ACCULTURATION OF MALAY CULTURE INTO MALAYSIAN NON-MALAY AND NON-MALAYSIAN AND ITS REFLECTION ON THE NEURAL SUBSTRATE OF CULTURE SPECIFIC EMOTION

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by

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LIST OF SYMBOLS

%	Percentage
ms	Milisecond
μv	Microvolt
p	P-value
n	Number
cm	Centimetre
α	Alpha value; Significance level
1-β	Statistical power
a	Multivariate test of pillia trace
df	Degree of freedom
F	F-statistic
f	Cohen’s f (Effect size estimate)
Hz	Hertz
SS	Sum of square
MS	Mean squares
kΩ	Kiloohm
nA	Nanoampere

LIST OF ABBREVIATIONS

BC	Before Century
ERP	Event Related Potential
fMRI	functional Magnetic Resonance Imaging
VPP	Vertex Positive Potentials
LPP	Late Positive Potentials
EPN	Early Posterior Negativity
VIA	Vancouver Index of Acculturation
CE	Common Era
UNESCO	United Nations Educational, Scientific and Cultural Organization
SAM	Self-Assessment Manikin
IAPS	International Affective Picture System
GAPD	Geneva Affective images Database
ANEW	Affective Norms for English Words
ANET	Affective Norms for English Texts
EEG	Electroencephalography
LTP	Long-Term Potentiation
CFA	Confirmatory Factor Analysis
ICC	Interclass correlation coefficient
CVI	Content Validation Inventory
I-CVI	Content Validity Index for Items
S-CVI	The Content Validity Index of Scales
HUSM	Hospital Universiti Sains Malaysia
USM	Universiti Sains Malaysia
SPSS	Statistical Package for the Social Sciences
MEG	Magnetoencephalography
GSN	Geodesic Sensor Net
KCI	Potassium Chloride
AIC	Aikaike Information Criterion
BIC	Bayesian Information Criterion
CFI	Comperative Fix Index
CI	Confidence Interval

MI	Modification Indices
MLR	Robust Maximum Likelihood
RMSEA	Root Mean Square Error of Approximation
SRMR	Standardized Root Mean Square Residual
TLI	Tucker-Lewis Fit Index
SD	Standard Deviation
S	Significant
NS	Non-Significant
HVNA	High Valence Neutral Arousal
NVNA	Neutral Valence Neutral Arousal
BA	Brodmann Area
VS	Versus
GROUP 1	Malaysian Malay participants
GROUP 2	Malaysian non-Malay (Chinese and Indian) participants
GROUP 3	non-Malaysian participants who have lived in Malaysia for more than one year
GROUP 4	non-Malaysian participants who have lived in Malaysia for less than one year
SMS	School of Medical Sciences
SHS	School of Health Sciences
SDS	School of Dental Sciences
SHBP	School of Housing, Building and Planning
SIT	School of Industrial Technology
SPS	School of Pharmaceutical Sciences
CS	School of Computer Sciences
SES	School of Educational Studies
SM	School of Management
GSB	Graduate School of Business
SOC	School of Communication
SA	School of Art
SLLT	School of Language, Literacies and Translation
SH	School of Humanities
SSS	School of Social Sciences
SBS	School of Biological Sciences
SCS	School of Chemical Sciences
SMS	School of Mathematical Sciences

SP	School of Physics
ACC	Anterior Cingulate Cortex
PCC	Posterior Cingulate Cortex
PFC	Prefrontal Cortex
OFC	Orbitofrontal Cortex
DLPFC	Dorsolateral Prefrontal Cortex
VmPFC	Ventromedial Prefrontal Cortex

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AKULTURASI BUDAYA MELAYU TERHADAP WARGANEGARA BUKAN MELAYU DAN BUKAN WARGANEGARA MALAYSIA DAN REFLEKSINYA PADA SUBSTRAT NEURAL YANG BERKAITAN DENGAN EMOSI KHAS BUDAYA

ABSTRAK

Rasisme, prasangka, dan diskriminasi adalah isu-isu yang timbul dari kepelbagaian budaya. Adalah penting untuk memahami kesan akulturasi dalam kalangan ahli kumpulan budaya yang berbeza dan bagaimana interaksi ini mempamerkan persamaan budaya. Kajian ini bertujuan untuk memahami pengaruh akulturasi budaya majoriti (Melayu) ke dalam kalangan bukan Melayu di Malaysia (Cina dan India) dan bukan Warganegara Malaysia terhadap proses neural berkaitan emosi khusus budaya. Kajian ini dilaksanakan dalam dua fasa, iaitu (1) kajian kesahihan, dan (2) kajian *Event Related Potential* (ERP). Amplitud dan latensi komponen-komponen ERP dianalisis menggunakan SPANOVA. Sumber lokalisasi dan ketersambungan dianalisis menggunakan analisis naratif. Dalam paradigma aktif, analisis kesan interaksi menunjukkan pengaktifan yang ketara dalam kawasan Temporal (T6) amplitud P200 [F (5.378, 207.932) =2.245, p = 0.047], N200 [F (5.798, 224.177) =2.727, p = 0.015], dan P300 [F (5.830, 225.432) =3.676, p = 0.002] komponen ERP. Sumber lokalisasi untuk peserta Melayu menunjukkan corak yang berasal dari lobus Temporal pada N100 dan lobus Oksipital pada P300, dengan corak yang serupa dikongsi oleh peserta bukan Melayu dan bukan warga Malaysia yang tinggal kurang dari satu tahun di Malaysia. Terdapat 21 ketersambungan yang diaktifkan dalam kalangan peserta Melayu, yang berkongsi persamaan dalam proses deria, motor, visual, memori, emosi, perhatian, dan membuat keputusan, dengan

