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Embrained Normativity: How Cultural Norms can Modulate Neural Correlates in the Brain

Vehbi Metin Demir

Department of Philosophy, Bursa Uludağ University, Faculty of Literature, Bursa, Türkiye

ABSTRACT

Cultural neuroscience is a new discipline that investigates how cultural norms and practices affect brain neural activities and structures. Some of these studies have focused on the interaction between cultural/normative self-construal and the neural correlates of the representation of the self in the brain. In this article, I discuss some studies on the cultural neuroscience of the self to show that cultural norms can reshape and modulate brain structures responsible for the representation of the self and others. By conceptualizing the results of these studies as embrained normativity, I argue that norms and values of a specific culture can be traceable within the brain, implying that norms not only reside in the intersubjective mental sphere but also diffuse into the brain. The concept of embrained normativity may open new ground for re-interpreting both the Hegelian idea of second nature and the results of the self's cultural neuroscience.

Keywords: Cultural neuroscience, habit, Hegel, neural correlates of self, second nature, self-construal.

ÖZ

Beyinlenmiş Normativite: Kültürel Normlar Beyindeki Nöral Korelatlarını Nasıl Biçimlendirebilir?

Kültürel nörobilim, kültürel normlar ve pratiklerin beyindeki yapılar ve nöral aktiviteleri nasıl etkilediğini araştıran yeni bir disiplindir. Bu araştırmaların bir kısmı, kültürel/normatif benlik yorumu ve beyindeki benlik temsilinin nöral bağlantılarının karşılıklı etkileşimini araştırır. Bu makalede, benlik ve ötekinin temsilinden sorumlu beyin yapılarının kültürel normlar tarafından nasıl yeniden biçimlendirilip şekillendirildiğini gösterebilmek için benliğin kültürel nörobilimine dair çalışmaların bazıları incelendi. Bu çalışmaların sonuçları beyinlendirilmiş normativite olarak kavramsallaştırılarak belirli bir kültürün norm ve değerlerinin beyinde takip edilebileceği iddia edildi. Bu da normların sadece özneler arası zihinsel alanda yer almadığına aynı zamanda beynin içine de yayıldığına işaret eder. Beyinlenmiş normativite hem Hegel'in ikinci doğa fikrini hem de benliğin kültürel nörobiliminin sonuçlarını yeniden yorumlamak için yeni bir zemin açabilir.

Anahtar Kelimeler: Alışkanlık, benlik yorumu, benliğin nöral bağlantıları, ikinci doğa, kültürel nörobilim, Hegel.

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Address for correspondence:
Vehbi Metin Demir.
Bursa Uludağ Üniversitesi, Edebiyat Fakültesi, Felsefe Bölümü, Bursa, Türkiye
Phone: +90 224 294 1825
E-mail: vmetindemir@uludag.edu.tr

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NEURAL CORRELATES OF THE SELF AND SELF'S CULTURAL NEUROSCIENCE

Cultural neuroscience is an emerging area of research that investigates the interaction between culture and neurobiology. This field investigates how cultural values and practices shape neurobiology and how neurobiological mechanisms facilitate the emergence and transmission of cultural traits. (Chiao 2009). The subject matter of cultural neuroscience is not only the brain but also the *enculturated brain* (Lende & Downey 2012). The concept of an enculturated brain implies a dynamic and dialectical relationship between culture and the

brain. Cultural neuroscience bridges two distinct questions. The first section delves into the realm of cultural psychology, exploring how culture shapes the mind and behavior. The second stems from social neuroscience, which investigates how brain structures and chemicals influence social norms. Consequently, cultural neuroscience endeavors to understand the dynamic interplay between culture and the brain as they co-construct each other within a research framework. Kitayama and Uskul (2011) highlight that "neuro-culture interaction" is bidirectional. One aspect of it is *cultural entrainment*, meaning that cultural values do reside in the intersubjective mental sphere but are observable in the brain. Another aspect involves brain enculturation, indicating that the brain is molded by the cultural environment in which an individual lives. One of the major implications of cultural neuroscience is that the brain is not only a biological organ but also has normativity. While patterned cultural practices, values, and norms are continually being materialized under the skull (embrainment of culture), these normative practices equally reshape and modulate our brain's biology. Although ample studies have examined different aspects of the culture–brain relationship,[1] this article exclusively focuses on examples from cultural neuroscience research concerning the neural representations of the self, which vary across cultural contexts.

