judaism and Christianity have permeated Western culture, serving as the basis of countless literary works over the centuries. Dante in his *Divine Comedy* conceived of moral infractions as transgressions against "love," and grouped them according to three broad classes: wrath and pride;

infractions that created "insufficient" love, such as sloth; and finally lust and greed, inducing "excessive" love or undue desire for material goods.

Geoffrey Chaucer in *Canterbury Tales* and Edmund Spenser in *The Faerie Queene* explicitly addressed these moral infractions. Spenser created visual images of individual immoral acts like gluttony and lust. In the early nineteenth century, the novelist Jane Austen devoted much of *Pride and Prejudice* to the impact of her leading male character's pride on the society around him and to the biased reactions of the woman (Elizabeth Bennet) he had grown to love. More recently Stephen Sondheim and George Furth, in their play *Getting Away with Murder,* constructed characters to represent the Seven Deadly Sins. An entire series of murder mysteries by Lawrence Sanders takes its titles from these sins.

In relation to contemporary secular society, each moral transgression anchors an evil. Within this framework we go from mild or seemingly insignificant nuances of infractions to the most profound offenses, such as those described in the Ten Commandments. Nearly every act that we may deem immoral relates to one or another of these breaches. Wrath or anger, for instance, can be petty, manifesting itself in social slights against another person, such as not inviting someone to an important social event because of unresolved past grievances. It can also be the basis of harmful psychological and physical acts. At the very extreme, homicide and even suicide find their sources in anger. Lust can also fall along a spectrum from a private interest in pornographic magazines and salacious movies to the imposition of one's sexual desires on another person, such as taking advantage of one's superior position to demand favors. When combined with anger, lust can lead to serious criminal behavior and sexual psychopathy – rape, assault to exact sexual pleasure, and even homicide.

Behavior that might easily classify as "greed" or avarice also falls along a spectrum from mild to serious. Mild greed might be an unwillingness to donate one's money to assist a socially important cause. On the more extreme level of greed are the many white-collar crimes of corporate executives skimming off millions for themselves at the expense of employees who suffer devastating reductions in

their retirement savings and the prospect of serious financial problems as they get older. In many cases this is done with the contrived appearance of legitimacy; in others, money is confiscated or embezzled by those in a position of trust. Perhaps even more reprehensible is when greed goes beyond acquiring money and goods to involve the physical destruction of innocent people, as when the clerk in a convenience store is shot for a few dollars in the till.

Do Moral Precepts Arise from Social Concerns?

The Ten Commandments and the Seven Deadlies are handy and simple references whose fame has spread far from their original sources: Moses (if you will), a Catholic saint, and a pope. And that begs a question: If Moses, Saint John, and Saint Gregory hadn't articulated them, would someone else have? I think so. Morality deals with people and how they relate to one another. One can engage in immoral acts by oneself, like shooting up heroin or snorting cocaine, but one is not immoral alone. One's actions – even if essentially victimless – affect others in society.

Social scientists have theorized for years that morality has its roots in primitive societies, claiming that the ways people treated each other determined whether they would survive or fail in the natural world. Men had to learn to work together to obtain food and protect their families against predators and natural disasters. In the formation of the family unit and of societies that would focus on the common good, rules of conduct emerged to ensure that communities would work in harmony and that dissension would be minimized or completely averted.

Basic human emotions, such as the territorial imperative (the need to control land and other property, as well as defined and predictable relationships, particularly with mates),[4] and the desire for love, affection, and respect had to be recognized and carefully factored into the structure of community. A male who aggressively sought out another person's property and disrupted that family unit by seducing the other man's wife would create enormous tensions, not just between the two males, but within the community at large.

These tensions would be destabilizing and could lead to serious disorder and the weakening of the bonds in the community.

By the same token, it is important to recognize that these "sins" involve behaviors that created an evolutionary advantage during certain early phases of man's development. They served the ends of individuals and to some extent groups. For example, greed and aggression (which activates the same reward pathways as drugs of abuse) led to ruthless leaders. The compulsion to eat, reflective of genes that lead to obsessive behavior, had the advantage of holding people over during periods of famine. Women having "extramarital" affairs resulted in children, which increased genetic diversity. Even homicide, during periods of limited resources, ensured the survival of some over others; perhaps, arguably, the stronger physically and emotionally would succeed.

