Pakistan Journal of Life and Social Sciences
www.pjlss.edu.pk

REVIEW ARTICLE

Acculturation of Indian Minority in Malay Majority Culture: A Narrative Review from the Cultural Neuroscience Perspective

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ARTICLE INFO	ABSTRACT
	The migration and acculturation processes of Malaysian Indians into the predominantly Malay culture of Malaysia present a fascinating study of cultural integration, identity transformation, and neurocognitive adaptation. This narrative review aims to explore these dynamics through the lens of cultural neuroscience, which examines how cultural contexts shape and are shaped by the human brain. Malaysian Indians primarily consist of Tamil who migrated during the British colonial period have established a significant presence in Malaysia, contributing richly to the cultural mosaic. Acculturation of Malaysian Indian involves negotiating between retaining their cultural heritage and adopting elements of the Malay majority culture. This can be seen through language use, dietary changes, intermarriage, and participation in national events and customs. Cultural Neuroscience provides a theoretical framework as a basis to understand how cultural variables influence brain function and structure. It integrates methods from anthropology, psychology, neuroscience, and genetics to understand how culture shapes neural mechanisms. By bridging cultural neuroscience with empirical and qualitative research, it develops a more comprehensive narrative of the Malaysian Indian experience within the majority culture of Malay ethnicity in Malaysia.

INTRODUCTION

Indian Community in Malaysia: The Population and Historical Overview

The Indian population in Malaysia makes up a significant ethnic minority within the country. According to the recent Malaysian data, individuals of Indian ethnicity comprised approximately 7.3% of the total population of Malaysia (*Department of Statistics Malaysia, 2010;* Malaysia National Digital Department, 2024) (Table 1)

Table (1): Indian population distribution according to the provinces in Malaysia

STATE	POPULATION	PERCENTAGE
Johor	259,321	7.2%
Kedah	147,105	7.1%
Kelantan	4,800	0.3%
Kuala Lumpur	183,340	10.3%
Labuan	832	1.0%
Melaka	57,735	6.2%
Negeri Sembilan	163,661	14.9%

Pahang	66,300	4.3%
Perak	302,243	12.2%
Perlis	3,100	1.3%
Pulau Pinang	172,205	10.1%
Putrajaya	1,325	1.5%
Sabah	12,259	0.5%
Sarawak	7,900	0.3%
Selangor	810,000	13.5%
Terengganu	3,000	0.3%

Source: Department of Statistics, Malaysia, 2010

The Indian community in Malaysia has a diverse background, including descendants of early Indian migrants, Tamil laborers brought by the British during the colonial period, as well as later waves of migration from various parts of the Indian subcontinent. The Indian community has made significant contributions to Malaysia's cultural, economic, and social landscape, particularly in areas such as trade, commerce, education, and cuisine (Othman, 2002; Yat, 1969).

While the Indian population in Malaysia is a minority compared to the Malay and Chinese ethnic groups, it has maintained its cultural heritage and traditions while also integrating into Malaysian society. The Indian community celebrates various cultural festivals, including Deepavali (Diwali), Thaipusam, and Pongal, which are recognized as public holidays in Malaysia alongside other major festivals of different ethnic groups.

In Malaysia, the Indian community is ethnically and culturally diverse, comprising various sub-ethnic groups with roots in the Indian subcontinent. These sub-ethnic groups have distinct linguistic, cultural, and religious identities. Tamils are one of the largest Indian ethnic groups in Malaysia, tracing their ancestry to the Indian state of Tamil Nadu (Ramamurthy, 1989). Tamil Malaysians maintain a strong connection to Tamil language, culture, and traditions. Sub-ethnic groups within the Tamil community may include as below (Table 2). Each group contributes to the multicultural fabric of Malaysian society, preserving their cultural heritage while also integrating into the broader Malaysian community.

The Indian community in Malaysia has a rich and diverse history that dates back centuries. Indian presence in the Malay Peninsula can be traced back to ancient times through trade relations, cultural exchanges, and migration. The facts of the Indian community growth in Malaysia have been reported in historical documents. It is reported that Indian traders and merchants had been interacting with the Malay Peninsula long before recorded history. The region's strategic location along major trade routes attracted Indian traders who engaged in commerce with the local Malay kingdoms (David, 2021; Kanval et al., 2024). Indian migration to Malaysia increased significantly during the colonial era, particularly under British rule. Indian laborers were brought to Malaysia by the British to work on plantations, in mines, and in other sectors such as the civil service and railways (Shafie & Zainudin, 2000; Jam et al., 2014). Many Indians came as indentured laborers, facing challenging working conditions. The Indian community in Malaysia brought with them their rich cultural heritage, including food, music, dance, art, and religious practices.

