

Within-Cultural Variation and the Scope of Cultural Neuroscience

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Chiao and colleagues (this issue) describe a multidisciplinary field that has recently debuted and it is clear that in only a relatively short time has made substantial progress and a number of exciting discoveries. In this commentary, I first offer some general remarks on the emergence of the field and highlight some aspects that seem particularly promising. I then describe three issues that the authors did not seem to address in their article, including (a) the possible complications of variation and heterogeneity within a single culture, (b) the need to carve out the scope of cultural neuroscience and have a working definition of “culture,” and (c) the promise of using neuroscience to constrain cultural psychological theory. I then end with some conclusions.

Given such advancement in our science that we are even seeing the emergence of this field, it seems striking that we are still at a time when, to many outside the field, the mere phrase “cultural neuroscience” may seem like an oxymoron: “What do culture and the brain have anything to do with one another?” We have known for a long time that sociocultural environments affect behavior and perceptual, cognitive, and affective processes (e.g., Heine, 2008; Nisbett, Peng, Choi, & Norenzayan, 2001), but the notion that they may affect brain function and structure may sometimes seem astounding. Consider, for example, a press statement released by the Association for Psychological Science (2010): “Where you grow up can have a big impact on the food you eat, the clothes you wear, and even how your brain works.” Examples of such statements abound in the media. They make clear that many people continue to make a critical distinction between culture shaping the mind and culture shaping the brain. Indeed, as Kitayama and Tompson (2010) noted, even we as researchers may accept clear cultural differences in a behavioral phenomenon but nevertheless find it intriguing just “to see how deep culture might go ‘under the skin’” and how deeply it might infiltrate underlying neural mechanisms (p. 97). And of course, it is intriguing and exciting. It highlights the immense power of culture. It connects incredibly disparate levels of analysis, from high-level sociocultural processes to low-level changes in neural structure and function.

As most would agree, however, such cultural infiltration into neural mechanisms should hardly surprise us. It is a reaction that reflects a legacy of Cartesian dualism deeply embedded in our folk psychology: that the

mind and brain are rigidly separable. Whereas a psychological process may be readily shaped by culture, cultural influences on a neural process are for some reason deeper and realer; they are material rather than “immaterial.” However, any experiential shaping of perception, cognition, or behavior must by definition reflect an experiential shaping of the brain—as how else could such psychological differences arise? Although it may seem surprising that culture can influence neural activation patterns that are detected with even relatively insensitive brain-imaging methods (which can only assess coarse neural details), it should not be surprising per se that there exists a neural difference underlying a psychological difference. That should be an axiomatic assumption, not an empirical question.

Cultural neuroscience prioritizes that assumption. It is a rigorous and scientifically mature approach going against the very grain of the mind–body dualism that still seems prevalent among the general public and entrenched within our folk psychology. Chiao et al. provide an exciting and promising view of a burgeoning field that already appears to have gained tremendous momentum. One thing that struck me about the field’s progress, as outlined by the authors, is a rapid growth of studies examining culture–gene interactions, with researchers examining cultural and genetic factors and how their unique interplay drives cognitive, neural, and behavioral processes. Ambady and Bharucha, in their review on cultural neuroscience in 2009, made a distinction between “cultural mapping” and “source analysis” approaches. Whereas cultural mapping involves mapping cultural patterns (e.g., in behavior or cognition) to neural patterns (e.g., fMRI activations), source analysis involves the perhaps trickier task of finding out the actual causes of those differences (or commonalities). The cultural mapping approach, they noted, had by far dominated the extant literature at that time. Chiao et al.’s review, however, suggests that the two approaches have now reached a more equal share. Examining how culture, genes, and their interactions together determine neural processes represents a powerful source analysis approach, and it is impressive that in only a few years since the 2009 review we are seeing a wealth of studies employing newer, more comprehensive approaches. With that said, however, one constraint on development in the source analysis approach to cultural neuroscience will

likely be the lack of feasibility for most researchers to measure genetic polymorphisms. Now that the use of functional brain imaging has virtually become a standard across the wider fields of cognitive and social neuroscience (at least in Western industrialized nations with active research underway), the same cannot be said for the availability of genetic methodologies. Solving this would greatly facilitate powerful source analysis approaches to cultural neuroscience.

