

## KEY NOTES

Research that sheds light on the development of human values presents a bridge between neuroscience and the humanities by enhancing our understanding in varied realms, including moral behavior, aesthetics, politics, economics and education.

In humans, education and acculturation add a set of socially permissible and desirable decision-making strategies on top of our automatic survival mechanisms. These suprainstinctual survival strategies generate something probably unique to humans: a moral point of view that, on occasion, can transcend the interests of the immediate group and even of the species.

It is tempting to believe that neuroscience can not only assist us with comprehension of the human condition, but that in doing so it can help us understand social conflict and contribute to its alleviation. This is not to suggest that neuroscience can save the world, but simply that the gradual accrual of knowledge about human beings can help us find better ways to manage human affairs.

# SOCIAL IMPLICATIONS OF RECENT ADVANCES IN THE NEUROSCIENCES

The impressive social cooperation of ant and bees—which most any day could easily put to shame the United Nations General Assembly—clearly is based on innate neural control rather than on the insects' capacity for memory, reasoning or creativity. Antonio Damasio, David Dornsife Professor of Neuroscience, Neurology and Psychology at the University of Southern California, explains that humans possess some of the same innate mechanisms as insects, and that such mechanisms are the likely basis for some ethical structures used by humans. The elaborate social conventions and ethical structures by which we live, however, must have arisen and been transmitted via culture. Damasio posits that ethical structures evolved as survival strategies in humans, who had developed the brain capacity to realize that their survival was threatened or that the quality of their post-survival life could be bettered. He describes primary innate emotions, such as fear, anger and happiness, and finer social emotions such as shame, compassion and admiration. These social emotions embody moral knowledge and are clearly fundamentally human. They enable us to develop culture and effectively deal with our complex human environment. Research that sheds light on the development of human values presents a bridge between neuroscience and the humanities by enhancing our understanding in varied realms, including moral behavior, aesthetics, politics, economics and education.

## Emotions and Feelings

*Emotions* and *feelings* normally are conflated and used interchangeably. But to fully understand the relevance of recent developments in neuroscience

to society and culture (and to devise good research strategies), it is important to distinguish between emotions and feelings.

The primary emotions—fear, anger, happiness, sadness and disgust—are innate, non-conscious decision-making mechanisms driven by our genomes. They are incredibly well-patterned and allow living beings to *act* smartly without having to *think* smartly—as when we either freeze or run in fear. That programmed action is unde-liberated and automatic. Emotions are devoted to regulating and maintaining the stability of life, or homeostasis. The average states of our body correspond to functional balance, or homeostasis, within which the organism's economy most likely operates at its best, with less energy expenditure and simpler and faster adjustments to new situations. Departures from that state are familiar to all of us: upon hearing of the unexpected death of a friend or relative, for example, your heart may pound, your mouth dry up, your gut contract, your back and neck muscles tense, and your facial expressions change. There is more: a number of peptide modulators are released from your brain into the bloodstream; your immune system rapidly modifies; and the muscles in your artery walls contract, thinning the blood vessels and causing your skin to blanch. These changes in the body and brain are varied and massive, and a marvel of coordination.

The essence of emotion is the collection of changes in body state that are induced in myriad organs by nerve cell terminals, under the control of a dedicated brain system, which is responding to the content of thoughts relative to a particular entity or event. Many of the changes in body state are actually perceptible to an external observer. Indeed, the etymology of the word *emotion*

suggests an external direction, from the body: *emotion* signifies literally “movement out.” Other changes in body state are perceptible only to the owner of the body in which they occur. But there is more to emotion than its essence. Emotion is the combination of a mental evaluative process with dispositional responses to that process, mostly toward the body proper, resulting in an emotional body state, but also toward the brain itself, resulting in additional mental changes as well.

*Feelings* are the perception and experience of all the changes that constitute the emotional response. Several distinct somatosensory cortices in the insular and parietal regions of the brain in particular receive an account of what is happening in your body, moment to moment, which affords a “view” of the ever-changing landscape of your body during an emotion. It is important to realize that current body representations do not occur within a rigid cortical map, as decades of human brain diagrams have suggested. Rather, they occur as a dynamic, newly instantiated, “on-line” representation of what is happening in the body now. Their value resides with that freshness. If an emotion is a collection of changes in a body state connected to particular mental images that have activated a specific brain system, the essence of *feeling* an emotion is the experience of such changes in juxtaposition to the mental images present at the start of the cycle. That is, a fundamental condition of experiencing a feeling is the correlation of the ongoing representation of the body in the brain with the neural representations constituting the self.