Table (2): Sub-ethnic group in Indian community

Malaysian Tamils	A descendants of Tamil migrants who arrived in Malaysia during the colonial period and subsequent waves of migration. They are known for their contributions to Malaysian culture, particularly in the fields of education, arts, and commerce.
Sri Lankan Tamils	Some Tamil Malaysians trace their ancestry to Sri Lanka, particularly those who migrated to Malaysia as refugees due to conflicts in Sri Lanka.
Telugus	This sub-ethnic is another significant Indian ethnic group in Malaysia, originating from the Indian state of Andhra Pradesh.

	They speak Telugu and maintain cultural practices unique to their community.
Malayalees or Keralites	Hail from the Indian state of Kerala. They have a distinct cultural heritage, including traditions in literature, dance (such as Kathakali), and cuisine. Sub-ethnic groups within the Malayalee community may include Syrian Christians - Malayalee Christians who trace their lineage to the St. Thomas Christian tradition in Kerala.
Punjabis	Punjabis in Malaysia trace their roots to the Punjab region of India and Pakistan. They have a rich cultural heritage, including Bhangra music and dance, traditional cuisine, and Sikh religious practices.
Sikhs	Sikhs are followers of Sikhism, a monotheistic religion that originated in the Punjab region. Sikh Malaysians have a distinct cultural and religious identity, with practices such as wearing turbans and adhering to the teachings of the Guru Granth Sahib.
Gujaratis	Originated from the Indian state of Gujarat. They are known for their entrepreneurial spirit, vibrant festivals, and rich culinary traditions.
Others	There are also smaller Indian ethnic groups in Malaysia, including Bengalis, Marathis, and Sindhis, among others.

Indian festivals such as Deepavali (Diwali), Thaipusam, and Pongal are celebrated with great enthusiasm across Malaysia. Indian civilization, particularly through Hinduism and Buddhism, had a significant influence on the cultural, religious, and linguistic landscape of Malaysia. Ancient Hindu and Buddhist temples, such as the famous Batu Caves near the capital city of Malaysia (i.e. Kuala Lumpur), stand as testaments to this early influence (Ishak, 2010; Jam et al., 2013).

Indian Community at Post-Independence Era

After Malaysia gained independence from British rule in 1957, the Indian community continued to play an essential role in the country's development. However, they faced challenges such as socio-economic disparities, which led to the emergence of Indian advocacy groups seeking to address issues like education, employment, and social welfare.

Education emerged as a crucial factor in addressing the socio-economic challenges faced by the Indian community. Indian advocacy groups and NGOs campaigned for better educational opportunities for Indian children, including access to schools, scholarships, and vocational training programs (e.g. AMMA, 2024). Efforts were made to improve educational outcomes and reduce the education gap between the Indian community and other ethnic groups.

In the political sphere, the Indian community sought greater representation and participation in governance. Indian politicians and activists worked towards advancing the interests and rights of the Indian community through political advocacy and engagement (Ramasamy, 2001). Several Indian politicians held positions in various political parties and government agencies, advocating for policies to address the needs of the Indian population.

Despite being a minority ethnic group, the Indian community in Malaysia actively preserved and promoted its cultural heritage. Indian festivals, traditions, music, dance, and cuisine continued to thrive and became integral parts of Malaysia's multicultural society. Cultural organizations and community centres (such as Netaji Subhash Chandra Bose Indian Cultural Centre, located in Kuala Lumpur, Malaysia) played essential roles in organizing cultural events and activities to celebrate Indian culture and identity (Netaji Subhash Chandra Bose Indian Cultural Centre, 2024)

Various community development initiatives were launched to uplift the socio-economic status of the Indian community. These initiatives focused on areas such as poverty alleviation, skills training, entrepreneurship, and healthcare. NGOs, religious organizations, and community leaders collaborated with government agencies and other stakeholders to implement programs

aimed at empowering the Indian community and improving their quality of life (e.g. Indian Community Welfare Fund, 2024).

Following independence, the Malaysian government implemented policies to diversify the economy, leading to new employment opportunities in sectors such as manufacturing, services, and commerce. However, despite this diversification, many Indians continued to work in low-paying jobs, including as laborers, construction workers, and in the service sector (Department of Statistics Malaysia, 2022).

The Malaysian government has made efforts to expand access to education for all ethnic groups, including the Indian community. Initiatives such as the establishment of schools and scholarship programs aimed to improve educational outcomes among Indians. Literacy rates increased significantly, and more Indian children had access to primary and secondary education (Twelfth Malaysia Plan, 2024).