In the last two decades, a succession of new discoveries has been made on the neural correlates of self-representation in the brain. Studies in the field of cognitive neuroscience have shown that the self and its related processes occur in a distributed rather than a modular network. Recent brain imaging studies reveal that the representation of the self in the brain is organized in dynamic, parallel, process-based networks, which debunk the idea of a distinctly localizable Cartesian self. For example, Damasio's (2010) famous book, *Self Comes to Mind*, suggests a three-layered idea of the self. Damasio hypothesizes that the self is stratified as the primitive self (proto-self), the core-mental self, and the autobiographical self, each corresponding to physiological, psychological, and spiritual levels. In a similar vein, another scholar investigating the self within the brain, George Northoff, confirmed the existence of a three-level organization responsible for representing the self in the brain. Northoff (2011) argued that the physiological/primitive self, which mostly regulates affective and sensory-motor functions, is connected to the periaqueductal gray matter, colliculi, and tectum. The psychological core self is associated with cortical regions, such as the thalamus and the ventromedial prefrontal cortex. The emergence of the autobiographical self depends on regions such as the hippocampus, the cingulate cortex, and the frontal lobes. Thus, neuroscientists infer that the self in the brain is not a distinct, localizable, substance-like entity. Instead, it is a layered, fluid, and dynamic active construct consisting of the brain's inner and outer activities.

Conventionally, when neuroscientists attempt to find brain regions related to the self, they perform a self-related cognitive task to observe which brain regions are activated while performing a self-referential semantic process. Studies have revealed that activities related to the self are mostly concentrated in cortical midline structures (CMS). However, Northoff shows that the CMS is active when performing a task, and that a degree of activation can be observed in the absence of any given task. In both the human and chimpanzee brains, the default mode network system maintains its activity with spontaneous fluctuation in this region, in a high resting state where no task is performed (Damoiseaux 2006; Fransson 2005). The perigenual anterior cingulate cortex is active in the self-related resting state (Qin & Northoff 2011). Therefore, the self-related activities occurring in the brain are, to some extent, independent of any cognitive task. The dynamic flow of physical and mental processes between self-related brain regions is constantly balanced. The CMS comprises medial cortical structures (the ventromedial and dorsomedial prefrontal cortex, anterior and posterior cingulate cortex, superior temporal gyrus, and hippocampus) and subcortical structures (the periaqueductal gray, superior colliculi, hypothalamus, and dorsomedial thalamus) (Northoff 2011). These essential regions regulate self-related brain operations.

Northoff et al. (2006) argued that self-related processes are domain independent. In other words, the CMS involve various verbal, spatial, or sensory-motor domain activities (Northoff et al., 2006). Hence, the self is not a meta-perception or apperception that integrates all sensory data. Instead, the self is a special code or mode that operates both higher- and lower-level cognitive activities (Han & Northoff 2009).

The self-associated CMS system appears as an active agent at multiple levels. Thus, if the self modulates or orients sensory information, our perception of the surrounding world is peculiarly associated with our sense of the self. Correspondingly, if the sense of self can change depending on culture and life experiences, then culture is also expected to be active in all cognitive processes related to the self.

Hundreds of neuroimaging studies in this field have been devoted to uncovering the neural correlates of cognitive processes related to the self, as well as brain structures that

[1]For the different aspects of cultural neuroscience research see: (Chiao 2009; Chiao et al. 2016).