peserta bukan Melayu dan diikuti bukan warga Malaysia yang tinggal lebih dari satu tahun di Malaysia. Dalam paradigma pasif, analisis kesan interaksi menunjukkan pengaktifan yang ketara dalam kawasan Parietal-Temporal-Oksipital untuk latensi T4 [F (8.896, 343.974) = 2.336, p = 0.015], O2 [F (9, 348) =2.446, p = 0.010] daripada N100 dan P4 [F (9, 348) = 2.546, p = 0.008], O1 [F (9, 348) = 2.355, p = 0.014] daripada komponen P300 ERP. Sumber lokalisasi untuk peserta Melayu menunjukkan corak yang berasal dari lobus Occipital pada N100 dan lobus Frontal pada P200, dengan corak yang serupa dikongsi oleh peserta bukan Melayu dan bukan warga Malaysia yang tinggal lebih dari satu tahun di Malaysia. Terdapat 17 ketersambungan yang diaktifkan dalam kalangan peserta Melayu, yang berkongsi persamaan dalam proses deria, motor, visual, memori, emosi, bahasa, dan fungsi kognitif tinggi dengan peserta bukan Melayu, diikuti oleh bukan warga Malaysia yang tinggal lebih dari satu tahun, dan seterusnya bukan warga Malaysia yang tinggal kurang dari satu tahun di Malaysia. Kesimpulannya, penemuan kajian ini menunjukkan bahawa peserta bukan Melayu berkongsi corak yang serupa dengan peserta Melayu dalam proses neural yang berkaitan dengan emosi khusus budaya disebabkan oleh pengaruh akulturasi.

ACCULTURATION OF MALAY CULTURE INTO MALAYSIAN NON-MALAY AND NON-MALAYSIAN AND ITS REFLECTION ON THE NEURAL SUBSTRATE OF CULTURE SPECIFIC EMOTION

ABSTRACT

Racism, prejudice, and discrimination are significant issues that can arise from cultural diversity. It is important to understand the effect of acculturation across members of different cultural groups and how this interaction displays cultural similarities. This research aims to understand the influence of acculturation of majority culture (Malay) into Malaysian non-Malay (Chinese and Indian) and non-Malaysian participants on the neural process of culturally specific emotion. This research was implemented in two phases: (1) Validation study, and (2) Event Related Potential (ERP) study. The amplitude and latency of ERP components were analyed using SPANOVA. The source of localisation and connectivity were analysed using narrative analysis. For the active paradigm, the interaction effect analysis showed significant activation in the Temporal area (T6) of the amplitude of P200 [$F (5.378, 207.932) = 2.245$, $p = 0.047$], N200 [$F (5.798, 224.177) = 2.727$, $p = 0.015$], and P300 [$F (5.830, 225.432) = 3.676$, $p = 0.002$] ERP components. The source of localisation for Malay participants indicated patterns originated in Temporal lobe for N100 and Occipital lobe for P300, sharing similar patterns with non-Malay and non-Malaysian participants living in Malaysia for less than one year. There were 21 connectivity activations in Malay participants, with shared similarities in sensory, motor, visual, memory, emotion, attention, and decision-making processes among non-Malay participants, followed by non-Malaysian participants living in Malaysia for more than one year. For the passive paradigm, the interaction effect analysis showed significant activation in

the Parietal-Temporal-Occipital area of the latency T4 [F (8.896, 343.974) = 2.336, p = 0.015], O2 [F (9, 348) =2.446, p = 0.010] of N100 and P4 [F (9, 348) = 2.546, p = 0.008], O1 [F (9, 348) = 2.355, p = 0.014] of P300 ERP components. The source of localisation for Malay participants indicated pattern originated in Occipital lobe in N100 and Frontal lobe in P200, shared similar pattern with non-Malay and non-Malaysian participants living in Malaysia for more than one year. There were 17 connectivity activations in Malay participants with shared similarities in sensory, motor, visual, memory, emotion, language, and higher cognitive functions among non-Malay participants, followed by non-Malaysian participants living in Malaysia for more than one year, and non-Malaysian participants living in Malaysia for less than one year. In conclusion, the finding of this research indicates that non-Malay participants share similar neural process pattern associated with culturally specific emotion with Malay participants due to the influence of acculturation.

CHAPTER 1

INTRODUCTION

1.1 Overview of Introduction

This chapter provides a comprehensive overview of the research, beginning with the background that sets the context and rationale for the research. It then identifies the research problem and the gap in existing knowledge that this research aims to address. The significance of the research is discussed, highlighting its theoretical, methodological, and practical contributions. The objectives of the research are outlined, detailing the specific goals the study seeks to achieve. This is followed by the hypotheses, which present the expected outcomes based on theoretical grounding and previous research. Finally, the research questions are articulated, guiding the focus and direction of the investigation.

1.2 Research Background

Malaysia, located in Southeast Asia, comprises two main landmasses: East and Peninsular Malaysia. Established in 1963 through the union of Malaya with Sarawak and Sabah (Mohamad et al., 2020), Malaysia is known for its hot and humid climate year-round due to its proximity to the equator (Lockard et al., 2024). The country is rich in cultural diversity, with a population of approximately 32.6 million in 2019. This population consists of 90.2% Malaysian citizens and 9.8% non-Malaysians. Among the Malaysian citizens, 69.3% are Bumiputera, 22.8% are Chinese, 6.9% are Indian, and 1.0% belong to other ethnic groups, as shown in Figure 1.1. Among the Bumiputera, Malays are the predominant ethnic group (58.7%), while the other Bumiputera include *Orang Asli*, *Siamese*, *Serani*, and minorities in Sabah and Sarawak (Department of Statistics Malaysia, 2019).

