

Original Research

Not 'culture' as Hofstede assumed, but 'context' is the software of the mind: The neuroscience of a dynamic, contextual, and polycultural self

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This paper reviews and discusses the neuroscience of a dynamic, contextual and polycultural self. Advances in neuroscience suggests that: (1) the brain can acquire contradictory cultural systems at the same time; (2) all three groups of bi/multi/ and mono-cultural individuals can activate corresponding cultural patterns of the self, based on the cultural cues given in a specific cultural context; (3) individuals may be born with some genetic predispositions and these interact with the cultural environment, such that the same genetic predisposition may have opposite expressions of the self in different cultural contexts. Based on these insights, future research could invest more in (1) understanding the neuroscience of polycultural and global citizens who may have a universal identity; (2) advancing new identity development models for monocultural individuals who have the potential of a dynamic, contextual and polycultural self, but don't benefit from living in a diverse cultural environment; and (3) because people can be both products and producers of culture, future research can focus on 'technologies of the self', in the sense that individuals, organisations and governments can promote human agency (i.e. people as producers/authors of culture), proactively raise awareness and support the cultivation of a dynamic, contextual and polycultural self.

KEYWORDS: cultural neuroscience, intercultural communication, multicultural identity, polycultural identity, identity development, Hofstede



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1. INTRODUCTION

Studies have long examined the impact of culture at different levels of analysis, e.g. at the 'interpersonal level' when people interact within a social context, and at the 'collective level' such as nations and organisations. However, culture is also a schema of knowledge structure within each individual. This 'intra-individual/personal level' of

analysis reflects the reality of globalisation and increasingly intercultural contact. As the world is becoming more of an interconnected community, many aspects of globalisation have forced as well as allowed individuals to extend beyond their own socialised worldviews, enriching and integrating multiple cultural schemas into their identities (Cross, 1991; Hong et al., 2016).

The topic of analysing and developing a multicultural orientation to life has gained well deserved attention in the literature. According to a review by Ponterotto and Fietzer (2014), three major lines of theory are: (1) racial identity development indicates a fluidity between statuses and stages of racial identities; (2) biculturalism and acculturation indicate dynamic processes of change (e.g. assimilation, separation, integration or marginalisation) as individuals interact with and adapt to two different cultural systems; and (3) multicultural personality focuses more on success-based adaption and moving beyond biculturalism.

From an evolutionary point of view, individuals with multiple sets of tools in their toolbox (DiMaggio, 1997) may adapt more successfully, using their dynamic multicultural mind as a buffer or a coping mechanism to deal with the challenges of the increasing intercultural heterogeneous environments (Ramirez, 1999; Ponterotto, 2010). A meta-analysis shows that biculturalism is associated with positive psychological and social adjustment such as self-esteem and career success (Nguyen & Benet-Martínez, 2013). While some studies pointed out disadvantages such as 'cultural homelessness' (Hoersting & Jenkins, 2011), other studies argued that these 'marginal' individuals were culturally competent, successful, creative, with a strong potential of being global leaders (Moore & Barker, 2012; Tadmor et al., 2012; Fitzsimmons et al., 2013). Based on these insights, multicultural identity has been given a new definition, as it reflects an identity that does not belong to any particular culture, but a blend of multiple cultures and contexts (Arasaratnam, 2013). This is the foundation for the recent rise of polyculturalism (Morris et al., 2015).

Advances in neuroscience lend supportive biological foundation for the argument of a dynamic self. First of all, neurogenesis (i.e. the production of new neurons) occur mainly in two important stages of life: early childhood and adolescence. Thus, Kitayama and Park (2010) argued that the second peak around the time when individuals become ready for reproduction could reflect a biological adaption for humans to accelerate the

process of culture acquisition, among others. By cultivating and selecting among different identities and self-narratives, teenagers strive to organise their cultural minds and become a cultural member of a community before they enter the reproduction market.

Secondly, neuroscience has provided more understanding of how the brain evolves distinct mechanisms for knowing the self, the development of the self and self-regulation (Heatherston, 2011). The notion of a polycultural and dynamic self has gained increasing evidence from findings on brain plasticity, epigenetics and especially how culture and specific contexts shape neural pathways. For example, we are now aware of how the brain can be primed with cultural cues, so individuals will be more likely to have a culturally corresponding cognitive, affective, and behavioural response (Hong et al., 2000; Oyserman, 2016).

This paper aims to review and discuss literature on the neuroscience of a dynamic, contextual and polycultural self by describing three major approaches to the subject. The first approach focuses on how the brain reflects a dominant culture, the second approach focuses on bi/multicultural individuals, and the third one focuses on monocultural individuals. The paper then points out the potentials and shortcomings of each approach. It continues by adding another aspect of genetic inheritance in the dynamic interplay of culture and biology in the development process of the self. The paper finishes with implications for theories and practices in an intercultural context.

