

The complexity of individual and socio-cultural ecology : interaction of genes and attachments on intercultural experience

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**NANYANG
TECHNOLOGICAL
UNIVERSITY**

**THE COMPLEXITY OF INDIVIDUAL AND
SOCIO-CULTURAL ECOLOGY:
INTERACTION OF GENES AND ATTACHMENTS ON
INTERCULTURAL EXPERIENCE**

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NANYANG BUSINESS SCHOOL

2016

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ON INTERCULTURAL EXPERIENCE**

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Acknowledgements

While this dissertation may be the finishing touch to my Ph.D. journey, I know this is merely the end of a beginning. But while I can make my plans, it is the Lord who directs my steps (Proverbs 16:9). Throughout the years, even since before I embarked on this journey, He has indeed been faithful. I am humbled and truly blessed to experience His provisions for me again and again. It is indeed His presence and His call that gave me meaning and the means to persevere in this unbelievably challenging endeavor.

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manner or tone so objective that I can never refute him. I am truly very blessed to have a great man like him in my corner.

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Abstract

In this age of globalization, sojourning is becoming an increasingly common experience. This prospective study sought to examine the differential effects of maternal, paternal and cultural attachments on young adults' ($n = 305$) ability to adapt to a foreign culture. 258 control participants were included to demonstrate the uniqueness of cross-cultural adaptations. In addition, this study also looked at whether one's genetic predisposition moderated the relationship between attachments and intercultural adjustment.

Current findings suggest paternal and cultural attachments were of particular importance. These effects were not present if participants were not in a foreign culture. Furthermore, overprotectiveness of fathers was especially important to how difficult sojourners perceived the cross-cultural experience to be, but it was the care dimension that predicted whether having a difficult experience led to lower self-esteem when sojourners returned home. Lastly, individual's genetic predispositions did moderate the effect of attachments on how much difficulties individuals experienced overseas.

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Chapter 1

Introduction

The current century has been increasingly described as a VUCA era – volatile, uncertain, complex and ambiguous. The technological advances in information technology, communication and aviation in this age of globalization have made the world much smaller and faster. People are no longer isolated or restricted to a limited number of geographical locations. Cross-cultural interactions have also become common-place; within two decades, the population of international migrants has increased by more than 50% worldwide (Harvey & Moeller, 2015), with 3.2% of the world's population (i.e., 232 million people) living in a foreign country in 2013 (UN International Migration, 2013). Market research by Finaccord (2014) revealed that the total expatriate population relative to world population has increased from 0.68% in 2009 to 0.72% in 2013. This is expected to increase over the next four years to 0.77% in 2017. In the domain of education, the number of international students has doubled from two million in 2000 to at least four million in 2012 (UNESCO Institute for Statistics, 2014). This population of international students is expected to grow the most rapidly among expatriates at an annual rate of 3.6%, followed by individual workers at a rate of 3.2% (Finaccord, 2014).

In a recent report by Brookfield Global Relocation Services (2015) stated international mobility of human resources and the development of international managers or leaders is an increasingly critical issue for businesses. Many expatriates have cited personal and professional development or career advancement as key reasons for accepting international assignments (Ayoun, Rowe, & Eyoun, 2014; Cartus Corporation, 2014; Stahl, Miller, & Tung, 2002; Suutari & Brewster, 2001; Thorn, 2009). Many universities have international exchange programs to send their students

overseas with the assumption that such exposures will allow the students to develop a global perspective and hence become more competitive in the marketplace (e.g., Institute of International Education, 2013). The number of incoming and outgoing exchange students in National University of Singapore have been increasing from 533 outgoing (2.41% of the undergraduate population that year) and 741 (3.35%) incoming exchange students in 2005 to 1966 (7.2%) outgoing and 1849 (6.78%) incoming in 2014 (NUS International Relations Office, 2014). This increasing number of expatriates and international students thus reflects the increasing global mobility and comprise of the bulk of sojourners who leave their country of origin for a period of time for livelihood.

Differential sensitivity to external and intrapsychic environment

The uncertainties embedded within change in cultural environment can cause stress and anxiety that arise together with the need to adapt fast. Such a demand on sojourners' biological and psychological systems may result in dysfunction (Hinkle, 1974). However, that said, there are huge individual differences in how the cross-cultural experience is appraised, interpreted and thus managed (Berry, 2006). Earlier work on psychological stress (e.g., Lazarus, 1966) reported individuals responded differently to the same stressful situation; the same circumstances may be detrimental for some, yet neutral or even beneficial for others (Lazarus, 1998).

Individual difference in stress response may be partly attributed to one's biological sensitivity to the environment. Biological sensitivity can be partly attributed to genetic variation that can influence one's patterns of selective attention and subsequently reaction and behavior (Bronfenbrenner & Ceci, 1994). This may be related to heightened physiological reactions to the stimuli in the immediate environment. As early as the nineteenth century, the autonomic nervous system has

been suggested to implicate one's emotional (James, 1884) and stress responses (Lazarus, 1998; Schachter & Singer, 1962).

Genetically determined sensitivity is not limited to particular types of social stimuli. For example, an individual who is socially sensitive because of the genetic predisposition will be sensitive to both negative and positive experiences, which is then consequently reflected in respectively stronger negative or positive effects on the self's well-being (J. Belsky & Pluess, 2009) relative to other people who are not as sensitive.