Various economic development programs were implemented to address socio-economic disparities within the Indian community (Twelfth Malaysia Plan, 2024). These programs focused on poverty alleviation, skills training, entrepreneurship, and small business development. However, despite these efforts, income inequality persisted within the Indian population, with a significant portion remaining in low-income brackets.

The Indian community became more politically active in the post-independence era, advocating for their rights and interests. Indian politicians and activists pushed for policies to address socio-economic inequalities and promote social inclusion. Representation of Indians in government and public institutions increased, with some holding prominent positions in politics, civil service, and other sectors (Twelfth Malaysia Plan, 2024).

Acculturation of Indian Minority in Malay Majority Culture in Malaysia

Acculturation of ethnic minorities refers to the process by which individuals or groups from minority cultures adapt to the norms, values, customs, and behaviors of the dominant or majority culture within a given society (Ahmad Farouk and Husin, 2020; Berry, 1980; Berry, 2005). This process involves both the minority group adopting aspects of the dominant culture and the potential retention of elements of their own cultural identity. Acculturation involves learning and adopting new cultural practices, behaviors, and values from the dominant culture (Berry, 1997; Sam & Berry, 2010). Acculturation contributes to cultural diversity within societies, enriching the social fabric with a variety of perspectives, traditions, languages, and practices. Recognizing and valuing this diversity is essential for fostering inclusivity, tolerance, and mutual understanding.

The acculturation of the Indian minority culture into the Malay majority culture in Malaysia is a multifaceted process influenced by historical, socio-economic, political, and cultural factors. From a socio-cultural perspective, several key dynamics shape this acculturation process. The historical interactions between Indian immigrants and the Malay population have laid the groundwork for acculturation. Indian migration to Malaysia dates back to the colonial period, and subsequent waves of immigration have contributed to the rich tapestry of Malaysian society (Dabriwal, 2023; Rostam, 1984).

Acculturation involves a reciprocal exchange of cultural elements between groups (Ang, 2015; Ben-Shalom & Horenczyk, 2003; see also Berry, 1980; Berry, 2005). Malaysian Indians bring with them their traditions, languages (such as Tamil), religions (predominantly Hinduism), cuisine, and customs. Over time, these cultural elements interact and blend with Malay cultural practices, resulting in a unique fusion of traditions. Malaysia is known for its religious diversity, with Islam being the dominant religion among Malays and significant minority populations practicing Hinduism, Christianity, and Buddhism. Acculturation often occurs within the context of religious practices, leading to syncretic beliefs and rituals that incorporate elements from both Indian and Malay traditions.

Language serves as a crucial medium for cultural exchange and integration (Enobi et al., 2022; Masaryk, 2017; Zhang et al., 2020). While Tamil is spoken within the Indian community, Malay (Bahasa Malaysia) is the national language and the lingua franca of Malaysia. As such, Malaysian Indians may adapt to Malay language and communication norms while maintaining their native languages at home.

Acculturation is facilitated through social interactions and interethnic relationships. Malaysian Indians engage with Malay neighbours, colleagues, and friends in various social contexts, fostering mutual understanding and cultural exchange. Interethnic marriages and friendships further contribute to the blending of cultural identities (Guarnaccia & Hausmann-Stabile, 2016; Negy & Synder, 2000; Padilla & Perez, 2003).

Educational institutions and media platforms play a significant role in shaping cultural attitudes and values (for example, O'Keeffe et al., 2011). Malaysian Indians may encounter Malay cultural perspectives through the national education system and mainstream media, influencing their acculturation experiences and cultural identities. Meanwhile, government policies, such as the New Economic Policy (Esa et al., 2022), aimed at promoting Malay economic empowerment have implications for social integration and acculturation. Socio-economic factors, including access to education, employment opportunities, and social services (see the discussion in previous section), also influence the extent to which Malaysian Indians participate in Malay cultural life.

Acculturation involves negotiation of identities (for example, Matsunaga et al., 2010; Zhang et al., 2018; see also the discussion on plural society in Milner, 2003), where individuals (Indian) reconcile their Indian heritage with their participation in Malay society. This process may result in the development of hybrid identities that incorporate elements from both cultures, reflecting the diverse and dynamic nature of Malaysian society. In fact, the acculturation of the Indian minority culture into the Malay majority culture in Malaysia is a complex which might reciprocal influence (Wilkinson, 1935) and ongoing process shaped by historical legacies, socio-cultural interactions, and individual experiences. While it may involve challenges and tensions, it also presents opportunities for cultural enrichment, social cohesion, and the creation of a uniquely Malaysian identity that celebrates diversity.

Several acculturation theories explain the adaptation of the Indian community into the Malay community in Malaysia (Table 3). These acculturation theories offer frameworks for understanding the complex processes involved in Indian adaptation into the Malay community in Malaysia, considering factors such as cultural identity, intergroup relations, social context, and individual differences.