Table 1. Conceptual Distinctions between Independent and Interdependent Self-Construals*

Feature compared	Independent self-construal	Interdependent self-construal
Core concepts	Self-understood as autonomous and distinct	Self-understood as relational and socially embedded
Structure	Coherent, bound, and relatively stable	Flexible, changable
Salient attributes	Inner traits such as beliefs, preferences, and emotions	Social roles, relationships, and positions
Normative Task	Emphasizing uniqueness and self-expression Be direct and "say what's on your mind."	Emphasis on belongingness and social attunement Be indirect; "read others' mind"
Typical behavioral tendencies	Acting according to internal goals and preferences; direct communication	Behavior adjustment to social expectations; indirect communication
Basis of self-esteem	Affirmation of personal abilities and consistency	Maintenance of harmony, responsiveness, and relational balance

*: Adapted from Kitayama and Markus 2011.

play a role in resting-state activity in humans. However, self-representation is not only a neural activity but also a function of a psychological and social whole. In this respect, social and cultural psychology studies have attempted to shed light on different aspects of self-representation. To this end, the research conducted by Markus and Kitayama has attracted significant attention in the field of cultural neuroscience. Markus and Kitayama (2011) reviewed a great deal of social and cultural psychology literature and depicted two types of self-representations. They classified two different self-conceptions concerning the boundaries between the self and the other as independent and interdependent. According to them, these self-construal systems determine the basic traits of individual experiences, such as cognition, emotion, and motivation. For example, Asian cultures have an understanding of individuality that is deeply interconnected with others. This interdependent self-construal emphasizes harmony with others and sets tasks and values according to this ideal of integrity. In contrast, American culture places little emphasis on this kind of overt connectedness among individuals. In American culture, expressing the difference between the self and others and paying more attention to individuals' inner emotions and opinions are priorities. While independent self-construal accentuates individualist, egocentric, separate, and autonomous characteristics, interdependent self-construal focuses on holistic, sociocentric, collective, contextualist, and relational attributes. Individuals in interdependent cultures perceive themselves as part of larger social relations and evaluate their thoughts, feelings, and actions in relation to others. In these cultures, "the self is viewed not as a hedged closure but as an open field." A comparison of the two distinct forms of self-construal can be seen in Table 1, adopted from Markus and Kitayama (1991):[2]

The table shows that the diverging forms of self-construal in the two cultures may influence how individuals perceive themselves in relation to others, what they should do in concrete situations, what they value, and what they should feel.

The question of whether these two forms of self-construal might cause variation in neural functions leads researchers to prepare new experimental setups. Previous imaging studies on self-representation in the brain have also been integrated into these experimental frameworks. In an important study by Craik et al., participants undergoing PET were asked to make judgments about a range of character traits. The subjects were asked to respond to the following questions: a) "How much does this adjective describe you?," b) "How does this adjective describe the Canadian prime minister?," c) "Is this adjective socially valuable?," and d) "Non-semantic numbers or syllables?" (How many syllables are in this adjective?). Thus, the experiment involved four conditions: three semantic and one non-semantic. Semantically processed adjectives were better remembered than traits processed under other conditions. The encoding of both self-related and other-related adjectives elicited activation in the left frontal lobe, whereas self-related encoding specifically activated the right frontal lobe (Craik et al., 1999). This study reveals that self-related encodings use a different pattern in episodic memory retrieval processes.

Another study extending Craik's experimental results, which used event-related fMRI, found that self-related processes are dissociated from other semantic operations in the brain. Participants were scanned while making judgments about self-related, other-related, and neutral adjectives. Imaging results demonstrated that judgments on self-related

[2]The table is adopted from this article: (Markus and Kitayama 1991).

adjectives activated the left inferior frontal cortex and anterior cingulate cortex more than neutral judgments. Moreover, the medial prefrontal cortex has been associated specifically with self-related judgment tasks (Kelley et al., 2002). Subsequent studies have repeatedly demonstrated that medial prefrontal activity consistently and selectively engages in self-related tasks, suggesting that selfhood is functionally distinguished from other-related processing in the human brain (Heatherton et al., 2006; Moran et al., 2006; Macrae et al., 2004). However, further research has shown that the distinction between the self and others in the brain is not a categorical distinction. Instead, dynamic differentiation fluctuates along a continuum depending on the context. Mitchell et al. found increased activation in the ventral medial prefrontal cortex (vMPFC) when subjects performed self-related tasks. In contrast, the dorsal medial prefrontal cortex (dMPFC) was activated while performing other-related tasks (Mitchell et al., 2006).