Much research on genetic sensitivity has focused on interaction with external environment, such as the neighborhood one lives in (Simons et al., 2012), being in intervention programs (Brody, Beach, Philibert, Chen, & Murry, 2009), richness of environment (Francis, Diorio, Plotsky, & Meaney, 2002) and many others. However, given that most physiological reactions are ambiguous and require top-down appraisals to attribute meaning to it (Cantril & Hunt, 1932), genetic moderation may also occur with individual's intrapsychic environment which relates to the way one perceives the ambiguous social world. According to attachment theory, one's intrapsychic environment is largely shaped by relationships with one's caregivers.

More than just biological, social and cognitive beings, humans are also emotional beings who reflect on their own experiences and react idiosyncratically as influenced by their past experiences (Richman & Leary, 2009). As such, one's past or existing attachments to significant others becomes a powerful framework that shapes a person's beliefs and theories about the social world. Attachment to caregivers, such as maternal care during childhood (Ainsworth, 1979), has been consistently shown to have powerful effects on the child's later social competence and emotional regulation (Cooper, Shaver, & Collins, 1998), appraisal of threatening situations (Mikulincer &

Florian, 1995), optimism (Baldwin, Keelan, Fehr, Enns, & Koh-Rangarajoo, 1996; Collins & Read, 1990; Radecki-Bush, Farrell, & Bush, 1993; Shorey, Snyder, Yang, & Lewin, 2003) trustfulness and openness to seeking help (Mikulincer, 1998; Mikulincer & Shaver, 2007; Mikulincer, Shaver, Sapir-Lavid, & Avihou-Kanza, 2009).

Other than parents, individuals can also become attached to the culture they grew up in. Such attachment to home culture has also been shown to affect how well one adjusts to foreign culture (Fu, Morris, & Hong, 2015; Hong, Fang, Yang, & Phua, 2013). This emotional attachment to home culture has been shown to alleviate the negative emotions that are experienced during cultural transitions, which in turn contributes to better cross-cultural adjustments.

This thesis thus lies at the intersection of existing work on sociogenomics and cultural psychology by exploring how one's genetic endowments may interact with both the (a) sojourners' intrapsychic environment shaped by one's parental and cultural attachment histories and (b) the external host environment to affect cross-cultural adjustments. This will add to knowledge in both the gene-by-environment literature and existing work on cultural adjustments by integrating the social-psychological and biological aspects underlying individual differences to stress response. Furthermore, I will argue that cultural transitions are highly complex phenomena that require deeper analyses into the nature of the cross-cultural adjustment and subsequent consequences on perception of self and society.

Multi-faceted nature of cultural transitions

Though it is not a permanent change, adjusting to another culture is still a multi-faceted and highly immersive experience for sojourners. Firstly, sojourners have to navigate a very different physical and social environment to manage day-to-day living in the host country. There is the loss of the familiar and certainty in the

mundane tasks that even trivial errands, such as finding food, requires more cognitive and emotional resources than required in the home environment. Interacting with people of a different culture will require knowledge of another language or customs that may elude novices of that culture.

Different bodies of work have examined the multi-faceted nature of cultural transitions by determining the stressors underlying acculturative stress (e.g., Arends-Tóth & Van de Vijver, 2007; Searle & Ward, 1990) or the adjustment patterns different groups of sojourners display (Demes & Geeraert, 2015; Wang et al., 2012). However, to my current knowledge, no research has simultaneously examined the variation in sojourner adjustment to the various stressors intrinsic to cross-cultural transition. In cultural transitions, stressors that range from the novel physical or objective environment – such as having to navigate an unfamiliar neighborhood or live in a very different climate, to more interpersonal such as interactions with, perceptions of or being discriminated by the host nationals. As such, in order to understand the effects of genetics with intrapsychic and external environments, it is necessary to first examine how sojourners vary in responses to various stressors in cultural transitions.

Costs of poor adjustments to cultural transitions

For businesses, it can be very costly for the home organization when their expatriate adjust poorly to an overseas assignment (Cole & Nesbeth, 2014). Such maladjustments often result in early termination of assignment, damaged reputation or relationships in the host country, and higher turnover as the repatriated employee is more likely to resign upon return (Bhaskar-Shrinivas, Harrison, Shaffer, & Luk, 2005; Mayrhofer et al., 2014). In the international student population, such acculturative stress can lead to anxiety and depressive symptoms (e.g., Crockett et al., 2007; J.-S. Lee, Koeske, & Sales, 2004; Sirin, Ryce, Gupta, & Rogers-Sirin, 2013), eating

disorders (Kroon Van Diest, Tartakovsky, Stachon, Pettit, & Perez, 2014) and lower career aspirations (Reynolds & Constantine, 2007). Lowered self-esteem has far-reaching implications for mental health and well-being (e.g., Baumeister, 1993; Harter, 1993; Spencer, Josephs, & Steele, 1993). As such, impact on self-esteem is utilized as a proxy outcome in this research to investigate if cross-cultural experience is indeed beneficial for everybody.

While cross-cultural difficulties have been shown to have significant impact on the individual and businesses, not much is known about how it affects the home nation of the sojourners. As individuals are immersed in another culture, the values they inherited from their native culture can change significantly (Vuong & Napier, 2015). These individuals now have a larger pool of cultural capital to draw from in forming their identity and sense of place in the world, hence sojourners can potentially change in their patriotism to home nation (Kluver & Weber, 2003).

Therefore, this thesis will examine the effects of genetic moderation of cross-cultural difficulties on two consequences – personal consequences in terms of self-esteem, and societal consequence in terms of sojourners' patriotism to home nation. The general conceptual model is illustrated in Figure 1.