The tangible and non-tangible aspects of cultural adaptations of the Indian community into the Malay community in Malaysia are visible across various aspects. In tangible, it is including language, cuisine, clothing, architecture, and festivals (see description in section 3 above). These tangible aspects illustrate the dynamic and multifaceted nature of Indian integration into Malay society in Malaysia. They reflect the rich cultural diversity and intercultural exchange that characterize Malaysian society as a whole. Many Indians in Malaysia, particularly those who have lived in the country for generations, are fluent in the Malay language. This linguistic adaptation facilitates communication and integration within the Malay community. Additionally, Indian Malaysians often incorporate Malay words and phrases into their everyday speech. Indian cuisine has become an integral part of Malaysian culinary culture. Indian dishes such as roti canai, nasi kandar, and biryani are popular across Malaysia and are often enjoyed by Malaysians of all ethnic backgrounds. Similarly, Malay dishes may incorporate Indian spices and cooking techniques, reflecting the culinary fusion that has developed over centuries of cultural interaction. While traditional Indian clothing such as sarees and kurta pajamas are still worn during religious and cultural celebrations, many Indian Malaysians also dress in Western attire for everyday wear. However, there may be instances where traditional Malay attire, such as baju kurung or baju kebaya, is worn by Indian Malaysians, particularly during Malay weddings and festive occasions. Indian architectural styles can be found in various parts of Malaysia,

particularly in areas with a significant Indian population. Temples, mosques, and churches built by Indian communities often incorporate architectural elements and design motifs from India. These structures contribute to Malaysia's multicultural architectural landscape. Indian festivals such as Deepavali (Diwali), Thaipusam, and Pongal are celebrated with great enthusiasm across Malaysia, not only by the Indian community but also by Malaysians of other ethnicities. Deepavali, in particular, is recognized as a national public holiday in Malaysia, reflecting its significance in Malaysian cultural life. In term of business and commerce, Indian Malaysians have made significant contributions to Malaysia's economy through businesses in various sectors, including retail, hospitality, and manufacturing. Indian-owned businesses are often integrated into Malay neighbourhoods and contribute to the local economy and community development. Indian Malaysians have established educational and cultural institutions to preserve and promote their heritage within the broader Malaysian society. Indian schools, cultural centers, and organizations play a vital role in fostering cultural exchange and understanding between Indian and Malay communities.

Table (3): The adaptation process in Indian's acculturation

	Acculturation-related theories	Theory description	Adaptation process
1	Berry's Model of Acculturation – introduced by Berry (1980). *See also the description in Fox et al. (2013), Mana et al. (2009)*	Proposes four acculturation strategies: integration, assimilation, separation, and marginalization	Indian may adopt different strategies. Integration involves maintaining aspects of both Indian and Malay cultures, which could be seen in individuals who celebrate festivals from both cultures. Assimilation may involve adopting Malay cultural practices and forsaking Indian ones. Separation could manifest as maintaining Indian cultural practices while avoiding interaction with Malays extensively. Marginalization may occur if individuals reject both Indian and Malay cultures.
2	Fourfold Model of Acculturation - introduced by Nguyen & Benet-Martínez (2013). *See also the description in Sidler et al. (2021)*	Identifies four possible outcomes of cultural contact: assimilation, acculturation, integration, and separation. Assimilation refers to the complete adoption of the dominant culture, while integration involves adopting aspects of both cultures. Acculturation is a more balanced exchange of cultural traits, and separation involves maintaining distinct cultural identities.	Indian adaptation into the Malay community may vary across these outcomes, with some individuals integrating elements of both cultures, while others may maintain more separation.
3	Social Identity Theory – introduced by Tajfel & Turner (1979). *See also the description in Spears (2021), Smaldino (2019)*	Individuals strive to maintain a positive social identity by categorizing themselves and others into ingroups (those	Indians and Malays represent distinct ethnic groups with their own cultural identities. Indian adaptation into the Malay community may involve negotiation of social identities, with individuals seeking to establish a positive sense of belonging within the Malay

		similar to them) and outgroups (those different from them).	community while retaining aspects of their Indian identity.
4	Contact Hypothesis – introduced by Allport (1954). *See also description in Cada & Gheorghiev (2023) and Halperin et al. (2012)*	Intergroup contact can reduce prejudice and improve intergroup relations, especially when certain conditions like equal status, common goals, and intergroup cooperation are met.	Positive intergroup contact between Indians and Malays, such as through shared workplaces, schools, neighbourhoods, or social events, can facilitate Indian adaptation into the Malay community by fostering mutual understanding, cooperation, and acceptance.
5	Developmental Model of Intercultural Sensitivity (DMIS) (Bennett, 1986). *See also description in Novikova et al. (2020), Tang & Zhang (2023)*	Proposes six stages of increasing intercultural sensitivity: denial, defence, minimization, acceptance, adaptation, and integration	Indian adaptation into the Malay community may involve progressing through these stages, starting from denial or defence of cultural differences to eventually reaching integration, where individuals can comfortably navigate and appreciate both Indian and Malay cultures.