2. THE NEUROSCIENCE OF A DYNAMIC, CONTEXTUAL AND POLYCULTURAL SELF

2.1. Cultural determinism approach

For a long time, the human brain was viewed as a device for mental computation. Below all the cultural variations, the deep mechanisms were universal and innate (Pinker, 2002, p. 39). This computer metaphor portrayed the human's mind as a set of algorithms with inputs and outputs, indicating the mind as fixed, bounded, and housed neatly in the head (Kitayama & Park, 2010). This section describes and discusses how this notion

has evolved, and together with advances in neuroscience, has led to a dynamic, contextual and polycultural notion of the self rather than a static one.

Over the last two decades, a growing body of studies have demonstrated that the brain's connectivity and functions change dynamically as a result of experiences in cultural encounters. Studies often found heightened activity in the medial prefrontal cortex (MPFC) when individuals process information about the self (Northoff et al., 2006). When culture is considered, studies found that in collectivistic cultures, the self and closely connected others may overlap (Zhang et al., 2006; Chiao et al., 2009; Wang et al., 2013; Wuyun et al., 2014). For example, the MPFC was strongly engaged when Chinese participants thought about the self, but also their mother. For Chinese participants, the personal self and parents were also intertwined in the motivational system in the brain (Zhu et al., 2016). This was not the case among people of Western backgrounds who tend to embrace individualistic values (Zhu et al., 2007).

Similar findings have been reported with respect to religion. In the study of Han et al. (2010), the Buddhist doctrine of no-self resulted in weakened neural activity in the ventral part of the MPFC – a region associated with self-judgement. At the same time, Buddhist doctrine also enhanced the activity of the dorsal part of the MPFC – a region associated with reappraisal and evaluation of one's own feeling. The authors suggested that Buddhists may think about the self from a third person perspective as a result of no-self and blurring the boundary between self and others.

All together, these studies suggested that culture influences the neurobiology of the self. In fact, a great number of studies in cultural neuroscience is dedicated to this direction of research, i.e. how culture shapes the brain (Bjornsdottir & Rule, 2018). While these studies advance the field significantly, critics have voiced concerns. Building upon the foundation of the cross-cultural discipline, cultural neuroscience tends to adopt the mainstream theories of culture, for example, a school of thought led by Hofstede (1980). These

theories posit that culture is static, national values are '*as hard as a country's geographic position*' (Hofstede et al., 2005, p. 13), and are very hard to change across multiple generations, regardless of global movements (Nakata, 2009; McSweeney et al., 2016). Moreover, this school of thought assumes that basic values have been programmed into a person's mind from a young age and remain stable: '*We assume that each person carries a certain amount of mental programming which is stable over time*' (Hofstede, 1980, p. 14).

When applying these theories to neuroscience, cultural values become embedded in biology. Hence, it's argued that cultural neuroscience should exercise caution in picking up the traditions of the cross-cultural studies to avoid the tendency of perpetuating cultural determinism, essentialism, reductionism, Eurocentrism, and dichotomising. For example, by associating culture with geographical territory while blurring the boundaries between 'culture' and 'race', we may risk 'neo-racism' (Martínez Mateo et al., 2013). The monolithic view of culture as a determinant of cognition, affection and behaviours may deny the autonomy of individuals, and force them to correspond to a conceptual essence. '*An Oriental man was first an Oriental and only second a man*' (Said, 1979). It's not uncommon to see studies advocating 'collectivistic brains' (Wang et al., 2013) or searching for the 'Chinese self' (Zhang et al., 2006). Such race-based terminologies have been argued to be used in a vague, inconsistent manner, and carry the potential to be misleading (Malinowska, 2016).

On the question of whether neuroscience could affect the lay understanding of personhood, O'Connor and Joffe (2013) argued that studies may foster essentialist representations of cultural groups, promoting a sharp 'us-them' split in which particular groups are wrongly perceived as biological 'other', thus, perpetuating stigmatisation and discrimination (Soylu Yalcinkaya et al., 2017). Similarly, Denkhauß and Bös (2012) warned that practitioners may interpret cultural neuroscience studies as evidence of well-established cultural clichés rather than mind-broadening knowledge.