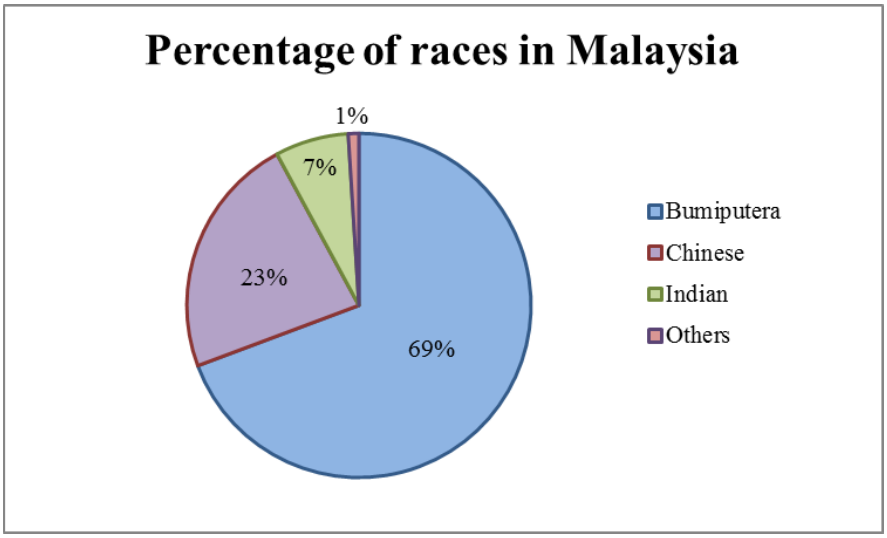

Figure 1.1 The percentage of races in Malaysia (source: Department of Statistics Malaysia, 2019)

Malays are the first and largest ethnic group in Malaysia. There is a significant discussion regarding the origin of the Malays in multidisciplinary studies. However, theories published by archaeologist Datuk Wan Hashim indicate that Malays have been present in the country since 74,000 BC (Kamarudin, 2014). The Malays were widely acknowledged during the founding of the Malacca Sultanate, where traders from around the world used the Malay language as common medium of exchange (Omar & Atoma, 2009; Din, 2011).

Peninsular Malaysia is home to indigenous groups known as *Orang Asli,* which include tribes such as *Negrito, Senoi*, and *Proto-Malay* (Masron et al., 2013). *Proto-Malay* are part of Malayo-Polynesian or Austronesian ethnic family (Embong et al., 2016), and the present-day Malays of the Malaysia Peninsula are described as *Deutero-Malays*, the descendants of the *Proto-Malays* (Comas et al., 1998; Masron et al., 2013). The Austronesian family of languages includes several dialects spoken by the Malays (Clifford, 2020). A member of an ethnic group from the Malay Peninsula and nearby Southeast Asian islands, such as the east coast of Sumatra, the coast of Borneo, and smaller islands that are located between these regions, is referred to as a Malay or *orang Melayu* (Malay people) (Embong et al., 2016). These areas are now a part of nations like Malaysia, Singapore, Indonesia, Brunei, and the southern portion of Thailand.

Malaysian Malays are people who practice Islam as their religion, and their tradition is a Malay tradition. The Constitution of Malaysia describes a Malay as an individual who practices Islam, speaks Malay on regular basis, and adheres to Malay custom (Barnard, 2003). Malay people are known for their uniqueness and rich heritage, which is evident in their interactions, values, practices, communication, architecture, clothing, arts, customs, and food. Immigrants in Malaysia consider the Malays as friendly and hospitable.

Additionally, the Chinese and Indian communities, the second and third largest ethnic groups respectively, have a long history of interaction with the Malays, dating back to the Qin dynasty and early centuries of maritime trade. Interaction between Malays and Chinese can be traced back to the Qin dynasty, around 221 BC. There was also documentation of voyage by Zheng He in 1405 to establish political relationship with the Malacca Sultanate (Yuanzhi, 2000; Mat & Sulaiman, 2007). Futhermore, many Chinese were brought to Peninsular Malaysia by the British to work in tin mines from 1824 to 1956 (Hussin, 2008).

The interaction between Malays and Indians dates back to the early centuries through maritime trade and the formation of the Funan state in Cambodia (Mishra, 2013). Documentation also records Indian immigrants arriving through the Straits of Malacca (Kumaran, 2008). Moreover, Chinese and Indian immigrants were reported to enter Malaysia during the British colonization between 1824 to 1956 (Hussin, 2008). Historically, Chinese and Indians in Malaysia were immigrants that had come to

Malaysia since hundreds of years ago. Therefore, Chinese and Indians in Malaysia are termed as long-term immigrants due to their long-standing presence.

As one of Southeast Asia's largest recipients of immigrants, Malaysia had approximately 1.9 million immigrants in 2005, increasing to 3.5 million in 2020 (Statista Research Department, 2022), as shown in Figure 1.2. Immigrants are attracted to Malaysia for its economic opportunities, quality education, and vibrant tourism industry, contributing to the nation's cultural diversity. Malaysia is a desirable destination for employees seeking higher pay and career opportunities due to its large economy in Southeast Asia (International Monetary Fund, 2022; Rao, 2024). Additionally, Malaysia offers high-quality education with good insfrastructure and a safe environment (Chong et al., 2014). The country also has many tourist attractions; Malaysia ranked ninth globally in 2009 and 2010, with 23.6 and 24.6 million international tourist arrivals, respectively (Alam et al., 2015). Immigrants that had come to Malaysia for the above reason stay for short duration. Immigrants coming to work, study, and tourist purposes are termed as short-term immigrants.

