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THE EFFECT OF BICULTURALISM ON EXECUTIVE FUNCTIONS

**XIE WENHAN
SCHOOL OF HUMANITIES
2019**

The Effect of Biculturalism on Executive Functions

XIE WENHAN

School of Humanities

A thesis submitted to the Nanyang Technological University in partial
fulfilment of the requirement for the degree of Master of Arts

2019

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ABSTRACT

Much debate in the field of bilingualism has centred around a bilingual's advantage in Executive Functions (For a recent review, see Lehtonen et al., 2018). In light of recent conflicting evidence regarding the premise of a bilingual advantage, scholars have begun to scrutinize possible variables and confounds arising from differences in the broader social and interactional environment (de Bruin, 2019). While variables such as proficiency, immigration, and age of acquisition have received much attention over the years, there is still a paucity of research into culture as a variable exerting an effect on bilingualism. To the best of our knowledge, the few studies considering the impact of culture on bilingual's Executive Functions group participants on the macro-level culture that is commonly associated with their nationality (e.g. Samuel, Roehr-Brackin, Pak, & Kim, 2018; Tran, Arredondo, & Yoshida, 2015). Yet, this does not capture a sufficiently nuanced perspective of the cultural diversity among bilingual populations (Grosjean, 2015). This thesis is the first to explore the effects of biculturalism on Executive Functions among bicultural-bilinguals. Study 1 surveyed 252 bilingual Singaporean young adults to provide an overview of how they viewed language and their ethnic cultural identities. The results show that the majority of Singaporean young adults (71.7%) were bicultural. The likelihood of biculturalism was predicted by their ethnic language proficiency and bilingual status (Balanced vs. Unbalanced). To augment the self-report data in the first study, Study 2 integrates self-report questionnaire data on cultural and language behaviour with a priming experiment (cultural frame switching, adapted from Hong, Morris, Chiu, & Benet-Martinez, 2000) to provide empirical evidence of bilingual Singaporean young adults' ability to switch between cultural frames. 233 participants from Study 1 continued with this follow up study, and the results suggest that Singaporean young adults were not only bicultural but were also able to switch between different cultures when primed with Western and ethnic cultural primes. Individuals who switched between cultural frames more frequently made a clearer distinction between Western primes than those who switched between cultural frames less frequently, suggesting that cultural primes impact cognition differentially depending on their frequency of switching between cultures. Study 3 explored the effect of cultural switching frequency on 48 young adult bicultural bilinguals' performance on tests for interference and inhibition-control (Simon and Flanker tasks), set-shifting ability (Wisconsin Card Sort Task), and attention (Attention Network Task). Frequent cultural switchers had an advantage in resolving stimulus-response conflict significantly faster in the Flanker task, were better at maintaining set in the Wisconsin Card Sort Task, and had a smaller CONFLICT effect compared to infrequent switchers in the Attention Network Task. Taken together, this thesis has implications for future studies of bilingual populations, as the bicultural switching effects on interference and inhibition-control persists even after tightly controlling for key socio-linguistic variables including bilingual proficiency, age of acquisition, IQ, socio-economic status and age. Our research underscores the importance of considering socio-cultural variables in future studies examining a bilingual advantage in Executive Functions.

Keywords: Bilingualism, Executive Functions, Biculturalism, Cultural Frame Switching, Bilingual Advantage, Cultural Effects

CHAPTER ONE

1. INTRODUCTION

The study of bilingualism, defined as the acquisition and use of two or more languages, has taken centre stage among researchers in many fields over the last half of the century. Despite early concerns that learning multiple languages may cause confusion and even lead to ‘mental retardation’ (Goodenough, 1926), there have been numerous studies debunking such myths since the 1960s. In a seminal study providing evidence for a bilingual advantage, Peal and Lambert (1962) conducted a number of verbal and non-verbal intelligence tests on French monolingual and French-English bilingual children. The researchers found that bilinguals outperformed monolinguals on measures such as cognitive flexibility, hypothesizing that this outcome was the result of the need to juggle different languages in their daily lives.

Over the years, studies comparing monolinguals and bilinguals continue to yield favourable findings regarding bilingual effects with reports of cognitive advantages for bilinguals across the lifespan. For instance, bilingual children have been shown to achieve developmental milestones at the same time as monolingual children when the vocabulary of both languages is taken into account, even when acquiring multiple languages (Hoff, Rumić, Burridge, Ribot, & Welsh, 2014). Among the elderly, scholars argue that bilingualism may contribute to ‘cognitive reserve’ that may delay neurodegenerative diseases such as Alzheimers and dementia by approximately four years compared to monolinguals (Bak et al., 2014; Bialystok, Craik, & Freedman, 2007; Calvo, Garcia, Manoilloff, & Ibanez, 2016). Researchers have proposed that bilinguals have an advantage over their monolingual peers due to the constant monitoring, selection, and inhibition of languages is said to hone their Executive Functions, giving them an

edge even in domain general, non-linguistic tasks that tap into these cognitive processes (e.g. Green, 1998; Green & Abutalebi, 2013; Bialystok, 2017).

One key area of focus in bilingual research has centred around the comparison of Executive Functions between monolingual and bilingual populations. While the exact definition and components of Executive Functions are still the subject of much debate (see Miyake & Friedman, 2012, for a discussion), the general consensus is that Executive Functions are higher-order cognitive functions that can be categorized into three core groups: inhibition and interference control (e.g. selective attention, behavioural and cognitive inhibition), cognitive flexibility (i.e. mental flexibility in task/set-shifting), and working memory (Diamond, 2013; Miyake et al., 2000). Executive Functions are believed to be the pivotal foundation upon which with important skills such as planning (Collins & Koechlin, 2012) and critical reasoning (Lunt et al., 2012) are built. Moreover, they are also found to predict theory of mind in developing children (Sabbagh, Xu, Carlson, Moses, & Lee, 2006) and have significant implications for an individual's personal, social, and academic development (Best, Miller, & Naglieri, 2011).

Proponents of a bilingual advantage in domain general Executive Functions typically argue that the advantage stems from a bilingual's need to direct attention in the monitoring of speech input and select the appropriate language to respond in while inhibiting the production of words and phrases in the other language. As both languages in the bilingual's repertoire are jointly activated in the brain during speech (Marian & Spivey, 2003; Thierry & Wu, 2007), the act of 'juggling' two activated schemas is said to hone the bilingual's Executive Functioning, especially in the domain of interference and inhibition-control (Kroll, Dussias, Bice, & Perrotti, 2015). Currently, two dominant views explaining the roots of the bilingual advantage exist. The first model, put forth by Green (1998) has sometimes been termed the 'Inhibition-Control Model' and

proposes that bilinguals' experience in inhibiting the co-activated non-relevant language present even in monolingual speech contexts enhances their ability to inhibit distracting or irrelevant stimuli better than monolinguals (Some seminal studies include Bialystok, Craik, Klein, & Viswanathan, 2004; Kroll, Bobb, Misra, & Guo, 2008). Expanding on this model, Green and Abutalebi's (2013) Adaptive Control Hypothesis proposes that different control processes including goal maintenance, conflict monitoring, interference suppression, cue detection, response inhibition, task (dis)engagement, and opportunistic planning, are activated depending on the demands of different interactional contexts (Single language, dual language, dense code-switching). These different contexts are hypothesized to result in differential enhancements of cognitive control. The second model takes the view that bilinguals may not necessarily be better at inhibition and control, but are instead better at directing attention for monitoring, orienting, and maintaining goal-relevant information (See Bialystok, Craik, & Luk, 2012; Bogulski, Rakoczy, Goodman, & Bialystok, 2015; Colzato et al., 2008; Costa, Hernández, Costa-Faidella, & Sebastián-Gallés, 2009 for supporting studies). This view builds on work by Engle and colleagues (2002, 2010, 2015) on Executive Attention, and has been hypothesized to be as the key driver of the bilingual advantage in domain general Executive Functions (Bialystok, 2017).

Another domain where the bilingual advantage in Executive Functions has been suggested involves task-switching. Some researchers have suggested that code-switching between languages inter-sententially and intra-sententially shares similarities between domain-general task switching (e.g. Abutalebi & Green, 2008; Green & Abutalebi, 2013; Prior & MacWhinney, 2010). In fact, a recent brain imaging (fMRI) study by de Baene and colleagues (2015) provide evidence for a significant overlap in neural connections and architecture when 36 high proficiency Spanish-Basque bilinguals were tested using language switching and domain-general non-linguistic

switching tasks. As such, these ‘cognitive exercises’ are believed to augment domain-general Executive Functions and confer a bilingual advantage that is evident in children as young as 7-months of age (Kovacs & Mehler, 2009).

While there is no shortage of literature supporting the bilingual advantage, a number of recent studies have cited concerns about the failure to replicate the results of certain key studies (Duñabeitia et al., 2014; Paap & Greenberg, 2013; Paap, Johnson, & Sawi, 2015; Lehtonen et al., 2018). In addition, various concerns have been raised about the analyses of raw Executive Functions measurements and insufficient power (Paap et al., 2017; 2018) as well as a general publishing bias in favour of studies that showed a bilingual advantage (de Bruin, Treccani, & Della Sala, 2015). Yet, there exist studies that predate the current concern for null results. For instance, a study conducted by Morton and Harper (2007) found no significant bilingual advantage in inhibitory-control when a Simon task was administered to both bilingual and monolingual participants who were closely matched on socio-economic status and ethnicity. More recent studies have suggested that a broad array of factors such as socio-economic status, immigration status, parental education, and culture may influence the development of Executive Functions providing conflicting evidence for what was assumed to be a domain of clear advantage for bilinguals (Anton et al., 2014; Carlson, 2009; Kousie & Philips, 2012; Samuel, Roehr-Brackin, Pak & Kim, 2018).

The lack of facilitative effects in these studies begs for closer scrutiny of the variables that may contribute to the reported bilingual cognitive advantage. As pointed out by Luk and Bialystok (2013) in an article titled “Bilingualism is not a categorical variable”, the cognitive consequences of bilingualism need to be considered within the broader, multi-dimensional bilingual experience. This view is further echoed by Valian (2014) and de Bruin (2019) as they argue for the diverse differences between bilinguals who may vary in aspects such as their unique cultural contexts,

social interaction habits, as well as the macro language politics and family environment within which they are brought up. One particular factor that has been gaining the attention of researchers involves the effects of culture on bilingual performance in Executive Functions tasks. A longitudinal study by Tran, Arredondo and Yoshida (2015) used the children's Attention Network Task to study the effects of different cultural upbringings on attention among three-year-old bilingual and monolingual children from the United States (Western culture), Argentina (Latin culture), and Vietnam (Eastern culture). The researchers found that while both bilingualism and Eastern cultures contributed to better task performance, Vietnamese children outperformed their Western counterparts regardless of whether participants were monolingual or bilingual. More recently, Samuel and colleagues (2018) reported that culture was a significant predictor of performance in the Simon task regardless of whether participants were bilingual or monolingual when they compared young adults from Korea (East Asian culture) and Britain (Western culture). Importantly, these studies highlight how cultural effects may muddy the waters and potentially confound results comparing Executive Functions performance among bilinguals and monolinguals.

This thesis seeks to provide a more nuanced understanding of how culture, in particular, biculturalism, may modulate bilingual's performance in Executive Functions tests. Similar to how bilinguals actively direct attention to select and inhibit languages in daily lives and conversations, cultural psychologists have found that bicultural individuals also select and shift between different 'cultural frames', choosing the appropriate actions, values, and norms when they interact with individuals and groups from different cultures (Hong et al., 1997; 2000; 2003; Tadmor & Tetlock, 2006). The thesis examines the effects of biculturalism and bicultural switching among bilinguals on performance in commonly used Executive Functions tasks measuring executive control (Simon

task, Flanker task, Attention Network Task (CONFLICT/EXECUTIVE CONTROL Network), set-shifting (Wisconsin Card Sort Task), and attention (Attention Network Task). This work takes an interdisciplinary perspective to integrate concepts from sociolinguistics, cultural psychology, and psycholinguistics – beginning with a survey of young adult Singaporeans to determine the extent of biculturalism the current generation of young adult Singaporeans, studying the relationship between their language- and cultural-switching behaviours, and finally, examining the effect of cultural-switching frequency on tests of Executive Functions. In particular, I highlight the importance of going beyond macro-level culture in studies looking at bilingual's performance in tests of Executive Functions. Instead, researchers need to recognise the nuances of individual biculturalism and how the frequency of switching between cultures may provide another explanation for the conflicting results in studies that have not found a bilingual advantage in Executive Functions.

1.1 Outline of the Thesis

The next chapter (Chapter 2) provides an overview of the literature on bilingualism and Executive Functions, including current discrepancies in findings of a bilingual advantage in Executive Functions. The review also discusses the relevance of cultural effects and biculturalism in contributing to potential confounds in measuring task performance of bilinguals. Chapters 3, 4, and 5 detail a series of studies conducted to find out if highly proficient bilingual Singaporean young adults are bicultural, and how their bicultural switching behaviour can influence performance on tests of Executive Functions. Chapter 6 provides a general discussion of biculturalism's relevance in the bilingual cognitive advantage debate. Chapter 7 provides an overview of the limitations and future directions before the conclusion in Chapter 8.

CHAPTER 2

2. LITERATURE REVIEW

In what follows, I review the extant literature examining claims of a bilingual advantage in Executive Functions in a variety of domains. Following that, counter-arguments against this advantage are explored with a particular focus on cultural differences as an important variable. Finally, the chapter concludes with a discussion of how biculturalism and bicultural frame switching may be an important factor contributing to a bilingual's Executive Functions.

2.1 Possible Bilingual Advantages in Executive Functions

2.1.1 Interference and Inhibition Control

At the dawn of the bilingual 'cognitive advantage' revolution in the late 1990s, a large number of studies were conducted to examine bilingual performance on interference and inhibition control. Interference and inhibition control is defined as the ability to control and direct "attention, behaviour, thoughts, and/or emotions to override a strong internal predisposition or external lure, and instead, do what's more appropriate or needed" (Diamond, 2013, p. 135). One of the first reports of a bilingual advantage in Executive Functions involved a study by Bialystok (1999) comparing the abilities of sixty preschool bilinguals and monolinguals on the Dimensional Change Card Sort (Frye, Zelazo, & Palfai, 1995) and moving word task, both of which require assess the subject's ability to attend to relevant information while suppressing distracting changes to rules or irrelevant cues. Bialystok found that on incongruent trials or instances with distractors, bilingual children were more accurate and made fewer errors than monolinguals, suggesting a bilingual advantage in inhibition and interference-control.

The advantages in executive control were also extended to older adults in a widely cited study by Bialystok, Craik, Klein and Viswanathan (2004). The researchers administered a Simon task to middle-aged and older adults by varying the location of green and red colour squares on the screen, manipulating the congruence of the stimuli's spatial location with the fixed response keys on either side of the keyboard. They found that regardless of age group, bilinguals reacted more quickly than their monolingual peers during incongruent trials. This smaller Simon effect was taken as an indicator of the bilinguals performing better at inhibition and control tasks compared to monolinguals. Furthermore, their study reported how the older bilinguals ($M_{age} = 71.1$) showed a smaller Simon effect even after considering the typical ageing-related decrease in performance, suggesting that lifelong bilinguals may mitigate certain age-related declines in cognitive performance.

Bilinguals have also been found to perform faster and more accurately on other common tests of inhibition and interference control such as the Flanker task (Eriksen & Eriksen, 1974). Costa, Hernandez, and Sebastian-Galles (2009) reported a bilingual advantage in terms of alerting networks and executive control networks in their sample of 200 young adults in the Attention Network Task, suggesting that bilingual participants performed faster and had lower switching penalties than monolinguals in various cue-by Flanker trials. Similar results were also demonstrated in studies using the Flanker task with children, such as one large study by Poarch and Bialystok (2015) involving monolingual, partially-bilingual (low-use bilinguals), bilingual, and trilingual participants aged between 8 and 11 years ($n=203$). While bilinguals performed significantly better than monolinguals in incongruent Flanker trials, the study was significant in presenting evidence for the non-linearity of the bilingual advantage in inhibition and interference

control as partial bilinguals and trilinguals did not show a performance advantage when compared to their monolingual and bilingual peers respectively.

Some studies have also leveraged on neuro-imaging techniques to supplement behavioural evidence to examine the functional activation of inhibition and interference control in the bilingual brain (See Pliatiskas & Luk (2016) for a review). In particular, fMRI studies making use of various inhibition and interference control tasks have shown activation of brain regions that were also co-activated in language tasks and domain-general non-linguistic tasks (Rodríguez-Pujadas et al., 2013). Moreover, these neural areas were also found to significantly overlap during linguistic and non-linguistic task switching among bilingual individuals (Weissberger, Gollan, Bondi, Clark, & Wierenga, 2015). In a study examining the differences in functional activation of executive networks in bilinguals and monolinguals, Coderre and colleagues (2015) administered a modified Flanker task as well as a semantic decision task (assessing if the prompt was a ‘living’ or ‘non-living’ entity) to 15 monolingual English speakers and 14 bilingual Spanish-English speakers. Bilinguals were found to activate the left inferior frontal gyrus for both linguistic and non-linguistic tasks, suggesting similar neural resources and pathways were being used for both tasks. In contrast, no overlap in activation was found in monolingual subjects. These findings provide evidence that bilingualism hones inhibition-control processes extending beyond the specific domain of language, and may yield more efficient processing even in domain-general tasks involving inhibition-control.

2.1.2 Cognitive Flexibility (Task-Switching)

In addition to benefits in inhibition and interference control, a bilingual’s ability to fluidly switch between languages or language varieties may enhance their cognitive flexibility – especially in switching and shifting tasks (Bialystok, 2011; Prior & Gollan, 2011). Previous studies

have reported how all languages spoken by a bilingual are simultaneously activated in listening (Spivey & Marian, 1999), reading (Dijkstra, 2005) and speech (Kroll, Bobb, & Wodniecka, 2006). Hence, choosing which language to use when interacting requires constant monitoring and oversight that may hone task-shifting abilities.

Cognitive flexibility is typically investigated using task-switching and set-shifting tasks. A seminal study by Prior and MacWhinney (2010) investigated how monolingual and highly proficient bilingual college students fared in a non-linguistic task-switching task. Bilinguals were found to perform faster than monolinguals in terms of reaction time in switch trials but not in non-switch trials, revealing a bilingual advantage for even domain-general cognitive shifting. Similarly, Wiseheart, Viswanathan, and Bialystok (2016) reported that young adult bilinguals were better able to resolve ambiguity in stimulus-response associations resulting in lower global switching costs in a non-verbal set-shifting task that required participants to remap their responses on every trial when compared to monolinguals. Research in neural imaging has also provided insight into the different activation patterns in bilingual and monolinguals during linguistic and non-linguistic task switching – namely, that the activation patterns of bilinguals showed greater overlap in the processing of both types of tasks as compared to monolinguals (Timmer, Grundy, & Bialystok, 2017). These results are hypothesized to point to a functional overlap and similarity between linguistic and non-linguistic task switching in bilinguals, which may result in a bilingual advantage due to more efficient switching networks.

Recent literature has been abuzz with interest in how bilinguals adapt their control mechanisms depending on their language environment. This has led to a closer study of the role of code-switching in bilingual contexts (Abutalebi & Green, 2008; Green, 1998; 2011). One influential theory, the Adaptive Control Hypothesis (Green & Abutalebi, 2013) proposes that

“language control processes themselves adapt to the recurrent demands placed on them by the interactional context” (p. 515). In particular, the researchers hypothesize that different interactional contexts (single language, dual language, code-switching) will impose varying demands in the cognitive control system. For instance, using two languages separately such as in school and at home (single-language context) is believed to require inhibition of a bilingual’s other languages. However, using two languages in the same context with different speakers (dual-language contexts) requires the most stringent cognitive control processes such as monitoring and interference and response inhibition. Finally, frequent code-switching in the same interactional context is hypothesized to require less cognitive suppression and control as it allows for ‘opportunistic planning’ to freely use lexical items from either language. In an article examining how different bilingual language experiences and the context of use would affect task-switching, Hartanto and Yang (2016) administered a colour-switching task to 58 bilinguals who seldom code-switched in the same context and 75 bilinguals who self-reported frequent code-switching often within the same context. The authors reported how code-switching within the same context resulted in reduced switch costs (i.e. participants were able to make the appropriate colour switch more quickly) among bilinguals who frequently code-switched. Moreover, among code-switching bilinguals, those who reported frequently code-switching intra-sententially (dense code-switching) were found to be able to switch more quickly than bilinguals who adopted more inter-sentential switching in their speech. In a recent study using an analogue of the Dimension Change Card Sort task, Yang, Hartanto, and Yang (2016) found that bilingualism facilitated task switching especially with regard to interference suppression evinced by lower switching costs and faster engagement/disengagement in shifting from one task to another among their sample of English monolinguals and Korean-English bilinguals.

