

## OUR BRAINS ARE WIRED FOR MORALITY: EVOLUTION, DEVELOPMENT, AND NEUROSCIENCE

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Psychological and neuroscience research both tell us that morality, our mental ability to tell right from wrong in our behaviors and the behaviors of others, is a product of evolution. Morality has been passed on through the course of evolution because it helps us to live in large social groups by enhancing our ability to get along and interact with others. “Building blocks” of morality, such as sensing fairness, experiencing empathy, and judging others’ harmful and helpful actions, can be observed in infancy, before a child’s social environment would be able to have a strong influence. Specific parts of the human brain are involved in moral reasoning – both the kind that happens very quickly and the kind that is thought out. Damage to certain parts of the brain can dramatically alter moral judgment and behavior. Although human morality has been passed down through evolution, it is also dependent on the culture in which we grow up. What humans consider to be moral behavior varies from culture to culture and also varies across time.

## INTRODUCTION

How do we distinguish good from evil, right from wrong, just from unjust, and vice from virtue? An obvious answer is that we have learned to do so through socialization, that is, our behaviors were shaped from birth onward by our families, our preschools, and almost everything we contacted in our environments. Morality is an inner sense of rightness about our behavior and the behavior of others. How we feel, think, and act about the concepts of “good” and “bad” are all parts of our morality. For example, hitting another person for any reason is seen as bad, while sharing something we like with another child who is sad is considered good. Morality is so deeply rooted in the fabric of our everyday lives that it seems hard to imagine a society without any moral rules. Indeed, observations made by scientists who study different societies around the world have shown that, despite cultural and individual differences, all human beings have some sense of right and wrong.

When we use the word “morality” we are generally talking about ideas of justice, fairness and rights, and the rules we have about how people should treat one another. Consider the following: as a reward for finishing your homework, you have been given 10 marbles that you really like. You are then told about a poor child who would not be able to get any marbles, even though he did his homework too. However, you have the option to give some of your marbles to the poor child. What would you choose to do? Most children would naturally share some of their marbles with a poor child and would also be surprised if another child received more than 10 marbles after doing the same amount of homework! This shows that children understand both fairness and justice. As humans, when we consider how we or others should share something we have been given, we tend to take into account both how much of a reward someone deserves for the “work” they did and whether rewards are evenly split between individuals.

Humans are an extremely social species. We are dependent on each other and cannot survive and flourish without interacting with others. Newborns only survive to adulthood if given enough care, and societies succeed through cooperation. Almost all of our actions and thoughts are about others or are in response to others. We cooperate with and help people who are not related to us at a level that is unmatched in the animal kingdom [1]. Since humans are, by nature, both helpful and selfish, we think that morality evolved to support our helpful social interactions with others and control our somewhat selfish tendencies.

However, it would be misleading to see morality as only a result of evolution. Although some human traits, like skin color, are determined by our genes alone, morality is quite different in that it is also determined both by our nature and the society in which we live. Many moral rules and values vary between

different cultures and also change over time. For instance, bull fighting is seen as a cruel form of entertainment or even as animal torture in North America and most European countries, but it is still very popular in Spain and Colombia where it is considered a form of expression, despite the obvious suffering of the animals. An example of a shift in morality over time is our attitude toward slavery. Most people in the world today think that it is immoral to own slaves but that was not the case a century ago.

Thus, our morality has been formed over thousands of years from the combination of both our genes and our culture, rather than just one or the other. This genetic and cultural evolution has shaped our brains to care for others, react to those who try to harm us, and to create moral rules that help us to live together successfully [2].

There are three main lines of evidence that support the view that our brains are wired for morality. (1) The “building blocks” of morality have been observed in non-human animals, (2) even very young babies appear to exhibit some **basic moral evaluations**, and (3) the parts of the brain involved in moral judgments are beginning to be identified.