In response to the critics in the previous section, some authors studying cultural neuroscience have distanced themselves from the static essentialist conception of 'cultural mapping', and turned their attention to its dynamic side, focusing more on the 'processes' (Denkhaus & Bös, 2012) of not only how culture shapes the mind but also how it evolves and manifests itself within each individual. This line of research is fundamentally based on the notion that culture is internalised as a loose network of shared knowledge structures and the principles of knowledge activation (Higgins, 1996) based on specific context. There are two major lines of theory in studies of this direction: (1) the dynamic-constructivist approach, and (2) the situated-cognition approach. The next two sections will discuss these two approaches and point out in what way they have advanced the understanding of a dynamic, contextual, and polycultural self.

2.2. Dynamic-constructivist approach

The dynamic-constructivist approach is pioneered by Hong (2009) and colleagues (Hong et al., 2000; Hong & Chiu, 2001; Hong et al., 2009) with a focus on bicultural and multicultural individuals. It is rooted in the assumption that human brains are biologically prepared to acquire knowledge and more importantly, can acquire more than one cultural knowledge system, even when these systems contain conflicting values and behaviours. When an individual is exposed to different cultural knowledge systems such as a multicultural society, these systems become 'available' in the cognitive inventory, and 'accessible' for individuals to 'apply' in the specific context (Higgins, 1996).

One common method to study this cultural frame switching is *priming* – a process that activates mental representations of a concept such as memories, thinking and doing procedures (Bargh & Chartrand, 2000). Individuals can be primed with languages such as reading a text with collective pronouns (*we, they, us*), individual pronouns (*I, me, my*), or looking at cultural icons such as the Statue of Liberty or the Great Wall. Primed bicultural individuals tended to respond in ways that

are typical of the priming cultures. For example, in Hong et al. (2000), being shown an ambiguous event such as a picture of a fish swimming in front of a school of fish, bicultural individuals who were primed with Chinese icons interpreted it as the fish being chased (external attribution), while those who were primed with American icons perceived the fish as a leader (internal attribution). Similar findings of cultural frame switching in bicultural individuals have been reported with regard to many aspects of self-view and identity evaluation (Cheng et al., 2014). Cultural-priming effects are robust, exerting influences at both explicit and implicit level of consciousness (Devos, 2006).

Further evidence from neural studies weighed in (Chiao et al., 2010; Harada et al., 2010; Huff et al., 2013). For example, the distinction between 'self' and 'others' in the ventral part of the MPFC can be weakened or eliminated by exposure to collectivistic cultural primes (Ng et al., 2010). Interestingly, in Chiao et al. (2010), collectivistic priming led to greater self-referential activation for contextual self-judgments in this region of the brain. The opposite occurred with individualistic priming for general self-judgement. This means the *same* brain region (i.e. MPFC) can be activated by opposing cultural values (collectivistic vs individualistic), allowing individuals to respond in a culturally corresponding way (contextual vs general).

Thus, for bicultural and multicultural individuals, conflicting cultural knowledge systems coexist and are shifted flexibly in a dynamic process. A major contribution of this approach is that it argues against the static paradigm of culture by suggesting that culture does not rigidly determine human behaviours from the early age in form of a 'software' that does not change across generations. Bicultural and multicultural individuals experience culture as flexible, open, and ever changing, unbound by their racial, ethnic, group, or national identities.

However, a major issue with the dynamic-constructivist approach is that it focuses only on individuals who are bicultural or multicultural. While globalisation has increased their population, these individuals still belong to small, distinct

and specific subgroups. The approach does not give a clear indication of whether monocultural individuals could exercise, benefit or cultivate such a dynamic activation of cultural knowledge systems (Oyserman & Lee, 2008). While the approach breaks free from the notion that people internalise cultural values from a young age and these values remain stable throughout their life, it still hinges on the notion that long-term cultural experiences in life shape the brain, albeit this shaping is dynamic and ever changing. It leaves open the question of what opportunities and potentials there are for those who do not benefit from a life enriched with bicultural or multicultural experiences.

2.3. Situated-cognition approach

The situated-cognition approach was proposed by Oyserman and Lee (2008). They argued that individuals have access to and can adopt different culturally grounded mental representations, depending on the cue given in context. However, different from the dynamic-constructivist approach, this cue-triggered process of selection does *not* require individuals to be bicultural or multicultural (Kühnen & Oyserman, 2002). When culture A seems to be different from culture B, these differences are not necessarily fixed in the mind in the individuals coming from those cultures. Many seemingly fixed cultural differences are actually differences in the accessible constructs, or cultural mindsets, that come to mind when situations render them accessible. In other words, people in any society are sensitive to cues that trigger opposing values such as an individualistic or collectivistic mindset. Once this mindset is activated, individuals will process the world and behave in a particular way.