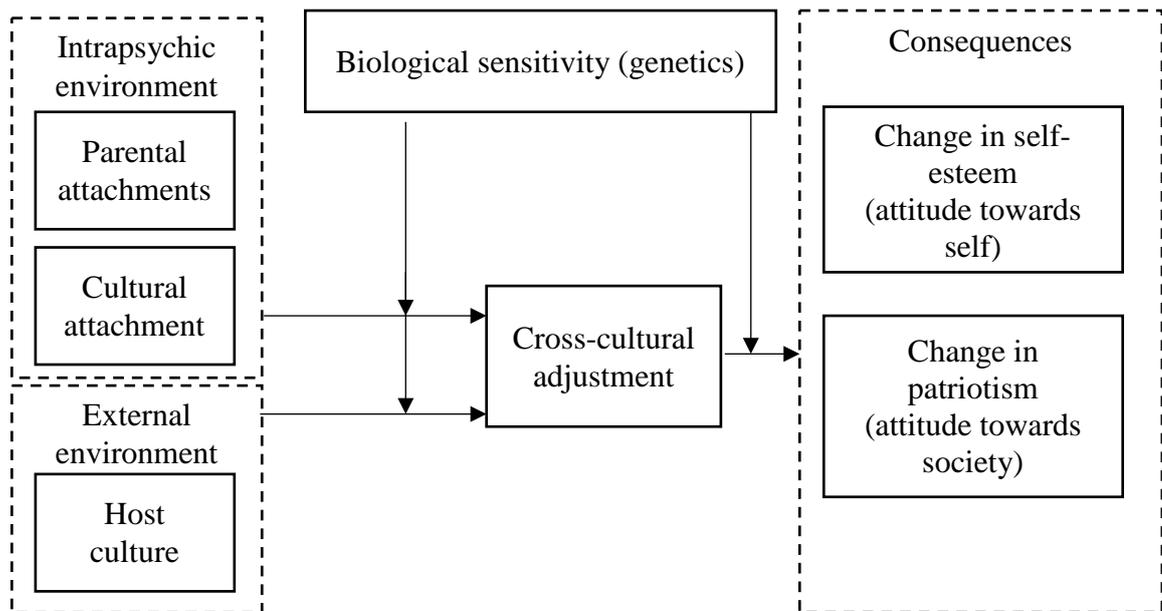


Figure 1. General conceptual model.

Research design, overview and contributions

The current research seeks to integrate molecular genetics and cultural psychology to better understand individual differences in adjusting to cultural transition and the consequences of said adjustments within a prospective design. There are three phases in this study: pre-trip (Phase 1), the cross-cultural process while in the host country (Phase 2) and post-trip (Phase 3). To better understand the nature of the adjustment overseas, I first sought to uncover whether there are distinct aspects to cross-cultural difficulties (e.g., physical and interpersonal stressors) and whether sojourners can be clustered in terms of how they respond to the different types of difficulties. This will allow for more powerful analysis as the quality of intercultural adjustments may vary for disparate difficulties and/or sojourners. Moreover, to demonstrate the uniqueness of adjustment to cultural transitions, a control group of participants are included. These control participants are similar to experimental group in demographic terms and undergo similar experimental procedures. However, the controls did not travel overseas throughout the duration of this study. Significant effects of attachments on psychological health found in sojourners but not control

participants thus suggest that they are due to the unique circumstances of cross-cultural transition.

This research contributes to the literature of cultural adjustment and gene-by-environment interactions in several ways. (a) Firstly, while most gene-by-environment research was focused on external environment, this thesis applies attachment theories to examine putative interaction of genes with one's intrapsychic environment. (b) In addition, multiple attachments (i.e., to parents and culture) are examined to better understand individual variation with respect to different intercultural difficulties. (c) Moreover, this research does not merely examine the consequences of cross-cultural difficulties on the attitudes toward self but society as well, in terms of returning sojourners' sense of patriotism to their home nation.

Chapter 2

Literature review & development of hypotheses

Difficulties with adjusting to foreign culture

Difficulties with adjusting to foreign culture, or acculturation, can be approached from three theoretical perspectives: cultural learning, acculturation stress (Berry, 2006) or psychological acculturation with change in social identity (Matsudaira, 2006). According to Berry's (1997, 2006) acculturation stress perspective, sojourners or immigrants adjusting to new cultures will have many new experiences as they make contact with host nationals who are culturally different, participate in various social activities and solve various trivial daily problems or hassles. As individuals transit to live in another culture for a substantial period of time, there will be many circumstances or demands that are novel, unpredictable, uncertain or ambiguous (Hunley, 2010) as well as the need to make lifestyle changes to accommodate the new physical and sociocultural environment (Searle & Ward, 1990). These incidents can be interpreted as either stressors or opportunities, which then contribute to the various psychological and psychosomatic stress symptoms. In addition to such uncertainties, sojourners will also need to deal with acculturation-related hassles (Abouguendia & Noels, 2001; Lay & Nguyen, 1998) that, though minor, can have significant effect on their psychological well-being and adaptation in the new culture.

Searle and Ward (1990) adopted the stress paradigm in the study of acculturation. In their study, they conceptualized problems with cross-cultural transitions as either psychological or sociocultural; the former being having depressive symptoms and the latter as having difficulties managing day-to-day affairs such as eating and shopping in the host environment. Though the two forms of adjustments

were correlated, they were predicted by distinctly different antecedents. Psychological adjustment was predicted by antecedents such as interpersonal relationships with host nationals and sociocultural competence; sociocultural adjustment was predicted by antecedents such as cultural distance. With this, they concluded the need to consider both psychological and sociocultural factors within the acculturation process that may be differently explained by the various existing theoretical paradigms.