2.1.3 Working Memory

Some scholars have also argued that bilingualism has a positive impact on working memory. Working memory refers to how the brain temporarily retains a limited amount of information for other cognitive processes (Cowan, 2008), and has been hypothesized to interact with other core Executive Functions (Miyake et al., 2000), as well as be influenced by or considered as a part of domain general attention abilities (Baddeley, 1986; Engle, 2002; Shipstead, Harrison, & Engle, 2015). As a result of bilingual language use and attentional engagement/disengagement during language switching, bilinguals are predicted to have an advantage over their monolingual peers in challenging and complicated tasks which tap on working memory for temporary storage and the subsequent processing of information (Gathercole, Pickering, Ambridge, & Wearing, 2004). While early studies did not find *global* differences in working memory between monolinguals and bilinguals, a few studies have argued for how some aspects of working memory may be augmented by bilingual experience that was evident only under more challenging task conditions (Calvo, Ibanez, & Garcia, 2016).

For example, Morales, Calvo, and Bialystok (2013) conducted two studies to compare monolingual and bilingual performance with varied working memory demands. Working memory demands were controlled by changing the number of response rules (hold either 2 or 4 rules in memory) for conflict and non-conflict tasks. The first study reported an advantage for 5-year-old bilingual children, who were more accurate and reacted more quickly than their monolingual peers in a modified Simon task. A second study compared the visuospatial working memory of both monolingual and bilingual children in a task that required children to remember multiple locations of frogs represented in a 3x3 grid that were shown sequentially or simultaneously. This frog matrices task was more complicated, as it required subjects to keep in mind information on both position and order. Bilinguals were found to outperform monolingual children in instances of

higher working memory load, as well as in conflict and incongruent trials that recruited other interference and inhibition-control processes. Further evidence for a bilingual processing advantage in working memory was also reported by Blom and colleagues (2014) who found that bilingualism augmented both visuospatial and verbal working memory of sequential Turkish-Dutch bilingual children from low socio-economic backgrounds when compared to monolingual Dutch children. In particular, children who had higher levels of bilingual exposure and proficiency performed significantly better in tasks assessing visuospatial and verbal memory. While the jury is still out regarding the role of bilingualism in facilitating working memory is still the subject of much discussion, there is some evidence that bilingualism may augment working memory especially in visuospatial tasks.

2.1.4 Executive Attention

Although inhibition and interference control are important mechanisms contributing to the bilingual advantage, some researchers argue it was unlikely to be solely responsible as all individuals have to frequently resolve conflicts even in linguistic and non-linguistic contexts and that bilingual infants as young as 7 months old showed an advantage over their monolingual peers despite limited language exposure (Sebastián-Gallés, Albareda-Castellot, Weikum, & Werker, 2012; Weikum et al., 2007). In an important review, Bialystok and colleagues (2009; also see Bialystok, 2015; 2017) discussed the possibility that the bilingual advantage in Executive Functions may stem from the way bilinguals monitor, control, and direct attention, and that bilingual exposure may alter the way in which individuals manage these resources. This concept, put forth as Executive Attention, is thought of as being broader than any single component in Miyake's three-component model of Executive Functions (inhibition and interference control, shifting, and working memory), and involves the ability to monitor, suppress or ignore irrelevant

stimuli, and direct cognitive resources to either maintain or switch depending on the relevant information (Bialystok et al., 2009).

For instance, Tao and colleagues (2011) tested the Alerting, Orienting, and Executive Control networks of monolinguals, early bilinguals (Age of acquisition(AoA): before age 6), and late bilinguals (AoA: after age 12) using the Attention Network Test developed by Fan and colleagues (2002). They found that bilinguals, regardless of the age of acquisition of their second language, outperformed monolinguals in terms of conflict resolution on incongruent trials. Early bilinguals also showed enhanced attentional monitoring while late bilinguals displayed the greatest advantage in conflict resolution. Moreover, the attentional disengagement abilities seem to be differentiated according to a bilingual's language proficiency. Mishra, Hilchey, Singh, and Klein (2012) investigated the effects of language proficiency on Hindi-English bilingual's ability to disengage attention from distractor cues measuring participant's inhibition of return in a visual cue-response task. Participants with high self-rated Hindi and English proficiencies responded significantly faster than less proficient bilinguals and showed significantly earlier inhibition of return that indicated greater efficacy at disengaging attention from the irrelevant task stimuli.

In a recent study, Grundy and Chahi (2017) reported how bilinguals experienced smaller sequential congruency effects compared to monolinguals, despite no significant differences between performance on a Flanker task. The researchers calculated sequential congruency effects by taking the difference between the interference effect following congruent and incongruent trials, arguing that bilingual's smaller interference effects regardless of the trial type indicated greater efficiency in disengaging attention compared to monolinguals. Using EEG, Grundy and Bialystok (2018) compared monolingual and bilingual adult's ability to exert control during conflict trials in a task-switching experiment, reporting that all participants responded more slowly after conflicting

trials with no between-group differences in reaction time. As monolinguals showed longer post-conflict Event-Related Potentials compared to bilinguals, the researchers argued that in order to achieve the same result as bilinguals, monolinguals had to engage more attentional resources in conflict resolution.

In addition to studies reporting a bilingual advantage in attention using visual tasks, Bak, Vega-Mendoza and Sorace (2014) made a unique contribution to the field by examining auditory attention among bilinguals. The researchers administered the Test of Everyday Attention (TEA) to investigate the effects of bilingualism on attention among four participant groups: monolinguals, early childhood bilinguals (L2 AoA: Below 4 years), late childhood bilinguals (L2 AoA:4-15 years), and early adulthood bilinguals (L2 AoA:15-19 years). The TEA task assessed sustained attention, selective attention, and attentional switching using a myriad of visual and auditory tasks such as the tone counting tasks, and bilinguals showed different levels of advantage over monolinguals especially in the tasks requiring selective attention, attentional switching, and response inhibition. More recently, Rämä and colleagues (2018) examined auditory attention between bilinguals (n=17, L2 AoA before 3 years) and monolinguals (n=17) using electrophysiological measures. The participants were presented with one tone stream in each ear, with each stream composed of pure tones, and deviant tones that differed in terms of intensity (loudness) or duration. Participants were then asked to pick out tones of deviant duration being played to them in either their right or left ears. While no differences in accuracy or speed of identification were found between monolinguals and bilinguals, the larger negative differences in attention related Event-Related Potentials as well as a larger late reorienting negativity among bilingual participants led the researchers to suggest that bilinguals had an advantage in both maintaining selective attention and disengaging attention compared to monolinguals.

2.2 Counter-Arguments Against a Bilingual Advantage in Executive Functions

In recent years, challenges to the firm conclusion of a bilingual advantage have been highlighted from various perspectives and research groups (Hernández, Martin, Barceló, & Costa, 2013; Paap & Greenberg, 2013; Paap et al., 2015; Duñabeitia et al., 2014; de Bruin et al., 2015; von Bastian, Souza, & Gade, 2016). Specifically, researchers propose that differences in experimental designs as well as confounds in participant selection including variables such as ethnicity, social background and social-economic status (Bak, 2016; Blom et al., 2017; Marton, 2016; Morton & Harper, 2007), differential definitions early or late bilingualism (Yang, Hartanto, & Yang, 2016), participant's cultural upbringing (Samuel et al., 2018; Yang, Yang & Lust, 2011), or immigrant status (Kousaie & Phillips, 2012) have not been well controlled or taken into account in many studies showing a bilingual advantage in Executive Functions.

Another issue of concern is that of publication bias where journal publications favour the publishing of significant effects in support of a bilingual advantage. de Bruin and colleagues (2015) examined abstracts submitted for conference presentations and found that research supporting the bilingual advantage was much more likely to be published, with only 29% of studies showing no bilingual advantage being accepted from the period of 1999 to 2012. In an attempt to synthesize existing studies relating to bilingualism and Executive Function in adults for comparison, Lehtonen and colleagues (2018) conducted an extensive meta-analytic review of 152 studies covering a range of six Executive Function domains (inhibitory control, monitor, shifting, working memory, attention, and verbal fluency). In order to mitigate the effects of publication bias, the authors chose to include unpublished doctoral and masters' theses in addition to journal articles, while also accounting for various effect sizes of each article. It was reported that no clear advantage in any of the six Executive Function domains provided evidence that bilinguals adults

were at an advantage when compared to their monolingual peers after correcting for publication bias. Another recent meta analysis by Paap (2019) compared the mean reaction time differences in interference-control tasks in 177 studies. Specifically, the researcher's scope was limited to studies that used 'benchmark' tests of interference-control such as the Simon, Stroop, Flanker and Attention Network Task (ANT). Importantly, he reported that an astounding 81.4% of the studies returned null results, with only less than 15% of studies showing a significant bilingual advantage in terms of reaction time over their monolingual peers. These findings present an important challenge to the dominant view of a domain general advantage in bilingual's executive functions and begs the question – what other factors might be at play that have contributed to a bilingual advantage in some studies but not others?

Furthermore, several studies have been unable to replicate findings of the original bilingual advantage found in seminal studies. One such example is a large scale study involving 504 monolingual and bilingual children matched on strict inclusion criteria (e.g. Age of acquisition, language proficiency). In the study, Duñabeitia and colleagues (2014) administered a verbal Stroop task (manipulating the congruence of printed fonts and the actual colour terms) and a numerical Stroop task (manipulating size-number congruency). While bilinguals were expected to have an advantage in terms of conflict costs, the researchers found no evidence that bilinguals and monolinguals differed in terms of global reaction time or accuracy. Additionally, Gathercole and colleagues (2014) were also unable to find a clear bilingual advantage in Executive Functions in a large sample of totalling approximately 1,500 participants who participated in card sorting (n=650), Simon (n=557), and metalinguistic judgement (n=354) tasks, despite bilingual participants' early age of acquisition (before age 4) and regardless of them being simultaneous or sequential bilinguals. When Paap, Johnson, and Sawi (2015) conducted a systematic review of

studies examining the bilingual advantages published after 2011, they found that an astounding 80% returned null results, and those that showed a bilingual advantage were often too weak in statistical power due to small sample sizes. The authors concluded that the bilingual advantage in Executive Functions probably did not exist, or were only evident in very specific instances of inhibitory control or set-shifting. In addition, studies examining a bilingual advantage in selective attention by looking at participant's performance in visual search tasks also failed to yield a bilingual advantage. Ratiu and colleagues (2017) tracked the eye movements of bilinguals and monolinguals in three experiments requiring participants to perform conjunctival visual searches. Across all experiments, a bilingual advantage was not evident, and a bilingual disadvantage in decision-making times was also reported in the third experiment. In a similar study, Paap and colleagues (2018) administered an executive functions battery of tests including the ambiguous figures, conjunctival visual search, spatial Stroop, and color-shape switching tasks to 123 college students (79 Bilingual, 44 Monolingual). The researchers found no statistically significant bilingual advantages. A further study by Paap and colleagues (2019) sought to find out if bilingualism would facilitate the resolving of Stimulus-Stimulus conflict compared to Stimulus-Response conflict as measured in Flanker/spatial Stroop and Simon tasks respectively. Flanker, Stroop and Simon tasks were administered to the 166 college students (104 Bilingual, 62 Monolingual), but no bilingual advantages in reaction time were found. Hence, the authors concluded that while Stroop and Simon tasks may share processing commonalities within the domain of inhibition-control, bilingual's use of multiple languages does not seem to enhance domain general abilities in inhibition-control to a significant extent.

Most recently, an extensive experimental study with more than 4500 participants by Dick and colleagues (2019) failed to find unequivocal evidence demonstrating better performance

among bilinguals in the Flanker, Dimension Change Card Sort and the Stop-Signal Reaction Time tests that measured common Executive Functions indicators including inhibition, attention and set-shifting abilities among 9-10-year-old children in the United States. Bilingual participants (n=1740) were grouped based on three different definitions of bilingualism: Bilingual status (if children identified as speaking any language other than English), bilingual degree (ratio of non-English language use to English use), and bilingual use (continuous measure non-English language frequency with different interlocutors). After controlling for demographic covariates such as socioeconomic status, age, education level, and intelligence, the regression analyses revealed a bilingual disadvantage in terms of poorer English vocabulary that is consistent with other studies in the literature (e.g. Martin-Rhee & Bialystok, 2008), as well as a disadvantage in the Stop-Signal Reaction Time test of inhibitory control with no other significant differences were found between monolingual and bilingual participants. While the study notes the benefits in terms of communication that multilingualism brings, it also bucks the trend with evidence suggesting that instead of a bilingual advantage in Executive Functions, bilingual children may be at a disadvantage compared to their monolingual peers. *Prima facie*, this seems to have upended years of research supporting a bilingual advantage in Executive Functions. This, of course, is unsettling for many researchers who have spent years committed to a ‘bilingual friendly’ research environment. However, much remains to be teased out and these recent waves of null findings themselves need to be further scrutinised. As usual, when it comes to theorising bilingualism there is always more than meets the eyes.

2.3 Possible Reasons for Contradictory Results

Importantly, the bilingual advantage in various Executive Functions cannot be simplified into a case of present or absent. In a state-of-the-art review, de Bruin (2019, p. 33) points out that

“in order to better understand [the effects of] bilingualism within and across studies, it is crucial to carefully examine and describe not only a bilingual’s proficiency and age of acquisition but also their language use and switching as well as the different interactional contexts in which they use their languages.” While it is not within the scope of this review to provide a detailed account of each possible variable and its interactions, we present a brief overview of few prominent variables and methodological concerns that can influence findings of a bilingual advantage in Executive Functions.

Firstly, the age group of participants may play a role in the detection of a significant bilingual advantage. Some articles suggest that the bilingual advantage seems to be most pronounced among young children and the elderly (Bak et al., 2014; Luo, Luk, & Bialystok, 2010), while differences between monolingual and bilingual young adults may sometimes show insignificant or no group differences, possibly as young adults are at the zenith of their cognitive functioning (Bialystok et al., 2004). Hence, bilingual effects may not be as pronounced in young adults compared to the elderly (for a counter perspective, see Samuel et al., 2018) as ageing has been found to take a toll on cognitive and Executive Function processing and differences in performance among older bilinguals could be attributed to the cognitive reserve built up from lifelong bilingualism (Abutalebi et al., 2015; Antoniou & Wright, 2017; Nickels, Haneau, Nair, Barr, & Biedermann, 2019).

Another possible source of variation involves the definition and classification of bilinguals based on their age of acquisition and age of fluency. Researchers do not all agree as to how ‘early’ or ‘late’ bilingualism may be unambiguously classified, in part due to disagreement on the exact age range of a critical period for language acquisition (Byers-Heinlein & Lew-Williams, 2013). Consequently, these different yardsticks may result in different conclusions. For example, Luk and

colleagues (2011) suggested that early bilinguals (AoA: before age 10) had an edge over late bilinguals and monolinguals. In contrast, Pelham and Abrams (2014) reported that while bilingualism had a facilitative effect in conflict resolution in incongruent trials over the monolinguals in their study, no differences in executive control were found between early (AoA: age 7 or younger) and late bilinguals (AoA: age 13 and above). When adapting age of acquisition as a continuous variable in a mixed model regression, von Bastian and colleagues (2016) were unable to detect a bilingual advantage in Executive Functions between participants on a broad range of tasks measuring inhibitory control, shifting, conflict monitoring and general cognitive abilities. Indeed, such methodological differences and inconsistencies could lead to dissonant findings and be an important source of variation as to whether a difference in Executive Functions tests are found.

Moreover, concerns have also been raised regarding self-rated language proficiency when used to compare between groups from different cultural or geographical backgrounds. Tomoschukt, Ferreira and Gollan (2019) highlighted this issue by comparing the self-rated language proficiency scores of Chinese-English and Spanish-English bilingual college students using self-rated proficiency scores as a subjective measure and a picture naming task as an objective measure of proficiency. The researchers found that self-rated proficiencies and picture naming test scores were not consistently correlated among different bilingual populations, with Chinese-English bilinguals performing better in the picture naming task compared to Spanish-English bilinguals who had the same self-rated proficiency scores. Notably, even grouping participants by language dominance (other-language vs. English) did not remove these discrepancies. These findings indicate potential confounds as the subjective, self-rated scores in one population may be conceptualised differently from another group of participants due to

different social environments and upbringing, ages of acquisition, and language dominance, even if they are taken from the same community (e.g. college students).

In fact, scholars have found that not only language proficiency, but also how balanced the bilingual is in terms of proficiencies and use in both languages can impact performance on tests of Executive Functions. A seminal study by Tse and Altarriba (2012) involved administering a Stroop task on 110 bilingual adults to determine the effects of varied language proficiencies on their attentional control system. The researchers reported that responses to the Stroop task were positively correlated to second-language proficiency and that bilinguals who were more balanced in both language proficiencies were more efficient at conflict resolution in incongruent trials. In particular, they argue that bilingual's language proficiencies honed aspects of attentional control (conflict resolution and goal maintenance) that explained differential performance on the Stroop task. Another study by Yow and Li (2015) lends support to these findings, showing how different aspects of bilingualism such as language proficiency, usage habits, and age of acquisition modulated performance in tests of Executive Functions among 72 English-Mandarin bilingual adults. They found that bilinguals who were both proficient and balanced in their use of both languages outperformed those who were less balanced in terms of use and proficiency on tasks of inhibition and set-shifting. Despite these findings, not all studies take into account bilingual proficiency balance within their study design. As such, while most studies offer some measure of proficiency, issues with validity and comparability can still arise due to methodological differences can potentially mask the effects of a bilingual advantage in Executive Functions.

2.3.1 Culture: The Overlooked Variable

One seldom studied variable that has recently garnered the attention of scholars is the effect of cultural background. Yang, Yang and Lust (2011) investigated the effects of language and

culture in their study of Executive Functions performance among children by recruiting monolinguals from Korea and America and comparing them to American Korean-English bilinguals. Their work suggests that children from various cultures are not ‘equal’ as they found a culture advantage favouring Korean monolinguals from Korea over English speaking American monolinguals in accuracy in the Attentional Network Test (Fan, McCandliss, Sommer, Raz, & Posner, 2002). Bilinguals also edged out monolingual participants in terms of reaction time and overall accuracy in the alerting, orienting, and conflict networks tested in the Attention Network Test, leading the authors to propose that the bilingual advantage superseded that of a cultural advantage. Building on these findings, Tran, Arredondo and Yoshida (2015) conducted a longitudinal study on 3-year-old monolingual and bilingual children from America, Argentina, and Vietnam over 5 intervals of 6 months (i.e. from 3 years of age to 5 years of age) to follow their Executive Functions development over time. Using the Attention Network Task, they found that bilinguals outperformed their monolingual peers in terms of accuracy and reaction time. More interestingly, they found that children from Vietnam (Eastern Culture) performed significantly better in terms of accuracy and reaction time compared to Argentinian children (Western-European culture with Latin influences), while there was comparable performance between American and Vietnamese children.

In contrast to earlier findings, Samuel and colleagues (2018) provide evidence using the Simon task demonstrating that cultural effects superseded the bilingual advantage in inhibitory control. By comparing participants from contrasting East Asian (Korean) and Western (British) cultures, the researchers found that Koreans were more accurate, had faster global reaction times, and smaller Simon effects compared to British participants, regardless of them being monolingual or bilingual after controlling for IQ, language proficiency, code-switching frequency, and socio-

economic status in their statistical model. These findings go against the grain of earlier work, but could possibly be different due to methodological differences in terms of investigating the cultural effect – for example, Samuel and colleagues (2018) only administered the Simon task, typically used as a measure of stimulus-response inhibition, while in the other studies previously mentioned, the authors adopted variations of the Attention Network Task which measures the alerting, orienting, and conflict attention networks.

To sum up the review on the effects of bilingualism and Executive Functions, we see that despite the robust report of a bilingual advantage over the last two decades, much current scholarly “chatter” is hotly contesting the validity and replicability of such claims. Scholars have made a call for more nuanced studies that take into account the complex social variables that influence bilinguals as part of different groups and communities. As seen above, there exist a few studies examining the cultural effects on Executive Function, however, there has been no study to date that examines the effects of biculturalism on Executive Functions. Our study contributes to the ongoing discussion of dissonant findings pertaining to the relationship between culture and Executive Functions among bilinguals. Importantly, the research is the first of its kind that addresses the impact of bicultural switching on bilingual’s Executive Functions. In the next section, we review the grounds for possible cultural effects in Executive Functions based on how different cultural orientations, mindsets, and value systems may influence cognition. Following that, we discuss how biculturalism is increasingly commonplace, especially in cosmopolitan and globalised contexts such as Singapore. Finally, the review ties together how biculturalism, specifically cultural frame switching, may contribute to honing Executive Functions.