The creation of "community" did not happen overnight; it developed over many millennia. People came to understand that emotions like shame, guilt, disgust, and fear of abandonment could be used to induce the individual to practice self-control for the common good.[5] Hence, according to many social scientists, agreed-upon morality came to serve as the device to use these emotions to control individual behavior. Over time, some system of rules for behavior had to prevail if a community was to prevent its own disintegration.

Today, research in evolution, genetics, and neuroscience is showing that what appeared to evolve from social need had in fact far more complex origins. It now seems more likely that human biology had to be of a certain type for society to be shaped in particular ways.

A new science, evolutionary psychology, emerged in the 1990s to focus on explaining human behavior against the backdrop of Darwinian theory.[6] This science considers how the biological forces of genetics and neurotransmissions in the brain influence unconscious strategies and conscious intentions, and proposes that these features of biology undergo subtle but continuous change through evolution.

Though it is indeed a social construct, morality gets its timelessness and universality from the human brain. The community's de-

mands for cohesiveness and continued existence – its own ideas of what is appropriate human behavior – brought into play certain qualities that were already present in the human brain.

We have some evidence to support this view. We know that the limbic structures of the brain, often referred to as the "old" brain, are the physical circuitry for our emotional responses – fear, disgust, guilt – to the environment. These structures work in concert with the prefrontal lobe to attach emotions to specific behaviors. When we have done something that we feel was terribly wrong – like failing the final examination in mathematics in college because we stayed up the night before at a party – our prefrontal lobe considers the facts and checks them against a particular set of emotions. We feel shame because we have been trained from childhood to understand that our parents and friends will look disparagingly at our failure. Over time we internalize that emotional response and automatically feel shame whenever we are not successful.

Similarly, guilt can be induced by certain kinds of behavior that our family and society see as bad. When we cheat on a test because we are ill prepared, or simply can't understand the complexity of the problems being presented, we naturally feel guilty about it.

We are not constructed to have consistent reactions of guilt or shame to specific types of behavior. Changes in attitudes and mores about human conduct will bring about adaptation in us to conform to what is going on in the environment. Certain thoughts and actions have always resulted in feelings of guilt, shame, and fear. Most significant of these are incest and homicide. Many kinds of behavior, however, are perceived differently by society now than they were even a hundred years ago. For example, attitudes toward premarital sex and infidelity have changed again and again and radically through the ages, depending upon a given society's mores. What was totally unacceptable a mere hundred years ago in our society, for example, may today be treated with a "get over it" attitude or by divorce.

Support for the evolutionary and biological thesis of social morality comes from our understanding of natural selection and evolution from primates and other animals.[7] Darwin recognized that social instincts exist among animals and believed that the development

of a moral conscience was related to well-developed intellectual powers.[8]

Thomas Huxley,[9] one of the major proponents of Darwinian theory, and more recently Richard Dawkins,[10] felt strongly that morality had to be learned, as a person was born to be basically self-interested, or selfish. Huxley went so far as to claim that human nature was fundamentally evil, with morality essentially a human invention. He saw it as a system to control competition and selfishness.[11]

Recently conducted research by many evolutionary scholars – most particularly the cognitive ethologist Frans de Waal – has questioned the validity of Huxley's and Dawkins' views. Since the early 1900s biologists have been aware of how evolution favors mutual assistance among animals.[12] In *Good Natured: The Origins of Right and Wrong in Humans and Other Animals*,[13] de Waal writes about his discovery that primates engage in many acts, such as sharing food, that are antecedents or building blocks of morality.[14] Sharing (which is not limited to apes)[15] may take the form of "reciprocal altruism," where even though giving is contingent on receiving, there may be a time lag before the favor is returned and the benefit to the recipient may require a significant cost and risk to the giver.[16]

De Waal and his colleagues have also shown that apes and even monkeys hold negative acts in mind as well and are capable of revenge.[17] Violations of the social code, such as when a chimpanzee cheats another chimpanzee by not returning a favor, can result in what has been called "moralistic" aggression. Furthermore he has found that nonhuman primates are capable of conflict resolution, consolation, and expressing empathy, sympathy, and even community concern.[18]

Neuroscience and Moral Precepts

The fact that morality in humans evolved from other primates and depends on the brain for its universality and stability does not negate the importance of social forces in its creation, or the role of "free will" in its execution. The moral proscriptions in the Judeo-

Christian tradition are our articulation of responses etched in the biological structure of the brain. We have the ability to understand how these proscriptions developed and to recognize the importance of regulating them for an ordered society. Furthermore we can alter our behavior to square with our understanding of the wrongness of certain behavior, and we can thus exert control over our emotional responses to provocations.