Priming has been used to examine this approach with evidence in both between-subject and within-subject studies, comparing two priming conditions of two opposing mindsets (Oyserman, 2016). For example, across diverse cultures of European America, China, Hong Kong, Korea and Norway, monocultural individuals primed with an individualistic mindset were better at ignoring

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context. On the contrary, when primed with a collectivistic mindset, they were better at paying attention to relationship (Kühnen & Oyserman, 2002; Lin & Han, 2009; Oyserman & Sorensen, 2009).

Neuroscience has also provided some evidence supporting this approach. For example, Sui et al. (2013) measured neural response to face recognition. Among Chinese participants whose chronic accessible cultural mindset is collectivistic, when primed with a mindset of individualistic, the faces of their friends became less salient. On the contrary, for British participants who have individualistic chronic cultural accessibility, when primed with collectivism, their own face became less salient. In another study, priming collectivistic prime led to an overlap of neural response for reward activation, so that 'my reward' is also 'my friend's reward' (Varnum, 2014). Other studies also suggested results that were congruent with the approach of culture as situated cognition, such that subtle environmental cues can activate relevant cultural mindsets and their associated neural networks (Sui & Han, 2007; Jiang et al., 2014; Wang et al., 2014). Impressively, this process of preparation for incoming cues occurs even in the brain's resting state (Wang et al., 2013).

A major contribution of the culture as situated cognition approach is the emphasis it places on context, or the specific situation that an individual is encountering. It argues against the assumption

that people are static products of their original culture at birth. Even without bicultural or multicultural life experiences, people can acquire, activate, and apply different mindsets, based on the cues given in the context. This resonates with what Osland and Bird (2000) called 'value trumping', that is, in a specific context, certain cultural values take precedence over others. Culture is not static, because it is embedded in the context. Not culture, but the dynamics of context contribute to the dynamics of the self.

However, context is more than cultural cues given in experimental settings. In reality, a specific context could refer to a particular situation in which there is an interplay of many factors that all together, create a unique dynamic. From an interdisciplinary point of view, context covers not only the external environment in which an individual interacts, but also her/his internal biology. The culture as situated cognition approach has gained support from neuroscience with regard to the role of the brain in dynamic responses to cultural cues. The next session brings genes into the picture, adding another element to what a context may entail, broadening the view of the neuroscience of the self and how it is developed.

2.4. Culture-gene interaction approach

The static paradigm of culture (see Hofstede et al., 2005) assumed that culture is socially learned, and people are born more or less as blank slates, ready to absorb their first culture in the form of a 'mental program'. In other words, inherited biology is not directly involved with cultural learning. However, the 'gene-culture co-evolution' theory (or dual inheritance) sees a dynamic connection between them. In essence, genes help to perpetuate important cultural traits that enhance survival (Boyd & Richerson, 1985). For example, in regions of the world with a high load of pathogens and other environmental risks, the value of collectivism and acceptance of hierarchy could be supported by the s5-HTTLPR – a shorter variant of the gene that encodes the serotonin transporter (Fincher et al., 2008; Murray & Schaller, 2010; Chiao & Blizinsky, 2010; Fischer, 2013; Mrazek et al.,

2013). This version of the gene is associated with stress reactivity and, hence, it has been argued to have played a crucial role in fostering threat avoidance and social cohesion in environments that need these cultural strategies for survival. To this day, the population of East-Asia still has twice of rate of s5-HTTLPR in comparison with other Western populations (Gelernter et al., 1997).

However, genes do not necessarily determine cultural tendencies. Genes co-evolve, but also interact dynamically with the cultural environment. The 'gene-culture interaction' theory posits that genetic influences shape psychological and behavioural predispositions, while cultural influences shape how these predispositions turn into outcomes (Sasaki et al., 2016). In other words, genes shape the possibilities and culture shapes both the selection and the direction.

For example, the 5-HTTLPR polymorphism mentioned earlier increases the likelihood of symptoms associated with depression, but this likelihood tends to happen when coupled with exposure to life stress (Caspi et al., 2003; Karg et al., 2011; Risch et al., 2009). Focusing on the same gene, Cheon et al. (2014) reported that those who had previous negative contacts with outgroups and perceived the social world as dangerous were more likely to report intergroup biases, but this relationship was stronger for those with the stress reactivity variant s5-HTTLPR. Interestingly, the same study reported that those with this gene variant showed more *positive* outcomes in a favourable and safe cultural environment. Thus, the 5-HTTLPR could be either positive or negative, depending on the socio-cultural environment.