### BUILDING BLOCKS OF MORALITY IN NON-HUMAN SPECIES

Natural observations of animals in the wild and research in laboratories show us that a number of “building blocks” of moral behavior can be found in animals. For instance, many animals exhibit behaviors that benefit other members of their species. Such **prosocial behaviors** (meaning behaviors that are good for others), like helping each other and caring for offspring, have been seen in rodents and primates. Rats will help other distressed rats that have been soaked with water, and it will also choose to help a cage mate that is in distress before obtaining a food reward. Chimpanzees will help each other and share with each other, but only when they benefit from the sharing, as long as the costs are minimal and the needs of the other chimpanzees are clear. Chimpanzees also collaborate and form alliances in fights or when hunting. Capuchin monkeys have even been shown to react in a negative way when they see other monkeys being treated unfairly.

Humans often try to comfort or console other humans who have been hurt or are afraid. Chimpanzees will also try to console the “victim” of a fight by grooming, hugging, and kissing. This behavior decreases the level of stress that the victim feels. Helping behaviors have also been demonstrated in mice and rats. Importantly, with both humans and animals, these prosocial behaviors are more likely to be shown toward kin (those related to the animal) and members of the same social groups. These examples illustrate that **empathy**, which is the ability to “feel” another’s emotional state, often leads to prosocial

#### SOCIOMORAL EVALUATION

Is considered to be a precursor to mature morality in babies and involves basic appraisals of the social interactions of others.

#### PROSOCIAL BEHAVIOR

Refers to any behavior intended to benefit another individual.

#### EMPATHY

Is the ability to “feel” the emotions that another person is experiencing, often leading to the motivation to care for someone in distress or need.

**KIN**

Refers to one's relatives or family with whom genes are shared.

behaviors and is present in many mammals. Empathy does not require conscious thinking or language. Empathy originally evolved to promote parental care for their offspring, but it is now expressed by humans in many different ways and is not restricted to **kin**.

Of course, just because we can observe some building blocks of morality in non-human animals does not mean that those animals have the same sense of morality that humans do. But, it strongly suggests that morality is a product of evolution. When behaviors seen in the animal kingdom are similar to behaviors found in humans, it suggests that these behaviors have been selected, because they increase the ability of humans to prosper both as individuals and in the groups in which they live.

**EVIDENCE FOR MORAL BEHAVIOR IN BABIES**

When we see early signs of morality in young babies, this provides strong evidence for the evolutionary roots of morality, because babies have not yet had much time to be influenced by their environment. Psychologists who study human development have shown that human babies enter the world ready to pay attention and respond to social stimuli, such as voices and faces, and that babies begin forming social relationships during the first year of life. Young children provide comfort and assistance to both other children and adults in emotional distress. For instance, when they see their mothers in pain, 18-month-old toddlers show comforting behaviors (such as hugging, patting, and sharing toys). As infants develop and become more able to analyze what is going on around them, they even have the ability to recognize when a person in their environment is treating another person badly. At a young age, infants are quickly able to figure out whether the consequence of a behavior is good or bad, suggesting that their genes are involved and that experience and learning are not the only causes of moral development. At just 3 months of age, infants spend more time looking at a puppet character that has previously acted in a nice way than at one that acted in a negative way, suggesting that infants prefer those who “do good things.” By 6 months of age, this preference is stronger, with children not only looking more at helpful and nice puppet characters but also actually reaching for them [3]. By 12 months of age, infants begin to understand the concept of fairness. When these infants witness cookies being shared, they expect an equal number of cookies to be given to all of the people involved.

Taken together, evidence from these laboratory studies tells us that children under the age of 2 have a very good understanding of which actions will benefit others. However, as children get older, the expression of their morality changes. For example, while infants seem to see fairness as equality (everyone should get the same number of cookies, for example), teenagers tend to prefer giving more resources to those who do not have any already or to those who

worked harder. Thus, these early tendencies (in infancy) are considered to be the foundation for, but not the exact same as, adult morality. Our concepts of morality are built from the combination of emotions, motivations, and our increasing level of mental understanding as we develop.