Most cultural neuroscience research to date, however, seems to be better described as part of the cultural mapping approach, where cultural influences are mapped from the psychological level to the neural level. With respect to this more prevalent approach, there was much to praise about Chiao et al.'s insightful target article, but there were also several issues that seemed unaddressed. These are detailed in the sections that follow.

Within-Cultural Variation and Individual Differences

Although there are often clear cultural differences in certain behaviors and personality characteristics, there is substantial within-cultural variation as well. Further, this variation is nontrivial and meaningful (Triandis, 2001). Although, for example, East Asian countries are considered collectivist and Western countries are considered individualist, there is also regional and individual variation. One study found Southern U.S. states to be relatively more collectivist and Mountain West and Great Plains U.S. states to be relatively more individualist (Vandello & Cohen, 1999). Presumably this reflects the historical and ecological contexts that, over the years, shaped the current population in these regions. Beyond regional differences, cultural psychologists readily recognize the problems of homogenizing culture and collapsing across within-cultural variation. This was in part the rationale for the advent of the terms *idiocentrism* and *allocentrism*, which reflect individual orientations toward individualism and collectivism, respectively. Whereas *idiocentrism* and *allocentrism* describe the individual psychological level, *individualism* and *collectivism* describe the cultural level. It is important to note, however, that *allocentric* tendencies are thought to exist in individualist cultures (as well as *idiocentric* tendencies in collectivist cultures), and all cultures are thought to exhibit a wide range of both *idiocentrism* and *allocentrism*. Further, both orientations tend to be cognitively available within a single individual (Triandis, 1995). This hardly challenges meaningful between-cultural variation but suggests some possible concerns about a lack of focus on within-cultural variation that may be worth considering in emerging cultural neuroscience work. This is especially true because cultural neuroscience work tends to

use relatively small sample sizes (e.g., because brain imaging is prohibitively expensive).

One example of the interplay between within- and between-cultural variation at the neural level can be seen in an fMRI study that my colleagues and I conducted (Freeman, Rule, Adams, & Ambady, 2009). American and native Japanese individuals were presented with figural outlines of dominant and subordinate bodies. The outlines removed cultural membership cues and preserved only nonverbal information about social status. After the scan, we assessed behavioral tendencies toward dominance or subordination using a questionnaire (e.g., "I impose my will on others" or "I let others make the decisions"). We found that Americans exhibited a greater tendency for dominant behavior, whereas Japanese exhibited a greater tendency for subordinate behavior. Such a pattern is consistent with the notion that Americans tend to be encouraged to be dominant and self-elevating, in line with individualism (Moskowitz, Suh, & Desaulniers, 1994; Triandis & Gelfand, 1998), whereas Japanese individuals tend to be encouraged to be more subordinate, in line with collectivism (i.e., to be affiliative rather than competitive and show obligation to others; Oyserman, Sakamoto, & Lauffer, 1998; Yamaguchi, Kuhlman, & Sugimori, 1995). Neuroimaging results revealed that the bilateral caudate nucleus and the medial prefrontal cortex, two important components of the mesolimbic reward system, showed opposite neural responses to the same bodily cues. These regions showed stronger responses to dominant stimuli in Americans but stronger responses to subordinate stimuli in Japanese individuals.

More important for the foregoing discussion, responses in the caudate and medial prefrontal cortex correlated with individual behavioral tendencies toward dominance versus subordination. Stronger responses to dominant stimuli were associated with more dominant behavior, and stronger responses to subordinate stimuli were associated with more subordinate behavior (regardless of culture). Thus, although at both the behavioral and neural levels clear cultural differences emerged, the individual-differences measure revealed a degree of overlap within cultures. A number of Japanese individuals exhibited responses associated more with dominance, and a number of Americans exhibited responses associated more with subordination. Thus, one could say that the cultural variation in behavioral and neural responses we found was able to be reduced to more precise individual-level variation (which simply covaried with the cultural groups). Why, then, not just talk about the influences of learned individual tendencies on the brain rather than the influences of learned cultural tendencies?