2.4 Cultural Differences and Executive Functions

Broadly, culture can be defined as “complex whole” that amalgamates the “knowledge, beliefs, art, morals, and all the capabilities and habits that man acquire as a member of society” (Tylor, 1871, p.1). In this study, we adopt the categorisation of cultures based on Hofstede’s Cultural Dimensions – an influential model that has been frequently utilized to delineate differences between cultures in cross-cultural psychology that comprises traits of power distance, individualism vs. collectivism, uncertainty avoidance, masculinity vs. femininity, long term orientation vs. short term orientation, and indulgence vs. restraint (Hofstede, 1980; 2001; 2011). Despite criticism that this model that is often used to index how people from a certain country behave and is subject to the ecological fallacy, it is nonetheless useful in identifying contrasting trends between cultures.

Perhaps the most common example in cultural comparisons is that of Eastern culture compared to Western culture. Individuals from Asian countries, or of Asian descent are commonly considered to embody Eastern cultural values and are viewed as being more collectivistic, having higher power distance in relationships with authority, are more likely to avoid uncertainty, and have a stronger sense of interdependence (Markus & Kitayama 1991; 2010; Oyserman & Lee 2008) compared to Americans or the British who epitomise Western culture in their desire for individual autonomy, egalitarian relationships, and willingness to take risks (Triandis, 1989; 2001; Harkness, Super, & Tijen, 2000). These differences in Eastern and Western culture have been well documented and shown to influence parent’s thoughts on how to raise their children (Chen et al., 1998; Bornstein, 2013), socialisation and personality (Varnum, Grossmann, Kitayama, & Nisbett, 2010), self-evaluation (Kim, Chiu, Peng, Cai, & Tov, 2009), individual’s ethics and moral values (Garcia, Mendez, Ellis, & Gautney, 2014; Jia & Krettenauer, 2017), as well as self-regulation

(Imada, Carlson, & Itakura, 2012; Jaramillo et al., 2017; Krassner et al., 2016) and emotion (Kitayama, Mesquita, & Karasawa, 2006; Masuda et al., 2008; Pavlenko, 2006). Hence, it is fairly well-established that cultural differences between East and West exist, though a fine-grained distinction of what constitutes 'East' and 'West' remains an on-going debate.

Cultural differences have also been shown to influence cognition. In a seminal study, Masuda and Nisbett (2001) reported differences in memory recall of East Asians compared to Americans due to different cultural upbringings. The researchers reported that East Asian adults were able to remember more background information in visual stimuli compared, and became less accurate when background cues were changed compared to their American counterparts. The authors hypothesized that these differences could be a result of different modes of attentional direction and focusing emphasised by Eastern and Western cultures. In another study investigating how children from different countries and cultural backgrounds would influence cognition, Sabbagh and colleagues (2006) examined the interaction between Executive Functions and theory of mind in 5-year-old children from America and China. The researchers found that Chinese children outperformed American children on all Executive Functions tests such as the Dimensional Change Card Sort and Stroop tasks that were administered. In the same vein, Oh and Lewis (2008) found that Korean pre-schoolers performed significantly better at inhibition and task switching compared to British children of a similar age, while no differences were found on measures of working memory. More recently, Imada, Carlson and Itakura (2012) present further evidence relating differences in Executive Functions to cultural differences. They compared 175 children from America and Japan and found that sensitivity to contextual cues was highly correlated with performance in Executive Functions tasks. Specifically, children from Japan outperformed American children in the set-shifting Dimension Change Card Sort Test, but Japanese children

were also more likely to peek on impulse during a delayed gratification task, indicative of poorer impulse control.

One influential theory has emerged in the forefront to explain the cultural effect on Executive Functions proposes that the differences between Eastern and Western cultures could stem from the different cultural values and upbringing that influences what individuals from different cultures focus on (Masuda & Nisbett, 2006). According to this theory, the subdivision between Eastern and Western cultures in cross-cultural studies has been correlated with different types of attentional focus and cognitive processing. Individuals brought up with Eastern, collectivistic cultural influences tend to have attentional processing tuned to focus on contextual cues (e.g. non-verbal cues, more holistic, distributed attention), while Western cultures direct attention to process specific, individualized information (Nisbett, Peng, Choi, & Norenzayan, 2001; Nisbett, 2003; Yang & Yang, 2016). Researchers suggest that as a result of greater ‘general sensitivity’, Eastern cultures may have an advantage in recognizing and reacting to stimuli that are displayed when reaction time is measured (Nisbett & Miyamoto, 2005; Miyamoto, Nisbett, & Masuda, 2006, Kuwabara & Smith, 2012). Taken together, these studies highlight how cultural differences play a part in the shaping of Executive Functions among individuals from different cultural contexts in both children and adults. Yet, in the increasingly globalised world, individuals can be immersed in multiple cultures possibly leading to biculturalism. In the following section, we discuss the concept of biculturalism and its prevalence, using Singapore as an example of a multilingual and possibly bicultural nation.

2.4.1 Biculturalism: When East meets West

Biculturalism can be broadly defined as an individual’s exposure and internalization of two cultures as part of their identity (Nguyen & Benet-Martínez, 2007; 2013). According to

LaFromboise, Coleman and Gerton (1993), multicultural individuals typically possess a certain degree of multicultural competence – be it in terms of explicit cultural knowledge, a tacit understanding of cultural scripts (culturally appropriate dos and don'ts) and values, friends and family within the other culture, and are often able to communicate in languages associated with the different cultures.

Early studies of bicultural individuals by social psychologists typically examined migrants and immigrants in their investigation of the acculturation processes when these individuals were immersed in a new culture (Berry, 1997, 2003; Sam & Berry, 2010). Yet, with globalization integrating multiple facets of society, culture, language, and economies, bicultural individuals of this day and age need not be migrants or immigrants. In fact, many scholars attribute globalization as one of the catalysts for the spread of biculturalism as it accelerated the pace of global migration, immigration, and contact (Reese, Rosenmann, & Cameron, 2019). For instance, air travel has 'shrunk' the world, not only by facilitating the mobility of individuals who visit, work, or study abroad, but is also the heart of international supply chains that bring various international fare and merchandise to our countries. Further advances in communications technologies have made connecting individuals across continents simultaneously a reality, and inventions such as the internet, cloud computing, and wireless streaming services have made a broad range of media content available to the masses at an economically accessible price promoting mass consumption (Castles, de Haas, & Miller, 2015).

As such, the cultural acculturation landscape is changing and it is no longer necessary to leave one's home or country to be immersed in a 'foreign' culture (Leung, Qiu, & Chiu, 2014; Ghost, 2011). Indeed, even before the turn of the century, cultural anthropologist Arjun Appadurai (1996) declared that the "world has become deterritorialized, diasporic and transnational" (p. 188)

through the powerful forces of globalization such as the global dominance of multi-national corporations, inter-national mass migration, and growing mass media consumption that collectively contributes to the creation of imagined communities no longer limited by national or cultural boundaries. Of special relevance to the younger generation worldwide are the powerful media influences that have brought Western (largely North American, and British) media, culture, values, and ideals to youths who may have never stepped foot in any of those countries. This new form of acculturation, known as ‘remote acculturation’, is increasing in prevalence especially among the younger generation, and describes the phenomenon where culture can be transmitted over the internet as well as conventional and social media in a way that promotes and enhances connections between cultural groups that may never have come into physical contact with each other (Adams & van de Vijver, 2017; Ferguson & Bornstein, 2012).

Correspondingly, the exponential growth of media streaming companies (e.g. Netflix, Hulu, and Spotify), as well as social media sharing platforms (e.g. Facebook, Twitter, and Youtube), have served to bring content from around the globe to the masses. These platforms expose individuals to culturally foreign values, attitudes, and ideas which have an impact on one’s identity and development (Ferguson & Bornstein, 2015). While research in this area is still in its infancy, early studies provide evidence for the feasibility and reality of remote acculturation. To exemplify, Ferguson and colleagues (2017) examined remote acculturation among Zambian youths who reported significant exposure to Western culture (American, British) as well as local cultures through social media. They found evidence for differences in the adolescents self-construal depending on whether they identified as traditional Zambians, or as Westernised Multicultural Zambians, providing evidence for the online cultural acculturation to Westernised values and attitudes despite the vast geographical separation between these cultures. Indeed, this

suggests that individuals may now be easily exposed to different cultures, even from the comfort of their own homes without having to set foot out of the country, or even their neighbourhood.

2.4.2 Singapore: Westernisation in an Eastern Nation

One example epitomizing the confluence of Western influences in an East Asian country is the nation-state of Singapore. Singapore is a multilingual and multicultural state, with more than 90 per cent of the population being ethnically Asian (Chinese, Malays and Indians). While most consider Singapore a nation with Asian or Eastern cultural values, the effects of our colonial past and open economy have led some scholars to suggest that Singaporean identity is a hybrid of Asian and Western cultures (Ang & Stratton, 1995; 2018; Chua, 1995). In fact, cross-cultural psychologists have long suggested that Singapore seems to straddle the middle ground on the spectrum of highly individualistic cultures such as the United States of America and the most collectivistic East-Asian nations such as China, Korea, and Japan (Hofstede, 1980; Markus & Kitayama, 1991; Triandis, 1995). As such, Singapore presents a unique opportunity for researchers to examine the effects of biculturalism as Western (mainly British and American) cultural influences co-exist with Asian cultures from the East (Minkov & Hofstede, 2011).

Furthermore, the prevalence of English as Singaporeans' *lingua franca* has paved the way for access to and consumption of Western culture. In a recent overview of language in Singapore, Ng and Cavallaro (2019) point out how English is ubiquitous in the lives of Singaporeans – as an official language of the country since independence, the language medium for education, public administration, and commerce. In fact, English has become such an integral part of Singaporean's lives even to the extent that scholars argue for English could take the place of local ethnic languages as the true 'mother tongue' of Singaporeans (Cavallaro, Ng & Tan, in press; Tan, 2014).

These unique circumstances have undoubtedly contributed to Singaporean's preference for and ability to consume Western media, music, and culture.

Today, the 'Western influence' in Singapore is frequently conceptualised as the glocalisation of American and British culture (Ho & Lin, 2011). In particular, American cultural icons are ubiquitous – from Starbucks coffee houses, McDonald's and Kentucky Fried Chicken fast-food restaurants dotting the heartlands, to fashionable apparel and cosmetic brands that have set up chain stores locally such as Levi Strauss, Polo Ralph Lauren, Crabtree and Evelyn, set up island wide. Additionally, since the 1960s, Singapore's technological and economic growth has fuelled investment from global corporations, such as Google and Amazon who have set up their Asia-Pacific headquarters locally, bringing the latest technological gadgets such as Google Pixel phones, and Amazon Prime shopping experiences, using Singapore as a testbed prior to entering the South-East Asian region. Indeed, Singapore's keen interest in competing in the global market, strategic geographical location, and thriving economic growth have made Singapore a prime destination for commerce on an international scale. In a tribute to the late Mr Lee Kuan Yew, The Economist lauded his contributions and foresight that led to Singapore being the most Westernized country in Asia since the late 1990s.

In recent years, globalization has allowed Singapore to keep abreast with cutting-edge technologies and communications infrastructure that have allowed for the proliferation of Western media in Singapore (Osman, Subhani, and Hasan, 2013). For instance, online video streaming platforms such as Netflix and Amazon Prime Video have enabled easy access to many Hollywood blockbuster movies and Western television programs including American productions such as House of Cards and How I Met Your Mother, and British dramatizations such as Sherlock and The Crown. With regard to music, Western music has long been a mainstay in Singaporean society. In

a review article tracing the growth of music in Singapore for the National Library Board Archives, Perera and Perera (2010) report how even in the mid 1940s, Western music became a salient part of local culture through the many touring Western bands that would come through Singapore, and reach the masses over the radio and through cinema screenings. In recent years, audio streaming platforms including Apple Music and Spotify have brought Western music to individual's mobile devices and allow users to listen and download the latest hits from America, Britain, and around the globe.

The influx of Western influences into Singapore was such a pertinent concern even since the mid 1960s that then Prime Minister Mr Lee Kuan Yew continually emphasized how Singaporeans ought to hold tight to their ethnic heritage and culture, lest they become “soulless creature[s]” (1966). He then championed the bilingual education policy where each Singaporean child was to study English as their ‘First Language’, and a ‘Mother Tongue Language’ derived loosely from their father's ethnicity, for a minimum of six years. The state's emphasis persists till today and is constantly a feature of education policies such as mandatory Civics and Moral Education (most recently Citizenship and Character Education) in primary and secondary schools. These programs highlight traditional Asian values and cultural traditions, designating certain schools as Special Assistance Plan schools to groom a group of bicultural elite students with Bicultural Programs in secondary and tertiary education to foster a greater appreciation of Oriental languages and cultures (Ministry of Education, 2004; Fong & Yen, 2016). Such tailoring of social policy was done in a bid to ensure that ethnic culture and language to continue to serve as a “cultural ballast” against Western values and morality that would provide a sense of direction and strength derived from each individual's cultural heritage (Lee, 1989).

Hence, in the case of Singapore, individuals have access to both Eastern culture through the state's policies and ethnic familial upbringing, as well as Western culture in the pervasiveness of consumer icons, technology, music, and media. Singaporeans thus have truly diverse avenues to accrue a broad span of cultural experiences and epitomize a highly bicultural environment.

2.5 Tying it together: Biculturalism, Bilingualism, and Executive Functions

Of relevance to this study is the idea that if culture has an impact on Executive Functions, it may contribute to confounding findings of a bilingual advantage in Executive Functions. In fact, past research by social psychologists has drawn a theoretical link between how acculturating to different cultures can hone an individual's cognitive abilities. The acculturation complexity model by Tadmor and Tetlock (2006) proposes that immersion in new cultures can augment an individual's cognitive skills. Specifically, cognitive abilities such as selective attention and inhibition can be developed due to the pressures of resolving diverse cultural complexities and the necessity of being able to behave 'appropriately' among interactants of different cultures. However, differences in individual's cultural preferences may influence such cognitive gains, as individuals who prefer to use only one of the two cultures more frequently are less likely to experience and have fewer opportunities to resolve conflicts arising from cultural differences compared to an individual with a more equal preference for both cultures. Over the years, research suggests that biculturals who integrated both cultures were able to provide more complex descriptions of each culture compared to monoculturals or biculturals with a distinct preference for one culture (Benet-Martinez, Lee & Leu, 2006), and that a bicultural's acculturation strategies can influence cognition through instances of conflict mitigation and behavioural inhibition (Crisp & Turner, 2011). Recently, Spiegler and Leyendecker (2017) show how Turkish-German immigrant children with a balanced view of both cultures outperformed their peers who favoured

one culture over the other in terms of cognitive flexibility. Indeed, converging evidence suggests that individuals who identify as bicultural frequently integrate different sets of cultural knowledge, or as Cheng and colleagues (2014) describes, “bicultural individuals possess ‘two cultural minds’ – two sets of cultural knowledge, use two cultural schemas to guide their thoughts and behaviour, and can activate these two cultural frames of references” (p. 279).

Research building on this hypothesis posits a theory of cultural frame switching that I propose, has relevance for studies of bilingualism and Executive Functions. Cultural frame switching is a term coined from the observation that individuals with multiple cultural identities are able to switch across cultural frameworks (or their various cultural minds) depending on the cultural cues being presented. In seminal studies by Hong and colleagues (1997; 2000) examining this phenomenon, the researchers found that bicultural individuals behaved differently depending on the cultural primes used. For instance, when bicultural individuals (Chinese Americans) were primed with icons representing the Chinese or American cultures (e.g. a dragon as an icon of Chinese culture, the American flag as an icon of American culture), the participants’ appraisal of an ambiguous stimuli (Figure 1a) tended to embody certain cultural values of the culture associated with the prime. In the studies, participants were asked if they thought the fish was being chased by the other fish (an external push factor) or if it was leading other fish (internal factor) when shown an animation of the fish on the right swimming away from the group (Figure 1b). When primed with Chinese cultural primes, bicultural participants were comparatively more confident that the fish was being chased (external attribution) and when primed with American primes, they were more confident that the fish was leading the school (internal attribution).

Figure 1. Conceptual replication of the stimuli used by Hong et al., 2000.

The researchers argued that bicultural individuals are able to tap into different systems and schemas of cultural meaning, and switch between them depending on the environment and context. Building on this, further research provided support for bicultural individual's ability to unconsciously and seamlessly switch behaviour (Benet-Martínez, Leu, Lee, & Morris, 2002) and even identity based on cultural cues (Luna, Ringberg, & Peracchio, 2008). Cultural frame switching often occurs when there is a significant difference in the interactant's environment, such as when moving between the public and private spheres. For instance, Suárez-Orozco, Suárez-Orozco and Todorova (2008) bring attention to the situation of immigrants in Boston and San Francisco in their longitudinal study of 470 immigrant children from countries such as Mexico, Central America, and China. Using parental interviews, test scores, and case studies, the authors exemplify different ways in which children cope with the disparity between their heritage culture and the broader American culture, and how intentional switching between cultural frames may be observed when moving between these different domains.

Extending the theory of cultural frame switching to bilingualism, Ramírez-Esparza and colleagues (2006) reported that Spanish-English bilinguals presented different personality traits depending on the language they answered self-report personality questionnaires in – namely, that they showed increased extraversion, agreeableness, and conscientiousness when answering in English compared to Spanish. Another study by Chen and Bond (2010) provides further evidence

for bilingual personality switching in their examination of how the interviewer's ethnicity can influence the way an interlocutor presents themselves. Bilingual interviewers (2 Caucasians and 2 Chinese) interviewed 76 Chinese-English bilinguals and observers were asked to rate participants' personalities on traits of extraversion and openness. Each participant was interviewed by a Chinese and a Caucasian interviewer, both of whom used English and Chinese separately. The researchers found that participants displayed increased extraversion and were more willing to speak about experiences to Caucasian interviewers compared to Chinese interviewers, regardless of the language mode used for the interviews. This highlights how bilinguals and biculturals have the resources to switch between cultural frames implicitly, often without conscious effort depending on the appraisal of the social speech context and cultural environment.

Collectively, these studies lend support to the idea that bicultural individuals possess different cultural systems that are selected and inhibited fluidly and automatically, depending on the situational context. In addition, bicultural individuals may need to direct cognitive resources to monitor the situational context, choose the 'appropriate' cultural values, attitudes and ideologies relevant while inhibiting inappropriate behaviour when switching between cultures. These processes seem to mirror how the bilingual's language system is hypothesized to function in terms of language inhibition and control, and directing attention for monitoring and language selection. If this is truly the case, cultural frame switching that bicultural-bilinguals participate in could influence the development of Executive Functions in a similar fashion that bilingualism hones the Executive Functions system.

This is an important issue to resolve, as to date, bilingual research frequently conflates bilingualism and biculturalism (Grosjean, 2015). Moreover, the reality is somewhat complex – just as there is a whole spectrum of bilinguals, from dominant bilinguals, balanced bilinguals,

simultaneous bilinguals, and receptive bilinguals etcetera, so a whole spectrum of bi- or even mono-cultural bilinguals exist. According to Grosjean (1992), some Europeans may be multilingual, having studied a two or more languages in a school setting, but are monocultural as they only work and stay in a country and a single cultural setting. On the other hand, individuals can be monolingual but multicultural by immersing themselves in other cultures in their social contacts but choosing not to learn their languages (Padilla, 2006; Schwartz, Birman, Benet-Martínez, & Unger, 2017; Shih & Sanchez, 2005). Hence, in this study we recognize that even individuals in a country with substantial avenues for multicultural experience and exposure may not produce multicultural individuals. Thus, a sociolinguistic exploration is necessary to assess if each individual feels a sense of bicultural identity and express attachment to both cultures (Cheng, Lee, Benet-Martínez, & Huynh, 2014).

To this end, this thesis will examine the relationship between language use and cultural behaviour, and seek empirical evidence that young adult Singaporeans shift between different cultural frames with different interlocutors. Following that, an Executive Functions battery is used to determine the effect of bicultural switching frequency on Executive Functions of highly proficient bilinguals who are also bicultural. More specifically, we ask the following research questions:

- 1) How do Singaporean young adults view their ethnic language and cultural identity? Do they see themselves as biculturals?
- 2) What is the language and cultural behavioural profile of Singaporean young adults in their day-to-day lives? Is there empirical evidence for the biculturalism of Singaporean young adults?