## THE ROLE OF THE BRAIN IN MORALITY

Our understanding of the role of the brain in morality is largely based on the three different methods. The first is the study of people with brain lesions, meaning individuals who have had an area of the brain removed in surgery or have experienced an injury to a certain area in an accident [4]. Neuroscientists (scientists who study the brain and nervous system) examine how moral behaviors change in these people. Another way to understand the role the brain plays in morality is to use MRI scanners or electrophysiology (EEG) to image the brain as it functions. In these experiments, neuroscientists presented children and adults with moral tasks or activities and looked at which regions of the brain were activated while the participants performed these activities. Finally, chemicals in the brain can also be explored to see if they might play a role in moral behaviors (see Box 1).

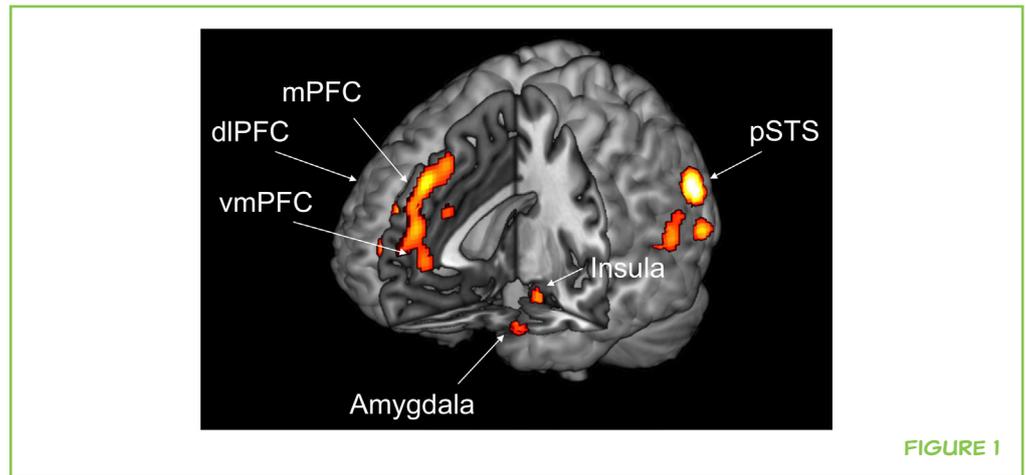
To determine which parts of the brain are involved in moral decisions, neuroscientists designed an experiment in which people have their brains imaged as they are performing tasks related to morality. For example, they were shown pictures or asked to read stories about situations that would usually be considered right or wrong, such as a story in which someone is hurt for no reason, or they were asked to make a difficult decision, such as whether they would steal a drug at a pharmacy to save the life of a sick child. These studies show that specific regions of the brain are responsible for morality and moral decision-making (Figure 1; Box 2). Other studies with children have also taught us about the parts of the brain that play a role in morality. These children were shown videos of cartoon characters either pushing and shoving others (bad) or comforting and sharing with others (good). Infants as young as 12 months of age showed differences in the way their brains reacted to the good and bad actions, and these differences were seen <500 ms (less time than a snap of

### BOX 1 - BRAIN CHEMICALS AND MORALITY.

Several chemicals produced in the brain, called neuromodulators, influence morality. The hormone, oxytocin, though wrongly called the moral molecule, has received a lot of attention and hype. In humans, oxytocin does increase trust and generosity in some situations but can increase envy and bias in others. What is really interesting from an evolutionary perspective is that this is a very ancient molecule that, across mammalian species, plays a critical role in the mother-child relationship by increasing bonding and reducing fear and anxiety. Another neuromodulator, serotonin, is involved in social behaviors, particularly aggression, and is manufactured in the brain and the intestines. Serotonin has been shown to influence moral judgment by enhancing the negative feelings we have in response to see others experience harm.

**FIGURE 1**

Morality requires an interaction among several separate but connected brain regions, in particular the posterior superior temporal sulcus (pSTS), the insula, the amygdala, the medial prefrontal cortex (mPFC), the dorsolateral prefrontal cortex (dlPFC), and the ventromedial prefrontal cortex (vmPFC). Morality thus involves several different processes, which are necessary to understand why other people behave the way they do and to help us feel the emotions necessary for making moral decisions.