Perhaps, therefore, it would be more fruitful to examine the influences of socially relevant individual differences rather than the influences of culture per

se. The cultural differences obtained in the study just cited were certainly meaningful, but they also were reducible to individual differences. One could argue that reducing behavioral and neural responses to individual differences (that may covary perhaps with cultural groups) would yield a more complete picture of human diversity than just examining the coarser level of cultural differences. Given this, should such work become a “social neuroscience of individual differences” rather than a “cultural neuroscience” per se? Nomenclature aside, what the previous discussion suggests is that putting a focus on within-cultural variation and simultaneously examining within- and between-cultural variation at the behavioral and neural levels could be highly promising for cultural neuroscience research. That said, in cases where most of the between-cultural variation can be explained by individual differences, one could make the argument that it makes more sense to merely reduce the coarser cultural differences to more fine-grained individual differences.

What is the Scope of Cultural Neuroscience?

Such issues beg the question as to what the scope of cultural neuroscience is and how it distinguishes “culture” from more general experiential learning. How should cultural neuroscience define “culture” for its purposes? Does it include *any* learned experience within a social context? Chiao et al. provide no explicit definition. Early on as brain imaging was being incorporated into cognitive neuroscience, already researchers noted the astounding impact of learned experience on the brain. Appearing in *Science* in the early 1990s, Posner discussed what he imagined the future of brain imaging to be, just as it was beginning to be applied to the study of human cognition:

If the neural systems used for a given task can change with 15 minutes of practice . . . , how can we any longer separate organic structures from their experience in the organism’s history? We must be able to trace the changes in the brain that occur with experience. Individual genetic makeup and learning together shape brain structure. We now have methods to understand how this takes place and what it means for the limits of human potential. (Posner, 1993, p. 674)

At one level, this sounds remarkably similar to what is at the core of Chiao et al.’s view of the future of cultural neuroscience. The principal difference would be that cultural neuroscience cares about cultural experience shaping the brain rather than any kind of other experience or learning (in tandem of course with genetic factors).

This distinction of “culture” versus “experience” or the broader social environment becomes fuzzier when considering some cultural neuroscience studies

reviewed by the authors. In Part IV, titled “Cultural Influences on Brain Function,” a wealth of interesting studies are discussed. Among them were studies comparing neural activity between Caucasians and African Americans in the U.S. while they watched racial in-group or outgroup members be inflicted with pain (Mathur, Harada, Lipke, & Chiao, 2010), and how such activation relates to racial identification (Mathur, Harada, & Chiao, 2012); or studies comparing neural activity in individuals from low versus high socioeconomic backgrounds when presented with status information (Ly, Haynes, Barter, Weinberger, & Zink, 2011). What is “cultural” about these studies seems reasonable at first blush, but one could potentially describe these studies as simply “social neuroscience” as well. There is no comparison across cultures; the studies assess social psychological processes within a single culture at the neural level. Consider, also, if the Freeman et al. (2009) study on dominant and subordinate tendencies had been done only on American participants. If among American participants mesolimbic responses were found to be correlated with individual differences in dominant versus subordinate tendencies, would this fit under the purview of “cultural neuroscience,” without a Japanese comparison? The theoretical underpinnings of such a hypothetical study would be similar to those of the actual study conducted, and the within-cultural variation in American participants would be sufficient to demonstrate a mapping between behavioral tendencies and mesolimbic response. Is, then, cultural neuroscience so inclusive as to fit under its purview the study of any influences of experience or learning on the brain within a wider social environment?