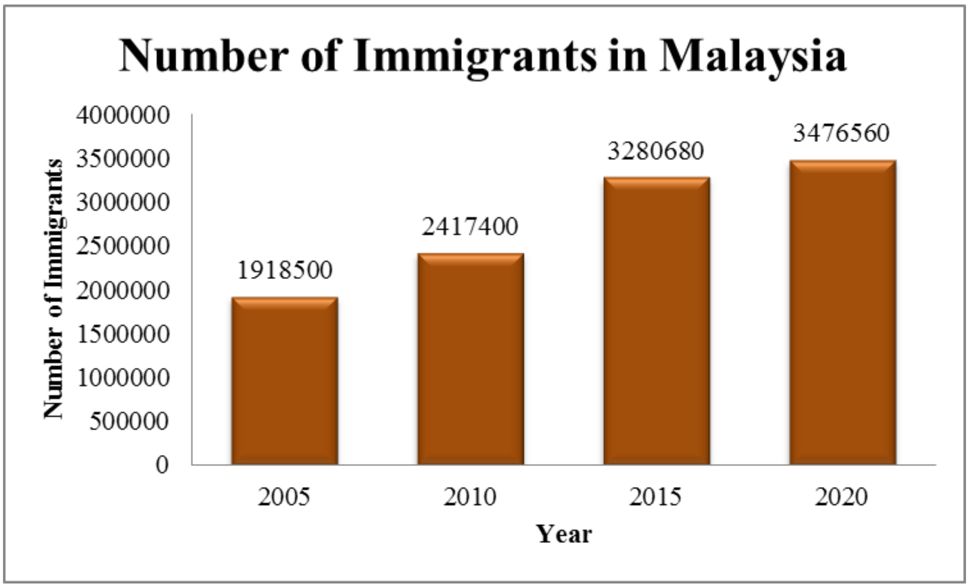

Figure 1.2 Number of immigrants in Malaysia from 2005 to 2020 (source: Statista Research Department, 2022)

As the majority ethnic group, Malays play a significant role in shaping Malaysia’s national culture, characterised by distinctive blend of traditions, languages, and social norms. The welcoming nature of Malay culture, combined with the country's overall multicultural ethos, creates an environment that attracts immigrants and fosters their adaptation. Malay culture is known for its hospitality, warm, and welcoming nature. This characteristic of Malay culture facilitates a comfortable environment for acculturation. Malays like their guests to feel comfortable and welcomed, often by providing a hospitable atmosphere (Salleh, 2005). This trait helps immigrants feel accepted and at ease in their new environment. The cultural emphasis on kindness and respect fosters a supportive community atmosphere.

According to the Federal Constitution of Malaysia, Islam is the religion of the Federation. However, other religions may be practiced in peace and harmony in any part of the Federation (Musa, 2022). Although Islam is the predominant religion among Malays, Malaysia is known for its religious tolerance. This environment of religious harmony allows immigrants from diverse religious backgrounds to practice their faiths peacefully, contributing to their overall sense of security and belonging. Malaysia is notable for its plural society, where Malays live alongside other ethnicities, creating a diverse cultural landscape (Ibrahim, 2007). Malaysia is inherently multicultural, with Malays, Chinese, Indians, and other ethnic groups coexisting harmoniously. This multicultural backdrop provides immigrants with a sense of familiarity and acceptance, making the process of acculturation smoother.

As more immigrants that come to Malaysia due to various factors, this contributes to more cultural diversity in Malaysia as immigrants come from different countries with varied cultures and ethnicities. This diversity positions Malaysia as

Asia’s most fascinating melting pot where different cultures merge and interact. As many people from various cultures come together, acculturation occurs. Acculturation, the process of adaptation arising from interaction with a majority culture while retaining aspects of one's original culture, plays a significant role in Malaysia's multicultural landscape (Salabarria-Pena et al., 2001). This interaction can lead to various challenges, such as racism, prejudice, and discrimination (Triandis, 1994; Duckitt, 2013; Baldwin, 2017; Conerly et al., 2021). However, embracing diversity and promoting unity can foster better understanding and relationships among different cultural groups (Markus & Kitayama, 1991; Kitayama & Park, 2007; Page, 2008; Gaither, 2018).

This research aims to explore the neural substrates involved in the emotion processing of Malay cultural stimuli, with a particular focus on high valence neutral arousal stimuli. Understanding how acculturation influences the neural processes associated with culturally specific emotions is crucial, especially given the increasing intercultural interactions facilitated by industrialization and ease of transportation (Salleh, 2005; Pawi et al., 2020). While previous studies have predominantly compared emotional responses across cultures (Conrad et al., 2011; Leshin et al., 2024), there is a growing need to understand the effect of interaction across members of different cultural groups and how this interaction displays cultural similarities even across diverse groups (Kelly et al., 2011; Adams et al., 2017).

Culture Neuroscience offers valuable insights into the neural mechanisms underlying psychological processes and behaviours across cultures (Chiao & Immordino-Yang, 2013). By investigating the neural substrates of acculturation in Malaysian non-Malays and non-Malaysians, this research aims to enhance our understanding of how cultural interaction with Malay culture influences neural substrates involved in the emotion processing. This research aspires to contribute to a deeper comprehension of the interplay between culture and neural processes, ultimately promoting better intercultural understanding and harmony in Malaysia's diverse society.

1.3 Research Problem and Gap

Acculturation, the process through which individuals or groups from different cultural backgrounds interact and adopt elements of a new culture, is a dynamic phenomenon with profound implications for cognitive and neural processes (Sam & Berry, 2010). In Malaysia, a nation characterised by its multicultural composition, the Malay culture represents the majority culture, influencing societal norms, practices, and emotional expressions. However, while previous research has explored acculturation broadly, there remains a notable gap in understanding how neural processes are modulated among Malaysian non-Malays (Chinese and Indian ethnicities residing in Malaysia) and non-Malaysians (immigrants living in Malaysia). Specifically, little attention has been given to how these groups' neural responses adapt to high valence neutral arousal stimuli from Malay culture.