EMBRACING CULTURE: EFFECTS OF CULTURAL VARIATION ON THE BRAIN'S REPRESENTATION OF THE SELF AND THE OTHER

Despite the converging results of prior studies suggesting that the self and the other are clearly dissociable in the brain, a study comparing American and Chinese participants yielded a surprising result. In this experiment, participants were asked to make judgments about their own character traits (such as being brave or childish), their mothers, and a public figure. As in Craik's study, both Chinese and American participants remembered self-related character traits better. However, the same pattern did not fully apply to the Chinese group, as they recalled traits about their mothers just as well as about themselves. Consistent with previous research, stronger activation in the medial prefrontal cortex (MPFC) and anterior cingulate cortex (ACC) was observed in fMRI results during self-versus-other judgments. Nonetheless, judgments about mothers triggered strong activation in the MPFC only in Chinese subjects but not in Westerners. Based on these imaging results, Zhu et al. (2007) concluded that

> *"Our findings suggest that Chinese individuals use MPFC to represent both the self and the mother, whereas Westerners use MPFC to represent the self exclusively, providing neuroimaging evidence that culture shapes the functional anatomy of self-representation."*

The MPFC activity of American participants increases while they make a self-related judgment, yet decreases during other-related and mother-related judgments. No difference was observed between mother-related judgments and judgments about President Bush among American participants. Only increased MPFC activation, which is specific to self-related judgments, was detected. Thus, Chinese participants represent both their mothers and themselves in the same brain regions, whereas American participants distinguish between the two As a result, the Chinese participants consider their mothers as "like-me," whereas the American subjects see their mothers as "like the other." In sum, while the MPFC is exclusively activated in self-judgments in Americans, both the representation of the mother and the self in Chinese individuals strongly activate the MPFC. Hence, the Chinese interdependent self-construal may lead individuals to perceive their mothers as identical to themselves, whereas the American independent self-construal emphasizes separation between the self and others. Interestingly, the effects of these different worldviews are traceable in the brain's neural networks involved in self-representation (Wang et al., 2012).

In both Chinese and American participants, judgments about the self and the mother induced activity in the ACC, which plays a significant role in evaluating one's own physical appearance (Kjaer 2002), recognizing one's own face (Kircher 2001), and emotional self-control (Allman 2001). Considering these studies, it is conceivable that thinking about oneself might induce ACC activity. Both American and Chinese participants showed activation in the MPFC and ACC when making self-related judgments; however, additional activation in the left prefrontal cortex (LPFC) emerged in Chinese participants. Furthermore, when Chinese individuals make judgments about their mothers, activation in the LPFC and ACC is observed, which is not observed in American participants. This result indicates that some additional brain structures are involved in Chinese subjects compared with those in Americans. In other words, culture-specific self-construal can affect the preference for existing neural pathways and the recruitment of new structures for the same task. Hence, it is possible to say that, to some extent, different neural components support Western and Asian forms of self-construal.

The aforementioned fMRI studies suggest that habitually acquired cultural values and normative differences can be visibly reflected in neural processes. In addition, it may be inferred that the "self and the other" are not categorically separated. Instead, a spectrum of the self and the other exists on a continuum from "self-like" to "other-like" (from ventral to dorsal MPFC) (Han & Northoff 2009). On this spectrum, for the Chinese subjects, their mothers appear much more "like-me," while Americans conceive their mothers more "like-other." This suggests that cultural values may alter how we perceive and encode those around us by recruiting different neural circuits in the brain. The cultural neuroscience of the self indicates that norms and values not only reside in our minds but are also embedded—carved into the very tissue of our brains.