Consider a structural MRI study by Maguire et al. (2000) on licensed London taxi drivers. Such drivers must complete elaborate training and navigate all around London. On average it takes 2 years to complete the training, and drivers must pass police examinations before obtaining a license. London is unique in requiring such extensively developed skills for its taxi drivers. Using voxel-based morphometry, Maguire et al. found that the volume of the posterior hippocampus was larger in London taxi cab drivers relative to controls. Further, hippocampal volume was positively correlated with the amount of experience a taxi driver had under his or her belt. This suggested that environmental demands and, specifically, spatial navigation experience due to one’s chosen occupation dynamically shapes the structure of the hippocampus. Does this fit under Chiao et al.’s view of cultural neuroscience? At its heart is the interplay between neural substrate and the social environment it is situated in.

This, of course, might then beg the question, What is “culture” itself? Answers to this question have had a complex history in psychology (Kashima & Gelfand, 2012). In Chiao et al.’s article, it would have been

helpful for a working definition of culture and the scope of cultural neuroscience to have been explicated. The goal of this would not be to create unnecessary disciplinary boundaries. Instead, it may help cultural neuroscience explicitly carve out the niche it seeks to fill, especially because the broader field of social neuroscience itself is quite young with boundaries that are not entirely yet clear. Thus, determining the scope of cultural neuroscience could help ensure it achieves its full potential as an emerging field, and that it does not merely collapse over time into the other disciplines from which it is derived.

Neuroscience as a Constraint on Cultural Psychological Theory

Finally, Chiao et al. perhaps could have emphasized more how cultural neuroscience may enhance a multilevel understanding of psychological phenomena by using neuroscientific models and data to constrain cultural psychological theory. This would advance an understanding of cultural influences on cognitive processes that may be otherwise unrealizable without knowledge of how the brain works. As one example, consider evidence suggesting that regions across the brain vary in their plasticity; some regions' structure may change more readily than others. Further, some regions' structure may change more as a function of experience-dependent learning, whereas other regions' structure may change more as a function of preexisting conditions, for example, genetic factors (Zatorre, Fields, & Johansen-Berg, 2012). If true, then researchers could exploit the knowledge of which neural regions are more or less sensitive to experience-dependent learning (or preexisting conditions) to make novel predictions about which cognitive processes would be more or less sensitive to cultural learning. Of course, taking up an approach would warrant caution with respect to issues of reverse inference (Poldrack, 2006), as any mapping function between neural regions and cognitive processes would. But if the susceptibility of certain cognitive processes to cultural influences could be predicted in part by the neuroplasticity of certain regions, this could be a highly valuable approach for cultural neuroscience to take in the future. This would be one example of how neuroscience could be used to uniquely explain and predict cultural influences on psychological phenomena.

Conclusion

Chiao et al. have provided an exciting look at the possible future of cultural neuroscience, a multidisciplinary field that has only recently emerged yet has gained impressive momentum. Their review indicates

that we are already seeing more comprehensive source analysis approaches that examine the interplay of cultural and genetic factors in parsing out diversity in psychological processes. With more standard cultural mapping approaches, however, several issues may be worth considering as researchers move forward in shaping the future of the field.

Focus could be placed on within-cultural variation rather than only between-cultural variation, and these could both be examined simultaneously at the neural level. In some cases when the between-cultural variation is primarily accounted for by within-cultural variation, the distinction between "cultural neuroscience" and a "social neuroscience of individual differences" may become less clear. Addressing the importance of within-cultural variation, especially given small sample sizes due to expensive methodologies, may be valuable in looking at the future of cultural neuroscience. Such issues stress the importance of explicating a scope of cultural neuroscience and how it is distinguished from the broader fields that situate it (e.g., social neuroscience, the scope of which as a recent multidisciplinary field itself is not always clear). This could help ensure that cultural neuroscience has a carved-out niche it seeks to fill and does not merely collapse into these broader fields over time. Finally, using neuroscience to constrain cultural psychological theory (e.g., through regions' variability in neuroplasticity) could be highly valuable in making novel predictions about cultural influences on psychological processes.

Aside from these issues, Chiao et al. make clear that cultural neuroscience offers a rigorous multilevel approach that is able to parse out the mutual genetic, cultural, and environmental impacts on brain and behavior. As such, it would seem to have the potential to change our fundamental understanding of the mind in its wider cultural context.

Note

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