Research by De Leersynder et al. (2020) indicated that immigrant's emotional patterns are not merely cultivated but also activated by interactions in different socio-cultural contexts. This research supports the idea by Mesquita (2003) and Mesquita et al. (2017) that emotional experiences are shaped by cultural engagements. The previous research indicated that immigrants' emotional patterns are shaped and activated by interaction within new cultural contexts. By investigating the neural correlates of acculturation in a Malaysian context, this research provides empirical support for these theoretical frameworks within a new cultural setting. It extends the understanding of how cultural interactions influence not only behavior and self-reported emotions but also the underlying neural mechanisms. Empirical studies exploring the neural correlates of these dynamically changing emotional patterns, particularly within the context of Malay culture, are sparse. This research fills this gap by examining how engagement with Malay culture alters the neural processing of emotions in non-Malays and non-Malaysians. Understanding the neural substrate of these dynamically changing emotional patterns fills a critical gap in the literature on Culture Neuroscience and acculturation.

The more an immigrant participated in a new culture, the more emotional patterns resemble those of that culture (De Leersynder et al., 2011; Consedine & Soto, 2014; Jasini et al., 2018). Previous research indicates that one's emotional pattern is not only cultivated, or one's being born with such pattern, but it also alters due to interaction with another culture. This research seeks to empirically validate and measure this phenomenon within the Malaysian context, focusing on how interaction with Malay culture specifically alters neural processing of emotions in non-Malays and non-Malaysians. This addresses the dynamic nature of emotional patterns in acculturation and the role of cultural interaction in shaping emotions, particularly for short-term immigrants (non-Malaysian) and long-term immigrants (non-Malay) in Malaysia.

Previous acculturation research had predominantly focused on comparing Western and Eastern cultural contexts, often overlooking the unique dynamics present within multicultural societies like Malaysia. Existing studies have highlighted the differential neural responses and cognitive processing patterns between distinct cultural groups (Nisbett & Masuda, 2003; Nisbett & Miyamato, 2005; Goto et al., 2010). However, few studies have systematically investigated how exposure and adaptation to the predominant Malay culture within Malaysia influenced neural substrates among non-Malays and non-Malaysians. Significant research progress has been made in documenting brain mechanisms underlying the cognition, emotion, and motivation of Westerners and Easterners. Few researchers have highlighted the importance of future research in Culture Neuroscience to go beyond Western-Eastern culture paradigm and expand the research population. Therefore, this research fills a gap in the literature by focusing on Malaysian non-Malays and non-Malaysians, contrasting with existing research that often compares Western and Eastern cultural contexts. This research emphasizes the need for studies that specifically address the Malaysian cultural landscape.

Much of the previous research initially focused on the comparison between Western and Eastern cultures by comparing behavior performance, such as research by Masuda & Kitayama (2004) and Kitayama et al. (2009). While previous studies often compared Western and Eastern cultures, this research fills a gap by specifically focusing on majority culture in Malaysian which is the Malay culture. This gap is critical as it hinders a comprehensive understanding of how cultural integration shapes neural processing and emotional responses within a diverse societal framework. It sheds light on how individuals from diverse cultural backgrounds acculturate into the Malay culture.

While traditional methods such as questionnaires provide valuable insights into self-reported acculturation experiences, they often fall short in capturing the intricate neural mechanisms underlying cultural adaptation. This limitation underscores the critical need for Neuroscience methodologies to explain how culture shapes the brain. This study addressed the gap by examining how acculturation into Malay culture shapes neural responses through application of Event-Related Potential (ERP) methods. Growing studies for emotion processing have been made possible through the application of ERP and fMRI methods into neurological and psychological science. The great spatial resolution of fMRI and millisecond temporal resolution of ERP enable excellent assessment of emotion responses. Compared to other Neuroscience methods, the processing of emotional stimuli from ERP studies has provided various insights into the emotion processes (Ding et al., 2017).

Additionally, the non-invasive and excellent temporal resolution of ERP has shown extensive benefit in exploring the relationship between cognitive processes and neuroanatomy. Previous research in ERP has repeatedly supported that component such as P100, N100, N170, vertex positive potentials (VPP), N250, N300, P300, late positive potentials (LPP), and early posterior negativity (EPN), are sensitive to the processing of emotional stimuli (Kubato & Ito, 2007; Luo et al., 2010; Wiens et al., 2011; Cowen, 2012; Sel et al., 2015). While questionnaires provide valuable insights into subjective experiences of acculturation, they are insufficient in capturing the dynamic neural processes involved. Adopting Neuroscience methods like ERP represents a crucial advancement in studying how culture shapes the brain, paving the way for a deeper understanding neural mechanism of acculturation.

In emotion processing research, the use of culturally specific stimuli is crucial for accurately capturing and analysing emotional responses within a given cultural context. Commonly, previous studies of emotion processing through the application of ERP used face affective pictures as stimuli to evoke an emotional reaction, and these affective stimuli were mostly taken from the standardised datasets known as the International Affective Picture system and Chinese Facial Affective Picture system (Lang et al., 1999; Lu et al., 2005; Xu et al., 2011). There was a notable absence of a similar database for Malay culture. Malay culture is rich in diverse traditions that are unique to Malaysia. The lack of a current database that captures the significant emotional stimuli inherent to Malay cultural experiences underscores the necessity and significance of validating Malay culture pictures for use as stimuli in ERP. The validation of Malay culture pictures is essential for filling the gap in existing databases and ensuring the accuracy and relevance of stimuli used in emotion processing research.