Other than psychological or sociocultural, other dimensions of cross-cultural adjustments have also been proposed. A study on Turkish immigrants suggested the distinction in adjustment between the private and public domains, with the former referring to more personal affairs such as celebrations or habits and the latter referring to the more impersonal sphere such as language and social participations (Arends-Tóth & Van de Vijver, 2007). Differential consequences have also been demonstrated with another group of Belgium adolescents whose self-esteem during a cultural exchange program was predicted by intrapersonal and intergroup factors, such as homesickness and affection for the host country respectively, but not interpersonal factors such as availability of social support (Geeraert & Demoulin, 2013).

Furthermore, different sojourners may also experience the cross-cultural process differently. A recent longitudinal study including approximately 2,500 adolescents on an exchange program showed five patterns of stress management sojourners exhibited during their sojourn (Demes & Geeraert, 2015). An earlier study on Chinese international students in the United States likewise showed multiple trajectories of psychological distress over three semesters of studies, each with different implications on the sojourners' self-esteem, perception of their problem-solving ability and perfectionism (Wang et al., 2012).

Given the existing evidence that demonstrates the multi-faceted nature of cultural transition, it is expected that the difficulties sojourners experience in the current research can be classified into multiple aspects. In statistical terms, multiple factors are expected to underlie variation in intercultural adjustment measured in this study. Given the evidenced in past research, at least two factors are hypothesized to be important in this study – one factor related to impersonal aspect of cultural transitions, such as navigating an unfamiliar environment; and the other factor to be more interpersonal and related to relationships with host nationals – Hypothesis 1.

Given that there are at least two studies demonstrating that sojourners may be heterogeneous in their cultural adjustment patterns while overseas, the homogeneity of sojourners in intercultural adjustment in the current study will also be tested. Other longitudinal studies have found acculturation stress to be highest in first six months (e.g., Geeraert & Demoulin, 2013; Ying, 2005). Furthermore, decreasing trend in depressive symptoms was found to reverse for a group of sojourners after four months of stay in a foreign culture (Ward, Okura, Kennedy, & Kojima, 1998), suggesting other factors coming into play that affect individual differences in intercultural adjustment. As such, high levels of stress or difficulties are expected to be common among sojourners, which will in turn be reflected in initial lack of heterogeneity in intercultural adjustment difficulties. Heterogeneity in intercultural adjustment is likely to be increasingly obvious as length of stay increases due to individual differences in stress management or emotional regulation. However, due to the short sojourning period (i.e., four to six months) in the current sample, heterogeneity among sojourners is not expected to be significant.

Biological sensitivity to environment

The theory that an individual's emotional response is both biological and psychological has existed as early as the nineteenth century (James, 1884). As individuals go about their day-to-day affairs, there may be many environmental stimuli that trigger a physiological response (Schachter & Singer, 1962) that the individual may or may not be consciously aware of. These ambiguous physiological reactions often require top-down appraisals, which in turn form the basis of emotional responses (Cantril & Hunt, 1932). While the classic theories of emotions may differ on whether the physiological response or attributions come first, none deny the relevance and importance of biology to one's emotional and stress response to the environment.

Our current understanding of the relevance of biology has expanded beyond physiological reactions to the deeper insights of neuroscience and genetics; yet the same old question of nature or nurture is still posed. Often implicit in the search for quantifiable or differentiable effects of genes versus environment is the erroneous assumption that a psychological trait arises from the sum of the individual contributions of environment and genes (Gottesman & Hanson, 2005). Neither genes nor environmental influences can function independently as one depends on the other; all phenotypes are the result of the synergistic and non-additive interaction of the individual's genome and the contexts (Meaney, 2001). This synergistic interaction can take many forms: from stress or emotional responses under stress, differentiated perceptions and thus responses to stimuli in environment, to the individual modifying and constructing of the environments one is in (Bronfenbrenner & Ceci, 1994).

The gene-environment effect was first approached with the diathesis-stress paradigm commonly adopted in the field of psychopathology once (Monroe & Simons, 1991); genetic predisposition was seen as a risk factor that made some individuals

more vulnerable to stressors than others (J. Belsky et al., 2009). However, later studies found that it is not just vulnerability to negative circumstances that is genetically determined. Individuals with these “risky genes” also reaped greater benefits from nurturing environments or interventions (e.g., Bakermans-Kranenburg, Van IJzendoorn, Mesman, Alink, & Juffer, 2008; Bakermans-Kranenburg, van IJzendoorn, Pijlman, Mesman, & Juffer, 2008; Laucht et al., 2012; Simons et al., 2012; Sweitzer et al., 2013; Taylor et al., 2006). This is also known as the differential susceptibility hypothesis (J. Belsky & Pluess, 2009). Sensitivity to positive experiences resulting in greater-than-average beneficial consequences is also known as vantage sensitivity (Pluess & Belsky, 2013). As such, sensitive individuals can benefit greatly from positive cross-cultural experiences rather than being merely sensitive to stress and adjustment difficulties.

Candidate-gene studies. Investigation into gene-environment interaction in mental disorders, or complex human behaviors and psychological traits in general, exploded with Caspi’s and colleagues (2003) Science paper on life stress, serotonin transporter gene polymorphism (5-HTTLPR) and depression. In this longitudinal cohort study, individuals with the short allele polymorphism had greater depressive and suicidal symptoms than their peers who experienced similar number of stressful life events (Caspi et al., 2003). Since then, the 5-HTTLPR has been very widely explored in the area of gene-environment interactions on behaviors.