- 3) What is the effect of bicultural switching frequency on highly proficient bilingual's performance on tests of Executive Functions, in particular, inhibition and control, set-shifting, and attention?

CHAPTER 3

3. STUDY 1: BICULTURALISM AMONG SINGAPOREAN YOUNG ADULTS

3.1 Introduction

Study 1 lays the groundwork leading up to the study of bicultural switching among Singaporean young adults. This study addresses an outstanding question in current research by collecting data on the relationship between the ethnic language and their ethnic cultural identity among Singaporean young adults who have grown up in a highly Westernised social environment. The objective of the study is twofold: First, to provide an overview of how young Singaporeans (18-30 years) view language and their ethnic cultural identity; Second, to determine if young Singaporeans view themselves as bicultural, and if so, what linguistic and social factors would predict biculturalism.

3.2 Method

3.2.1 Participants

252 young-adult Singaporeans ($M_{\text{age}} = 22.6$, $SD = 2.65$, Female = 179) participated in the first study (excluding 30 particulars for the pilot study). Young adults were recruited using flyers posted around Nanyang Technological University, as well as by word of mouth through the researcher's social networks. All participants were either born in Singapore or permanent residents in Singapore who arrived before the age of three and who had been through the mainstream school system that provides at least 10 years of bilingual education. Participants were all at least bilingual, with 80 trilinguals and 28 quadrilinguals. In addition, Singapore citizens who had spent more than two years abroad were excluded from the study to mitigate the inclusion of other possible cultural confounds.

3.2.2 Materials

The participants were asked to complete a short language and culture questionnaire to understand how Singaporeans between the ages of 18 and 35 years viewed language and culture. The survey captured a broad range of social demographic information including their highest level of education, age, number of languages spoken, age of acquisition, parental education, social-economic status, language use and proficiencies in both English and their ethnic language (Either Mandarin Chinese, Malay, or Tamil). In particular, our questionnaire collected self-report data focusing on ethnic language and cultural attitudes as a way of determining the relevance and importance of ethnic culture and ethnic language to Singaporean young adults growing up in a Westernised environment (Table 1). Finally, participants were asked to indicate the extent to which they identified as biculturals. All survey questions were scored on a 7-point Likert scale where a score of 1 indicated strong disagreement, while 7 was indicative of strong agreement with the statement. A full set of survey questions can be found in Appendix A.

Table 1. *Sample questions assessing identity and attitudes towards ethnic language and culture.*

Category	Question
Ethnic language for relationship building	My ethnic language is essential in building relationships with my immediate family.
	My ethnic language is essential in building relationships with my extended family.
	My ethnic language is essential in building relationships with my friends.
Ethnic language and individual identity	My ethnic language is an important part of my identity.
	I would be sad to lose my ethnic language.
	Being able to speak my ethnic language is a critical part of my self-definition.
Ethnic language and ethnic membership	I am still [Chinese/Malay/Indian] even if I do not speak my ethnic language.
	I am still [Chinese/Malay/Indian] even if I cannot speak my ethnic language.
Ethnic Cultural identification	I feel a strong sense of attachment towards my ethnic culture.
	My ethnic culture is an important part of who I am.

3.2.3 Procedure

A pilot study (n=30) was conducted to ensure clarity and comprehensibility of the questionnaire questions. Participant feedback from the pilot study was incorporated prior to the dissemination of the finalised survey using an online link hosted on the Qualtrics survey system to young adults who met our age, citizenship, and bilingual education pre-requisites. Prior to the beginning the questionnaire, participants read through a document detailing the information to be collected, potential risks of their participation, as well as the confidentiality and anonymity of their responses, after which, informed consent was sought before proceeding with the study. This study was approved by Nanyang Technological University's Institutional Review Board (IRB Reference: IRB-2018-06-25).

3.2.4 Data Analyses

In total, 252 responses were collected, but only 244 were used in the final data analysis due to incomplete surveys (n=5), errors in data filling (n=2), or did not fulfil the participation pre-requisites (n=1). Data was consolidated and analysed using SPSS. Where the grouping of survey items was necessary, Cronbach's Alpha was calculated as an indication of internal reliability.

3.3 Results

3.3.1 Language and Ethnic Cultural Identity

The 10-question survey on language and ethnic cultural identity were subdivided into four components highlighting different aspects of the relationship between ethnic language and identity. A summary of the overall ratings can be found in Table 2.

Table 2. *Participant's mean ratings for questions assessing ethnic language and cultural identity.*

Category	Question	Mean	SD
Ethnic language for relationship building	My ethnic language is essential in building relationships with my immediate family.	5.54	1.65
	My ethnic language is essential in building relationships with my extended family.	5.71	1.36
	My ethnic language is essential in building relationships with my friends.	4.72	1.54
Ethnic language and individual identity	My ethnic language is an important part of my identity.	5.90	1.19
	I would be sad to lose my ethnic language.	6.20	1.08
	Being able to speak my ethnic language is a critical part of my self-definition.	5.65	1.38
Ethnic language and ethnic membership	I am still [Chinese/Malay/Indian] even if I do not speak my ethnic language.	5.22	1.60
	I am still [Chinese/Malay/Indian] even if I cannot speak my ethnic language.	4.77	1.74
Ethnic cultural identification	I feel a strong sense of attachment to my ethnic culture.	4.95	1.39
	My ethnic culture is an important part of who I am.	4.92	1.44

3.3.1.1 *Ethnic Language for Relationship Building*

The participants were asked to rate how essential they felt their ethnic language was for building relationships within three social domains – immediate family, extended family, and with their peers (Cronbach's $\alpha = 0.757$). The participants were in strong agreement that their ethnic language was critical in fostering familial relationships. This was especially so with their extended family, as the extended family in the local context typically includes older individuals and elderly who may not be as conversant in English. However, ethnic language was rated significantly lower when paired-sample t-tests were conducted between ratings for friends and immediate family [$t(243) = 7.865, p < .001$] as well as between friends and extended family [$t(243) = -10.32, p < .001$]. Yet, it is not surprising that participant's ethnic language does not feature prominently as an

essential language for bridging friendships with peers, as English in Singapore is the typical lingua franca for communication, especially among the younger generation.

3.3.1.2 *Ethnic language and Individual identity*

The second group of questions investigated the role of participant's ethnic language on their identity (Cronbach's Alpha = 0.862). The first question overtly queried the extent to which their ethnic language was an important part of their personal identity, while the second assessed affective attachment to their ethnic language. The final question sought to understand how the ability to speak the ethnic language was related to their personal identity. On the whole, ratings were highly positive for each of these questions, indicating each participant's view and ownership of their ethnic languages as being a critical part of their identity, and that losing the ability to use the language would be detrimental to their individual identity. Paired-samples t-tests revealed that being able to speak their ethnic language was rated significantly lower than identifying with their ethnic language [$t(243)=9.07, p<.001$] and being sad if they were to lose their ethnic language [$t(243)=3.61, p<.001$].

3.3.1.3 *Ethnic language and Ethnic Membership*

The participants were asked two questions (Cronbach's Alpha = 0.871) to elucidate the difference between how they would identify a person based on their ethnic cultural group if they were able to speak the ethnic language but chose not to use it vis-à-vis someone who was unable to speak the language at all. A paired-samples t-test revealed that being unable to speak one's ethnic language was rated significantly lower than someone who knew the language but did not use it [$t(243)=6.136, p<.001$]. In other words, this indicates that respondents were more reluctant to agree that someone who does not know their ethnic language belongs to that ethnic group, in comparison to someone who knows the language but does not use it. This highlights our

participant's views that knowledge of one's ethnic language is still valued, even if they chose not to use it.

3.3.1.4 *Ethnic cultural identification*

The last group of questions sought to survey participants' identification with their ethnic culture (Cronbach's Alpha = 0.889). On the whole, participants were in agreement that their culture was an important part of who they were and that they felt a strong sense of attachment to their respective ethnic cultures. No significant differences between responses were observed [$t(243) = .571, p = .569$].

In summary, these findings indicate that in general, young Singaporeans between the ages of 18-30 still identify with a strong sense of belonging to their ethnic cultures, and reflects the intertwined influences of ethnic language and cultural identity. Given how every participant in our study was bilingual and grew up within multilingual and multicultural milieu that is Singapore, the following section proceeds to explore in detail the extent to which young Singaporeans identify as being bicultural, as well as certain demographic variables that may predict differing levels of biculturalism.

3.3.1.5 *Bicultural Identity*

The final question elicited participant's self-report perceptions of biculturalism using the question: "I view myself as belonging to more than one culture" as a preliminary gauge of how bicultural our sample was. 71.7 per cent of the participants (n=175) rated in the affirmative to being a part of more than a single culture (i.e. 5 out of 7 on the Likert scale measuring agreement). These results support the idea that the majority of young Singaporeans seem to identify as bicultural if not multicultural.

3.3.2 Factors Predicting Differences in Bicultural Identification

Due to the differences in terms of grouped sample sizes, equal variances among groups were not assumed. In addition, normality tests (Shapiro-Wilks) were conducted prior to each analysis and the appropriate non-parametric tests were used if assumptions of normality were not met (Delacre, Lakens, & Leys, 2017; Wilcox, 2012). In what follows, we examine sociolinguistic and demographic variables to see how individuals grouped according to their ethnic language proficiency, the number of languages spoken, bilingual type, ethnicity, gender, and socio-economic status differ in terms of their perceptions of self-rated biculturalism. A comparison of mean ratings when participants were grouped by these categories can be found in Table 3.

Table 3. *Mean ratings for self-report biculturalism by different grouping variables.*

<i>I view myself as belonging to more than one culture</i>			
Grouping Variable	Level	n	Mean (SD)
Ethnic language proficiency	<i>Low</i>	11	4.76 (1.46)
	<i>Average</i>	63	4.64 (1.63)
	<i>High</i>	170	5.34 (1.54)
Bilingual Type ¹	<i>Balanced bilingual</i>	168	5.35 (1.44)
	<i>Unbalanced bilingual</i>	76	4.74 (1.66)
Number of languages spoken	<i>Bilingual</i>	136	4.98 (1.61)
	<i>Trilingual</i>	80	5.43 (1.32)
	<i>Multilingual (>3)</i>	28	5.29 (1.70)
Ethnicity	<i>Chinese</i>	197	5.09 (1.57)
	<i>Malay</i>	38	5.21 (1.33)
Gender	<i>Male</i>	69	5.07 (1.74)
	<i>Female</i>	175	5.19(1.46)
Socio-Economic Status	<i>Low</i>	53	5.20 (1.65)
	<i>Mid-Low</i>	84	5.24 (1.45)
	<i>Mid-High</i>	60	5.15 (1.41)
	<i>High</i>	47	4.77 (1.68)

¹ Criterion for bilingual classification is described on p. 47 (Section 3.3.2.2)

3.3.2.1 *Ethnic language proficiency*

The participants were classified into three groups based on an overall average Ethnic language proficiency metric that took into account their self-reported language proficiencies in three areas: speaking, comprehending, and reading abilities. As such, three groups were created: low ethnic language proficiency (combined mean ≤ 3 on a scale of 7), average ethnic language proficiency (combined mean between 3 and 5 on a scale of 7) and high ethnic language proficiency (combined mean ≥ 5 on a scale of 7).

A Kruskal-Wallis test was conducted to ascertain if the respondent's views on cultural belonging and their ability to switch between cultures were different for groups with different levels of ethnic language proficiency. It should be noted that Ethnic Language used in this study is analogous with the term 'Mother Tongue Language' within the local context. In Singapore, English is instituted by the state as a Singaporean's first language, and another language termed 'Mother Tongue Language' is assigned based on individual's ethnicity (See Tan, 2014). As this differs from its more typical use in linguistics, we chose to use the term ethnic language in this study to prevent confusion of the read, however, respondents to our survey were asked about their 'Mother Tongue Language' since that was the term they were familiar with.

The mean ratings between individuals with different ethnic language proficiencies were statistically significant between groups [$\chi^2(2)=7.72, p=.021$]. Post-hoc analyses (Dunn) revealed that the high proficiency group rated their certainty of belonging to more than one culture significantly higher than both the low proficiency ($p<.05$) and average proficiency ($p<.01$) groups.

3.3.2.2 Bilingual Type (Balanced vs. Unbalanced)

As part of the *Compulsory Education Act*, all our respondents who are currently between 18-30 years of age would have been through a minimum of 6 years of bilingual schooling in English and their ethnic language. While the education system has provided robust exposure, there will still be variation in the language proficiencies among our participants due to differences in the social environment. To this end, we sought to group participants according to how balanced they were in terms of their English and ethnic language proficiencies. This was done by first creating an average metric for English language proficiency, similar to how ethnic proficiencies were grouped previously (See Section 3.3.2.1, pg. 44). Once participants were grouped by their respective English and Ethnic language proficiency bands, they were compared to see if their English and Ethnic language proficiencies matched. For example, respondents with both languages falling in similar bands (e.g. High English and Ethnic proficiency; Average English and Ethnic proficiency; Low English and Ethnic proficiency) were termed Balanced bilinguals, while those with languages falling in different bands (e.g. High English, average Ethnic proficiency; High Ethnic, low English proficiency) were grouped as Unbalanced bilinguals. A Mann-Whitney test revealed that balanced bilinguals viewed themselves as belonging to more than one culture significantly higher than unbalanced bilinguals [$U=5015, p<.001$].

3.3.2.3 Number of languages spoken

Participants were grouped according to the number of languages they spoke, forming three groups: Bilinguals, trilinguals, and multilinguals (more than 3 languages). A Kruskal-Wallis test was run comparing across groups, however, no statistically significant differences were found [$\chi^2(2) = 4.06, p=.132$].

3.3.2.4 Ethnicity

Although our questionnaire was open to participation from all three major ethnic groups in Singapore (Chinese, Malays, Indians), only 9 participants of Indian ethnicity completed the survey. Hence, for this analysis, only Chinese and Malay participants were compared using a Mann-Whitney test, no significant differences were found between respondents of Chinese ethnicity or Malay ethnicity [$U=3680, p=.865$].

3.3.2.5 Gender

Participants were grouped according to gender and a Mann-Whitney test was conducted to see if there were significant differences between each gender's response to the question. No significant differences were found between groups [$U=6021, p=.973$].

3.3.2.6 Socio-Economic Status (SES)

Participants were divided into four groups for this analysis, based on the approximate quartiles of gross home income according to the 2018 Household Income Trends (Singapore Department of Statistics, 2019). The four groups approximate low, middle-low, middle-high, and high SES classes in Singapore. A Kruskal-Wallis test revealed no significant differences between groups [$\chi^2(3)=5.40, p=.142$].

3.4 Discussion

3.4.1 Ethnic Language and Ethnic Cultural Identity

Recent studies have highlighted trends in language shift from vernacular languages towards English among Singaporeans, especially among the younger generation (See Cavallaro, Ng & Tan, *in press*, for an overview). Despite the growing influence of Westernisation and English becoming the dominant culture and language of the home for many Singaporeans respectively (Bolton & Ng,

2014, Vaish, 2006), our results suggest that ethnic language still remains critically valued as an integral part of the home language ecology even among the younger generation of Singaporeans.

The perception that ethnic languages remain important for relationship building within the home domain can likely be attributed to the presence of elderly relatives or grandparents who may not be as conversant in English. This is in line with earlier studies conducted among the Chinese and Malay communities in Singapore. For instance, Cavallaro and Serwe (2010) found that one's conversation partner was the vital factor in predicting language choice, even over and above the domain or conversation or topic discussed in their research of the Malay community in Singapore. Tan (2014) also reported how the majority of young Chinese Singaporeans still use their ethnic language, Mandarin, with their grandparents and relatives, suggesting that ethnic languages are still important linguistic tools when communicating within the family. Consequently, while the use of the ethnic language in the home seems to be on the decline, the intrinsic value of each individual's ethnic language continues to remain an important contributor to relationship building in the home domain.

However, it is a different story outside the confines of the home as individuals' ethnic language seems less critical for bridging friendships with peers. Perhaps the most significant reason for this finding can be accounted for in our selection of participants who belong to the younger generation of Singaporeans. Our participants between the age of 18 and 30, have all undergone a minimum of 6 years of rigorous English language education in primary and secondary schools, and speak English at a high level of proficiency. Moreover, with the state's constant emphasis of English as the lingua franca for inter-racial communication among Singaporeans, the role that an individual's ethnic language plays in relationship building among peers and co-workers is limited,

with English as the ‘natural choice’ for communication especially among young Singaporeans (Bolton & Ng, 2014; Cavallaro, Ng & Tan, *in press*).

At the individual level, the ethnic language was strongly alluded to as being an integral part of our respondents’ identity, with strong agreement that losing one’s ethnic language would be a sad consequence for most respondents. In particular, the ability to speak one’s ethnic language was an integral aspect of how respondents’ self-perception and the ability to speak their ethnic language was still considered a vital characteristic for ethnic group membership. These findings concur with a comprehensive study conducted by Leimgruber, Siemund and Terassa (2018), who also found strong support in the role of their participant’s ethnic language when it came to self-identity, and identifying themselves as ‘Singaporeans’. In addition, our study reveals that respondents were significantly more reluctant to agree with the statement that someone who does not know their ethnic language can be a part of an ethnic group, in comparison to someone who knows the ethnic language but chooses not to use it. This distinction between actual ability compared to one’s decision to speak the language highlights the notion that it is more acceptable to know a language and not speak it. However, if an individual is unable to even speak the language, they are less likely to be acknowledged as a part of that ethnic group by the younger generation of Singaporeans. Taken together, these findings give us a sense of how strongly and personally the younger generation of Singaporeans consider their ethnic language and identity as a part of who they are.

In summary, our findings indicate that young Singaporeans still maintain a sense of belonging to their ethnic cultures despite the ever-growing influences of Westernisation in Singapore over the years. The survey also provides a glimpse into the intertwined relationships of ethnic language and cultural identity among young Singaporeans. Given how every participant in our study was bilingual or multilingual and grew up within the unique multicultural milieu that is

Singapore, the following section proceeds to explore in detail the extent to which young Singaporeans identify as being bicultural, as well as certain demographic variables that may predict differing levels of biculturalism.

3.4.2 Bicultural Identification

With regard to the extent of biculturalism among young Singaporeans, nearly three in four Singaporeans surveyed affirmed belonging to more than one culture. While this self-rated measure of biculturalism may be subject to social desirability bias (Krumpal, 2011), it offers us preliminary insight into how Singaporeans view themselves. The findings further revealed that individuals who had higher ethnic language proficiency, as well as those who were approximately equally proficient ('balanced') in the languages they spoke were significantly more likely to view themselves as bicultural.

Prior studies have drawn a link between language and cultural identity among multilingual individuals. A meta-analysis conducted by Mu (2015) examining the relationship between ethnic identity and language-related variables reported a small to moderate positive correlation between the sense of ethnic identity and ethnic language proficiency across various international studies. As Segalowitz, Gatbonton, and Trofimovich (2009) suggest, ethnolinguistic affiliation is closely intertwined with an individual's motivation to be part of the culture, which often manifests itself overtly in fluency in the target language. Indeed, this relationship may be bi-directional – on the one hand, proficiency in one's ethnic language can facilitate greater access to ethnic cultural heritage in the form of oral traditions and foster a deeper appreciation for the culture. On the other hand, interest in ethnic cultures can pique the individual's interest hone their language to further understand its cultural nuances. This tacit understanding of how language and culture go hand in hand has been discussed by scholars in cross-cultural psychology, and have for years now

championed the inextricable link between language and culture echoing that “culture [provides] the necessary context for language use” (Stern, 1992, p.205). Hence, it is understandable that we see the influence of language proficiency on biculturalism, with respondents who reported high ethnic language proficiency, as well as those who were equally balanced bilinguals (i.e. similar proficiencies in both English and their ethnic language) being more likely to identify as bicultural compared to participants who were had lower ethnic language proficiency, or were unbalanced bilinguals.