Non-tangible aspect of adaptations refers to changes or adjustments in attitudes, beliefs, values, and social norms that may occur as a result of cultural interaction and integration. These non-tangible cultural adaptations reflect the process of acculturation and cultural exchange between the Indian and Malay communities in Malaysia. They highlight the dynamic nature of cultural interaction and the ways in which individuals negotiate and navigate cultural differences to foster social harmony and cohesion. Indian Malaysians may adapt their social etiquette and behavior to align with Malay cultural norms. This could include practices such as greeting others with the Malay salutation "Salam" or observing Malay customs related to hospitality and respect for elders. While maintaining their own religious traditions, Indian Malaysians may adopt certain Malay customs or practices related to Islam, the dominant religion in Malaysia. This could involve participating in Malay-Muslim festivals or incorporating Islamic rituals into their own religious observances. Indian families in Malaysia may adapt aspects of Malay family structure and values, such as emphasizing respect for authority, strong family ties, and collective decision-making. This may influence patterns of communication, hierarchy within the family, and the role of extended family members in childcare and support. In addition to tangible language adaptation, Indian Malaysians may also adjust their communication styles and language use to align with Malay cultural norms. This could involve using polite forms of address, adapting speech patterns, and incorporating Malay idioms or expressions into conversation. Indian Malaysians may participate in Malay cultural celebrations and festivals, such as Hari Raya Aidilfitri alongside their own religious and cultural festivals. This cross-cultural participation fosters mutual understanding, respect, and social cohesion within the Malaysian community. In educational and professional settings, Indian Malaysians may adapt to Malay cultural expectations regarding teamwork, cooperation, and hierarchical relationships. This could involve conforming to Malay leadership styles, communication protocols, and workplace etiquette. Indian Malaysians may consume Malay-language media, including television programs, films, music, and literature, as well as participating in Malay cultural events and performances. This exposure to Malay cultural expressions contributes to cultural familiarity, appreciation, and integration.

How the Cultural Neuroscience Framework Explaining the Acculturation of Indian Minority in Malay Majority Culture?

Cultural neuroscience, as proposed by researchers like Shinobu Kitayama (Kitayama & Park, 2010; Kitayama & Tompson, 2010), seeks to understand how cultural factors shape neural

processes and behavior. Cultural neuroscience is an interdisciplinary field that investigates how culture shapes and is shaped by the brain, cognition, and behavior. It examines the dynamic interaction between cultural factors, such as beliefs, values, practices, and social norms, and biological processes, including neural mechanisms, genetics, and hormonal responses (Ames & Fiske, 2010; Bhui, 2018; Chiao et al., 2013). This field explores questions such as how cultural experiences influence brain development, perception, emotion regulation, decision-making, and social behavior. Researchers in cultural neuroscience use a variety of methods, including neuroimaging (such as fMRI and EEG), genetics, behavioral experiments, and cross-cultural comparisons to understand the complex interplay between culture and the brain (Chiao et al., 2010; Fiske & Taylor, 2016; Han & Ma, 2014; Kim & Sasaki, 2014; Martínez Mateo et al., 2012). Again, to highlight that cultural neuroscience provides insights into the diversity of human experience and highlights the importance of considering cultural context in understanding the human mind and brain.

In the context of Indian acculturation in the midst of Malay majority culture in Malaysia, the cultural neuroscience framework provides insights into the cognitive and neural mechanisms underlying this phenomenon. As based on the this Kitayama's framework of cultural neuroscience, the process or construct of acculturation among the Indian community in the midst of the Malay community can be structured based on domains as below (Table 4):