Another study using a similar experimental template with Nisbett and Zhu's results recently found that Chinese self-construal is supported by different neural circuits compared to those of Danish subjects. Ma et al. (2014) scanned Chinese and Danish subjects with fMRI, while they were making judgments about physical, social, and mental attributes of both themselves and a public figure to observe the influence of cultural variation on self-referential cognitive processing. In this study, participants were asked to assess a group of character/mental adjectives (such as hardworking and talkative), physical qualities (such as a wrinkled face and curly hair), and social positions (such as professor) of themselves and a well-known public figure. As expected from earlier studies, both Chinese and Danish participants showed strong activity in the medial prefrontal cortex (MPFC), but this activity was much stronger in Danish subjects, who belong to a more individualistic cultural background. Moreover, when the Chinese participants made judgments about their social attributes, they displayed stronger activity in the temporoparietal junction (TPC), which is generally associated with social thinking (Saxe & Kanwisher, 2003). This implies that compared with Danish participants, Chinese participants conceive of their social position from the lens of others. Much greater activation in bilateral TPJ together with vMPFC functioning is observed during judgments about social roles in Chinese subjects than in Danes (Han & Ma 2016). Thus, the involvement of the TPJ in the self-reflection task depends on the task content (social or physical) and cultural variation.

These experimental results demonstrate that different forms of self-construal depending on social norms might determine which neural circuits would be chosen in a given task. Who would be regarded as "like-me" (vMPFC) and who as "like-other" (dMPFC) might vary depending on a specific culture's self-construal. The most radical example of this is that social norms and prejudices can dehumanize some people. Socially excluded people are marginalized over time until they are no longer perceived as human beings. For instance, in the United States, homeless persons and drug addicts are not perceived as normal individuals. Some people are perceived so much as others that they are perceived as non-human without even entering into the self-other scale. While MPFC activity is observed in all kinds of social perceptions about the self and the other, Americans do not react when they see homeless people in this region. An imaging study revealed that lower-class people fail to elicit a neural reaction in the dorsal medial prefrontal cortex (dMPFC), which is normally engaged in perceiving the other and the other's mind (Harris & Fiske 2006). American subjects show reduced mPFC activation along with increased insula and amygdala activity, which usually react in cases of aversive and disgusting emotional states (Hart et al., 2000; Krendl et al., 2006; Phelps et al., 2000). This indicates that many Americans no longer consider a homeless person as human beings. Although the person in front of our eyes is objectively a human being, he or she is not categorized as a person in the brain when the person is not pertinent to our culture's self-construal. Hence, the extent to which our perception of self and the other can be variable depends on the dominant self-construal of a culture, class, and social status.

Another interesting psychological tendency discovered about the self in recent years is "face recognition advantage." Recognition of self-face is remarkably faster and more accurate compared with strangers' faces and is noticed in various different experimental tasks (Ma & Han 2010). In comparative studies, it has been observed that the British give a greater ERP response in recognizing their own faces (Sui et al., 2009). In addition, self-face recognition advantage can also be modulated by the psychological method of cultural priming. An experimental setup was prepared with Chinese and British subjects to observe whether the ERP responses of the neural regions responsible for recognizing one's own face and the face of others were affected when they primed with independent or interdependent cultural self-construal. Both British and Chinese display similar ERP responses (an early frontal negative activity at 220–340 ms, anterior N2 response) when they perceive their own face. However, when British participants primed with an interdependent self-construal (for example, giving a long text including too many words like "we" and "together"), their default anterior N2 response to their own faces was reduced. Conversely, Chinese subjects primed with an independent self-construal suppressed anterior N2 to their friends' faces. Other studies also confirm that the neural correlates of self-face recognition can be modulated by changing cultural priming (Sui & Han 2007). Studies using priming techniques on bicultural individuals have found that neural activation in self-face recognition regions might change as a result of independent or interdependent priming. Based on this study, it is possible to infer that the same person unconsciously slips into one cultural mindset to another in the priming process (Ng et al., 2010). Their brains flexibly opt for one cultural framework in a certain context.

These results evince that the self-construal of different civilizations might also change or modulate neural activities. However, the purpose of cultural neuroscience is not to make an essentialist biological justification by comparing East–West cultures in an orientalist fashion. The differentiation regarding self-construal is not only due to culture. A similar differentiation can be observed as a result of organized behavioral patterns, such as socioeconomic class and religious

structures. Studies have shown that individuals in the same cultural geography may use different modes of self-construal when they make judgments about themselves or their mothers (Ray et al., 2010). Therefore, the issue here is not biological determinism but patterned behavior (Roepstorff et al., 2010). For example, people who travel a lot or who have to immigrate tend to have a much more individualistic self-construal, pay less attention to their surroundings, and usually focus on their own characteristics (Oishi 2010; Chen et al., 2015). In other words, one's relationship with the surrounding environment or lifestyle might change one's self-conception. Similarly, different behavioral patterns caused by different religious affiliations within the same culture can change the self-perception of individuals.