Aside from ethnic language proficiency and bilingual type, grouping participants based on socio-demographic factors such as social-economic class, gender, or ethnicity did not yield statistically significant differences between groups. One explanation for this could be that a strong sense of biculturalism and its importance has already been ingrained in the consciousness of young adults in Singapore. To elaborate, the importance of biculturalism among Singaporeans has been present in state rhetoric since the early days of Singapore’s independence. Faced with increasing Westernisation in Singapore, then Prime Minister Lee Kuan Yew emphasized that even as Singapore made significant economic and developmental progress, Singaporeans needed to continue to be “educated in our own cultures and our own languages” (Lee, 1978). Over the years, these ideas have been propagated over the airwaves, disseminated through the media, and implemented most visibly in the local education system. For example, the bilingual education policy introduced in 1966 mandated that all students study English and an ethnic language tied to their ethnicity: Mandarin for the Chinese, Malay for the Malays, and Tamil for the Indians as a means of “preserving for each child [a] cultural ballast and appreciation of his origin and his background” (Lee, 1966). Indeed, even as English gained traction as the language of administration, education, and commerce, Lee reiterated the belief in a speech to local educators

that Singaporeans should always remember their roots, and the emphasis on acquiring proficiency in the ethnic languages was not “just [about] learning the language. With the language goes the fables and proverbs. It is the learning of a whole value system, a whole philosophy of life, that can maintain the fabric of our society intact, in spite of exposure to all the current madnenses around the world.” (Lee, 1972). Hence, it is not unexpected that even growing up with the ubiquity of Western cultural influences and ideology in Singapore, the majority of young Singaporean adults still profess to be rooted in their ethnic culture, identifying as multicultural individuals.

To sum up, Study 1 confirms that Singaporean young adults still hold dearly to their ethnic identities, and view their ethnic language as an important part of their cultural identity. In addition, the majority view themselves as bicultural individuals when asked about their cultural affiliations overtly. In Study 2, we build on the results of Study 1 by examining the participants’ language and cultural behaviour with various interlocutors on a daily basis and integrate it with empirical data from an experiment on biculturalism using the cultural frame switching paradigm.

CHAPTER 4

4. STUDY 2: LANGUAGE, CULTURAL BEHAVIOUR, AND BICULTURAL SWITCHING

4.1 Introduction

The aim of Study 2 is to provide empirical support for the self-reported perception of biculturalism among Singaporean young adults. The study consists of two parts: First, the participants were administered a priming task to measure if they switched between cultural frames. This task is hypothesized to show how Western and Ethnic cultural primes can lead to different patterns of cognition if the participants are bicultural and have access to distinct cultural repositories. This would corroborate and augment the self-reported findings of biculturalism in Study 1. Next, we collected participant's self-report data on the cultural behaviour and languages used when communicating with different interlocutors in their daily lives. Using data from the participant's cultural switching behaviour, then grouped the participants into frequent and infrequent cultural switchers based on a composite metric of cultural behaviour and frequency of interaction with different interlocutors to examine if there were between-group differences in the cultural frame switching task.

4.2 Method

4.2.1 Participants

Out of the initial 252 participants that took part in Study 1, 233 participants continued on to the second phase of the study. A total of 229 valid responses were used after manually excluding incompletely filled forms (n=3), or in cases where participants stated that they were unfamiliar with one of the cultures (n=1).

4.2.2 Materials

4.2.2.1 Experimental Task: Cultural Frame Switching

The cultural frame switching experiment is adapted from a seminal study by Hong, Chiu, Morris, and Benet-Martinez (2000) which tests if participants are primed by cultural images to make differing attributions, based on the cultural icons they are exposed to. Our experiment consists of three blocks of different priming conditions with Western, Neutral (Control), and Ethnic primes. In the creation of the Western and Ethnic primes, images and lists were generated for each of the three major ethnicities in Singapore (Chinese, Malay, Indian), and were consolidated in consultation with young Singaporean adults from the respective cultures to ensure cultural relevance and fit.

Within each experimental priming block (Western primes, Ethnic primes), participants were required to:

- 1) Go through a word list of items, and pick out words that match the cuisine and festivals of the particular culture (Example 1).

Example 1. *Categorisation list for participants of Chinese ethnicity.*

Drag and drop the following items into their respective categories.
(Note: Some words will not be classified)

Items	Food Items (食品)	Festivals (节庆)
中国		
小龙包		
人民币		
中秋节		
万里长城		
面线		
中国茶		
北京		
上海		
饭		
农历新年		
汤圆		

- 2) Select a cultural symbol that they felt was the most iconic representation of the culture (Example 2).

Example 2. *Selection of cultural symbols for participants of Chinese ethnicity.*

Q Which of the following pictures is most symbolic of the Chinese culture?

- 3) Select a food item that best represents the culture (Example 3).

Example 3. *Selection of food icons for participants of Malay ethnicity.*

Q Which of the following food items is most iconic to you as a Malay?

- 4) Write 5 statements that would be able to describe the culture in question to someone who knew nothing about it. The participants were encouraged to talk about values, characteristics, and what made the culture distinctive.

For the Neutral block (control condition), participants were asked to group shapes into categories of either two dimensions or three dimensions, selecting which colour was the most versatile, and their preference of landscape and scenery from a series of black and white drawings. Participants were then asked to write five statements about the landscape or scenery. The full set of primes, as well as questions, can be found in Appendix B.

Following this, participants were shown an animation depicting an image of fish swimming away from the group (See Figure 1b, p.35). They were then asked to rate the how confident they were that fish on the far right was leading the other fishes (Internal attribution/cause) or being chased by them (External attribution/cause). The ratings were based on a 12 point scale similar to the procedure detailed in earlier studies conducted by Hong and colleagues (2000; 2003), where a score of 1 indicated strong confidence that the fish on the right was leading the others, while a score of 12 indicated strong confidence that the fish on the right was being chased by the group. As per earlier studies, it was theorised that if participants were bicultural, Western primes would evoke a stronger confidence that the fish was leading the pack, corresponding to an internal attribution, while Ethnic primes are hypothesized to influence the participants to choose an external attribution, where the fish to the right was being chased (Morris, Nisbett, & Peng, 1995).

4.2.2.2 Language Use and Cultural Behaviour Survey

The second part of the study gathered self-report cultural behaviour and language use as a means of comparing if Singaporeans perceived themselves to adopt culturally different behaviours in different domains. Participants were asked to reflect on the cultural behaviour they would generally adopt when communicating with five different interlocutors – relatives/grandparents, parents, siblings, at school/work, and on social media platforms (See Example 4 on the next page), and rate it on a 7-point Likert scale from Completely Western to Completely Ethnic, with a rating of ‘4’ indicating a mix of both cultural behaviours. Likewise, participants were also asked to indicate the languages used with the above-mentioned interlocutors on a 7-point Likert scale ranging from Completely English to Completely Non-English (See Example 5 below)² as loosely

² Singapore Colloquial English (i.e. Singlish) in interactional situations can vary on a wide continuum from completely English-based lexicon to intra-sentential language switching depending on interlocutor and personal choice. Hence, the questionnaire looking at language behaviour specifically took into account this possibility by offering a range of options from completely English, to mix of languages, and finally completely non-English.

adapted from a section of the Language Experience and Proficiency Questionnaire (LEAP-Q) by Marian, Blumenfeld, & Kaushanskaya (2007). These two measures were used to examine how language and cultural behaviour varied when participants interacted with these different interlocutors.

Example 4. *Self-reported cultural behaviour with different interlocutors.*

Qn. What cultural behaviour would you generally adopt in the following situations?

Interacting with parents

0	1	2	3	4	5	6	7
N.A.	Completely Western			Mix of both			Completely Ethnic

Example 5. *Self-reported language behaviour with different interlocutors.*

Qn. What language do you use when interacting with the following interlocutors?

Interacting with relatives/grandparents

0	1	2	3	4	5	6	7
N.A.	Completely English			Mixed			Completely Non-English

Finally, participants responses relating to the frequency of their interactions were also solicited. Participants selected from a total of eight possible options indicating the estimated time they spent with each of the five interlocutors/domains: Grandparents/Relatives, Parents, Siblings, Peers/Co-workers, Social media (See Example 6 below).

Example 6. *Self-reported frequency of interaction with different interlocutors.*

Qn. In your day-to-day life, how much time do you usually spend on average, engaged in the following situations?

Interacting with peers or colleagues

0	1	2	3	4	5	6	7
N.A.	Yearly	Monthly	Weekly	2-3 times per week	Daily, <1 hr	Daily, 1-2 hrs	Daily, >2 hrs

4.2.3 Procedure

The participants who agreed to the second follow up study were asked to complete the task in a quiet location, free from distractions on a 15.4 inch MacBook Pro (2.9Ghz, Intel Quad-core i7 processor, 16gb RAM). Participants completed the cultural frame switching priming experiment before responding to the questionnaire to mitigate the possibility of them guessing the purpose behind the priming experiment or being influenced by the questions about cultural behaviour in the questionnaire. The entire study took between 30 and 45 minutes on average to complete. Upon completion, the participants were debriefed about the experiment, especially with regard to the purpose of rating the ambiguous fish image. The experiment was untimed and administered using a custom script uploaded onto the Qualtrics system to integrate data collected from the survey for analysis. All responses were recorded on the Qualtrics central server and downloaded as a CSV file into an SPSS database for data sorting and analysis. This study was approved by Nanyang Technological University's Institutional Review Board (IRB Reference: IRB-2018-06-25).

4.3 Results

4.3.1 Cultural Frame Switching Experiment

The results suggest that in general, Singaporean young adults are bicultural in that they have access to two different cultural frames that they can switch between. A repeated measures (within-subjects) ANOVA was conducted to ascertain the effect of different primes (Western, Neutral, Ethnic) on participant's ratings. As Mauchly's test of sphericity was violated, a Greenhouse-Geisser correction was applied ($\epsilon = .687$). This revealed a main effect of prime type on participant scoring [$F(1.375, 313.48) = 34.91$, $p < .001$]. Post-Hoc Tukey tests revealed significantly different ratings between Western Primes ($M_{\text{rating}} = 3.64$, $SD = 3.03$) and Neutral primes ($M_{\text{rating}} = 4.72$, $SD = 2.91$), $p < .001$. In addition, ratings for Western primes were significantly lower

than and Ethnic Primes ($M=5.85$, $SD=3.52$), $p<.001$. These findings follow a similar pattern to early studies by researchers such as Hong and colleagues (2000; 2003) in which bicultural participants primed with ethnic icons and images were more likely to choose external attributions (i.e. the fish is being chased) as seen in a higher rating on our scale, in contrast to priming with Western (American) icons where participants seemed to favour internal attributions (i.e. the fish was leading the group) and hence, lower ratings (Figure 2).

Figure 2. Participant's mean ratings of the ambiguous fish animation under different priming conditions. (** indicates statistical difference of $p<0.001$)

4.3.2 Relationship between Language and Cultural Behaviour

In general, participants reported using mostly English as the language of choice when communicating with various interlocutors with the exception of grandparents and relatives. In contrast, greater variation is present when examining cultural behaviour. When interacting with members of one's extended family, participants generally rated their behaviour as being highly

ethnic, while their cultural behaviour became increasingly non-ethnic (negative gradient) when communicating with siblings, friends and colleagues at school or work, as well as on social media platforms. The gradual sloping gradient contrasts with the sudden decrease in terms of language behaviour moving from grandparents and relatives indicating more English language use, as seen in the combined visualisation in Figure 3. Table 4 below provides a summary of the self-rated language and cultural behaviour ratings of the participants.

- a. Rating for cultural behaviour corresponds to: 1=Completely Western, 7=Completely Ethnic
- b. Rating for language behaviour corresponds to: 1=Completely English, 7=Completely Ethnic

Figure 3. Mean ratings of participant's cultural and language behaviour when speaking with different interlocutors.

Table 4. *Self-rated language and cultural behaviour with different interactants/interlocutors.*

Interactant	Language behaviour	Cultural behaviour
	Mean (SD)	Mean (SD)
Grandparents/ Relatives	4.98 (1.67)	5.76 (1.22)
Parents	2.21 (0.79)	4.93 (1.58)
Siblings	2.12 (0.67)	3.50 (1.31)
Peers/co-workers	1.94 (0.72)	2.98 (1.26)
Social Media	1.92 (0.71)	2.58 (1.28)

Figure 4a. Boxplot showing distribution of responses for language behaviour with different interlocutors.

Figure 4b. Boxplot showing distribution of responses for cultural behaviour with different interlocutors.

Due to the different sample sizes and non-normal distribution of responses as assessed visually from boxplots (Figure 4a,b), Levene's test of homogeneity of variances was conducted. As $p > .05$, the assumption of equal variances was maintained. Hence, a two-way mixed ANOVA was run to determine the effect interlocutor (Grandparents/relatives, Parents, Siblings, Peers/co-workers, Social media) on behaviour (Cultural, Language). There was a statistically significant difference between interlocutor's ratings of cultural and language behaviours [$F(4,1163)=425, p<.001$]. Post-hoc Tukey comparisons revealed significantly lower cultural behaviour scores ($p<.001$ for all) when comparing between grandparents/relatives, parents, siblings, peers or co-workers, and communicating on social media. Further within-subject posthoc comparisons between language behaviour only showed a statistically significant difference between language behaviour scores when comparing between grandparents/relatives ($p<.001$) and all other interlocutors, while comparisons of ratings between parents ($p=.87$), siblings ($p=.29$), peers or co-workers ($p=.83$), and posting on social media ($p=.12$) were not significantly different.

4.3.3 Relationship between Switching Frequency and Prime Ratings

Integrating data collected regarding the participant's cultural behaviour and frequency of interacting with different interlocutors, participants were then divided into two groups – frequent cultural switchers and infrequent cultural switchers based on a composite score of both cultural behaviour and cultural switching frequency. *Cultural switching type* was defined based on two factors: 1) Frequency and duration of contact with interlocutors, 2) Varied cultural shifting. Specifically, frequent cultural switchers ($n=79$) were defined as individuals who interact with at least three out of five interlocutors (Grandparents, Parents, Siblings, Friends/co-workers, Social Media) for at least one hour on a daily basis (i.e. Likert scale rating 5-7). In addition, they must also have adopted different cultural behaviours with their interlocutors. Specifically, their

interactions with the interlocutors had to span at least 2 standard deviations from the individual means as an indication of the variability of their cultural behaviour. Only individuals satisfying these two conditions were considered frequent cultural switchers in our analysis. Individuals who did not meet these requirements were considered infrequent cultural switchers (n=165).

A one-way Analysis of Variance (ANOVA) was conducted with frequent/infrequent cultural switchers as the independent variable and prime type as dependent variables. Frequent cultural switchers ($M_{\text{rating}}=3.06$, $SD=2.69$) rated significantly lower than infrequent cultural switchers ($M_{\text{rating}}=3.94$, $SD=3.16$) for the Western primes [$F(1,227)=4.45$, $p=.036$]. No significant between groups were observed for the Neutral primes [$F(1,227)=2.71$, $p=.101$] or Ethnic primes [$F(1,227)=0.850$, $p=.358$]. As seen in Figure 4 below, the change in attribution spans a wider range for frequent switchers (change of 3.08) compared to infrequent switchers (change of 1.75).

Figure 5. Comparison of ratings between frequent and infrequent cultural switcher's response to Western, Neutral, and Ethnic primes. (* indicates significant difference of $p<0.05$)

Overall, it is evident in this experimental task that cultural primes shown to young Singaporean adults were successful in influencing cognition and effected a change in their appraisal of the same ambiguous picture. Participants were more confident of making external attributions (i.e. Fish was leading) when primed with Western primes and more confident of making internal attributions (i.e. Fish was being chased) when primed with Ethnic primes. Moreover, there are differences between frequent and infrequent switchers when it comes to cultural primes. On the whole, this experimental task thus complements the self-report survey findings, confirming that many young Singaporeans are bicultural, and can switch between different cultural frames in different cultural situations.

4.4 Discussion

4.4.1 Cultural Shifting with Different interlocutors/domains

As our respondents indicated a high level of biculturalism in Study 1, we wanted to find out if they adopted different cultural behaviours when speaking to different interlocutors. In particular, we asked how language use and the culture our participants adopted when speaking to different interlocutors were related. With regard to language behaviour, English was used when interacting with nearly all interlocutors. This is likely due to the high level of English proficiency of our participants, as well as the ability of all interlocutors to hold a conversation in English with the exception of some elderly grandparents or relatives. Hence, it is not surprising that English is the language of choice when speaking to all interlocutors except grandparents and their relatives. Examining cultural behaviour, our data show a continuous variation in behaviour with different interlocutors corroborating earlier findings of biculturalism in Study 1. Figure 3 (p. 61) clearly shows the divergence between how individuals adopt different cultural behaviours with different interlocutors in typical, every-day interactions compared to speaking mostly English with most

interlocutors. In particular, the participants indicated adopting behaviour that could be associated with their Ethnic culture increasingly when corresponding with interlocutors in the home domain (siblings, parents, and grandparents and relatives), in contrast to the adoption of a more Western way of behaving with peers at school or work or when posting on social media.

One explanation for such differences in cultural behaviour can be attributed to the different ‘cultural worlds’ that Singaporean young adults typically live in. When at home, deeply ingrained Asian cultural scripts may evoke values such as filial piety, deference to elders, as well as ideologies such as ‘knowing one’s place in the family’ (Tan & Tan, 2014). In contrast, when interacting with peers or others on the online ‘netscape’, individuals tend to feel less restricted with cultural obligations and may adopt behaviours typically associated with Western culture – independent and individualistic behaviour, egalitarianism in relationships, as well as freedom of expression (Wong, 2015). The results reveal how young Singaporean adults engage in frequent shifting between different cultural identities, value systems, and views depending on their social interactions on a day-to-day basis. We hypothesize that this could be effective in collectively contribute to the honing of cultural shifting abilities which we elaborate further in the discussion of Study 3. To provide further nuance to our self-report data, we examined the abilities of young Singaporeans in shifting between cultures empirically in the next task.

4.4.2 Cultural Frame Switching

Thus far we have seen that the majority of young Singaporean adults identify as belonging to more than one culture. Furthermore, their self-report data from suggests that they adopt a range of cultural behaviours spanning the whole spectrum from Ethnic to Western when interacting with interlocutors in various domains in their daily lives. As such, the next question we sought to answer

was to determine if there was empirical evidence of switching between Western and ethnic cultural frames among our participants.

Results from our study replicate findings in earlier studies showing that different cultural primes can result in a shift in cultural attributions among individuals who have been exposed to both cultures (Hong et al., 1997; Verkuyten & Yildiz, 2007; Dewaele, 2016; Schwartz et al., 2017). Importantly, this study is the first to provides empirical evidence for the biculturality of Singaporean young adults corresponding to different attributions of internal and external attributions when primed with Western and Ethnic primes respectively. As with previous studies, when primed with Western primes, our participants were more confident that the fish shown in the ambiguous picture was leading the school of fishes, indicative of an internal, self-driven motivation to move. This pattern of more confidence in making external attributions follows a similar pattern typically made by participants of individualistic cultures (Masuda & Nisbett, 2001). On the other hand, when the same participants were shown ethnic primes, they rated the fish in the lead as being more likely to be chased by the other fishes, corresponding to pressure from an external source playing a role in the fish swimming away from the group. Such attributions are commonly found among participants from highly collectivist cultures such as in China, Korea, and Japan (Masuda & Nisbett, 2001).

Statistical analyses revealed the differences between ratings in this task comparing Western and Ethnic primes to be statistically significant, indicating that participants exposed to pictures and cultural cues associated with the Western (American) culture were significantly more confident in attributing the causal explanation to internal causes, vis-à-vis external causes for Ethnic cultural primes. These contrasting patterns can be thought of as highlighting a distinction between Western (individualistic) and Eastern (collectivist) cultural perceptions, and yet, were

activated by bicultural participants. This suggests that these individuals have internalised both cultures and were displayed different tendencies when primed, thus providing robust support confirming that the younger generation of Singaporean adults is indeed bicultural.

To further understand the possible effects of switching frequency among the participants, we adopted rigorous selection criteria to group our participants into frequent cultural switchers and infrequent cultural switchers based on their daily interactions and switching frequency. At least two observations can be made from our findings when examining the effects of cultural switching frequency on priming attributions: First, that frequent switchers rated the confidence in attributing the fish as leading the school significantly lower (i.e. more confident) compared to infrequent switchers. A plausible explanation could be that frequent cultural switchers were more adept at identifying salient Western cultural cues or traits present in primes due to their familiarity with these cultural icons, resulting in greater confidence in external attributions with the Western primes. This would agree with previous studies that have shown that individuals who are more deeply integrated in their cultures are more sensitive to cultural priming, and have the potential to evoke strong associations to the culture when primed (Friedman, Liu, Chi, Hong, & Sung, 2012; Hong, Zhan, Morris, & Benet-Martinez, 2016).