Variations in genes encoding components of the neurological systems related to stress and emotional responses are likely to result in individual differences in neurobiological sensitivity to environmental cues, changes and stimuli (Ellis, Boyce, Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2011). Taking the serotonin transporter as an example, individuals with the short variant of the 5-HTTLPR have

been found to be less capable of disengaging their attention from emotional stimuli, suggesting that they are more sensitive to emotions (Beevers, Wells, Ellis, & McGeary, 2009). This is likely to be related to their heightened amygdala activity, a brain region largely responsible for emotions (Gillihan et al., 2010). This increased emotional reactivity has also been implicated in the stronger negative impact of childhood maltreatment on risk of persistent depression (Uher et al., 2011), and current life events on neuroticism (Pluess, Belsky, Way, & Taylor, 2010) and depression (Caspi et al., 2003). Individuals with the short allele are more likely to show unresolved attachment, likely due to a short circuited emotional regulatory system which can lead to heightened affective intensity when reflecting on past loss (Caspers et al., 2009). Furthermore, a fMRI study suggested these individuals are also more likely to ruminate on life stressors, as indicated by higher amygdala activation at rest (Canli et al., 2006).

The dopamine D4 receptor is also a commonly studied gene in the field of gene-environment interaction. Children with the 7-repeat variant of the gene are more likely to exhibit disorganized attachment behavior if the mothers have unresolved loss or trauma (van Ijzendoorn & Bakermans-Kranenburg, 2006) and they respond most positively to behavioral intervention (Bakermans-Kranenburg, van Ijzendoorn, Pijlman, et al., 2008). In adolescents, this genetic variation moderates the effects of family environment on participation in gangster or violent criminal activities (Simons et al., 2012). In adults, people with the sensitive variant of the gene are more reactive to priming effects on prosocial behavior (Sasaki et al., 2011), peer influence on their own political ideology (Settle, Dawes, Christakis, & Fowler, 2010) and smoking cues if they are smokers (McClernon, Hutchison, Rose, & Kozink, 2007).

While environment is often used to refer to the external context, candidate gene studies also show that the environment may refer to the intrapsychic environment within the individual. The external becomes the internal as people reflect and react idiosyncratically (Richman & Leary, 2009) to what is happening within and outside of them. People do not merely react to environmental events, but they act upon and construct their own experiences; this construction is often affected by one's intrapsychic environment which is in turn also affected by the genome to varying degrees (Meaney, 2001). Acculturation is a good context for the study of gene-environment as it is an abrupt, naturalistic stressful event, yet not so extreme that it will restrict the range of phenotypic variations (Ellis et al., 2011). Given its effect on perceptions and emotional responses, attachments can be a proxy for the individual's intrapsychic environment.

Pitfall of candidate-gene studies. As the field of gene-environment advances, researchers are increasingly discouraged from candidate-gene studies (e.g., Hewitt, 2012; Johnston, Lahey, & Matthys, 2013). Many of these studies have not been successfully replicated. There is often an over-estimation of genetic effects and publication bias (Colhoun, McKeigue, & Smith, 2003; Ioannidis, Ntzani, Trikalinos, & Contopoulos-Ioannidis, 2001). Small effect sizes and low statistical power have resulted in a surprisingly high false discovery rate and spurious associations (Duncan & Keller, 2011; Sullivan, 2007). A review of candidate-gene-disease association studies showed that out of 166 associations that have been reported at least three times in the literature, only six were replicated successfully (Hirschhorn, Lohmueller, Byrne, & Hirschhorn, 2002). One lab embarked on an admirable attempt to replicate their earlier candidate-gene-association studies, but all twelve studies were not successfully replicated (Hart, de Wit, & Palmer, 2013). Moreover, according to the authors, these

studies used intermediate phenotypes instead of complex traits. Larger effect sizes of the genes would be expected for intermediate phenotypes, which should allow for easier replication, however none of the studies were replicable.

Another flaw of candidate-gene studies is an implicit neglect of the reality that human biology is a very complicated system that relies on an intricate layered network within the individual which responds to the social milieu the individual is immersed in (Meaney, 2001; Strohman, 2002). Not only does the environment exert influence on genetic functions, manifestations of genes are also contingent on other genes. Complex traits and diseases, are inevitably the result of networks of multiple genes and biological systems (Wray et al., 2013).

Use of polygenic risk scores as alternative. That said, humans fundamentally are biological creatures embedded in a complex social-cultural ecology. One's genome does place constraints on the neural and hormonal systems that affect how an individual interprets the ambiguous contexts they are often in. As such, the problems with candidate-gene studies do not render the study of gene-environment obsolete or invalid. Current research points in the direction of polygenic scores (D. Belsky & Israel, 2014; Iyegbe, Campbell, Butler, Ajnakina, & Sham, 2014; Wray et al., 2014). Polygenic scores essentially aggregate the small effect sizes of multiple genetic variations from large-scale genome-wide association studies into a single score. This goes some way to taking into account the pleiotropic nature of the genome.

In the last few years, efforts have been made to investigate the validity, reliability and feasibility of using polygenic risk scores in gene-environment interactions in psychiatric disorders (Dudbridge, 2013; Kong et al., 2014; Wray et al., 2014). A recent systematic investigation on polygenic scores (Krapohl et al., 2015) demonstrated the plausibility and usefulness of such scores to predict complex traits

ranging from cognitive ability, personality (e.g., Big Five measures), life satisfaction and psychopathology (e.g., autism, hyperactivity, anxiety).