Han et al. tested the assumption that religious belief can also change the neural correlates of self-referential processing (Han et al., 2008). Non-religious and Christian subjects were scanned when they made judgments about themselves and others. Imaging results showed that while making judgments about themselves, non-religious participants showed stronger activation in the MPFC, whereas religious individuals showed increased activity in the dMPFC. In addition, the activity in the dorsal MPFC was stronger in those who gave more importance to Jesus' judgment in their subjective evaluation of a person's personality. According to the researchers, since in Christianity, a person constantly has to judge himself from God's perspective, the neural coding of the ego-related stimuli in religious Christian participants decreased, while the neural activity in the dorsal MPFC increased, which is active in the evaluation of other-related processes (Han et al., 2008). In other words, religious people are more prone to judge themselves through the eyes of others. Hence, religious practices shape our mentality, ultimately affecting the use of different neural pathways.

Another experiment comparing religious and secular Danish participants showed that religious participants who performed improvised prayer showed greater activation in the temporopolar region, MPFC, temporoparietal junction, and precuneus (Schjoedt et al., 2009). These brain regions are typically activated during engagement in social relations. Based on this fact, the researchers speculate that religious individuals during prayer consider God as a real person in direct relation to them, so that they recruit brain areas of social cognition. What is significant here is that a patterned religious praxis can change the degree of activation of the same brain region and can sometimes change the brain region used in a certain task.

DISCUSSION: RECONSIDERING THE CULTURAL NEUROSCIENCE OF THE SELF WITH THE HELP OF THE HEGELIAN SECOND NATURE

In the preceding discussion, I reviewed the neural structures involved in self-representation and demonstrated that they are dynamic systems engaged in multilayered functions rather than static ones. By combining cultural psychology's idea that different forms of self-construal might change the mental representation of the self with the dynamically changing neurobiology of the self, cultural neuroscience enables us to ask whether different forms of self-construal could change the neural activity of self-representation in the brain. I have presented a range of empirical brain imaging studies demonstrating that different cultural norms and practices can change, modulate, or reorganize self-representation-related neural activity. The brain may recruit different neural components or exhibit varying degrees of activity in the same regions depending on cultural self-construal. The neural representation of the self and the other in the brain can vary depending on the culturally shaped self-construal.

These empirical findings in cultural neuroscience open new avenues for discussing the relationship between culture and our biological nature. Cultural norms are not merely external impositions upon the body. Instead, they diffuse into the body and actively reconfigure it. This plastic relationship between the brain and culture can be best understood through Hegel's concept of second nature. Hegel develops his idea of second nature in two places in his Encyclopedia. In *anthropology*, he says that habit (*die Gewohnheit*) is second nature, which plays a crucial role in the transition from nature to culture (Hegel 1978a, p. 391). He also uses the term "second nature" to describe his theory of ethical life (*Sittlichkeit*) (Hegel 1978b, p. 108). In both contexts, Hegel shows that human nature is not only a natural animal body but also posited by the spirit. In his *anthropology*, he calls this intermingling "nature-spirit" (Natur-Geist). Habits, in this context, enable the incorporation of our practices into the body so that our actions become part of our bodily capacities. Habits can change our mental abilities by reshaping our bodily existence.[3] Thus, with the help of the brain's plasticity, which underlies the capacity to form habits, the body takes shape from cultural practices and gives shape to our cultural behaviors.