A number of other studies supported the dynamics of gene x culture interplay. In Chi et al. (2016), carriers of the 7-repeat variation of the dopamine transporter gene (DRD4-7R) who came from a higher socioeconomic status were associated with higher educational achievement and thus, higher frequency of *voluntary* job changes. In contrast, carriers of the same variant coming from higher neighbourhood poverty were associated with lower educational achievement, and thereafter higher frequency of *involuntary* job change,

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such as being let go. Together with this 7-repeat variation, another version – the 2-repeat (DRD4-2R) – was more associated with *independence* among European American carriers, but *interdependence* among East Asian carriers (Kitayama et al., 2014). In the same vein, the GG variant of the oxytocin receptor gene is associated with more emotion sensitivity, however in Kim et al. (2011), the behavioural outcomes were almost opposite among carriers from a Korean background (reportedly using more emotion *suppression*) and a European American background (more emotion *expression*).

Such a differential plasticity is the reason why many genes previously named 'depression' or 'risk-taking' have been re-labelled as 'plasticity genes' (Sasaki et al., 2016). Individuals with the same genetic inheritance can have different outcomes, depending on the specific socio-cultural context. Likewise, the same socio-cultural environment can create different consequences for people, depending on their genetic tendencies. How an individual perceives and expresses the self as outcomes of intercultural experiences would be a result of an interplay between both biological predispositions together with the particular socio-cultural environment. Thus, for an individual, culture is not just socially learned, but to a certain extent, could be genetically influenced (Nguyen-Phuong-Mai, 2019).

Taken together, in this section, it has been argued that the cultural pattern of the self is not static. There are many factors that contribute to the development of the cultural self. Firstly, the brain can acquire more than one cultural system, even when these systems are contradictory. Secondly, an individual can switch frames and express the

self in accordance with the cues given in a specific cultural context. Thirdly, this frame switching can occur regardless of whether an individual has bi-cultural or multicultural life experiences. Finally, genetic predisposition in each individual can lead to different expressions of the self even when being exposed to the same socio-cultural environment. Likewise, the same genetic predisposition may have opposite expressions of the self in different cultural contexts.

Such a dynamic view of the self suggests that we may reconsider the cultural deterministic view proposed by Hofstede et al. (2005), i.e. 'culture is the software of the mind'. As shown in the aforementioned studies, culture does not stand alone but interacts with other factors. Together, their interaction creates a specific context. The Diversity Pathways (see Figure 1) illustrate context as a dynamic interplay of five factors: (1) the opportunities and challenges posed by geographical environment; (2) the guiding power of collective culture; (3) the potentials and limits of genes; (4) the plasticity of the brain; and (5) the impact of behaviours (Nguyen-Phuong-Mai, 2017a, 2017b). Culture, as a participating factor, probably does not impose its deterministic and unidirectional power on environment, brain, gene, and behaviour. Instead, culture interacts dynamically with these factors, creating a unique context through which the cultural diversity of life is manifested. In other words, the cultural pattern of the self is not the 'consequence of culture' (Hofstede et al., 2005) alone, but the result of a much more multidimensional, holistic, complex, interactive, and dynamic interplay among culture, geographical environment, gene, brain, and behaviour. For each individual or collective, this interplay may manifest differently, creating different specific contexts, expressing different cultural patterns in reality. The power of a specific context makes even more sense if we look at the globalised world where cultural borders are constantly merged and emerged, both online and offline, for both individuals and collectives. Thus, not culture, as Hofstede assumed, but potentially, 'context is the software of the mind' (Nguyen-Phuong-Mai, 2017a, 2017b).

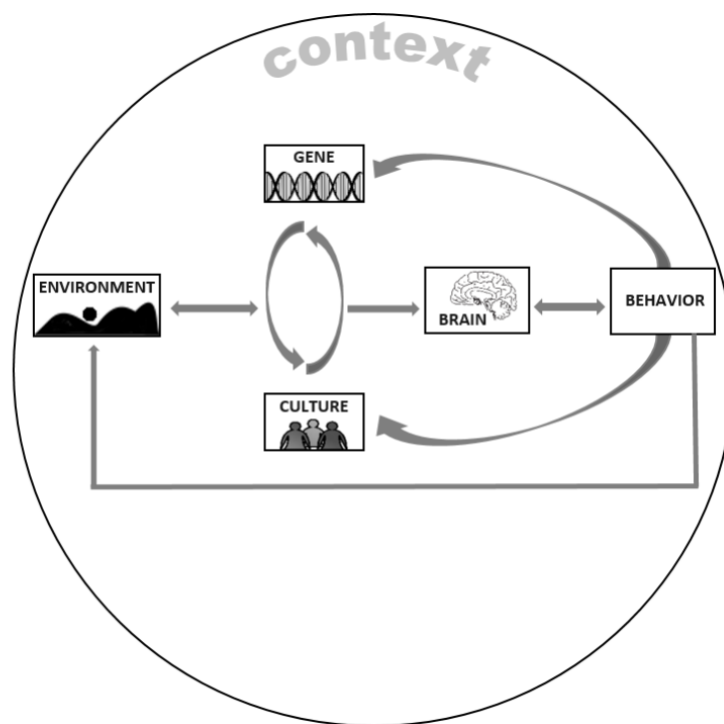


Figure 1. The Diversity Pathways (Nguyen-Phuong-Mai, 2017b)