Table (4): The construct of acculturation among Indian community

Domains	Descriptions
Cultural Values and Neural Plasticity	Cultural values influence neural plasticity, shaping how individuals perceive and respond to their environment. Indian culture and Malay culture have distinct values, such as hierarchical vs. egalitarian social structures, and different norms regarding emotional expression and social interactions. As individuals from the Indian community acculturate into Malay culture, their neural networks may undergo changes to align with the cultural values and norms of the Malay community.
Cultural Learning and Brain Development	Cultural learning begins early in life and plays a crucial role in brain development. As Indian individuals interact with the Malay community through socialization, education, and exposure to cultural practices, their brains may undergo neural reorganization to accommodate the new cultural knowledge and skills. This process involves encoding, consolidating, and retrieving culturally relevant information, leading to changes in neural circuitry associated with language, social cognition, and cultural identity.
Cultural Priming and Neural Activation	The role of cultural priming in shaping neural activation patterns. Cultural cues and context can activate specific neural networks associated with culturally learned behaviors and attitudes. For instance, exposure to Malay cultural symbols, language, rituals, and social norms may prime neural circuits linked to Malay identity, social hierarchy, and interpersonal relationships among individuals from the Indian community. Over time, repeated exposure to these cultural cues can strengthen neural associations and facilitate acculturation into Malay culture.
Cultural Conflict and Cognitive Dissonance	Involves navigating cultural conflicts and reconciling differences between one's original culture and the dominant culture. Cultural neuroscience suggests that such conflicts can induce cognitive dissonance, triggering neural responses associated with stress, uncertainty, and cognitive control. As Indian individuals encounter cultural differences and negotiate their identity within the Malay community, they may experience cognitive dissonance, leading to neural activation patterns related to cognitive conflict resolution, perspective-taking, and cultural adaptation.

As suggested by Kitayama and Uskul (2010), cultural adaptation of the Indian minority into Malay culture may take place throughout the seven phases of neuro-cultural development, as illustrated in Figure 1.
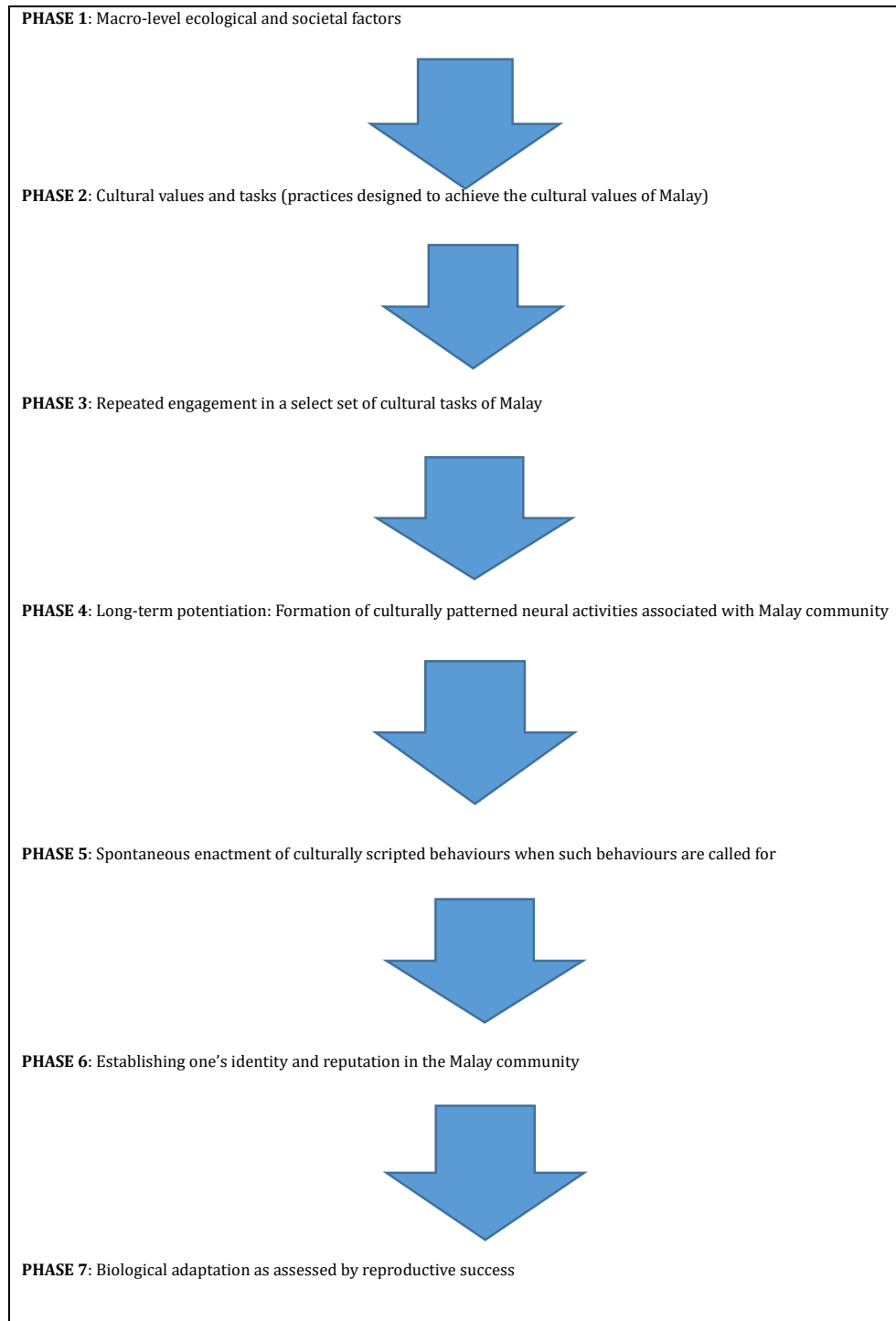
PHASE 1: Macro-level ecological and societal factors