**FIGURE 1**

**BOX 2 - THE HUMAN BRAIN DOES NOT HAVE ONE MORAL CENTER OR ONE SYSTEM THAT IS DEVOTED SOLELY TO MAKE MORAL DECISIONS.**

Instead, various regions and circuits of the brain that are associated with emotion, planning, problem solving, understanding others, and social behavior are recruited when making moral judgments. These parts of the brain include

- Medial prefrontal cortex plays an important role in interpreting and understanding the thoughts and mental states of ourselves and others.
- Amygdala is important for emotional (positive and negative) reactions.
- Ventromedial prefrontal cortex: a critical hub for caregiving behaviors, morality, and decision-making, by combining cognitive and emotional processes necessary to guide social behavior.
- Dorsolateral prefrontal cortex plays an important role in self-control and intelligence.
- Insula provides the foundation for being aware of our body feels.
- Posterior superior temporal sulcus is a key region to understand the intentions of others.

your fingers) after they saw these actions [5]! However, most moral judgments require both a rapid, automatic reaction guided by an emotional response, and a more slower reasoning capacity.

An area of the brain called the ventromedial prefrontal cortex has been found to be important for certain aspects of human morality. If this brain region is damaged early in life (before 5 years of age), the person is more likely to break moral rules or inflict harm on others, suggesting that the ventromedial prefrontal cortex helps us to understand what is and is not moral. Patients who have damage to this brain region or who have had it removed also tend to experience less empathy, embarrassment, and guilt than people without damage to this region.

## CONCLUSION

Using evidence from evolutionary biology, developmental psychology, and neuroscience, we have come to realize that morality is not merely the result of cultural learning, handed to us from our families, peers, and environment.

Morality was selected by evolution in our human ancestors in order to promote cooperation and smooth social interactions. Developmental psychologists have demonstrated that some building blocks of morality are in place very early in development [3]. Additionally, the parts of the brain and the brain chemicals involved in morality and decision-making are beginning to be identified.

Morality is a product of evolution but that does not mean that it is set in stone and totally unchangeable. The culture in which we live influences what we think is right and wrong. For instance, second-hand smoking was totally ignored some decades ago, while in Western Europe and North America, it is now considered morally (as well as medically) wrong. In a nutshell, we create our own definition of morality through our interactions with the people around us. Ideas about what is and what is not moral are guided by our unique human reasoning and intelligence, and not just by our feelings or gut reactions. It is reason, and not emotion, that provides the push to widen the circle of empathy and concern for others beyond those related to us and our community.

Neuroscience, psychology, and evolutionary biology will continue to help us gain a better understanding of how we think and make moral decisions [2]. Future research in neuroscience will help us to explain how we make decisions, weigh our options, reflect on our desires, and modify our behaviors on the basis of their moral consequences. Hopefully, Science will also help us to understand why some people, like psychopaths, are not able to act morally, and discover ways to help them.

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### BEA, 12 YEARS OLD

My name is Bea and I am 12 years old. I like wearing vintage clothes, reading books, and playing with my cats.



### SADIE, 13 YEARS OLD

My name is Sadie. I am 13 years old and am in seventh grade. I love school, and the topics that I really enjoy are Science, Math, English, Latin, Arabic, and History. I also enjoy sports and have participated in soccer and track and field. Outside of school some of my hobbies include competitive/noncompetitive sailing, swimming, windsurfing, reading, hanging out with my friends, and art.



### THADDEUS, 13 YEARS OLD

Hi my name is Thaddeus; I am a student who enjoys Math, Science, and Latin. I sail and play squash, as well as practice archery. I like video games and YouTube. My favorite food is anything that is Asian. I play chess and I have a rating. I like school, but not homework. If I could make one change in school it would be to make school longer but have no homework. Most of what I do after school is Science related.

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