Second, frequent cultural switcher's ratings across Western and Ethnic primes spanned a larger range (Min=3.06, Max=6.19) compared to infrequent cultural switchers (Min=3.94, Max=5.70). One possible explanation for this could be attributed to differences in the micro-level cultural and social environments could explain our data. For instance, the smaller range among infrequent cultural switchers could be due to the more homogeneous cultural environment that the participants were exposed to on a daily basis. As a number of our participants were university students staying in on-campus accommodation, they may have limited opportunities to interact

with their parents, siblings, grandparents and relatives – key interlocutors where cultural behaviour and language behaviour differed significantly, on a day-to-day basis. Instead, their most frequent interlocutors would be their friends and engaging virtually on social media or other networking sites. Thus, it is possible that their behaviour when interacting with a limited number of different interlocutors resulted in comparatively less switching between cultures compared to frequent cultural switchers. This could have contributed to a narrower range of switching. In contrast, participants who had engaged in frequent cultural switching with different interlocutors were more adept at identifying the most salient cultural cues and making distinctions between how to behave, think, and respond as they had more opportunities and experience in shifting between cultures.

Another possible reason for the differences in response range could stem from each participant's individual construct of whether the two cultures (Western and Ethnic) were distinct, as well as the issue of how 'distinct' or separation between the two cultures could be different for infrequent cultural switchers compared to frequent switchers. One way of interpreting the narrower band of cultural switching performance for infrequent switchers would be that they did not view the cultures as being as distinct or with well-defined boundaries – in other words, the two cultures could be thought of as intersecting or existing as a blend for some participants (Benet-Martínez & Haritatos, 2005; Huynh, Nguyen, & Benet-Martínez, 2011). In fact, some researchers suggest that individuals living in two distinct cultural worlds may create their own culture that integrates aspects of both cultures while being distinct enough from either culture that they do not identify with one or the other. As a result, these participants may not even find it necessary to switch between cultures as frequently as Frequent Cultural switchers, if at all. Such possibilities are explored in theories of cultural blending (See Hong, Zhan, Morris, & Benet-Martinez (2016) for an overview) and could account for the narrower range of internal and external attributions with

Western and ethnic primes, although it is not within the scope and aims of this research to further delve into.

CHAPTER 5

5. STUDY 3: EXECUTIVE FUNCTIONS BATTERY

5.1 Introduction

The first and second studies have provided self-report and experimental data indicating that the majority of young Singaporeans are bicultural, are both able to and do switch between different cultural frames in their daily lives. Moreover, differences in the frequency of cultural shifting resulted in significantly different ratings when primed with Western, Neutral, and Ethnic cultural primes. Hence, a third study was conducted to investigate the effects of frequent cultural shifting among bicultural-bilinguals. Specifically, we want to explore if differences in the frequency of cultural switching among bicultural-bilinguals result in performance differences on tasks of Executive Functions. We hypothesize that frequent cultural switchers will be better (more efficient) than infrequent cultural switchers in terms of their attentional processing and switching ability (Wisconsin Card-sort Test, Attention Network Test (Alerting and Orienting Networks)), and executive control as measured by stimulus-response incompatibility tasks (Simon, Flanker, Attention Network Test(Conflict/Executive Control Network)).

5.2 Method

5.2.1 Participants

We recruited participants controlling for nationality, cultural background, age, and education level. All participants were Singaporeans of Asian ethnicity (either Chinese or Malay) between 18 and 25 years of age. Our participants were all university students of either Nanyang Technological University or the National University of Singapore, although they came from diverse backgrounds including the humanities, sciences, engineering, art, and education

departments. A total of 48 participants (34 Female, $M_{age} = 21.94$, $SD = 1.6$) agreed to participate, and all participants were successful in completing the background tests and executive functions battery. Of these participants, 22 were Infrequent Cultural Switchers and 26 were Frequent Cultural Switchers according to the criteria set out in Study 2 (Section 4.3.3, p.60-61).

5.2.2 Materials

5.2.2.1 Background Measures

A thorough self-report survey collecting information about citizenship/immigrant status, language repertoire, cultural behaviour, socio-economic status, and specific language proficiencies were collected in face-to-face interviews with the researcher. Participant's language grades at the Singapore-Cambridge GCSE O'Level examinations were also collected as a formal measure of language proficiency for the national examination provides a good measure of language proficiency with oral, written, and comprehension components being tested and are normed across students in Singapore. The participants were also asked to estimate their gross household income, which was benchmarked against the four quartiles of Singaporean household income from the General Household Survey as an estimate of Socio-Economic Status (Singapore Department of Statistics, 2019). Furthermore, in light of recent studies showing how code-switching frequency may influence results of Executive Functions tests (Hartanto & Yang, 2016; Hofweber, Marinis, & Treffers-Daller, 2016), as well as Singaporean's well documented propensity for code-mixing (Leimgruber, 2011), participants were asked to fill out a short questionnaire of their code-switching/mixing habits (Example 7). In addition, in order to participate, participants had to declare that they did not suffer any history of neurological or psychological impairments, and were administered the Test of Non-Verbal Intelligence (TONI).

Example 7. *Code-switching frequency questionnaire.*

It is a common occurrence for people to switch between languages during a single conversation. In general, how frequently do you **switch between languages** in the following situations?

With grandparents/relatives	▼ Never (0) ... Always (5)
With parents/family members	▼ Never (0) ... Always (5)
Among friends	▼ Never (0) ... Always (5)
In school/at work	▼ Never (0) ... Always (5)
On social media (e.g. Facebook, Twitter)	▼ Never (0) ... Always (5)

Test of Nonverbal Intelligence – 4th Edition (TONI-4). This untimed, standardized test provides a measure of an individual’s non-verbal reasoning abilities and was selected as it was a language-free test with high test-retest reliability (Ritter, Kilinc, Navruz, Bae, 2011). Individuals are asked to complete a set of 60 questions testing intelligence, pattern recognition, and problem-solving. However, when they made 5 responses in a row, the test would end and their IQ scores tabulated. This measure provides an objective measure of intelligence among the participants and is a necessary control factor as previous studies have shown IQ to predict performance in certain tests of Executive Functions (Arffa, 2007; Friedman et al., 2008).

5.2.2.2 Experimental tasks

Simon task. The Simon task (Simon & Wolf, 1963) is a popular measure for executive control among studies in bilingualism and cognition. In this study, Blue and Red circles on a white background were used as stimuli for the Simon Task (See Figure 6). The circles could either appear on the right or the left half of the screen. Participants were asked to respond by pressing the right shift key when they saw a Blue circle and the left shift key when they saw a Red circle, regardless of where the circle appeared on the screen. Trials in which the location of the circles corresponded with predetermined shift key (Blue circle – Right shift, Red circle – Left shift) were considered

congruent trials, which trials in any the opposite direction were incongruent trials. When the circle appeared at the centre of the screen, it was labelled as a neutral trial.

Figure 6. Pictorial representation of different trials in the Simon task. Participants were asked to press the L key when you see the red square, and the R key when you see the green square.

Each trial in the task was presented in this manner: First, a fixation cross would appear for 500ms indicating the start of a trial; Next, the circle stimuli appeared on screen until a response was selected, with a cut-off time set at 2000ms; Finally, a blank screen appeared for 1000 ms before the next trial began. In total, there were 20 randomised practice trials, followed by 3 blocks of 48 trials each (total 144 trials, excluding practice trials). After each block, a computerised message enquired if participants needed to take a break, and participants would continue on to the next block by pressing the spacebar to continue.

Flanker task. The Flanker task (Eriksen and Eriksen, 1974) requires participants to engage attention to identify symbols/objects flanking the target, and inhibiting prepotent responses based on the direction of the flankers. In this study, white arrows on a black background were used as stimuli and flankers (See Figure 7). There were a total of four conditions for this task (No flankers, Neutral flankers, Congruent flankers, Incongruent flankers). For the No Flanker condition, a single target arrow appeared on screen without any flankers and was used to estimate reaction time when no other visual stimuli was present. For Neutral, Congruent and Incongruent Flanker conditions,

stimuli consisted of either white arrows (congruent/incongruent) or white dashes (neutral) on a black background. Stimuli was made up of five arrows in congruent and incongruent trials (e.g. <<<<<<), with 4 white dashes flanking the target in neutral trials (e.g. - - > - -). Participants were asked to indicate the direction of the target arrow by pressing either the left shift key or right shift key, corresponding to the direction of the target arrow (i.e. <<<<<< press right shift, <<<<<< press left shift). In congruent trials, flanking arrows were all pointing in the same direction as the target arrow (e.g. >>>>>>), while for incongruent trials, the target arrow and flanking arrows would be pointing in the opposite direction (e.g. <<<<<<).

Figure 7. Pictorial representation of various Flanker target conditions presented during the Flanker Task.

Each trial in the task was presented in this manner: First, a fixation cross would appear for 500ms indicating the start of a trial; Next, the stimuli appeared on screen until a response was selected, with a cut-off time set at 1500ms; Finally, a blank screen appeared for 1000ms before the next trial began. In total, there were 24 practice trials, followed by 4 blocks of 48 trials each (total 192 trials, excluding practice trials). After each block, a computerised message enquired if participants needed to take a break, and participants would continue on to the next block by pressing the spacebar to continue.

Wisconsin Card-Sort Task (WCST). The WCST (Grant & Berg, 1948) is an untimed task that measures attention and set-shifting. In our experiment, an on-screen analogue of the original task was used. Each participant is required to sort cards based on one of three sorting rules – colour, shape, or the number of shapes on each card in the unsorted deck. At the start of each

trial, a new card from the deck is shown on the computer screen and requires participants to sort it into one of four decks of varying colour (Red, Green, Yellow, Blue), shape (Triangle, Star, Crosses, Circles), and number of shapes (e.g. 1 Red Triangle, 2 Green Stars, 3 Yellow Crosses, 4 Blue Circles). As participants are not told the implicit sorting rule, they must choose from logical possibilities based on the card to be sorted. Once a participant sorts the card, feedback is given on-screen to inform the participant if the sorting is correct or incorrect before proceeding to the next trial. Participants are required to remember the rule once they receive positive feedback, and the number of errors made after an implicit rule change has occurred is seen as a measure of task-shifting/switching ability. After 10 consecutive correct sorts, a category is considered to be complete, and the rule changes. In total, participants have 128 trials to complete as many categories as they can (maximum of 9 categories, 3 rules (colour, shape, number) x 3 repetitions), after which the experiment ends.

Each trial was presented in the following manner: Four sorting piles and an unsorted deck of cards appeared on the computer screen. The participants would drag the card on the top of the unsorted deck to the pile corresponding to the sorting option they would like (See Figure 8, p.77). Once the card to be sorted was placed on one of the four piles, feedback (Correct or Incorrect) would be displayed for 1500ms, before the next card to be sorted appeared on the unsorted deck.

Figure 8. Visualisation of sorting options for the Wisconsin Card Sort Task administered from the Psychology Experiment Builder Library (Fox, Mueller, Gray, Raber, & Piper, 2013). Annotations (i.e. Options text) is not shown, the participants only see the four piles and the unsorted deck of cards on the screen.

Attention Network Task. This task is hypothesized to measure the efficiency of three attentional networks: Alerting, Orienting, and Executive Control. This task is a modified cue-by-flanker task, where Fan and colleagues (2002) theorize that the efficiency of various networks can be measured by comparing the difference in participant's reaction time between various types of trials. In our experiment, a 24 trial practice block was first administered, with feedback about whether their response was correct or incorrect given after every trial to ensure participants understood what was required. In the main experimental, three blocks of 96 randomised trials without feedback (total trials = 288, excluding practice trials). Within each block, trials had the following cue conditions: (1) no cue, (2) centre cue, (3) double cue (Above and Below fixation), (4) spatial cue (Above or Below fixation), and participants were instructed to respond to the direction of the target arrow they would see on screen (Left – press Left shift key, Right – press

Right shift key) while doing their best not to be influenced by one of three Flanker conditions (neutral, congruent, incongruent). Each trial in the task was presented in this manner: First, a fixation cross would appear for a random interval between 400-1600ms indicating the start of a trial; Next, one of four cue conditions appeared on screen for 100ms, after which another fixation cross appeared for 500ms. Finally, a Flanker target appeared on screen until a response was entered, subject to a cut-off time set at 2000ms. After each block, a computerised message enquired if participants needed to take a break, and participants would continue on to the next block by pressing the spacebar to continue. Figure 9 provides a visualisation of the various cue conditions, Flanker targets, and an example of the trial presentation flow.

Cue Conditions

Flanker Target Conditions

Procedure (Main experiment)

Trial 1----- | Trial 2----- >

Figure 9. Cue conditions, Flanker targets, and experimental procedure for the Attention Network Task.

To calculate the efficiencies of the three attention networks, we adopted the method by Fan and colleagues (2002), with mean scores for each of the three networks calculated as follows:

- ALERTING NETWORK (*Alerting* = *No cue RT* – *Double cue RT*): Differences in reaction time between cued and non-cued trials.
- ORIENTING NETWORK (*Orienting* = *Central cue RT* – *Spatial cue RT*): Differences in the reaction time between cues indicating where the target will occur (either top or bottom) and double cues (both top and bottom cued at the same time).
- EXECUTIVE CONTROL/CONFLICT NETWORK (*EC* = *Incongruent RT* – *Congruent RT*): Differences in reaction time when responding to neutral, congruent, and incongruent flankers (similar to Flanker task described above).

5.2.3 Procedure

Participants were invited to the NTU linguistics laboratory for the Executive Functions test battery. The experiments were conducted in a soundproof room with ambient temperature and relative humidity set at 24 degrees Celsius, and 50% respectively. Prior to the start of the experimental procedures, informed consent was sought, and participants were briefed about the experiment in line with standards set out by the NTU Institutional Review Board. Demographic information and background measures were then collected before they were seated a comfortable distance away from the computer screen and allowed to make adjustments to the screen-viewing distance and brightness of the monitor. All experiments were delivered using the Psychology Experiment Building Language (PEBL) Version 2.1 for Macintosh (Mueller & Piper, 2014) on a 15.4 inch MacBook Pro (2.9Ghz, Intel Quad-core i7 processor, 16gb RAM). After each task was completed, the researcher entered the room to check if the participant was fatigued, and offered vision or restroom breaks if necessary. Upon completion of the computerized experiments, participants proceeded to complete the TONI-4 Non-verbal IQ test, after which they were debriefed about the purpose of the study and paid a token sum of \$10 for their time. The entire

experiment lasted for approximately 1 hour and 30 minutes. This study was approved by Nanyang Technological University's Institutional Review Board (IRB Reference: IRB-2018-06-25).

5.2.4 Data analysis

Data was collated and aggregated using Microsoft Excel in the CSV format. For reaction time studies (Simon and Flanker tasks), outliers greater than 3 standard deviations from the mean were examined manually. Only data that was highly anomalous and clearly due to distraction or errors in response (e.g. timeout from questions) was trimmed from the data and excluded from analyses. The resulting data was then exported to SPSS for analysis.

5.3 Results

5.3.1 Background Measures

Socio-linguistic measures. Non-parametric Mann-Whitney tests were used to compare different socio-linguistic variables between frequent and infrequent cultural switchers. There were no significant group differences on age [$U=206$, $p=.089$], gender [$U=248$, $p=.318$] and socioeconomic status [$U=202.5$, $p=.070$]. All participants were Singapore citizens who reported their age of acquisition of at least 2 languages before 3 years and had been through the minimum 6-year bilingual education system. All individuals were bilingual if not multilingual, and obtained a minimum B3 grade³ for English and ethnic language ('Mother Tongue Language') papers at the secondary level (GCE O'level examinations).

With regard to English proficiency, no significant difference between groups was found across four measures of speaking [$U=240.5$, $p=.398$], comprehending [$U=267.5$, $p=.844$], reading ability [$U=250$, $p=.539$], and writing ability [$U=243$, $p=.458$]. No group differences were found

³ The B3 grade is the third highest grade possible for the GCSE O'Level examinations after A1 and A2 grades. This corresponds to a score of at least 65/100 points.

for ethnic language speaking ability [$U=198.5, p=0.09$, ability to comprehend [$U=201, p=0.061$], reading ability [$U=238.5, p=.299$], or writing ability [$U=260.5, p=.578$]. Participants also did not differ in terms of bilingual type (i.e. balanced vs. unbalanced) [$U=202, p=0.81$]. Moreover, there were no significant between-group differences in terms of averaged self-rated code-switching frequency [$U=193, p=.055$]. A full table of descriptive statistics is presented in Table 5.

Table 5. *Participant demographics and self-rated language proficiencies. Standard Deviations in parentheses beside the mean.*

	Infrequent Switchers	Frequent Switchers
N	26 (Female = 20)	22 (Female = 14)
Age (years)	21.54 (1.21)	22.41(1.89)
SES band ^a	2.05 (.844)	2.58 (1.03)
Age of Acquisition (years)	1.51 (.422)	1.73 (.280)
English (Speaking)	6.40 (.734)	6.61 (.571)
English (Comprehending)	6.59 (.666)	6.69 (.470)
English (Reading)	6.45 (.671)	6.61 (.496)
English (Writing)	6.04 (.722)	6.23 (.710)
Ethnic (Speaking)	5.41 (1.07)	4.96 (1.07)
Ethnic (Comprehending)	5.68 (.945)	5.19 (.895)
Ethnic (Reading)	5.27 (1.12)	5.03 (.915)
Ethnic (Writing)	5.04 (1.49)	5.07 (1.05)
Code-switching frequency ^b	2.54 (.845)	3.09 (1.02)
TONI-NVIQ	115.82 (7.76)	115.46 (5.66)

^a Socio-Economic Status bands were based on government supplied household income quartiles (Singapore Department of Statistics, 2019). These bands correspond to the following monthly household salaries: 1: Below \$4,000 per month, 2: Between \$4,000 - \$8,000 per month, 3: Between \$8,000 - \$12,000 per month, 4: Above \$12,000 per month.

^b Rated on a 5-point Likert scale: 1: Never mixing, 2: Seldom mixing, 3: Mixing at times, 4: Frequently mixing, 5: Always mixing.

Test of Nonverbal Intelligence (TONI). All participants declared no known history of cognitive impairments. Welch's t-test revealed no statistical differences for switching frequency (Frequent vs. Infrequent) [$t(46)=.184, p=.855$].

Overall, our preliminary analyses of background measures indicate that the participants did not differ statistically in various socio-linguistic measures and intelligence and were comparable in terms of high language proficiencies.

5.3.2 Experimental tasks

5.3.2.1 *Simon task*

The Simon task is a measure of executive control where participants need to inhibit stimulus-response incompatible responses. Consistent with prior studies in the literature using the task, this study shows a clear overall main effect, with incongruent trials ($M_{RT}=424.10$, $SD=50.44$) being significantly slower than congruent trials ($M_{RT}=394.95$, $SD=48.52$), [$t(47)=-9.42$, $p<.001$]. A one-way ANOVA was conducted with the grouping variable of cultural switching frequency (Frequent cultural switchers, Infrequent cultural switchers), however, no significant differences were found between groups for either reaction time or accuracy, despite frequent switchers showing a 10ms advantage in the Simon effect. A summary of the results as well as mean reaction times and accuracy values can be found in Table 6 below.

Table 6. *Between-group reaction times for Simon task, grouped by cultural switching frequency. Standard Deviation is given in brackets.*

Trial Type	Reaction Time (SD)			Accuracy (%)		
	Infrequent Switchers	Frequent Switchers	P-value	Infrequent Switchers	Frequent Switchers	P-value
Congruent	390.20 (44.51)	398.98 (52.19)	.934	98.04 (2.37)	97.54 (2.43)	.406
Neutral	407.09 (48.59)	408.37 (57.09)	.538	97.91 (3.08)	96.31 (4.90)	.862
Incongruent	425.04 (48.29)	423.28 (53.14)	.906	93.03 (5.47)	92.47 (5.56)	.515
Simon Effect	34.85 (23.52)	24.30 (18.59)	.090	-	-	

5.3.2.2 Flanker task

Averaged across all participants, the Flanker task reflects the different cognitive loadings of each of the four conditions (Figure 10). The fastest reaction times were recorded in the No-Flanker condition ($M_{RT}=376.63$, $SD=27.12$), while neutral flankers imposing a heavier cognitive load compared to the ($M_{RT}=397.72$, $SD=36.88$) stimuli where only the target arrow was shown. Consistent with previous studies, there was a significant main effect of congruence, where incongruent trials ($M_{RT}=434.29$, $SD=39.60$) were responded to significantly slower than congruent trials ($M_{RT}=391.78$, $SD=34.45$) [$t(47)=-15.41$, $p<.001$].

Figure 10. Mean reaction times across participants for various Flanker trials. (** indicates significant difference of $p<0.001$)

A one-way Analysis of Variance (ANOVA) conducted to examine differences between frequent switchers and infrequent switchers on reaction time revealed no significant between-group differences in the no flanker, congruent flanker, and neutral conditions. However, a significant group difference emerged in the incongruent condition [$F(1,46)=5.20$, $p<.05$]. These trends are reflected visually in Figure 11 below.