PHASE 2: Cultural values and tasks (practices designed to achieve the cultural values of Malay)

PHASE 3: Repeated engagement in a select set of cultural tasks of Malay

PHASE 4: Long-term potentiation: Formation of culturally patterned neural activities associated with Malay community

PHASE 5: Spontaneous enactment of culturally scripted behaviours when such behaviours are called for

PHASE 6: Establishing one's identity and reputation in the Malay community

PHASE 7: Biological adaptation as assessed by reproductive success

Figure 1: Indian adaptation to Malay socio-cultural environment as based on the Neuro-culture Interaction Model (Kitayama & Tompson, 2010).

A critical question related to the Indian acculturation into the Malay community in Malaysia could be "*How does the process of acculturation among Malaysian Indians into the Malay community influence neural pathways associated with cultural identity formation, cognitive processing of cultural norms, and emotional responses to intercultural interactions*?". This question delves into the neurobiological mechanisms underlying the complex process of acculturation, exploring how the brain adapts to and integrates cultural experiences (Kitayama & Uskul, 2011; Liu et al., 2015; Zhou & Cacioppo, 2010), from both Indian and Malay contexts. It could involve studying neural plasticity, cognitive biases, emotional regulation, and social cognition within the framework of cultural neuroscience. Specific aspects to investigate might include the areas as below (Table 5)

Table (5): Critical questions according to specific neuroscience domains

Neuroscience Domains	Critical Questions
Neural Plasticity	How does exposure to diverse cultural practices shape the structure and function of brain regions associated with cultural identity, such as the prefrontal cortex and the insula?
Cognitive Processing	How do Malaysian Indians navigate cognitive conflicts between Indian and Malay cultural norms, and what neural mechanisms mediate their decision-making and behavior in culturally ambiguous situations?
Emotional Responses	How do emotional responses to intercultural interactions differ between Malaysian Indians who strongly identify with either their Indian or Malay heritage, and what neural circuits underlie these emotional reactions?
Social Cognitive Processing	How do neural networks involved in social cognition, such as the mirror neuron system and the theory of mind network, contribute to understanding and empathizing with cultural practices and beliefs from both Indian and Malay cultures?
Neuroendocrine Regulation	How do cultural stressors and acculturative experiences modulate neuroendocrine systems such as the hypothalamic-pituitary-adrenal (HPA) axis and the oxytocinergic system, and what are the implications for mental health and well-being?

By addressing these questions, researchers can gain insights into the neurobiological underpinnings of cultural adaptation and identity negotiation among Malaysian Indians acculturating into the Malay community. Understanding these mechanisms may inform interventions aimed at promoting cultural integration, reducing intergroup conflicts, and fostering positive intercultural relations in multicultural societies like Malaysia.

Neuroscientific Method in Exploring Indian Cultural Adaptation

Exploring Indian socio-cultural dimension through the lens of neuroscience involves understanding how cultural practices, beliefs, and social structures influence neural processes and behaviors among Indians in their adaptation with the culture of majority (Malay ethnicity) in Malaysia. Here are some neuroscientific methods (see Harmon-Jones and Beer, 2009) that can be used in such exploration (Table 6). By utilizing these neuroscientific methods, within the framework of acculturation research, researchers can gain a deeper understanding of how Indians adapt to Malay cultural practices at neural, cognitive, and behavioral levels, ultimately contributing to the broader understanding of cultural diversity and neuroplasticity within multicultural societies like Malaysia.