3. IMPLICATIONS FOR THE DEVELOPMENT OF THE SELF IN AN INTERCULTURAL CONTEXT

3.1. From a dynamic, contextual and polycultural self to global citizen and universal identity

Taking into account the insights from interdisciplinary studies, future research could take note of a number of implications. This section suggests further attention to the neuroscience of not only bi/multicultural individuals, but also those who identify and have traits of global citizen and universal identity. Next, future studies should advance identity models not only for bi/multicultural individuals but also monocultural individuals. Finally, there could be incorporation of a change agent spirit in how individuals can proactively influence and shape their dynamic, contextual and polycultural self.

The idea of a changing self is not new. In *Technologies of the Self*, Foucault (1988) said he didn't feel that it is necessary to know exactly what he is. The main interest in life and work is to become someone else that you were not in the beginning. Some scholars even go further by arguing that the self does not exist (Puett & Gross-Loh,

2016) – a view that resonates with the Buddhist concept of 'anatta', meaning 'no self'. Neuroscience has provided some support that there is no stable selfhood because the brain and body are constantly in flux (Dahl et al., 2015; Rosenberg et al., 2015). As previous sections have shown, individuals can acquire conflicting cultural systems and implicit cues can activate corresponding cultural patterns of self-expression in terms of cognition, affection and behaviour. More importantly, this process can occur despite a lack of bicultural or multicultural experiences.

This dynamic not only argues against essentialising of the self in terms of race, nationalities, gender or social class, but also suggests a potential connection with the emerging body of literature on 'global citizenship' (Reysen & Katzarska-Miller, 2013) and 'universal identity' (Kanayama, 2006). In the age of hyper-connection and increased intercultural encounters, the depth of identity may build upon and exist in parallel with other local cultural identities in the process of creative self-destruction, and as Jung (2014) argued, may invoke the transcendent function of universal uncon-

consciousness. Going beyond the focus on bi/multi-cultural individuals, future research could give more attention to the neuroscience of those that identify themselves with a superordinate identity. This would help us gain more understanding of how a dynamic, contextual and polycultural self manifests. Although this may sound far-fetched, we could ask whether this dynamics could go beyond cultural frame-switching, even potentially reach a 'culture-free' mindset, to the extent that to be individual is to be universal (Kanayama, 2006). As Kanayama (2006) argued, through intercultural encounters, individuals don't necessarily become cultural drifters. They could become culturally fluid, achieve universal identity, and exist with others in symbiosis.

3.2. Advancing models of identity development

The neuroscience behind a dynamic, contextual and polycultural self suggests that future research could advance models of identity development. Current models are, to a certain extent, still influenced by how different cultural identities interact rather than how they synergise and exist 'in symbiosis', as Kanayama (2006) suggested. For example, the 'multiple identity development' model posits that while people may have multiple cultural identities, they are inevitably caught between them and may suffer from fragmented or marginalised self-concepts (Shih & Sanchez, 2005). Stepping away from this problem-approach, the general racial identity development models suggested that a person could achieve a stable identity of mixed races. However, this model did not allow a person to identify with multiple cultural identities at the same time (Gillem et al., 2001). In response to this critic, researchers developed many identity models specifically for people with mixed cultural backgrounds (Collins, 2000), yet these models could force individuals to choose between their different components of self.

Models with a fusion approach (Bennett, 1986; LaFromboise et al., 1993) addressed this issue, and suggested that a person can reach an integrated stage when (s)he can move in and out of

different cultural views and create a new cultural identity. However, the popular DMIS model created by Bennett (1986) indicates a linear path of development which may not reflect the complexity of how the self is socially constructed (Zafar et al., 2013). An ecological approach (Rockquemore et al., 2009) overcomes this shortcoming by recognising that cultural identities are not predictable, not linear, and not even goal-consistent. This is because the creation of the self depends on how each specific context interacts with both self-views and other-views. This model tends to resonate more with insights from neuroscience discussed in previous sections, in the sense that cultural patterns in the brain could be activated depending on a specific context in which specific cultural cues are given and a specific intercultural relation is set up. With three levels (i.e. context, self-view, and other-view), this model also allows us to understand situations in which cultural priming does not lead to the corresponding cultural patterns of thinking and doing, because self-view and other-view interact and influence the context. For example, among individuals who held an essentialist view of culture, seeing American primes may remind them of their Asian identity, and that they might never become a 'real' American. Thus, despite being primed with American cues, they would backfire, react against the primes, and respond in a typical Asian way, creating a contrast effect (No et al., 2008).