Recent neuroscience discoveries are adding twists to this equation. We are getting a handle on brain biology as it relates to specific moral precepts, and in time all of them will be seen as originating, to some degree, in biology. This understanding might suggest that under certain conditions "immoral" behavior is not necessarily the product of willful acts. By controlling behavior, brain biology might be responsible for some of the extreme manifestations of these bad behaviors. In that case, some individual "sins" may not be "sins" at all.

Three of the Seven Deadlies, for example, have already been shown to be affected by biological factors in varying degrees, and in some cases the individual may have little power, or "free will," to prevent them from happening. These three are gluttony, sloth, and lust.

Gluttony is a complex concept, but we have made some progress in understanding it. To a large extent, the "immoral" character of gluttony flows from the notion that this behavior consists of excessive consumption, waste, and a basic unwillingness to exert self-discipline. It is this tendency toward excessive self-indulgence that most likely resulted in gluttony's inclusion as one of the Seven Deadly Sins.

With regard to the most conspicuous display of society's notion of gluttony – obesity – the two conditions are not always compatible. Many causes of obesity have nothing to do with lack of control or excessive self-indulgence. Metabolism, which is genetically determined, can result in weight gain despite efforts toward control of excessive eating. Studies have shown that obesity may involve either of two brain systems: the system that sends hunger and satiation messages to the brain or the system associated with the reward circuits involved in drug (cocaine, heroin, marijuana) addiction.

Gluttony is on its way to being seen as part of the spectrum of addictive diseases. Research is already showing that gluttony and obesity may involve abnormalities in specific areas of the brain. With the use of positron emission tomography (PET scans), researchers have shown within the past few years that the human brain is highly sensitive to food and that the presence of food increases brain metabolism in specific areas.[19] Increased metabolism in the right orbitofrontal cortex correlates highly with self-reports of increased hunger and desire for food, just as it does for drugs in those who are addicted.

Sloth, or pathological laziness (another of the Seven Deadlies), is closely aligned to depression. A person experiencing serious depression has no desire to do anything. Some people suffer a "retarded" depression, which means that they think and move slowly, are unable to concentrate and focus on information, and may experience some memory loss. This is clearly a biological condition, as we know that in depression major neurotransmitters – in particular serotonin, dopamine, and norepinephrine – have been decreased in amounts in the synapses of neurons located particularly in limbic structures. Though an individual may appear willfully lazy, often he (or she) is suffering from an underlying depression and is biologically limited in his ability to become active and productive.

The third "sin," which relates to the Sixth Commandment against adultery, is *lust.* The biology of testosterone and its impact on structures of the brain – such as the hypothalamus – of vulnerable individuals, mostly men, has been the focus of much research on sexual behavior. Again, extreme behavior seems to be aligned with addictive propensities in the brain. The power of "lust" varies among individuals. Some people have minimal sexual desires. This may be due to less testosterone, or to differences in the brain biology that responds to hormones. Others may have overactive libidos, whereby they become obsessed with sexual thoughts and indiscriminately engage in sexual behavior. The two extremes may reflect biological differences. The person consumed with lust may be powerless to exert free will and control his or her behavior. When lust is

combined with anger it can result in violent acts – rape, assault, and even murder.

With more research we are likely to find that other behaviors proscribed in the Ten Commandments or in the Deadly Sins are also influenced by biological factors. Such findings do not suggest that those afflicted with strong biological pressure are without responsibility for their behavior. But in some cases the biological influences may be so intense as to preclude restraints of behavior through free will. Neuroscience findings that are supporting the power of biology have been forcing a reexamination of the morality of much behavior, as well as the importance of handling abnormalities through medicine rather than guilt, shame, and criminal sanctions.

This is not to discount the relevance of "free will"; but under some circumstances its importance does diminish. In the same vein, I am not saying that there is no such thing as "immoral behavior" simply because we can demonstrate its specific biology. The idea of a moral transgression is a nontechnical compass pointing to behavior that can injure oneself or one's society. Biology is unlikely to supply all the answers necessary to erase the uncomfortable notion of immorality, but evidence is building that brain biology will make major advances in that direction.

In this book I examine the history of our general ideas about morality and its development through childhood; show how modern neuroscience research is shifting the focus to the brain as a physical organ shaping moral responses; and illustrate the outcome of defective "brain wiring" in the development of undesirable moral traits. Finally, a view through the crystal ball into the future will explore how the shift to "physicalism" will lead to hard choices about how we deal with each other, and will discuss the potential for political control to create a homogenized moral society.