Dana Foundation Blog

Triggering the Brain's Emotional Response

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A relentless rain didn't keep attendees from filling the elegant auditorium at Columbia University's Italian Academy for Tuesday evening's panel discussion on "Shaping the Brain," a Brain Awareness Week event that also celebrated the Mind Brain Behavior Institute—a university-wide effort to integrate neuroscience with allied disciplines like psychology and statistics, but also studies in the humanities and social sciences.

"I see neuroscience as providing a modern angle on concepts derived and cultivated outside itself," said Columbia faculty and Dana Alliance member Michael Shadlen. "It's a two-way exchange, a dialogue."

Among the three Columbia professors who discussed their work, art historian David Freedberg best exemplified this broad vision. When he began his studies in the 70s, he said, "one was not allowed to talk about emotions in art, let alone the notion that when you look at a picture, your body is involved in the experience."

But this, he felt sure, was essential to the universal power of great artworks. "My aim was to reinsert emotions and the body back into the esthetic experience...and even in the mid-1980s I realized we couldn't go ahead without understanding the neural substrate of our emotional, visceral, physical responses to works of art."

Subsequent discoveries and speculations about "mirror neurons"—cells in the premotor cortex of a spectator that apparently fire in the same pattern as in the one performing an action—were a revelation to Freedberg; it helped explain why we felt as we did when viewing an emotionally engaging painting.

Freedberg's talk resembled the familiar college art history lecture—with a neuroscience edge. Projecting details from Rogier van der Weyden's great 15th century altarpiece in the Prado museum in Madrid, he suggested how the "slump of Christ's body," echoed in the

posture of the Virgin, might elicit our own emotions: "When we see someone making a gesture, we feel it in ourselves." He proposed that the "frisson" I experience at the sight of Christ's lacerated hand, in the same painting, reflected activation of my own somatosensory cortex.

When the head of the Medusa, depicted by the Italian master Caravaggio, appeared on the screen, "we start back... no one could fail to have a sense of fear," he said—courtesy of the amygdala, reacting to the open mouth and snaky hair of the painting as if we were faced with the monster itself.

Kevin Ochsner, a researcher in social cognitive neuroscience, invited us to imagine life without emotions, "to go on a honeymoon or view great art without the capacity to experience love, joy, or awe... to lose a family member or get into an argument without sadness, anger, or fear." Such experiences would be "pallid imitations of themselves," he said.

Beside adding richness to life, emotions are "the map, the compass that guide us to think, feel, and act," Ochsner said, describing research that found two-thirds of meaning ascribed to people, places, and things derive from brain systems that decide whether they are good or bad. Such "core evaluations" begin in ancient regions like the amygdala and ventral striatum, he said.

But emotions don't end there. Ochsner detailed what he and others have discovered about elaborations and modifications orchestrated throughout the higher brain: how the ventral medial prefrontal cortex puts our responses in context, and the lateral prefrontal cortex lets us consciously transform them (the primal fear of a snarling dog fades quickly if we tell ourselves "his bark is worse than his bite").

One of the evolutionarily newest regions, the dorsal medial prefrontal cortex, allows us to conceptualize and articulate our feelings, giving us the distinctly human capacity "to share our worries with others... and to write sonnets," he said.

For psychologist Frances A. Champagne, “the question that motivates my research is: “why are we unique? Is it our genes? Our experiences? Nature and nurture have been fighting it out for decades. We’re trying to find a resolution to that battle.” Research in her lab and elsewhere, Champagne said, seeks such resolution in epigenetics—the mechanism by which experience modifies gene expression. “DNA is compacted and needs to be read. Altering proteins associated with genes can make it harder or easier to read them, turn them “on” or “off.”

Environmental factors like smoking and pesticide exposure have known epigenetic effects—but so do social experiences, particularly in early life. “Good maternal care activates genes in the brain that allow offspring to self-regulate, to respond appropriately to stress in later years,” for example.

Events all through life may also change gene expression, Champagne said, and such changes are transmitted across generations. “Your experiences not only affect you, but your offspring too.”

—Carl Sherman

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