Table (6): Neuroscientific approach and exploration in cultural neuroscience perspective

Modalities/ Neuroscientific Approach	Neuroscientific Explorations
Functional Magnetic Resonance Imaging (fMRI)	Investigate how Indians acculturating into Malay cultural practices process culturally relevant stimuli. Researchers can examine differences in neural activation patterns during tasks related to language processing, social interactions, or engagement in specific Malay cultural rituals and traditions.
Electroencephalography (EEG)	Provide insights into real-time changes in brain activity associated with Indians acculturation into Malay cultural practices. Studies can assess neural responses to culturally salient stimuli and examine how acculturation affects cognitive processes such as attention, memory, and emotional regulation in the context of Malay culture.
Cultural Priming Paradigms	Elucidate how exposure to Malay cultural norms and values influences neural processing in Indian individuals. These paradigms involve tasks designed to activate cultural schemas, stereotypes, or social hierarchies relevant to the Malay community, allowing researchers to observe neural responses to acculturation cues.
Psychophysiological Measures	Measures such as skin conductance, heart rate variability, or facial electromyography (EMG) can assess physiological responses associated with Indians' acculturation into Malay cultural practices. These measures can provide insights into emotional reactivity, stress levels, and nonverbal communication within the acculturation process within the context of Malay cultural settings.
Cross-Cultural Comparisons	Cross-cultural studies comparing neural responses between Indian individuals acculturating into Malay cultural practices and those who maintain their cultural heritage can highlight the neural correlates of acculturation. By examining cultural-specific patterns of brain activity, researchers can identify neural markers of cultural adaptation specific to the Malay cultural context.
Genetic Studies	Investigate how genetic variations interact with cultural factors to influence brain function in Indians acculturating into Malay cultural practices. By examining gene-environment interactions, researchers can elucidate how genetic predispositions shape neural responses to acculturation stressors and cultural adaptation processes within the Malay cultural context.
Cultural Neuropsychology	Examine how acculturation influences cognitive processes and brain functioning in Indians adapting to Malay cultural practices. These studies can assess cultural influences on neuropsychological test performance, cognitive biases, and neural correlates of cultural identity within the specific context of Malay cultural practices.
Longitudinal Studies	Track changes in brain structure and function over time in Indians undergoing acculturation into Malay cultural practices. These studies can investigate the trajectory of cultural adaptation processes and identify neural mechanisms underlying successful acculturation outcomes within the unique context of Malay cultural practices in Malaysia.

CONCLUSION

The exploration of Indian acculturation into Malay culture in Malaysia from a Cultural Neuroscience perspective holds several implications and directions for future research. Understanding neural mechanisms of acculturation provides insights into the neural mechanisms

underlying the process of acculturation. By identifying neural correlates of cultural adaptation, researchers can elucidate how individuals from Indian ethnicity backgrounds integrate into Malay cultural practices and norms at a neural level. In addition, understanding the neural processes involved in acculturation can inform interventions aimed at promoting social cohesion and integration among diverse cultural groups in Malaysia. By identifying factors that facilitate successful acculturation outcomes, policymakers and community leaders can develop strategies to foster understanding, empathy, and acceptance across cultural boundaries. It has to be noted that acculturation can have significant implications for mental health and well-being, with individuals facing challenges such as identity conflict, discrimination, and social isolation. Cultural Neuroscience research can shed light on the neural mechanisms underlying these challenges and inform culturally sensitive interventions to support the mental health needs of individuals acculturating into Malay culture in Malaysia. All these aspects have a connection with cultural identity formation and enhancing cultural competence. Acculturation involves navigating complex processes of identity formation and negotiation. Cultural Neuroscience research can investigate how acculturation influences the neural substrates of cultural identity, including the integration of cultural values, beliefs, and practices from both Indian and Malay cultural backgrounds. Meanwhile, insights from Cultural Neuroscience can enhance cultural competence among healthcare providers, educators, and policymakers working with individuals from Indian backgrounds acculturating into Malay culture in Malaysia. By understanding the neural underpinnings of cultural adaptation, professionals can provide more effective support and services tailored to the needs of diverse cultural groups. Towards more comprehensive understanding of the issue, examining intergenerational transmission of culture should be highlighted. Future research could explore how acculturation experiences influence the intergenerational transmission of culture within Indian-Malay families in Malaysia. By investigating how cultural values, practices, and neural processes are passed down from one generation to the next, researchers can deepen our understanding of cultural continuity and change within multicultural societies. Most importantly, utilizing multimodal neuroimaging approaches should be a main focus. This includes integrating multiple neuroscientific methods, such as fMRI, EEG, and psychophysiological measures, in order to provide a comprehensive understanding of the neural dynamics underlying acculturation processes. Multimodal neuroimaging approaches allow researchers to capture the complexity of cultural adaptation and its neural correlates from different perspectives. In conclusion, the exploration of Indian acculturation into Malay culture in Malaysia from a Cultural Neuroscience perspective offers rich opportunities to deepen our understanding of cultural diversity, social integration, and neural plasticity in multicultural societies. By bridging the gap between culture and neuroscience, this research can contribute to more inclusive, equitable, and resilient communities in Malaysia and beyond.

ACKNOWLEDGEMENT

AUTHORS' CONTRIBUTIONS

Only one author contributes - conceived the idea, designed the project, wrote the manuscript and analysis.

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