Therefore, as this research focuses on Malay culture, to evoke reliable emotional responses related to culture and to confirm the true impact of cultural emotion on ERP, this research validated affective culture pictures that were used as stimuli in ERP sessions. The same population of subjects from previous studies by Utama et al. (2009) and Aguado et al. (2012) were asked to rate the intensity of stimuli in a psychological experiment followed by an electrophysiological experiment with selected stimuli based on prior ratings. This research also adopted a similar method where the affective pictures were validated, and affective value of each picture was rated and followed by ERP study. Without validated Malay culture pictures, researchers risk using stimuli that may not accurately reflect the emotional triggers and experiences pertinent to Malay cultural contexts.

Emphasizing the validation of the Vancouver Index of Acculturation (VIA) questionnaire within the Malaysian context highlights the cultural specificity of this research. The VIA is a widely used questionnaire designed to measure acculturation experiences and preferences. While VIA has been validated in various countries, including Canada, England, Germany, Poland, and Russia (Tieu & Konnert, 2014; Doucerain et al., 2016), its applicability and reliability in the Malaysian context remain unclear. The VIA validation in Westerner and other non-Malaysian contexts may not capture the unique acculturation experiences specific to Malaysian non-Malays and non-Malaysians. Validating VIA in the Malaysian context enhances the reliability and consistency of acculturation measurements. It ensures that the questionnaire items effectively capture the multidimensional aspects of cultural adaptation and appropriately reflect the acculturation processes faced by individuals' interaction with Malay society. Therefore, validating VIA within the Malaysian non-Malay and non-Malaysian population is important.

This research addresses several critical gaps in the existing literature on acculturation and neural processing of emotions. By focusing on the Malaysian context, expanding research population to include Malaysian non-Malays and non-Malaysians living in Malaysia, and specifically focusing on majority culture in Malaysia, which is the Malay culture, this research expands the understanding of Culture Neuroscience beyond the Western-Eastern paradigm. It employs advanced Neuroscience methodologies like ERP to capture the neural mechanisms underlying acculturation, providing a deeper insight into how culture shapes the brain. Moreover, by validating culturally specific Malay stimuli and the VIA questionnaire, this research ensures the accuracy and relevance of its findings, contributing significantly to the field of Culture Neuroscience.

1.4 Significance of the Research

1.4.1 Theoretical contribution

The theoretical contributions of this work assist to explain the relationship between culture and brain, providing insight for future research, theory development and testing. This research brings together interdisciplinary collaboration from Culture Psychology and Neuroscience to understand the influence of acculturation of Malay culture on Malaysian non-Malays and non-Malaysians, focusing on the neural process of culturally specific emotions. This research explores a model of Neuro-Culture Interaction, ssuggesting that brain serves as an important site that collects the effects of cultural experiences and where neural connectivity is likely altered through continuous engagement in cultural practices. This model highlighted that the brain as crucial site of cultural influence. Research on neuroplasticity supports this model, proposing that systematic modifications in neural connectivity occur due to repeated behaviours (Schwartz, 2002; Kitayama et al., 2015; Wei et al., 2024). Hence, Neuroscience methods such as ERP can be applied to explore the link between culture and the brain and gain better understanding in Culture Neuroscience.

As early as 1990s, Culture Psychology initiated the idea that underlying psychological processes such as cognition, motivation, and emotion may be influenced by culture (Triandis, 1989; Markus & Kitayama, 1991). This is parallel with initiated ideas proposed in the 1990s. Additionally, it has been identified that there is a stronger correlation for brain measures compared to behavioural measures such as questionnaire, which highly accord with the Neuro-Culture Interaction Model (Kitayama & Uskul, 2011). The Neuro-Culture Interaction Model is an important component for a comprehensive of the relationship between culture and brain. Most research in culture has been based on the Western-Eastern paradigm. Through application of this Neuro-Culture Interaction Model, it is possible to expand the research population and identify other cultural dimensions for further theory building.

1.4.2 Methodology contribution

This Culture Neuroscience research, through application of ERP, represents an innovative approach to its methodology contribution. Research in Culture studies has predominantly used conventional methods such as the questionnaire. Implementation of Neuroscience methods such as using tools like ERP, can answer more research questions that conventional methods cannot, as ERP is able to provides more robust and accurate information and results (Luck, 2014).

Using tools such as ERP in Neuroscience methods enables a quantitative understanding of the cognitive processes and is sensitive to neural responses to cultural stimuli in Culture research. The questionnaire method involves subjective evaluation, which is straightforward but cannot generate quick responses of cognitive processes to cultural stimuli without compelling the respondent to intervene in appraisal and respond behaviourally. The questionnaire method is unable to record subject's real-time effect (Calvert & Brammer, 2012; Ding et al., 2017; Fang et al., 2021). Additionally, it is difficult to explain the cognitive processing of attention and emotion through traditional questionnaires. Subjects may find it difficult to distinctly and explicitly explain their feelings when asked, as behaviours may be driven by subconscious processes, making it difficult to express something that happens at a subconscious level because it is not within their awareness (Calvert & Brammer, 2012; Fang et al., 2021).

Cognitive processes are implicit and challenging for subjects to express in words alone, even with logical thought. The development of Neuroscience methods enables the measurement of physiological parameters, which can be used to investigate the cognitive processes more objectively compared to questionnaire methods (Luck, 2014). Moreover, Neuroscience methods can help researchers better explore cognitive processes related to culture, while traditional questionnaire methods can complement methods such as ERP to assess cognitive processes related to culture (Calvert & Brammer, 2012; Fang et al., 2021).

1.4.3 Practical contribution

This Culture Neuroscience research aims to explore and understand the neural substrate of cognitive processes influenced by the majority culture, which is the Malay culture, on short-term and long-term immigrants. Through this research, able to understand better the effect of acculturation across culture through the findings from neural activity. This aims to offer insights into cultural influence and cultural differences. Researchers in multidisciplinary field of Culture Neuroscience will benefit from this finding as this research provide a better understanding the neural substrates of various cultural groups within this research population.