Why is it important to distinguish emotions and feelings? One reason is that although some feelings relate to emotions, there are many that do not. I call these *background feelings*, and suspect that they preceded the others in evolution. Background feelings are more restricted in range than emotional feelings. In all probability, they are what we experience most frequently throughout our lives. The background feeling is our image of the body landscape when it is not shaken by emotion. The background body sense is continuous, although one may hardly notice it, since it represents not a specific part of anything in the body but rather an overall state of most everything in it. We are only subtly aware of a background feeling—but aware enough to be able to report promptly on its quality, as in responding to the specific question, “How do you *feel*?” with an answer that does relate to whether we feel fine or do not feel well. (Note that the question is not the simple “How are you?” to which one may reply politely and perfunctorily without saying anything about one’s body state.) Our individual identity is anchored on this stable continuity of background feelings, against which we can be aware of myriad other things that manifestly change around us. Patients with brain damage that disrupts this ongoing body-state mapping

can fail to recognize even dramatic body changes, such as paralysis following a stroke, and cannot reason effectively about their current personal and social state.

### **Leverage for Survival**

On the surface, the elementary secrets of the mind reside within the interaction of firing patterns generated by many neuron circuits, locally and globally, moment by moment, within the brain of a living organism. The human genome specifies the construction of our bodies in great detail, and that includes the overall design of the brain. But not all the circuits actively develop and work as set by genes. Much of each brain’s circuitry, at any given moment of adult life, is individual and unique, truly reflective of that particular organism’s history and circumstances. Moreover, each human organism operates in collectives of like beings; the mind and the behavior of individuals belonging to such collectives and operating in specific cultural and physical environments are not shaped merely by activity-driven circuitries and even less by genes alone. To understand the brain that fabricates the human mind and human behavior, it is necessary to take into account its social and cultural context. While it is apparent that humans possess some innate mechanisms, it is also clear that the elaborate social conventions and ethical structures by which we live must have arisen and been transmitted culturally.

What was the trigger for the cultural development of social conventions and ethical structures? It is likely that they evolved as a means to cope with the suffering experienced by individuals whose capacity to remember the past and anticipate the future had attained a remarkable development. In other words, the strategies evolved in individuals able to realize that their survival was threatened or that the quality of their post-survival life could be bettered. Such strategies could have evolved only in the few species whose brains had developed a large enough capacity to not only remember the past, but also manipulate and recombine those memories to anticipate outcomes and form new plans and new goals. I call these memorized creations “memories of the future.”

But why did suffering arise in the first place? Pain and pleasure are the levers the organism requires for instinctual and acquired strategies to operate efficiently. They occur when we become conscious of body-state profiles that clearly deviate from the base range. The configuration of stimuli and of brain activity patterns perceived as pain or pleasure are set a priori in the brain structure. They occur because circuits fire in a particular way, and those circuits exist because they were instructed genetically to form themselves in a particular way. Although our reactions to pain and pleasure can be modified by education, they



are a prime example of mental phenomena that depend on the activation of innate dispositions.

The activity pattern that corresponds to pain signals and the perceptual characteristics of the resulting representation are prescribed entirely by the brain but otherwise are not neurophysiologically different from any other kind of body perception. If this were all, I suggest that all you would experience would be a particular image of body change, without any troublesome consequence. However, the process doesn't stop there. The innocent processing of body change rapidly triggers a wave of additional body-state changes, which further deviate the overall body state from the base range. It is from the subsequent body-state deviations that the unpleasant *feeling*

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of suffering will be formed. The suffering puts us on notice. It offers us the best protection for survival, since it increases the probability that individuals will heed pain signals and act to avert their source or correct their consequences.

In all probability pain and pleasure were also the levers that controlled the development of social decision-making strategies. When many individuals, in social groups, experienced the painful consequences of psychological, social, and natural phenomena, it was possible to develop the intellectual and cultural strategies for coping with the experience of pain and perhaps reducing it.

### **Bridge to the Humanities**

The most universal primary emotions are happiness, sadness, fear, anger and disgust. These emotions correspond to profiles of body state response that are largely pre-programmed. When the body conforms to the profiles of one of these emotions, we feel happy, sad, fearful, angry or disgusted. When we have feelings connected with emotions, attention is allocated substantially to body signals, and parts of the body landscape move from the background to the foreground of our attention.