In polygenic risk score studies, two samples are usually involved: a large-scale genome-wide association study (GWAS) used to derive the genetic effect sizes to the phenotype-of-interest for assembly of the polygenic risk score and another independent sample used to study the association of the between the score and the phenotype. One study used this method to calculate a polygenic risk score for adolescent alcoholism and found significant association between the risk score and alcohol problems, particularly in negative environments characterized by low parental supervision or high number of friends who exhibited deviant behaviors (Salvatore et al., 2014). Besides alcoholism, polygenic risk scores have been used to study genetic influences on a diverse range of phenotypes, ranging from psychiatric disorders such as ADHD (de Zeeuw et al., 2014), schizophrenia (The International Schizophrenia Consortium, 2009) and bipolar disorders (Hamshere et al., 2011) to medical problems such as asthma (D. Belsky et al., 2013) and migraine (Ligthart et al., 2014). The goal of these studies is often not to merely demonstrate relevance of genes but as the first step to finding out the biological pathways involved in these disorders or illnesses.

Other than single disorder or illness, polygenic risk scores can also be calculated based on cumulative effect sizes of multiple disorders as major psychiatric disorders often share common genetic architecture (Cross-Disorder Group of the Psychiatric Genomics Consortium, 2013). This is also known as cross-disorder polygenic risk score. Individuals whose families have history of mood disorders were found to have higher cross-order polygenic risk scores (Whalley et al., 2015). Moreover, this study showed that for individuals without such a family history, cross-disorder polygenic risk score was positively associated with left lateral front brain

activation during a verbal executive function task that had been demonstrated to distinguish psychiatric patients from healthy controls (McIntosh et al., 2008; Whalley et al., 2011).

As the current evidence favoring the use of polygenic score and there is lack of specificity to particular psychiatric disorders in the current research, cross-disorder polygenic score will be used as proxy for genetic susceptibility for this study. Higher polygenic score suggests higher genetic susceptibility to being more reactive to the environment. As such, polygenic score is expected to positively moderate the effects of attachments on intercultural difficulties as well as changes in self-esteem and patriotism, such that these effects will be stronger for individuals with high rather than low polygenic score.

Impact of the social ecology

The idea that an individual's behavior is more than the product of personality was fiercely debated in the 1970s. In 1977, Bronfenbrenner (1977) introduced the ecological systems model that described how individuals' development is affected by the environment they are situated in. These levels are termed as systems that nest within one another that influence individuals both directly and indirectly.

The microsystem refers to the immediate environment and the relationships the child is in. One example of microsystem that will be examined later is the parent-child relationship depicted by attachment theory. The mesosystem refers to interaction between an individual's microsystems, which is relevant for the current research. One example of mesosystem is the interaction of parent-child relationship with the unfamiliar social environment of the host country.

The exosystem refers to the broader environment the child or individual is in but not playing an active role in influencing. For example, the neighborhood's

infrastructure, mass media or provision of goods and services in the neighborhood are part of an individual's exosystem. In the current context, a part of cross-cultural adjustment is moving and adapting to an unfamiliar exosystem. Being immersed in another country means having to navigate and live in a different exosystem from what one is familiar with.

Adjusting to a foreign culture also involves immersion in that culture, or also known as macrosystem. However, opposed to the exosystem, the macrosystem is implicit and carried in the minds of the members of the society and manifested through the seemingly trivial behaviors, practices and beliefs of the people. As such, in acculturations, the sojourner is not only immersed in another macrosystem but experiencing the 'clash' of two or more macrosystems – the macrosystem the individual is currently in versus the macrosystem he or she brought along into the host country.

Attachments as microsystem. One microsystem that has been consistently demonstrated to have significant implications on a child's subsequent psychological and interpersonal functioning is affectional bonds with caregivers, typically the parents. This is also known as attachment theory and was proposed by John Bowlby (1969, 1969/1982, 1973, 1980). Early experiences with one's parents or caregiver form the internal working models that become the expectations and beliefs one has about other people. There is a script or expectation on whether the individual will be able to get support, acceptance, comfort or affection from others when necessary (Mikulincer & Shaver, 2007). Generally, the working models of individuals with secure attachments are more positive and optimistic about life (Radecki-Bush et al., 1993; Shorey et al., 2003), people (Baldwin et al., 1996; Collins & Read, 1990) and their own capability in

dealing with challenges (Brennan & Morns, 1997; Cooper et al., 1998) than individuals with insecure attachments.

Parental attachment can be further deconstructed into two specific behavioral traits (Parker, Tupling, & Brown, 1979) – care and overprotectiveness. Care is characterized by the affection and warmth the child feels from the parent. Overprotectiveness is experienced by high levels of anxiety of parents (Ingram, Overbey, & Fortier, 2001) which manifests into excessive control and constrains the child's development of autonomy and independence. While correlated, these two dimensions of parental behavior have different effects on some characteristics of the individual. In a sample with adolescents, parental control or overprotectiveness was positively associated with depressive symptoms, but there was no significant effect of parental care (Kraaij et al., 2003). In another study, lack of maternal care, but not high overprotectiveness, was associated with dysfunctional automatic thoughts about the self (Ingram et al., 2001).