Generally, research focuses on cultural differences, which are often seen as dividing people. However, researchers have also found out that neural patterns can be modified through interaction (Park & Huang, 2010; Han et al., 2013). This research highlights a sense of unity and togetherness despite cultural differences. This research wants to highlight a sense of unity and togetherness even though different cultures. The finding of this research would not only benefit the research community but also promote a sense of unity in a community made up of various cultures.

A better understanding of acculturation would promote more harmonious environment in culturally diverse society. When people understand that, while culture can be hardwired in the brain, interaction can also cause emotional changes, it will foster a more inclusive society. Different socio-cultural environments influence the brain (Kitayama & Uskul, 2011). Even people from diverse culturak backgrounds can develop similar emotional patterns to the mainstream culture, promoting a harmonious society. Peace in a culturally diverse society will attract visitors from other countries, benefiting the tourism industry and boosting the economy. Research in the field of Culture is crucial as we live in communities with various cultural backgrounds. It is important to understand how culture affects individuals and the community at large (Chiao & Ambady, 2007).

1.5 Research Objective

General objective

To understand the influence of acculturation of majority culture (Malay) into Malaysian non-Malay and non-Malaysian on the neural process associated with culture specific emotion.

Specific objectives 1

To assess Malay Cultural Heritage domain and non-Malay Cultural Heritage domain pictures relevancy

Specific objectives 2

To quantify the affective value of Malay and non-Malay culture pictures using the Self-Assessment Manikin (SAM)

Specific objectives 3

To assess the reliability and validity of the Vancouver Index of Acculturation

Specific objectives 4

To measure the neural activity that indicate process of culture specific emotion in acculturation of Malay culture into Malaysian non-Malay and non-Malaysian as index by amplitude of ERP components (N100/P200/N200/P300) during ERP recording

Specific objectives 5

To measure the neural activity that indicate process of culture specific emotion in acculturation of Malay culture into Malaysian non-Malay and non-Malaysian as index by latency of ERP components (N100/P200/N200/P300) during ERP recording

Specific objectives 6

To identify the source of localisation of the neural activity that indicate process of culture specific emotion substrate related to acculturation of Malay culture into Malaysian non-Malay and non-Malaysian as index by ERP components (N100/P200/N200/P300) during ERP recording

Specific objectives 7

To identify neural connectivity that indicate process of culture specific emotion substrate related to acculturation of Malay culture into Malaysian non-Malay and non-Malaysian during ERP recording

1.6 Research Hypothesis

Specific Hypothesis 1

The pictures under Malay Cultural Heritage domain and non-Malay Cultural Heritage domain will be rated as highly representative of domain Malay Cultural Heritage and non-Malay Cultural Heritage by experts

Specific Hypothesis 2

There is a difference in valence and arousal ratings of Malay culture and non-Malay culture pictures measured by Self-Assessment Manikin (SAM)

Specific Hypothesis 3

Revised version of Vancouver Index of Acculturation (VIA) questionnaire has good psychometric properties in measuring acculturation among population of Malaysian (Chinese and Indian) and non-Malaysian

Specific Hypothesis 4

There is a significant difference of neural activity that indicate process of culture specific emotion in acculturation of Malay culture into Malaysian non-Malay and non-Malaysian as index by the amplitude of ERP components (N100/P200/N200/P300)

Specific Hypothesis 5

There is a significant difference of neural activity that indicate process of culture specific emotion in acculturation of Malay culture into Malaysian non-Malay and non-Malaysian as index by the latency of ERP components (N100/P200/N200/P300)

Specific Hypothesis 6

There is a pattern of neural activity that indicate process of culture specific emotion in acculturation of Malay culture into Malaysian non-Malay and non-Malaysian as reflected by the source of localisation of ERP components (N100/P200/N200/P300) from ERP recording

Specific Hypothesis 7

There is a pattern of neural activity that indicate process of culture specific emotion in acculturation of Malay culture into Malaysian non-Malay and non-Malaysian as reflected by the neural connectivity from ERP recording

1.7 Research Question

Research Question 1

Do the pictures under Malay Cultural Heritage domain and non-Malay Cultural Heritage domain relevanty represent domain of Malay Cultural Heritage and non-Malay Cultural Heritageas identified by experts?

Research Question 2

Does Malay culture and non-Malay culture pictures evoke the valence and arousal as measured by Self-Assessment Manikin (SAM)?

Research Question 3

Does Vancouver Index of Acculturation (VIA) questionnaire have good psychometric properties among population of Malaysian (Chinese and Indian) and non-Malaysian?

Research Question 4

Does the amplitude of ERP components (N100/P200/N200/P300) evoked across neural activity that indicate process of culture specific emotion in acculturation of Malay culture into Malaysian non-Malay and non-Malaysian?

Research Question 5

Does the latency of ERP components (N100/P200/N200/P300) evoked across neural activity that indicate process of culture specific emotion in acculturation of Malay culture into Malaysian non-Malay and non-Malaysian?

Research Question 6

Where is the source of localisation of ERP components (N100/P200/N200/P300) evoked across neural activity that indicate process of culture specific emotion in acculturation of Malay culture into Malaysian non-Malay and non-Malaysian from ERP recording?

Research Question 7

Is there any neural connectivity from ERP recording evoked across neural activity that indicate process of culture specific emotion in acculturation of Malay culture into Malaysian non-Malay and non-Malaysian?