In humans, education and acculturation add a set of socially permissible and desirable decision-making strategies on top of these automatic survival mechanisms, which further

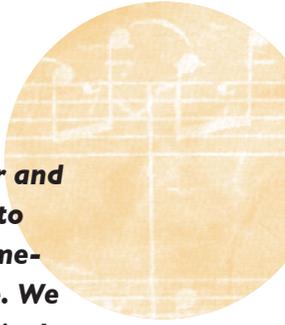
enhance our survival and serve as the basis for constructing a *person*. The neurophysiological base of those added strategies is interwoven with that of the instinctual repertoire and not only modifies its use but extends its reach. They require the intervention of society to become whatever they become, and thus are related as much to a given culture as to general neurobiology. These suprainstinctual survival strategies generate something probably unique to humans: a moral point of view that, on occasion, can transcend the interests of the immediate group and even of the species.

The most universal social emotions are shame, guilt, contempt, indignation, compassion, admiration and awe. These emotions are clearly fundamentally human, although vestigial forerunners of some of them can be found in primates, specifically the higher apes. That said, the social emotions are very strongly human, much as complex language is uniquely human. They developed out of collectives of human beings that found value in certain kinds of behavior in terms of survival and managing the complexity of their society. These emotions are finely tuned by the heavy action of parenting, guidance and education within the context of culture.

The social emotions embody moral knowledge. Consider shame and guilt: not only are you blaming yourself for something you did or did not do—a violation of some norm—but you are also applying punishment, very much in keeping with the definition of emotions. That is, you are doing something valuable to yourself and to the group because of the highly homeostatic corrective effect of being guilty or ashamed. In the case of admiration and awe, you are engaging the emotion that produces high reward for the target of your emotion.

I believe that admiration is one part of the wonder and awe system that is uniquely human. Humans need to want to be like someone or want to accomplish something to feel hope and be driven toward the future. We cannot be pulled by the future if we cannot cognitively construct a future that is worth being pulled into. This navigation of the future is very powerful. It is driven by emotions that serve to correct a sort of deficit, one that must be compensated for by achieving something or dreaming that we can achieve something.

These mechanisms of basic homeostasis constitute a blueprint for the cultural development of the human values that permit us to judge actions as good or evil, and classify objects as beautiful or ugly. As such, they offer hope that a two-way bridge can be established between neuroscience and the humanities. The intent is not to reduce ethics or aesthetics to brain circuitry, but rather to explore the threads that interconnect neuroscience to culture. Today, a number of brain studies have crossed into the realms of moral behavior, aesthetics, politics, economics and education. In the coming years, as the



research advances, I have no doubts that neuroscience will begin to address issues that have traditionally been dealt with in philosophy, the social sciences and the humanities—all in the spirit of partnership and striving to understand more about human nature.

The biological knowledge itself ultimately may help us design better educational systems. We now know, for example, that learning requires strength in the synapses that connect the neurons. The stronger the connections, the more readily the neurons fire. Microscopy allows us to observe anatomical changes in neurons and in gene expression at the level of the synaptic cleft. Knowledge does occupy space, albeit quite small, as neurons develop more connections and become richer. Thus the brain is not fully formed as a result of genomic action; on the contrary, it is formed under the impetus of the genome and then shaped by education and individual development.

Finally, with regard to the use of digital media, I am certain that children learn from each other via partnering and online peer-based interaction. However, the importance of supervision must be noted, as it is via supervision and guidance that the voice of what is most characteristic of human civilization—the social and moral standards that impose regulation on the behavior of society—is passed on.

## Conclusion

For quite some time now, humans have been in a new, thoughtful phase of evolution, in which their minds and brains can be both servants and masters of their bodies and the societies they constitute. Of course, there are risks when brains and minds that came from nature decide to play sorcerer's apprentice and

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influence nature itself. But there are also risks in not taking the challenge. Indeed, there are enormous risks in not doing anything. Doing just what comes naturally can only please those who are unable to imagine better worlds and better ways, those who believe they are already in the best of all possible worlds.

It is tempting to believe that neuroscience can not only assist us with comprehension of the human condition, but that in doing so it can help us understand social conflict and contribute to its alleviation. This is not to suggest that neuroscience can save the world, but simply that the gradual accrual of knowledge about human beings can help us find better ways to manage human affairs.



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