As such, this study seeks to contribute to the adult attachment literature by distinguishing the effects of parental care and overprotectiveness on young adult's ability to adjust to foreign culture. As high care is characterized by acceptance of self by parents, this is likely to relate to one's ability to regulate one's emotions or thoughts. Two individuals may report having had a difficult intercultural experience, but may differ in translation into long-term consequences. This difference is hypothesized to be moderated by experience of parental care. On the other hand, parents' overprotectiveness might be internalized by the child as meaning the world is unsafe, uncertain or difficult to cope with. As such, it is expected that parental overprotectiveness will affect experience of intercultural difficulties directly.

Most of attachment research is based on attachments to mothers with little mention of attachments to fathers. This neglect of paternal attachment in the literature partly started with lack of consistent findings when the relationship between fathers' attachment behaviors and child's development (Bretherton, 2010; Ijzendoorn & Wolff, 1997) was assessed by the traditional Strange Situation protocol (Grossmann, Grossmann, Fremmer-Bombik, Kindler, & Scheuerer-Englisch, 2002; Palm, 2014; Paquette & Bigras, 2010). However, though the role of fathers has been underplayed relative to the mothers in the literature, it is not so in the original attachment theory (Bowlby, 1969/1982).

Two systems critical to a child's optimal development were introduced by Bowlby (1969) in the original attachment theory – attachment and exploration. While interrelated, the attachments and exploration systems are distinct constructs and activated primarily (though not exclusively) by mothers and fathers respectively (Grossmann et al., 2002). The attachment system is activated in times of distress and motivates one to seek social support from attachment figures; the exploration system is related to the child's sense of security and confidence in exploring an uncertain and novel environment (Elliot & Reis, 2003; Grossmann, Grossmann, Kindler, & Zimmermann, 2008).

Furthermore, humans can form other emotional attachments that can affect sense of security and worldview as well. One of such attachments is the attachment to home culture. Cultures have to be found to ascribe meanings and frameworks to understand the world, together with a sense of epistemic security and certainty to its members (Pyszczynski, Greenberg, Solomon, Arndt, & Schimel, 2004).

Maternal attachment & relationships with strangers. Securely attached adults are individuals who have positive affectional bonds with their parents, particularly

their mothers. Not only do these people have a lower tendency in perceiving stressful situations as threatening (Mikulincer & Florian, 1995), they are also better at processing information in a way that encourages them to be open in seeking help when distressed (Mikulincer et al., 2009). In the event that their trust is violated, they are also more trusting and constructive in rebuilding the damaged relationship (Mikulincer, 1998). This trust is also manifested towards unfamiliar others such as the outgroup, as securely attached adults are likely to have less negative appraisals of outgroups (Mikulincer & Shaver, 2001).

When people are securely attached with mothers who are caring but not overprotective, they have confidence in their self-worth and acceptance by unfamiliar others; however, insecurely attached individuals with overprotective or less caring mothers are likely to question whether others will accept them or if they are worthy to be accepted by others (Baldwin et al., 1996; Collins, 1996). Furthermore, without the secure base provided for by secure maternal attachments, there is a fear of unfamiliar people that if not regulated (Bowlby, 1969) can manifest into negative reactions or attitudes towards outgroup members (Mikulincer & Shaver, 2001). This is highly relevant in the context of the current research as host nationals are likely unfamiliar strangers or outgroup members to sojourners.

As such, sojourners with overprotective or low caring mothers are expected to have greater difficulties in cultural transitions, particularly with host nationals (Hypothesis 2a). This effect is expected to be positively moderated by genetics such that sojourners who are biologically more sensitive and experienced maternal overprotectiveness or low maternal care will experience the greatest degree of difficulties with host nationals (Hypothesis 2b). However, the effect of maternal overprotectiveness or low maternal care is not expected to be significant for the

controls as they are not interacting with outgroup members who are from another culture.

In addition, poor experiences with mothers in early childhood contribute to inability to manage distress in later life (Berant, Mikulincer, & Shaver, 2008). This inability to manage distress is expected to manifest into various negative consequences on emotions and social cognitions as sojourners are not able to process the difficult intercultural experience even after they return home. These consequential effects will be elaborated further below in the sections on consequences of intercultural adjustments.

Paternal attachment & exploration. Paternal involvement during childhood has been found to contribute to better academic performance and enjoyment of school (Nord, 1997). This is due to the higher security of exploration which translates into greater confidence, resilience and autonomy to manage unfamiliar environments and tasks (Grossmann et al., 2002), such as early years of formal schooling. By contrast, under-activated exploration system due to overprotective fathers results in children who are shy, overly cautious of novelty (Paquette & Bigras, 2010) anxious and unwilling to explore (Paquette & Dumont, 2013).

As mentioned above, the effect of paternal attachments is only seen in very specific contexts that involve exploration of novel and risky situations. In intercultural adjustments, exploration becomes particularly relevant and essential as sojourners will need to explore a new environment that is uncertain, unfamiliar and probably risky. Given this, paternal attachment should also be relevant for sojourners' adjustment in the new country. Specifically, high care from father should enhance a sense of security of exploration in a new environment, whereas overprotection from father should undermine security. As such, sojourners with a low paternal protectiveness or high

paternal care are expected to report fewer difficulties with navigating the new host environment (Hypothesis 3a). This effect is also expected to be positively moderated by sojourners' genetic predisposition, such that the effect of paternal overprotectiveness will be stronger for those who are biologically more sensitive (Hypothesis 3b). However, such effects of paternal attachment are not expected to be relevant if individuals remained in home country. Thus, paternal attachments are not expected to have any significant effects on psychological well-being for individuals who are not overseas.

