The Mind in the World: Culture and the Brain

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How the "outside" affects the "inside" is at the heart of many of the deepest psychological questions. In this fast-paced survey of research on how culture shapes cognition, Nalini Ambady examines the neural evidence for socio-cultural influences on thinking, judgment, and behavior. She does this by giving us numerous examples of group differences in core human capacities that are shaped by how "one's people" engage socially. I'm pleased to be able to share this piece with members of APS.

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Both the structure and function of the human brain throughout its development are shaped by the environment. The social environment, in turn, is shaped by culture. The emerging field of cultural neuroscience examines how the interplay and mutual constitution between neural and cultural forces gives rise to different patterns of behavior, perception, and cognition. The main goal of this emerging, young field is to understand how culture, which is comprised of behaviors, values, symbols, meaning systems, communication systems, rules, and conventions, is shaped by and in turn shapes the mind and brains of individuals in the culture. In order to accomplish this goal, state-of-the-art neuroscience techniques are being used to not only show how widely researched behavioral differences are manifested in the brain but also to highlight where such cultural differences are located. Research in this field has begun to rapidly uncover how psychological processes thought to be universal are affected by cultural

experience and exposure at both the behavioral and neural levels. Thus, recent advances from cultural neuroscience have demonstrated how even the most basic of functions, with expected similar behavioral outcomes across cultures, can have underlying differences at the level of the neuron.

Take mathematics, for example. Solving basic arithmetic problems activates the Broca's and Wernicke's brain areas, the main parts of the brain also involved in the processing of language. However, in a 2006 study comparing native Chinese and native English speakers solving these same simple math problems, Tang and colleagues discovered that among native Chinese speakers, there was not only less activation in these language-related areas than among the English speakers, but also more activation in the premotor cortex areas associated with movement. These researchers suggested that the source of this difference might be the Chinese language's focus on images and writing in contrast to the sound-focused English language in which each letter has a particular sound. Thus, areas associated with vision and movement might be more useful in accessing the rules for solving a math problem for Chinese speakers, whereas areas linked to language processing and verbal information might be more involved for English speakers' solution of the same problem. So although Chinese and Americans alike should arrive at the same conclusion that 2 + 2 = 4, the internal paths they navigate to get there seem to be quite different.

One of the most fundamental ways in which cultural beliefs, practices, and ideologies influence psychological processes is in the cognitive schema or self-construal style that people use to think about themselves and their relation to others. In particular, previous cultural psychology research has identified two main styles of self-construal: independent (or individualistic) and interdependent (or collectivistic). Individuals from independent cultures, such as the United States, tend to value their autonomy, uniqueness, freedom, and right to self-expression; whereas individuals from interdependent cultures, such as Japan, tend to prize social harmony, conformity, and adherence to group norms. In a 2007 study Zhu and his colleagues asked native Chinese and Western participants to decide whether a given trait adjective described themselves (self condition), their mother (mother condition), or an unrelated other (other condition), or if the adjective was pleasant or unpleasant (semantic condition). In Western participants, the medial prefrontal cortex, or the MPFC, a part of the brain implicated in processing self-referential information, was activated only in the self condition. In the Chinese participants, however, there was no difference in activity within the MPFC during processing of self and processing of the mother, indicating that Chinese participants who are more interdependent use the MPFC to represent both themselves and a close other. Because the self is core to our social and interpersonal interactions, this finding that culture can affect these representations at the neural level is striking and has important implications regarding how we represent ourselves and others across cultures.

Culture affects both what and how we see. In one study, adapting the classic Rod-and-Frame Test, participants were shown a line shown within a frame and were asked to reproduce a line of the same absolute length or a line of the same proportional length with reference to the printed frame (Kitayama, Duffy, Kawamura, & Larsen, 2003). American participants were more accurate at reproducing lines of correct length when asked to attend to their absolute size and Japanese participants were more accurate at reproducing lines of correct length when asked to attend to their relative size. These differences suggest cultural variation in visual attention reflecting differences in the integration of percepts across cultures. Building on these behavioral findings, Hedden et al. (2008) examined neural activity during this task using fMRI. Results revealed cultural variation in neural responses to the extent that distinct brain regions were recruited to perform the relative and absolute line-judgment tasks in relation to the

perceiver's culture. Participants recruited frontal and parietal regions associated with attentional control to a greater extent when drawing the line that was more incongruent with their cultural patterns, suggesting that East Asians and Westerners use different neural circuitry for fairly simple perceptual tasks.