In this article, I draw attention to the dialectical relationship between the brain and culture by demonstrating how the representation of the self's neural correlates may diversify across individuals from distinct cultural backgrounds. This dialectical relationship is examined along two dimensions: culture entrainment and brain enculturation. From the perspective of

[3]For the details of the Hegelian idea of second nature, see: (Wolff 1992; Pippin 2008; Pinkard 2012; Testa 2013; Lumsden 2013; Khurana 2016; Ranchio 2016; Novakovic 2017).

cultural entrainment, cultural difference leaves indelible traces on the brain, suggesting that it cannot be easily transformed. However, from the perspective of the enculturated brain, the human mind does not operate through a universal or necessary mechanism; perceptual, emotional, and cognitive capacities are not governed by *a priori* Kantian necessity but can instead be shaped by the material, socio-cultural, and politico-economic milieu in which the individual lives. If culture diffuses in to our brains, then cultural differences are deep-seated and unchangeable. However, in another sense, the plastic cultural shaping of the brain also reveals the inevitability of change—precisely because plasticity is an activity-dependent mechanism.

This article also resists a prevalent metaphysical assumption among neuroscientists. Almost all researchers in the field of cultural neuroscience, whether consciously or not, are committed to a naturalist metaphysics. Chiao acknowledges this in her book *The Philosophy of Cultural Neuroscience*, which states, "As empirical science relies on the science of the mind and the social processes of the scientific community, naturalism seeks to address the philosophical issues that arise with the advancement of scientific theory and evidence-based knowledge" (Chiao 2017, p. 94). However, even though most cultural neuroscientists assume a naturalist framework, their findings disclose—perhaps unintentionally—that *human nature is not entirely natural*. Cultural neuroscience underscores that human nature is fundamentally biosocial. Sociality is not an accidental feature of the brain but a constitutive and intrinsic property.

Most neural processes are profoundly shaped by lifelong practices, habits, and the cultural context in which individuals live. Our way of life, our habits, and the culture in which we are raised manifest themselves in the brain by influencing hormonal activity, prompting the use of different neural regions, or by volumetrically altering certain brain tissues. Consequently, cultural neuroscience implies that there is no such thing as a human essence, as opposed to liberal theories that posit a single universal human nature; individuals vary according to the cultural values, civilizational frameworks, and class-based habitus that shape their sense of self. Thus, we might draw this bold conclusion considering contemporary scientific evidence: human nature cannot be grasped within a strictly physicalist naturalism.

If the historical and social dimensions were merely epiphenomenal to the biological, they would exert no transformative influence upon it. However, cultural neuroscience itself demonstrates that emergent structures arising from natural processes can retroactively alter the very natural substrates from which they emerged. *Culture is not entirely natural, yet it is not reducible to nature alone*. That culture arises from and is influenced by natural conditions does not entail its reducibility to the natural. Thus, the *non-naturalist orchestration of biology and culture* revealed by cultural neuroscience can be understood through a Hegelian speculative lens of the "identity of identity and non-identity." The data produced by cultural neuroscientists cannot be adequately explained from within their metaphysical assumptions. Hegel's speculative metaphysics and his concept of "second nature" are particularly fruitful here.

Cultural neuroscience also shows that norms are embrained, which means that norms can be inscribed in the brain's tissue. The *biosocial* (*Natur-Geist*) character of the human brain cannot be neglected (Han et al., 2013). Hegelian dialectical ontology can be re-evaluated in the light of plasticity (Malabou, 2004). The second nature Hegelian plastic ontology should be reconsidered as the best approach for interpreting the results of cultural neuroscience.

CONCLUSION

This article has examined how neural processes involved in self-representation should be understood as dynamic and context-sensitive rather than fixed or universal. Drawing on findings from cultural neuroscience, it has shown that different forms of self-construal are associated with variations in the neural activity underlying self-related cognition. Empirical studies reviewed in the preceding sections suggest that culturally sustained norms and practices can modulate how the brain differentiates between self and other, as well as which neural regions are recruited during self-referential tasks. Notably, the evidence that cultural norms systematically influence the recruitment and organization of self-related neural processes shows that normative cultural structures can be observed in the brain.

By conceptualizing these findings as embrained normativity, the study highlights the significance of norms and culture in the brain and its operations. Rather than treating cultural norms as external influences acting upon an otherwise stable biological substrate, the evidence indicates that culture becomes integrated into bodily and neural processes through long-term habits and practices. The interpretations in this article indicate the potential value of future collaboration between neuroscience and the social sciences.

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