Figure 11. Reaction times to the different Flanker types by Frequent cultural switchers and Infrequent cultural switchers in the Flanker task.

The resulting Flanker effect, found by subtracting the average reaction time of congruent trials from incongruent trials, was also statistically significant [$F(1,46) = 54.73, p < .001$], indicating that frequent cultural switchers were able more quickly in incongruent trials, but also exhibited a smaller overall flanker effect which is hypothesized to be a measure for better inhibition-control. Table 7 summarizes the results for the between-groups ANOVA.

Table 7. Reaction time and accuracy of frequent and infrequent cultural switcher's performance in the Flanker task.

Trial Type	Reaction Time (SD)			Accuracy % (SD)		
	Infrequent Switchers	Frequent Switchers	P-value	Infrequent Switchers	Frequent Switchers	P-value
No Flanker	379.89 (25.46)	373.88 (28.65)	.450	.982 (.039)	.978 (.031)	.862
Congruent	390.20 (37.46)	393.12 (32.38)	.773	.968 (.046)	.940 (.073)	.132
Neutral	402.80 (40.52)	393.42 (33.71)	.386	.950 (.047)	.962 (.053)	.605
Incongruent	447.86 (45.44)	422.81 (30.23)	.027*	.938 (.073)	.939 (.070)	.970
Flanker Effect	57.67 (12.02)	29.68 (13.87)	<.001**	-	-	

* indicates statistically significant effect of $p < 0.05$. ** indicates statistically significant effect of $p < 0.001$

5.3.2.3 *Wisconsin Card-Sort Task*

In this test, participant's global (COMPLETED CATEGORIES) and local performance (PERSEVERATIVE ERRORS, NON-PERSEVERATIVE ERRORS) provide indices of cognitive flexibility and the ability to shift between sets (Barceló & Knight, 2002; Yudes, Macizo, & Bajo, 2011). On the whole, our participants completed 8.13 categories (SD = 1.27) out of the maximum of 9 categories in 128 trials. The data was then grouped based on participants' cultural switching frequency and analysed using a one-way Analysis of Variance (ANOVA). The aggregated values for the three indices are reported in Table 8.

Table 8. *Summary of components reported for frequent and infrequent switchers for the Wisconsin Card Sort Task.*

Measure	Infrequent Switchers (SD)	Frequent Switchers (SD)	P value
COMPLETED CATEGORIES	7.82 (1.44)	8.38 (1.06)	.123
PERSEVERATIVE ERRORS	13.27 (3.27)	12.69 (3.27)	.545
NON-PERSEVERATIVE ERRORS	8.77(7.46)	5.58 (2.87)	.049*

* indicates statistically significant effect at $p < 0.05$.

COMPLETED CATEGORIES reflects the participant's global performance and ability to sort correctly within a category, while also being able to make an appropriate switch when the rules change. In this test, the maximum number of categories participants could complete are 9 categories, with the sorting rule switching at random between colour, shape, or number after 10 consecutive correctly sorted trials. Although frequent switchers completed on average, more categories than infrequent switchers, no significant between-group differences were found [$F(1,46)=2.64, p=.123$].

PERSEVERATIVE ERRORS are a measure of failure in executive control to inhibit the previous sorting rule when an implicit rule change occurs. PERSEVERATIVE ERRORS indicated here record the

total number of incorrect selections made based on the prior sorting rule after a rule change, thus reflecting inflexibility in shifting between mental sets. Despite frequent cultural switchers performing better than infrequent switchers with a lower number of PERSEVERATIVE ERRORS, no significant between-group differences were found indicating no statistical differences between inhibiting the previous sorting rules [$F(1,46)=.372, p=.545$].

In contrast, NON-PERSEVERATIVE ERRORS reflect a participant's failure to keep within the existing sorting rule and ends up sorting differently when there has been no rule change. Frequent switchers performed better than infrequent switchers with an average of 3.19 fewer errors compared to infrequent switchers [$F(1,46)=4.068, p=.049$].

5.3.2.4 Attention Network Task

The Attention Network Task studies the efficiency of three attention networks: Alerting, Orienting, and Executive Control. Overall accuracy rates and average reaction time data were analysed with Welch's t-tests. Each of the three attention networks was then analysed using a 2 (trial-type⁴, within-subjects) $\times$ 2 (Switching Group, between-groups) mixed-ANOVA. Significant interactions were further subject to t-tests with the corresponding Attention Network Task index as the dependant variable.

Overall results. An independent samples t-test revealed no statistically significant differences between the average reaction time averaged across trial types for frequent cultural switchers ($M_{RT}=488.93, SD=59.81$) and infrequent cultural switchers ($M_{RT}=499.94, SD=63.01$), [$t(46)=.698, p=.48$]. Differences in mean reaction times across all participants for different cue types and trial conditions are illustrated in Table 9.

⁴ Trial types corresponding to three Attention Network Task indices: ALERTING (non-cue vs. double cue); ORIENTING (centre cue vs. spatial cue); CONFLICT (incongruent vs. congruent)

Table 9. *Reaction time and accuracy of frequent and infrequent cultural switcher's performance in the Attention Network Task. (* indicates statistically significant different of $p < 0.05$)*

	Reaction Time (SD)		Accuracy (SD)	
	Infrequent Cultural Switchers	Frequent Cultural Switchers	Infrequent Cultural Switchers	Frequent Cultural Switchers
No Cue	544.17 (65.7)	541.89 (70.8)	0.983 (0.023)	0.978 (0.018)
Double Cue	498.38 (59.7)	485.74 (59.6)	0.973 (0.032)	0.975 (0.024)
ALERTING Effect	45.79 (27.0)	56.15 (21.4)	-	-
Centre Cue	498.17 (64.5)	490.55 (63.2)	0.978 (0.032)	0.971 (0.026)
Spatial Cue	472.45 (58.7)	459.37 (59.3)	0.991 (0.015)	0.983 (0.016)
ORIENTING Effect	25.71 (30.1)	31.17 (25.4)	-	-
Incongruent	577.51 (80.9)	554.75 (66.8)	0.952(0.045)	0.947 (0.043)
Congruent	479.85 (55.9)	479.32 (63.9)	0.993 (0.012)	0.991(0.013)
CONFLICT (Executive control)	97.65 (34.8)	75.43 (27.9)*	-	-

Alerting Network. Overall, the participants performed faster on double-cued trials compared to no-cue trials, $t(47)=14.5$, $p<.001$. No differences in overall accuracy were observed between double-cued ($M=.974$, $SD=.028$) and no-cue trials ($M=.98$, $SD=.024$) [$t(47)=1.623$, $p=.111$]. A mixed-ANOVA revealed no significant differences between frequent and infrequent cultural switchers for average reaction time [$F(2,45)=1.61$, $p=.12$], or accuracy [$F(2,46)=.487$, $p=.61$]. Differences in the duration of the ALERTING EFFECT between groups were not significant [$t(46)=1.48$, $p=.145$].

Orienting Network. In general, spatial cued trials were responded to more quickly compared to central cue trials by the participants [$t(47)=7.211$, $p<.001$]. The participants were also more accurate in spatial cue trials ($M=.987$, $SD=.016$), with significantly higher accuracy than central cue trials ($M=.968$, $SD=.026$), [$t(47)=4.935$, $p<.001$]. A mixed ANOVA revealed no significant differences between frequent and infrequent cultural switchers in their reaction time

[$F(1,46)=.355, p=.554$], or accuracy [$F(1,46)=.084, p=.773$]. Differences between the central and spatial cued trials as measured by the ORIENTING EFFECT were not significant when comparing between groups, [$t(46)=.681, p=.499$].

Executive Control Network. On the whole, the effect of trial type was significant with participants performing faster on congruent trials compared to incongruent trials [$t(47)=18.03, p<.001$]. Moreover, they were significantly more accurate in responding to congruent trials ($M=.992, SD=.018$) compared to incongruent trials ($M=.94, SD=.065$) [$t(47)=6.975, p<.001$]. A mixed ANOVA revealed significant a significant effect of group where frequent and infrequent cultural switchers in their reaction time [$F(1,46)=3036.6, p<.001$], but not in accuracy [$F(1,46)=.714, p=.617$]. There was a significant group x trial type interaction effect for reaction times [$F(1,46)=6.02, p=.018$]. A follow-up t-test using indices of the Conflict (Executive control) effect as the dependent variable revealed frequent switchers had a significantly smaller CONFLICT EFFECT when compared to infrequent cultural switchers [$t(46)=2.45, p=.018$].

5.4 Discussion

As highlighted by Miyake and colleagues (2000), examining experimental tasks of executive functions can be highly complex and different tests of executive functions may include “nonexecutive processes within which the executive processing requirement is embedded” (p. 90). To mitigate this, the researchers suggested that using multiple tasks examining the same processes could provide a truer representation of the executive functions being tested. Hence, we adopted a battery of four widely used experimental tasks were used to elucidate differences in attentional, set-shifting and inhibition-control among our young bicultural-bilingual participants who differed on their self-report frequencies of cultural switching. We hypothesized that frequent cultural

switchers would perform better than infrequent cultural switchers in terms of their attentional processing and switching ability (Wisconsin Card-sort Test, Attention Network Test (Alerting and Orienting Networks)), and inhibition-control tasks as measured by stimulus-response incompatibility tasks (Simon, Flanker, Attention Network Test(Conflict/Executive Control Network)). Importantly, we found benefits such as faster reaction times in incongruent tasks and smaller conflict effects among frequent cultural switchers compared to infrequent cultural switcher even after controlling for a high level of bilingualism, IQ, and socio-demographic factors. Furthermore, frequent cultural switchers were significantly better at maintaining attention in the Wisconsin Card-Sort Test compared to infrequent cultural switchers.

5.4.1 Executive Functions Battery

Despite no significant differences between groups for the Simon task, frequent cultural switchers had a smaller overall Simon effect ($M=24.3\text{ms}$) compared to infrequent switcher ($M=34.85\text{ms}$). This initial result seems to suggest that participants from both groups may not differ in terms of inhibiting distractor interference in stimulus-response incompatibility tasks. However, the Flanker task revealed that frequent cultural switchers were significantly faster in selecting the ignoring incongruent stimuli and only selectively attending to the correct in direction of the arrowhead in incongruent trials than participants who were less frequent switchers. Frequent cultural switchers also exhibited a significantly smaller Flanker effect than their peers, suggesting greater efficiency in inhibition control processes (Cepeda, Kramer, de Sather, 2001). While the Simon task and Flanker task are often considered similar stimulus-response compatibility tasks in their purpose of elucidating the effects relating to inhibition-control, some studies have reported a larger interference effect in Flanker tasks compared to Simon tasks due to different neurophysiological processes (Hübner & Töbel, 2019; Stoffels & van der Molen, 1988; Mansfield,

van der Molen, Falkenstein, & van Boxtel, 2013). In addition to different neurological processes, Mückschel and colleagues (2016) suggest that differences could be due to differences in the way stimuli are presented in the tasks, with the source of interference being stimulus features for the Flanker task (i.e. direction of arrowheads) and spatial features in the Simon task (i.e. where a coloured circle appeared on screen). This could be the reason for detecting a statistically significant interference effect in the Flanker task but not in the Simon task among our participants, despite there being a smaller Simon effect for frequent cultural switchers when compared to infrequent switchers.

We focused on three measures of performance in particular for the WCST: COMPLETED CATEGORIES as a measure of global set-shifting ability, PERSEVERATIVE ERRORS indicate a failure to inhibit prior sorting rules when a rule change appears and indicate task-shifting ability, and NON-PERSEVERATIVE ERRORS indicate a failure to maintain set by sorting differently when the rule has not changed. Our findings indicate that bilinguals who were frequent cultural switchers were able to complete more categories and had fewer PERSEVERATIVE and NON-PERSEVERATIVE ERRORS compared to bilinguals who were infrequent cultural switchers, although the differences did not reach statistical significance. However, frequent cultural switchers made significantly fewer NON-PERSEVERATIVE ERRORS compared to infrequent cultural switchers. While the lack of statistically significant differences in terms of COMPLETED CATEGORIES and PERSEVERATIVE ERRORS indicate a lack of support for differences in global efficiency and set-shifting ability between frequent and infrequent cultural switchers, the presence of fewer NON-PERSEVERATIVE ERRORS has been associated with better inhibition-control. A study by Steinmetz and Houssemand (2011) compared the WCST to inhibition tasks such as the Go/No-Go and Stop-Signal tasks and found that scores on inhibition tasks predicted NON-PERSEVERATIVE ERRORS in the WCST. These findings are consistent with our

findings in the Flanker task, where frequent cultural switchers outperformed infrequent cultural switchers.

Finally, the Attention Network Task revealed that in trials where there was conflicting information, frequent cultural switchers were able to respond significantly more quickly in incongruent trials, as well as having a smaller conflict/incongruence effect compared to infrequent switchers on the whole. This provides evidence for a more robust EXECUTIVE CONTROL network where distractions were better inhibited from influencing their responses. Moreover, frequent cultural switchers showed slightly more efficient ALERTING and ORIENTING networks, although these gains did not result in statistical significance. Critically, the statistically better performance of the EXECUTIVE CONTROL network persists even after closely matching socio-demographic variables, non-verbal intelligence, as well as language proficiencies of all our bilingual participants. This suggests that biculturalism and bicultural switching frequency may play an important role in explaining conflicting results pertaining to whether a bilingual advantage in Executive Functions exists, especially in studies examining response inhibition. As the ALERTING and ORIENTING networks have been hypothesized to correspond with increased vigilance in responding to stimuli and ability to engage or disengage attention respectively (Posner & Fan, 2004), it would be interesting to find out if a larger and more varied sample of participants spanning a wider age range would result in statistically significant differences between frequent and infrequent cultural switchers. As earlier studies have found a decline in ALERTING networks when comparing young adults and the elderly (Jennings, Dagenbach, Engle, & Funke, 2007; Gamboz, Zamarian, & Cavallero, 2010), it would be valuable to examine if frequent biculturalism among ageing bilinguals may mitigate declines in attention and contribute a protective effect for the elderly.

Taken together, these findings agree with prior studies suggesting that cultural effects may contribute to honing inhibition skills as a result of enculturated behavioural self-regulation, a key cultural component in many Eastern (Asian) cultures (Carlson, 2005; Montgomery, Anderson & Uhl, 2008). The different experimental tasks converge to provide evidence that bicultural bilinguals who switch frequently between cultures may have an advantage in certain Executive Functions such as inhibition-control, but not in cognitive flexibility (set-shifting) and in terms of selective attention (alerting or orienting) compared to those who switch infrequently.

CHAPTER 6

6. GENERAL DISCUSSION

6.1 Summary of key findings

The impetus for this thesis was to understand the effect of biculturalism and bicultural switching on Executive Functions. The first study established that ethnic culture was still an important part of Singaporean young adult's identity. Despite being brought up in a highly Westernised country, the majority of our participants still maintained their ethnic identity and language within the home domain, especially so with their relatives and grandparents. The use of ethnic languages and ethnic cultural identification was greatly reduced when interacting with friends, colleagues, or in virtual and online interactions, where English remains the language of choice. Moreover, the majority of Singaporean young adults identified as belonging to more than one culture.

Building on these findings, Study 2 reports how our participants adopt significantly different cultural behaviours depending on who they were interacting with. Interestingly, this happened in spite of relatively homogeneous language behaviour – that is, most respondents spoke mostly English with all interlocutors except relatives and grandparents. The second study also provides empirical support for biculturalism among Singaporean young adults. Adapting earlier research paradigms by Hong and colleagues (2000), our results show that Singaporean young adults were not only bicultural but also able to switch between different cultures as seen from their significantly different ratings Western and Ethnic cultural primes. In addition, individuals who switched between cultural frames more frequently made a clearer distinction between Western primes than those who switched between cultural frames less frequently, suggesting that cultural

primes shown to bicultural Singaporean young adults influence cognition differentially depending on their frequency of switching between cultures.

Study 3 explored how bilingual participant's frequency of cultural switching impacted their performance on Executive Functions tests for inhibition-control (Simon and Flanker tasks), set-shifting (Wisconsin Card Sort Task), and attention (Attention Network Task). The results suggest that frequent cultural switchers had an advantage in the certain tasks of inhibition-control, such as resolving stimulus-response conflict more quickly in the Flanker task, and were better at tasks requiring participants to remember existing rules and determine if there was a rule change in the Wisconsin Card Sort Task. Finally, the Attention Network Task revealed that frequent cultural shifters were able to respond more quickly to incongruent stimuli conditions and had a smaller conflict/incongruence effect compared to infrequent switchers. Additionally, frequent switchers showed slightly more efficient ALERTING and ORIENTING networks, although these gains did not result in statistical significance.

6.2 The Relevance of Biculturalism to the Bilingual Advantage Debate

In recent years, a growing number of studies have returned null or contradictory results contesting the hegemony of a bilingual advantage in executive functions. In particular, Paap and colleagues (2015; 2018; 2019) have suggest that bilingual's use of multiple languages does not seem to enhance domain general abilities in selective attention or inhibition-control to a significant extent. As such, they, as well as many other scholars have suggested that other social and environmental factors may be contributing to enhancing performance on tests of executive functions that may sometimes result in contradictory findings. To this end, our findings that highly proficient bilinguals differed significantly in the time they took to resolve conflict in the Simon and Flanker tasks when grouped according to their frequency of day-to-day bicultural-switching seems to

suggest that inhibition and executive control can be honed by bicultural switching. In other words, our study shows that over and above bilingualism, frequent bicultural switching in an individual's daily life seems to facilitate inhibition-control. Consequently, biculturalism could be an important variable contributing bilinguals outperforming monolinguals on tests of executive functions in previous studies.

While the influence of culture has been highlighted in the literature on bilingualism approximately a decade ago (e.g. Carlson, 2009), it has only recently started gaining traction as an important and viable factor that could be contributing to the 'bilingual advantage' in Executive Functions (e.g. Wu, Zhang, & Guo, 2016). One recent article by Samuel and colleagues (2018) even attributed the differences observed between bilinguals and monolinguals solely to cultural differences, wherein their East Asian (Korean) participants performed significantly better than Western (British) participants in the Simon task regardless of the number of languages participants spoke. Our study contributes a unique perspective to the ongoing bilingual advantage debate by highlighting how cultural switching frequency may significantly influence the results of commonly used tests of Executive Functions. This research provides greater nuance to the concept of culture and bilingualism as it shines the spotlight on biculturalism amidst the broader, cultural narrative that may be considered an ecological overgeneralization, especially among the younger generation exposed to a multitude of cultural influences. As scholars wrestle with the question of whether a bilingual advantage in Executive Functions exists, especially with claims that the advantage is 'unverifiable' in studies predominantly targeting inhibition and selective attention (e.g. von Bastian et al., 2016; Paap et. al, 2018), our study brings to the fore the possibility that cultural switching among bicultural bilinguals could be contributing to the differing observations of effects among bilingual populations. As seen from Study 3, bilinguals who were closely matched in terms

of proficiency and ability had statistically significant differences in performance – frequent bicultural switchers performed better than their infrequent switcher peers, resulting in smaller conflict effects in tasks requiring inhibition.

In particular, bicultural switching effects may provide an explanation for the lack of a clear bilingual advantage in studies where participants may adopt significantly different cultural behaviours within and outside the home. One such example could be that of participants who are second- or third-generation immigrants. While previous studies have addressed the importance of distinguishing between immigrant and non-immigrant populations (Mezzacappa, 2004; Fuller-Thompson & Kuh, 2014), most studies in the literature on bilingualism do not typically consider the ‘carryover’ cultural effects for second- or even third-generation immigrants. Although these second-generation immigrants may be citizens of the country, those whose parents (first-generation immigrants) coming from a very different culture may find it difficult to reconcile the differences between the culture within and outside of the home. In fact, social and cultural psychologists have long been studying the different acculturation struggles of second-generation immigrants and the influence on their multicultural identity. For example, Stroink and Lalonde (2009) report how some second-generation Asian-Canadian immigrants found it difficult to integrate the differences between their Eastern family culture with the general Western culture in the larger society, resulting in a conflicting bicultural identity. Lee and Kim’s (2014) qualitative study of second-generation Koreans immigrants in Germany detailing different coping mechanisms and shifting strategies for bridging Eastern and Western culture in their daily lives such that individuals are able to “blend into both Korean and German societies, similar to a chameleon” (p. 97). This study’s examination of the impact of biculturalism on Executive Functions is merely the tip of the iceberg. It would be invaluable for future research to shed light

on important questions such as the differential effects of how integrated a bicultural's cultural identity is (Schwartz et al., 2017) and hone in on the differences between specific types of cultures (e.g. Eastern, Western, Latin American, European) and how these aspects contribute to the development of Executive Functions.