However, none of these models involves application for monocultural individuals who have less exposure to multicultural experiences. As discussed earlier, these individuals do have the potential to activate the corresponding cultural mindset associated with the cultural cue given, as long as they are aware of such cultural patterns. For those who live in a homogeneous cultural environment, using the theory of Higgins (1996) stated earlier, knowledge is not 'available' in the cognitive inventory, hence will not be 'accessible' to 'apply'. Mourey et al. (2015) gave a specific example: during Lunar New Year, Chinese participants put more food on their plates in a Chinese buffet if given plates with the design for Lunar New Year.

However, if it was not Lunar New Year, and if the participants did not know about this holiday, there was no effect.

The insight that monocultural individuals can switch cultural mindsets indicates that education should play a crucial role in creating 'available knowledge' so that learners can access and apply them, despite the fact that they are not living in multicultural environments. Intercultural education, hence, is at the forefront of the task to develop such a dynamic and contextual mind. Future studies could invest more in the development of identity models that could be applied in non-multicultural societies. One suggestion could be the insights from a rich line of research in Identity-Based Motivation theory. It posits that people's self-concepts of who they want to be will motivate and trigger them to take action towards how that identity is socially perceived (Oyserman, 2015). Literature on identity (re)construction is also abundant. For example, identity can be cultivated through discourse (Bamberg et al., 2011), self-regulation (Nurra & Oyserman, 2018) or participation in different communities (Blåka & Filstad, 2007). Moving from priming identities to cultivating identities takes time and may demand the systematic restructure and cooperation of different stakeholders. However, the immense advantage of internalising an identity that is contextual, dynamic and polycultural should not be undermined.

3.3. Human agency in neural grafting of the self

Finally, future research could investigate how insights from mechanisms such as the culture-gene interaction, neural plasticity, neurogenesis and epigenetics could contribute to the understanding and development of the self.

With regard to culture-gene interaction, studies on the interlay of genes and cultures suggested that for those who carry a number of genotypes (e.g. the s5-HTTLPR, the DRD4, or the GG allele of the oxytocin receptor gene as discussed earlier), cultural differences may be more pronounced than others (Kim & Sasaki, 2012, 2014). For instance, cross-cultural differences of individualism vs col-

'Moving from priming identities to cultivating identities takes time and may demand the systematic restructure and cooperation of different stakeholders. However, the immense advantage of internalising an identity that is contextual, dynamic and polycultural should not be undermined'

lectivism (e.g. 'European Americans as independent' vs 'Asians as interdependent') were more pronounced among the carriers of the 7- or 2-s of the DRD4 gene. However, *no* cultural difference was apparent among the noncarriers (Kitayama et al., 2014). Also, as cited earlier in Cheon et al. (2014), among the carriers of the s5-HTTLPR, *negative* intercultural experiences were associated with more intergroup biases, but *positive* intercultural experiences were associated with less intergroup biases, compared to those without the variant. In other words, these environmental susceptibility or 'plasticity' genes could be either positive or negative, depending on the socio-cultural environment. They could be associated with a tendency to have better or worse experiences in different cultural contexts, depending on how supportive their cultural context is.

Considered that these 'plasticity' genes are more prevalent in some regions of the world than other, for example the GG genotype is more prevalent in Europe (Kim et al., 2010), the s5-HTTLPR in Asia (Gelernter et al., 1997) and the 7-repeat variant of DRD4 in North and South America (Wang, 2004), there is much to explore in terms of the interaction between culture and genes. A case in point is the study of Kashima et al. (2015). Immigrants from a country with a higher frequency of the s5-HTTLPR carriers tend to have a decrease in life satisfaction compared with those from a country with a low frequency. For example, if we combine the result of this study and the finding that the s5-HTTLPR is associated with *positive* outcomes (i.e. reduced intergroup biases and prejudices) in a

favourable safe intergroup environment (Cheon et al., 2014), then a potential hypothesis could be: will immigrants from countries with a higher frequency of the s5-HTTLPR such as Asia psychologically benefit more from a safe cultural environment and suffer more from a threatening one, compared to those from countries with a lower frequency? This kind of research could help to formulate governmental and organisational policies in terms of international mobility and supportive systems, aiming at providing the most effective cultural support for expats and immigrants in their acculturation process.