So far, I have highlighted how culture shapes neural activity associated with some of our most basic mental tasks and processes, such as solving math problems, perceiving objects, or thinking about oneself. Culture also affects our preferences. In a study conducted in my laboratory, we discovered that even when people were presented with the same information, culture influenced how the brain processed the information (Freeman et al., 2009). Specifically, American and Japanese participants in this study viewed silhouettes of bodies in either dominant or subordinate postures, while in the scanner. We were particularly interested in one circuit of brain regions, the mesolimbic reward system, which is associated with the detection representation of motivationally important stimuli. A post-scan survey confirmed that American participants exhibited a greater tendency to enact dominant behaviors, whereas Japanese participants exhibited a greater tendency to enact subordinate behaviors. Critically, however, when perceiving visual stimuli depicting dominant and subordinate social behaviors, regions within the American and Japanese participants' mesolimbic reward system responded in a culturally congruent manner. Specifically, both the head of the caudate nucleus and the MPFC, two components of the mesolimbic reward system, showed stronger responses to dominant stimuli (relative to subordinate stimuli) in American participants, whereas these regions showed stronger responses to subordinate stimuli (relative to dominant stimuli) in Japanese participants. Moreover, activity in the right caudate and MPFC was significantly correlated with the participants' self-reported, individual behavioral tendencies toward dominance versus subordination as measured by the post-scan survey. Individuals characterized by a more dominant disposition showed stronger responses in the caudate and MPFC to the dominant stimuli, whereas individuals characterized by a more subordinate disposition showed stronger responses in the caudate and MPFC to the subordinate stimuli. This brings up another key point: Although, as the cognitive neuroscientists have pointed out, the same brain areas may be activated in a particular task, the extent and onset of this activation may be fine-tuned by cultural values and preferences.

Such culture–brain interactions have clear real-world implications, as they might impact whom we choose to affiliate with, both from a personal standpoint as well as a broader, political one. For instance, whom we elect as our leaders can have a substantial impact on our lives and well-being. In a recent study using fMRI, we made a surprising discovery about leadership preferences across cultures (Rule et al., 2010). American and Japanese participants saw faces of actual U.S. and Japanese political candidates, formed impressions of them based on power and warmth, and indicated their voting choices. American participants preferred candidates who looked more powerful while the Japanese participants preferred those who looked warmer, and this preference was reflected in their actual voting decisions. However, fMRI scans showed that both American and Japanese participants used the exact same area of their brains in this task—the amygdala. In this case, members of both cultures showed the same neurological path but the different behavioral outcomes reflected cultural preferences.

The nascent field of cultural neuroscience is also revealing the deep roots of some of our cultural differences. Thus, we have found that people react strongly at the neural level to emotional signals from ingroup members compared to outgroup members. We found greater activation in the amygdala was found to faces of people from participants' own cultural group than from another group (Chiao et al.,

2008). In another study, we found a similar pattern of activity in “superior temporal sulcus” to facial cues on a mind-reading task to members of one’s own culture as compared to other cultures. People in this study were also more accurate at mind-reading members of their own culture (Adams et al., 2010). We thus seem to be less attuned to people from other cultures. This lack of attunement may set the stage for future misunderstandings and conflicts. But experience and exposure shape the brain, as suggested by several recent studies. For example, an interesting study attesting to the role of expertise showed that expert Brazilian ballet dancers who watched a video performance of the moves they were trained to perform had twice the activation in the mirror-neuron system as Brazilian non-expert controls who had never performed this dance. The good news, then, is that with exposure to other cultures, perhaps, the brain can become more culturally tuned. In sum, the emerging findings from cultural neuroscience illustrate how the sustained attitudes, values, and behavior that we encounter in our day-to-day lives give rise to distinct patterns of neural activity responsible for basic functions such as our self-views and academic performance, to more complicated behaviors, such as electing political officials to office and understanding the subtle cues of outgroup members. Such processes carry important consequences for outcomes such as the quality and quantity of our relationships, work success, and mental health. Although the field of cultural neuroscience as it now stands might raise more questions than it answers, one thing remains clear: It is expanding quickly and paving the way for new and exciting areas of investigation. Numerous questions remain to be answered. For instance, are people with certain gene expressions more or less susceptible to particular cultural influences? Are there critical periods during which the brain might be more sensitive to cultural exposure? What type of neural reshaping occurs when people move from one culture to another?

The take-home message here is that our brains actively absorb the regularities in our cultural environments. The representations created in the brain in turn influence how we interact with and shape our own environments. Culture impacts the way in which the brain is wired and activated, but the brain is malleable. Much like the changing tide can erode a footprint in the sand, so too can changed experience over time reshape these brain activations. In this sense, the brain can be seen as a “cultural sponge” of sorts, absorbing the regularities of our surrounding physical and social environments. œ