In addition, our study provides some support for the hypothesized augmenting of bicultural's cognitive abilities theorised in the acculturative complexity model (Tadmor & Tetlock, 2006). As seen in Study 3, bicultural bilinguals who are frequently switching between divergent cultures (implying their willingness and preference for both cultures) perform better in terms of inhibition compared to their peers who are less frequent switchers. In contrast, individuals who move between cultural frames less frequently could be thought of as individuals preferring one culture over the other or as those who do not have the exposure necessary to culturally diverse interactions in their daily lives. The model suggests that constantly coping with the need to resolve different cultural complexities and behaving 'appropriately' among interactants of different cultures may well enhance Executive Functions processes such as inhibition, cognitive flexibility, and selective attention. Indeed, frequent cultural switching bilinguals in our study were faster at resolving stimulus-response conflicts compared to bilinguals who were infrequent cultural switchers, indicating robust performance on tests of inhibition-control. Moreover, frequent cultural switchers were also better at directing attentional resources to maintain set in the Wisconsin Card Sort Task. While no significant differences between groups were found in indices of cognitive flexibility (Set shifting) and in the Alerting and Orienting networks in the Attention Network Task, it is unclear if these effects may have been reduced by the fact that our participants are highly proficient, young adult bilinguals who are at the zenith of their cognitive abilities. In fact, frequent cultural switching bilinguals were at a slight advantage in terms of performance in Alerting and

Orienting networks, hence, future studies of older adults who may not be functioning at their peak may provide further insight and tease apart other effects of bicultural switching on cognitive flexibility and attention.

Taken together, these findings have important implications for future studies in bilingualism as significant differences were observed between frequent and infrequent bicultural switchers even after our study controlled for a high level of bilingualism among our participants. With remote acculturation becoming a growing reality given the pervasiveness of online media and increasing internet penetration, future research needs to delve deeper to consider how bicultural experience and cultural switching habits of individuals across the lifespan can contribute to the discussion in order to tease apart potential confounds to the advantage in bilingual's Executive Functions.

6.3 Expanding what Constitutes A Bilingual's Interactional Context

The Adaptive Control Hypothesis by Green and Abutalebi (2013) proposes that a bilingual's interactional context places different demands on their cognitive control processes. As such, cognition adapts to different interactions, shaping each bilingual's Executive Functions in an individual and unique way. The scholars highlight three different contexts where bilinguals typically interact– 1) Single-Language context where languages are used in distinct, non-overlapping contexts, 2) Dual-Language contexts where both languages are used, but with different interlocutors, and where inter-sentential but not intra-sentential language switching takes place, 3) Dense Code-Switching contexts where languages are mixed even within the same utterance, such as the borrowing lexical or grammatical items from one language and inserting them into another language within the same sentence. These distinctions have been useful in contextualizing bilingual's language behaviour beyond broad categorizations of 'bilingual' and

‘monolingual’. Indeed, numerous studies to date have shown the value of such a distinction, showing how each of the different language contexts can modulate the bilingual advantage in different tests of Executive Functions (Yang et al., 2016; de Bruin, Samuel, & Duñabeitia, 2018; de Bruin, 2019).

Our study provides evidence that it is not just the language-based interactional context or code-switching frequency that may modulate bilingual’s performance in tests of Executive Functions. As we have seen from Study 3, highly proficient bilinguals demonstrated differences in performance when grouped by their cultural-switching frequency, even after being matched on a myriad of socio-demographic variables including intelligence, age of acquisition, language proficiency, social-economic status, and code-switching frequency. This drives home the relevance of bicultural switching frequency and biculturalism in studies of bilingual’s cognitive advantage in Executive Functions. Coupled with growing evidence of the role of macro-level (or country level) culture in studies of bilingual’s in Executive Functions (Posner & Rothbart, 2017; Samuel et al., 2018), there is a need to examine the results of a bilingual advantage incorporating a broader understanding of the role that socio-cultural factors play in contributing to gains in executive functions. Specifically, the current study provides a counterpoint to prior literature reporting no differences between bilinguals and monolinguals in Executive Functions tasks of inhibition-control processes where the effects of cultural background were not controlled for or included in the study design (e.g. Barac et al., 2016; Carlson & Meltzoff, 2008). To further exemplify, Kousaie and colleagues (2014) administered a series of inhibition-control tasks (Stroop Task, Simon Task) as well as set shifting tasks (Wisconsin Card Sort Task) to compare the performance of bilinguals and monolinguals across different age groups (young adults, elders). The reserachers did not find unequivocal evidence for a bilingual advantage – although bilinguals

performed better in the Stroop task, they did not show smaller interference effects in the Simon task and were even at a disadvantage in the Wisconsin Card Sort Task when compared to the monolingual participants. While the authors themselves allude to the possible effects of language environment modulating task performance, it is also possible that differences in bicultural identity, integration, and switching frequency could have emerged in their choice to recruit participants from parts of the country with distinctly different cultural milieus – Quebec City, a region with a very strong French nationalistic sentiment, and Ottawa that is more open to multiculturalism (Anderson, 2007; Meadwell, 1992).

Likewise, Naeem and colleagues (2018) reported how young adult bilinguals had slightly smaller Simon effect, but were outperformed by monolinguals in the Tower of London task (Planning). Although the researchers showed that socio-economic status predicted task performance in both tasks over language status (bilingual/monolingual), it is possible that cultural effects could have had a part to play in the bilingual's performance as it was not controlled for in the study design. While monolinguals recruited for the study were born and raised in Britain, the social background of the bilinguals recruited likely varied as the authors did not mention nor control for the where they came from or the languages they spoke. In fact, some bilinguals in the lower socio-economic status bands were immigrants who were refugees or asylum seekers. Finally, a study by Tran, Arredondo and Yoshida (2019) provide further support for the effects of culture on Executive Functions in which the researchers reported how Eastern cultural upbringing predicted performance even over language status (bilingual or monolingual) among their sample of young children from Eastern, Latin American, and Western cultures in a range of Executive Functions tasks, reiterating the pertinence of cultural effects in predicting performance of bilinguals in tests of Executive Functions.

In summary, while the exact implications and complex effects of culture on Executive Functions are still being teased apart, it is nonetheless evident that culture plays an important role in influencing a bilingual individual's cognitive abilities. Thus, we argue that greater emphasis needs to be placed on understanding not just the effects of broad, macro-level cultures, but also the influences of bicultural switching and the broader effects of biculturalism in future studies of a bilingual's cognitive advantage. Only by first taking into account the individual differences and socio-linguistic factors, broadening the current boundaries of what constitutes a bilingual's interaction context, will we be able to arrive at a better understanding of the unique contribution of bilingualism to Executive Functions.

CHAPTER 7

7. LIMITATIONS AND FUTURE RESEARCH

While great care was taken to control for various confounds, our study has a number of limitations. Our first limitation is based on our definition of biculturalism. We adopted a highly rigid approach in categorizing our bicultural participants according to how they would adopt a more Ethnic (East-Asian) or Western (American/British) way of behaving in different interactional circumstances. However, we recognize that some individuals may not view these cultures as being distinct or separate, and live out a blend of cultures (Benet-Martinez & Haritatos, 2005; Repke & Benet-Martínez, 2017). The differential effects of participant's views of each culture's compatibility, incompatibility, and blendedness are unknown at this stage. Future studies may look into these different constructs and examine the effect they have on bicultural switching among bilinguals. For instance, if a researcher theorises cultural blending as being a form of very efficient switching that has become second-nature to the individuals, studies can adopt more nuanced comparisons and finer gradations between frequent switchers and infrequent switchers can hone in on the effects that bicultural switching contributes to various Executive Functions.

Another limitation of the current study is that the medium of testing for all experimental studies was English based. As highlighted by a reviewer, the language of testing could possibly influence the results, especially for attributions made in the Fish task (Study 2). It would not be unreasonable to conjecture that if we primed our participants using instructions in ethnic language for the sections relevant to ethnic culture instead of English, we might see greater confidence ratings in internal attributions in the corresponding Fish task. Based on our current results, we have already seen a significant difference between the participant's level of confidence in made external attributions when primed with Western primes as compared to internal attributions when primed

with Ethnic primes. As such, we hypothesize that if participants were to respond to the cultural primes with instructions in their own ethnic languages, the confidence in making internal attributions when primed with Ethnic primes could be even higher than what we found if language were to be further thought of as another cultural prime. This would provide additional evidence for a language-culture interaction, and a follow-up study will be planned to include testing in both the participant's languages to confirm this hypothesis.

Moreover, it should be qualified that emotion could have played a moderating role in our findings. As cultural identification often engenders some form of emotional response, be it positively or negatively valenced, the effects of emotional attachment or individual's appraisal of a culture could influence the way in which participants responded to our questions. For instance, our participants in Study 2 were asked to reflect and making judgements about whether their behaviour was more Ethnic or Western with different interlocutors. These decisions can conjure a myriad of emotions tied to social desirability and norms based on their upbringing or the dominant social environment when thinking of their own identities and cultural experiences (Kitayama & Markus, 1994). Indeed, as language is often used as a means to encode emotional expression (Basnight-Brown & Altarriba, 2018), multilinguals have access not only to an increased range of emotional expression but may also associate particular feelings, emotions, and attachment to different languages. Hence, Future studies can interrogate the links between language, culture, and emotion to contribute to our understanding of how emotion and language choice can contribute to cultural identity, especially for multilingual and multicultural individuals.

Finally, due to the social and educational context Singapore, it was virtually impossible to find local Singaporeans to make up a monolingual group to fully tease apart the effects of biculturalism and bilingualism as all participants within our age range had gone through the

bilingual education system. Future studies can expand the scope of the study to examine the effects of cultural switching on four groups of participants: monocultural monolinguals, bicultural monolinguals, monocultural bilinguals, and bicultural bilinguals. This will allow for a more in-depth study which can isolate the effects of bilingualism, biculturalism, and bicultural switching frequency.

CHAPTER 8

8. CONCLUSION

We set out to find out if Singaporean young adults were bicultural, if they were able to switch between different cultural frames, and if this switching ability would influence their performance on tests of Executive Functions. By using both self-report and empirical data, we were able to confirm that biculturalism is the norm among the majority of Singaporean young adults and that many of these individuals are able to fluidly move between different cultural worlds when interacting with others. Indeed, most Singaporean young adults are not just bilingual but are able to draw on cultural resources from at least two cultures – their ethnic culture and Western culture in their daily lives. In addition, this thesis provides the first look at the effects of biculturalism on Executive Functions among highly proficient bilingual young adults and provides evidence for how biculturalism and bicultural switching frequency can influence bilingual's performance on tests of Executive Functions. Even when our participants were high proficiency, young adult bilinguals matched on a variety of sociolinguistic variables, we still found an effect of bicultural switching on Executive Functions tasks, especially those measuring inhibition-control processes.

Critically, our research reiterates the importance of considering socio-cultural variables that may explain the lack of consensus as to whether a bilingual advantage in Executive Functions exists. With a growing body of research examining the relevance of cultural effects within the field, this thesis draws attention to the effects of biculturalism on bilingual's Executive Functions as we believe that biculturalism is becoming increasingly ubiquitous in today's globalised world. This is certainly aligned with the growing call by scholars worldwide to capture a more detailed sociolinguistic context that their bilingual participants are exposed to or have been brought up in,

so as to mitigate potential confounds and tease apart the true effects of bilingualism on Executive Functions.

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Appendix A: Participant Demographics and Language/Cultural Identity (Study 1)

Q1 What is your gender?

- ☐ Male
- ☐ Female

Q2 How old will you be at your birthday this year?

Q3 What is your ethnicity?

- ☐ Chinese
- ☐ Malay
- ☐ Indian C

Q4 What is your gross household income? (Total combined income of all working individuals in your household)

- ☐ Below \$4,000
- ☐ Between \$4,000 - \$8,000
- ☐ Between \$8,000 - \$12,000
- ☐ Above \$12,000

Q5 What are your parents' highest educational qualifications?

Father	N.A.	Primary school	Secondary School	Nitec/Diploma/A levels	University degree	Postgraduate degree
Mother	N.A.	Primary school	Secondary School	Nitec/Diploma/A levels	University degree	Postgraduate degree

Q6 What was your 'Mother Tongue Language' in school?

- ☐ Mandarin
- ☐ Malay
- ☐ Tamil

Q7 How many languages do you speak?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ More than 3

Q8 What languages do you know or speak? (Please select ***all*** languages you know/use)

- ☐ English
- ☐ Mandarin
- ☐ Malay
- ☐ Tamil
- ☐ 'dialects'
- ☐ Others: 'Ethnic' languages (e.g. Hindi, Telugu etc)
- ☐ Others" 'Interest' languages (e.g. French, Japanese etc)

Q9 ***At what age*** were you ***first exposed*** to the following languages?

(only previously selected language options in Q8 will appear for participants to select)

	Since I was born	before 3 y.o.	before 6 y.o.	7 years old	8 years old	9 years old	10 years old	11 years old	12 years old		After 20 years old
English	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Mandarin	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
.											
.											
.											

Q10 ***How long have you spoken*** the following languages?

(only previously selected language options in Q8 will appear for participants to select)

	More than 10 yrs	Between 7-10 yrs	Between 5-7 yrs	Around 5 years	Between 3-5 yrs	Between 1-3 yrs	Less than 1 yr
English	☐	☐	☐	☐	☐	☐	☐
Mandarin	☐	☐	☐	☐	☐	☐	☐
.							
.							
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Q11a How good you are at ***speaking*** these languages?

(only previously selected language options in Q8 will appear for participants to select)

	Extremely Poor	Very poor	Poor	Average	Good	Very good	Excellent
English	☐	☐	☐	☐	☐	☐	☐
Mandarin	☐	☐	☐	☐	☐	☐	☐
.							
.							
.							

Q11b Please rate how well you ***understand*** these languages

(only previously selected language options in Q8 will appear for participants to select)

	Extremely Poor	Very poor	Poor	Average	Good	Very good	Excellent
English	☐	☐	☐	☐	☐	☐	☐
Mandarin	☐	☐	☐	☐	☐	☐	☐
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Q11c Please rate how well you are ***able to read*** in these languages

(only previously selected language options in Q8 will appear for participants to select)

	Extremely Poor	Very poor	Poor	Average	Good	Very good	Excellent
English	☐	☐	☐	☐	☐	☐	☐
Mandarin	☐	☐	☐	☐	☐	☐	☐
.							
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.							

Q12 *How frequently* do you speak these languages?

(only previously selected language options in Q8 will appear for participants to select)

	I don't speak it anymore	Yearly	Once every few months	Monthly	Once in 2 weeks	Weekly	At least 3x a week	Daily
English	☐	☐	☐	☐	☐	☐	☐	☐
Mandarin	☐	☐	☐	☐	☐	☐	☐	☐
.								
.								
.								

Q13 To what extent do you agree with the following statements?

	Strongly Disagree	Disagree	Somewhat Disagree	Neither agree nor disagree	Somewhat Agree	Agree	Strongly Agree
My ethnic language is essential in building relationships with my immediate family.	☐	☐	☐	☐	☐	☐	☐
My ethnic language is essential in building relationships with my extended family.	☐	☐	☐	☐	☐	☐	☐
My ethnic language is essential in building relationships with my friends.	☐	☐	☐	☐	☐	☐	☐
My ethnic language is an important part of my identity.	☐	☐	☐	☐	☐	☐	☐
I would be sad to lose my ethnic language.	☐	☐	☐	☐	☐	☐	☐
Being able to speak my ethnic language is a critical part of my self-definition.	☐	☐	☐	☐	☐	☐	☐
I am still (Chinese/Indian/Malay) even if I don't speak my ethnic language.	☐	☐	☐	☐	☐	☐	☐
I am still (Chinese/Indian/Malay) even if I can't speak my ethnic language.	☐	☐	☐	☐	☐	☐	☐
My ethnic culture is an important part of who I am.	☐	☐	☐	☐	☐	☐	☐
I feel a strong sense of attachment to my ethnic culture.	☐	☐	☐	☐	☐	☐	☐
I view myself as belonging to more than one culture.	☐	☐	☐	☐	☐	☐	☐

Appendix B: Bicultural Switching and Language/Cultural Behaviour (Study 2)

Start of Block: Bicultural switching (Western)

Q1. Drag the following items into their respective categories
(Note: Some words will not be classified)

Items	Food Items	Festivals
California		
Christmas		
London		
Bacon		
Thanksgiving		
Beer		
New York		
Easter		
Garden salad		
Ice cream		
Coffee		
Steak		

Q2 Which of the following pictures is most symbolic of the West?

Q3 Which of the following food items is most iconically Western?

Q4 Suppose you are asked about the **characteristics of Western culture** by someone who knows nothing about it. How would you describe it? You can describe the way the community behaves, or talk about what is distinctive about the culture.
E.g. Independence and freedom of expression are important characteristics of Western culture.
Please write 5 statements that describe Western culture.

Q5 In your opinion, is the fish on the right **leading** the other fishes, or **being chased** by them?

Fish is leading

0

6

Fish is being chased

12

End of Block: Experimental block (Western)

Start of Block: Bicultural Switching (Control)

Q6 Drag the following items into their respective categories

Items	2 dimensional shapes	3 dimensional shapes
Circle		
Line		
Rectangle		
Cube		
Pyramid		
Parallelogram		
Sphere		
Cone		
Triangle		
Square		

Q7 In your opinion, which is the most versatile colour?

☐	☐	☐
☐	☐	☐

Q8 Which landscape is the most peaceful?

☐	☐	☐
☐	☐	☐

Q9 Suppose you are asked to describe your favourite landscape/scenery - What would you say?

Please write **5 statements that describe your ideal landscape/scenery.**

Q10 In your opinion, is the fish on the right **leading** the other fishes, or **being chased** by them?

Fish is leading
1

6

Fish is being chased
12

End of Block: Experimental block (Control)

Start of Block: Bicultural Switching (Ethnic)

*Note: Participants were only shown the relevant primes based on their ethnicity reported previously.

For participants of Chinese ethnicity:

Q11C. Drag and drop the following items into their respective categories.
(Note: Some words will not be classified)

Items	Food Items (食品)	Festivals (节庆)
中国		
小龙包		
人民币		
中秋节		
万里长城		
面线		
中国茶		
北京		
上海		
饭		
农历新年		
汤圆		

Q12C. Which of the following pictures is most symbolic of the Chinese culture?

Q13C. Which of the following food items is most iconic to you as a Chinese?

Q14C. Suppose you are asked about the **characteristics of Chinese culture** by someone who knows nothing about it. How would you describe it? You can describe the way the community behaves, or talk about what is distinctive about the culture. E.g. Respect for one's elders is important in Chinese culture. Please write **5 statements that describe Chinese culture**.

Q15 In your opinion, is the fish on the right **leading** the other fishes, or **being chased** by them?

Fish is leading

1

6

Fish is being chased

12

For participants of Malay ethnicity:

Q11M Drag and drop the following items into their respective categories.
(Note: Some words will not be classified)

Items	Food Items	Festivals
Nasi Lemak		
Baju Kurung		
Malaysia		
Hari Raya		
Mee Rebus		
Sarong		
Indonesia		
Ramadan		
Sayur Iodeh		
Nasi Goreng		
Sambal belacan		
Hari Raya Puasa		
Rendang		

Q12M Of these pictures, which is the most iconic representation of Malay culture?

Q13M Which of the following food items is most iconic to you as a Malay?

Q14M Suppose you are asked about the **characteristics of Malay culture** by someone who knows nothing about it. How would you describe it? You can describe the way the community behaves, or talk about what is distinctive about the culture. E.g. Respect for others is an important part of Malay culture. Please write **5 statements that describe Malay culture**.

Q15 In your opinion, is the fish on the right **leading** the other fishes, or **being chased** by them?

Fish is leading
1

6

Fish is being chased
12

For participants of Indian ethnicity:

Q11I Drag and drop the following items into their respective categories.

(Note: Some words will not be classified)

Items	Food Items	Festivals
Masala		
Ganges		
Hyderabad		
Naan		
Diwali		
Calcutta		
Roti		
Tikka		
Bombay		
Sayur lodeh		
Aloo Gobi		
Holi		

Q12I Which picture is most iconic to you as an Indian?

Q13I Which of the following food items is most iconically Indian?

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Q14I Suppose you are asked about the **characteristics of Indian culture** by someone who knows nothing about it. How would you describe it? You can describe the way the community behaves, or talk about what is distinctive about the culture. E.g. Respect for one's elders is an important part of Indian culture. Please write **5 statements that describe Indian culture**.

Q15 In your opinion, is the fish on the right **leading** the other fishes, or **being chased** by them?

Fish is leading

1

6

Fish is being chased

12