CHAPTER 2

LITERATURE REVIEW

2.1 Overview of Literature Review

This chapter provides a comprehensive review of the existing literature related to the research, establishing a theoretical foundation, and identifying gaps that this research aims to fill. It reviews the literature on key topics relevant to the research, beginning with an overview of the ethnic diversity in Malaysia, focusing on Malays, Chinese, Indians, and immigrants. It then explores Malay cultural heritage and the process of acculturation, including various models, strategies, measurement tools, and the integration of Neuroscience in acculturation research. The chapter also examines emotion classification and measurement, the concepts of valence and arousal, neural substrates in emotion processing, and emotional acculturation. It delves into Event-Related Potentials (ERPs), discussing components such as N100, P200, N200, and P300, and their relevance to cultural research. Culture Neuroscience is reviewed to understand how cultural experiences shape brain function. A table summarising key studies is provided, followed by a discussion on the underpinning theories and the theoretical framework guiding the research.

2.2 Ethnicity in Malaysia

2.2.1 The Malaysian: The Malay ethnic

Malaysia, a Southeast Asian country slightly just north of the equator, is divided into Peninsular Malaysia (*Semenanjung Malaysia*) and East Malaysia (*Malaysia Timur*), which includes the states of Sabah, Sarawak, and Labuan (Leinbach et al., 2024). The capital of Malaysia is situated in Kuala Lumpur, while the administrative hub is in Putrajaya (Ho, 2006). Nearly all nations in the world are distinctive and unique in their own ways. Malaysia encapsulates and characterises the essence of cultural diversity; this distinctiveness makes Malaysia unique (Muhamad et al., 2023). Malaysia is distinctive due to its diversity of cultures, religions, and racial groups. This highly unique trait stems from its diversity.

The multiracial nation of Malaysia is home to a wide range of cultures, religions, social customs, and values. One of its most notable characteristics is the extremely diverse ethnic makeup of its population. Malaysia's ethnic groups are primarily composed of the Malays, with minority ethnics groups including the Chinese and Indian populations (Kawangit et al., 2012). Numerous historical and anthropological studies have been conducted to better understand the complex origins of the Malay people (Deng et al., 2015).

The majority of natives, including the Malays and indigenous populations known as *Orang Asli*, called peninsular Malaysia home. The term "indigenous peoples" refers to ethnic groups that are the original inhabitants of a particular region (Halim & Nordin, 2021). These groups have historical ties to the land that predate the arrival of outside populations. The term is often synonymous with "original peoples of the land" or "aborigines," both of which emphasise their long-standing presence and deep-rooted connection to their native territories (Halim & Nordin, 2021). These peoples typically maintain distinct cultural, social, and economic systems that have been passed down through generations, despite external influences and changes over time. Malays belong to the Austronesian family, and the language spoken by this ethnic group is Malayo-Polynesian (Bellwood, 1997; Omar & Omar, 2004). The Malays primarily live on the Malay Peninsula, the east coast of Sumatra, and the coast of Borneo. According to Aghakhanian et al. (2015), *Negrito, Senoi,* and *Proto-Malay* are the three main divisions of *Orang Asli*.

As early as the 1800s, academics had produced several theories about the origin of the Malays in prehistoric periods, giving rise to the term "Proto-Malays", sometimes known as aboriginal Malays, which has a more diversified provenance (Isa & Zen, 2014). These theories were developed in accordance with archaeological data and the linguistic traditions of the Malayo-Polynesian language used by the indigenous Malay community (Donohue & Denham, 2011; Hays, 2015). *Deutero Malays* were introduced following the historical influx and repeated admixtures of events throughout centuries. It is said that *Deutero Malays* are the descendants of *Proto-Malays* and the forebears of modern-day Malays.

The Malay ethnic group is one of many diverse ethnic groups found in Southeast Asia and the Pacific Islands that make up the greater Austronesian family (Bellwood, 1997). Consequently, there are several Malay descendants, each with its own distinct cultural identities and historical origins. While these communities share some ancestral and cultural characteristics, each descendant of the Malay ethnic group has developed over time in its own places, leading to separate cultural identities (Omar & Omar, 2004). The Malay in Malaysia are renowned for being hospitable and friendly people. The Malay community fosters the value of welcoming people from other cultures (Kawangit et al., 2012). For immigrants, this kindness fosters a sense of comfort and belonging. The Malays in Malaysia have their own unique culture, which includes delightful cuisine, beautiful and intricate clothing, distinctive features in architecture, and rich in cultural arts. These unique characteristics of the Malays, along with the strategic location of the Straits of Malacca, have been able to attract immigrants to Malaysia (Andaya, 2008).

The Straits of Malacca served as a significant hub for trade between Southeast Asia, China, and India in the 14th century, drawing traders and mariners from all around the world into the Malay world (Andaya, 2008). A significant maritime trade route connecting China and India was established through the Straits of Malacca (Hall, 2011). The emergence of the Malacca Sultanate in the 15th century increased the Strait of Malacca's significance in international commerce networks, and the importance of the Straits of Malacca as a trading hub persisted long into succeeding decades (Gerke et al, 2008). The Malacca Sultanate, established by Parameswara, was a significant maritime trading empire that controlled important trade routes. Traders from China, India, the Middle East, and Europe were drawn to the Malay world. Islam was disseminated throughout the Malay Peninsula and the archipelago as a result of Malacca's prosperity as a trade centre.

Following the religious conversion of Parameswara to Islam, subsequently known as Sultan Iskandar Shah (Wain, 2012), Islam spread further throughout the Malay Peninsula and the archipelago. Islam's introduction to the Malay world is a pivotal moment in Malay history. Through trading relations with Muslim traders from the Middle East and the Indian subcontinent, Islam was first adopted in the 13th century, which grew into a strong Islamic kingdom and a hub of trade and study, was prompted by the spread of Islam among the Malays. Before the arrival of Islam, Buddhism and Hinduism had an impact on the Malay civilization (Milner, 2011). The Islamic civilization, which began in West Asia, has had a significant influence on the Malay world. The Malays converted to Islam and abandoned their polytheistic beliefs