Such a proactive approach to influencing the culture-gene interaction is of immense significance because it capitalises on the change within our own power. As a philosopher, Foucault (1988) emphasised a variety of means to work and transform the self, so much so that one must become the doctor of oneself, knowing oneself well enough to be willing to renounce anything. Advances of neuroscience could add a contemporary application of Foucault's technologies of the self (Brenninkmeijer, 2010). Examples of such technologies are (1) mindfulness – a method that has been suggested to help create a more flexible sense of self and identity (Atkins & Styles, 2015); and (2) neurofeedback – a therapy that uses negative or positive feedback for brain activities, and thus, train the brain to self-regulate, for example, to help people learn open listening (Schaefer, 2018).

More importantly, technologies of the self could also be understood as the kind of self-awareness that would positively influence consequential behaviours. Take neuro-education for example. Among elementary students, a brief class visit with an introduction on brain plasticity and how their effort matters had a positive influence on student attitudes towards science and shifted their attitude from a fixed mindset to a growth mindset (Fitzakerley et al., 2013). Among seventh-graders, students who were taught that intelligence can be developed predicted an upward trajectory in grades over the two years (Blackwell et al., 2007).

In the context of intercultural communication, such a proactive approach indicates human agency in our relationship with culture. The static paradigm of Hofstede posits that as a collective, people are the 'consequences', or the product of their culture. However, viewing people as passive 'cultural dope' (Crane, 1994) may undermine our own role of authority (Swidler, 1986). Proposing a shift of paradigm, Nguyen-Phuong-Mai (2019, 2020) argued that humans are both products and producers of culture. People are shaped by their cultures, but they can also actively be change agents, re-shaping both themselves and the cultures around them. Individuals don't just passively absorb a cultural programme from young age, which is 'stable over time' (Hofstede, 1980), but they can be the programmers themselves throughout their lives. In other words, the shaping power of culture does not override the possibilities of people exercising their authority, agency and creation in the process of re-shaping cultures. People can be both the 'consequences' of their 'cultural software' and the creators of that very software.

This view also suggests a move away from the problem- and difference- focused approach which regards 'culture as a source of conflict than of synergy' a 'nuance at best and often a disaster' (Hofstede, 2001). By promoting human's agency in the shaping of culture, people can actively turn cultural diversity into resource rather than threats, potentials rather than problems (Nguyen-Phuong-Mai, 2020). As much as knowing about brain plasticity can change students' attitudes towards intelligence and personal development (Blackwell et al., 2007; Fitzakerley et al., 2013), it is argued that a similar hypothesis can be formed. We may want to know whether learning the possibility of cultivating a dynamic, contextual and polycultural self may encourage people to work towards building one. This could lead to a reduction in essentialist views, increase autonomy in dealing with self-concepts, and motivate individuals to actively advocate positive cultural change in a wider society.

Such a notion of human agency also resonates with the third major line of research on multicultural orientation of life in the review of Ponterotto

and Fietzer (2014) mentioned in the introduction to this paper. Specifically, it aligns with the 'multicultural person' construct by Nieto (2000) which advocates a behavioural activism component with teachers as role models. Other constructs in this line of research also emphasise the development aspect, or a focus on success-based adaption. For example, traits of successful multicultural personality such as cultural empathy, open-mindedness, emotional stability, social initiative, and flexibility (Van der Zee & Van Oudenhoven, 2000, 2001) can be cultivated. This indicates the crucial role of empowering multicultural education (Banks, 2014) as well as the significant impact of national policies (Novoa & Moghaddam, 2014) and organisational policies in cultural diversity (Brannen & Lee, 2014).

4. CONCLUSION

This paper reviews and discusses the neuroscience of a dynamic, contextual and polycultural self. It points out the shortcomings and potentials of different approaches in understanding how the self interacts with specific cultural contexts. Taken

together, advances in neuroscience suggest that: (1) the brain can acquire contradictory cultural systems at the same time; (2) all three groups of bi/multi and mono-cultural individuals can activate corresponding cultural patterns of the self, based on the cultural cues given in a specific cultural context; (3) individuals may be born with some genetic predispositions and these interact with the cultural environment, such that the same genetic predisposition may have opposite expressions of the self in different cultural contexts.

Based on these insights, future research could invest more in (1) understanding the neuroscience of polycultural and global citizens who may have a universal identity; (2) advancing new identity development models for monocultural individuals who have the potential of a dynamic, contextual and polycultural self, but don't benefit from living in a diverse cultural environment; and (3) advocating for technologies of the self, in the sense that individuals, organisations and governments can promote human agency, proactively raise awareness and support the cultivation of a dynamic, contextual and polycultural self.

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