Cultural attachment. Culture is an inescapable aspect of every individual that has far-reaching effects on all domains of one's psyche. Though research has concentrated on examining national cultures, cultures are more than national or ethnic boundaries. Culture is a normative shared reality (Wan, Torelli, & Chiu, 2010) where there are shared values, beliefs, attitudes and behaviors among a group. With such shared meanings and experiences, individuals can feel a sense of affectional bond to others of the same culture or with the abstract collective (Chao, Kung, & Yao, 2015).

Extending the attachment paradigm to cultures, affection for one's culture can thus also become a source of security, particularly in intercultural contexts or transitions. Similar to the patterns of secure attachment to caregivers, international students securely and affectionately attached to their home culture reported lower acculturation stress and perceived discrimination in the host culture (Hong et al., 2013). In another experimental study, students who were anxious about going for an exchange program in another country reported better adjustment to the host culture after being primed with their home culture (Fu et al., 2015).

The current research thus seeks to replicate and extend the existing findings. Sojourners with greater attachment to home culture are expected to have fewer

difficulties in adjusting to the host environment as well as to host nationals (Hypothesis 4a). This effect is expected to be moderated by genetic endowments, such that individuals who are more biologically sensitive will benefit most from the protective effect of cultural attachment. In other words, polygenic score is expected to positively moderate the effects of cultural attachments on intercultural adjustment difficulties, such that the effect will be stronger for sojourners with higher than low polygenic score (Hypothesis 4b).

Differences between macrosystems. Difference in macrosystems is examined as the external environment that can interact with one's genetic endowments to affect the cultural transitions. In other words, this research examines how the difference between sojourners' home and host cultures (i.e., cultural distance) affect intercultural adjustment with moderation by one's polygenic score. Adjusting to a host culture very different from home is expected to be challenging as there will be uncertainties with regards to both living environment and social interactions with host nationals (Hypothesis 5a). Sojourners who are biologically sensitive may be more sensitive to such differences and thus report greater intercultural difficulties than do those with low sensitivity (Hypothesis 5b).

Consequences of intercultural experience

Self-esteem. Self-esteem has far-reaching implications on one's mental health and well-being (e.g., Baumeister, 1993; Harter, 1993; Spencer et al., 1993). It has also been significantly correlated with psychological stress in cultural transitions (Buddington, 2002; Padilla, Wagatsuma, & Lindholm, 1985; Wang et al., 2012) and thus has been a common proxy for psychological adjustment of immigrants and sojourners. Quality of acculturation has also been found to affect Hispanic immigrants' self-esteem development (Meyler, Stimpson, & Peek, 2006; Portes & Zady, 2002;

Smokowski, Bacallao, & Buchanan, 2009). An advantage of using self-esteem as proxy for outcome of cultural transition is that lower self-esteem may not only suggest poor psychological adjustment, higher self-esteem can also be an indicator of personal growth (Geeraert & Demoulin, 2013). While sojourning in a foreign culture may be a stressful event, it may also be an event of personal development as individuals overcome novel challenges in an unfamiliar environment. As such, the use of self-esteem change in the current study allows for examination of both the negative and positive impacts of temporal cultural transition. It is expected that sojourners who report the cultural transitions as being more difficult to experience negative change in self-esteem (Hypothesis 6a) as it is likely they have already processed and internalized the challenges negatively.

Individuals do not merely react to the external stressors as they navigate the unfamiliar host environment. Sojourners are also likely to reflect upon and assign meanings to their overseas experience. These reflections in turn become a part of the individual's intrapsychic environment and affect self-esteem. As such, biological sensitivity is expected to moderate one's experience of adjustment difficulties in affecting self-esteem (Hypothesis 6b).

As mentioned earlier, poor experiences with mothers in early childhood contributes to inability to manage distress in later life. This inability to manage distress is expected to manifest into negative change in self-esteem as sojourners are not able to process difficult intercultural experiences even after they return home. In other words, sojourners with less caring or overprotective mothers as well as higher intercultural difficulties while overseas are expected to show decrease in self-esteem (Hypothesis 6c).

Patriotism. As sojourners immerse themselves in another culture, even if it is for a few months, they will have been exposed to a way of life that is very different from what they are used to. This entails not merely different behaviors and norms, but also different values and belief systems. Such exposure has been suggested to weaken one's sense of identity, loyalty and patriotism towards one's home country (Kluver & Weber, 2003). This may be particularly true for adolescents and young adults, as they are in the life stage of searching and forming their own identity and beliefs (Jensen & Arnett, 2012). In particular, there has been limited empirical research on effect of intercultural experience on individuals' patriotism to home culture.

Sojourners with great difficulties adjusting to another culture are expected to show positive change in patriotism, as this difficult experience is likely to make them feel that the way of life they grew up in is better or more comfortable (Hypothesis 7a). This relationship is expected to be accentuated by high biological sensitivity (Hypothesis 7b). Good maternal attachment, in terms of high maternal care or low maternal protectiveness, is also expected to moderate the effect between intercultural adjustments and patriotism (Hypothesis 7c) as sojourners with caring mothers are likely to manage distress without letting it affect subsequent emotions or cognitions.

Summary of research questions and hypotheses

The first research question of this study pertains to the multi-faceted nature of intercultural adjustments. Are there different dimensions of adjustment difficulties one may experience during cultural transitions?

H1: The measures of adjustment difficulty can be clustered into two significantly separated factors, one pertaining to impersonal aspects and one to interpersonal aspects.

Once the latent structure of intercultural adjustments has been found, the subsequent analyses will pertain to answering the other research questions. The second set of research questions is regarding the effects of parental attachments on cultural adjustments. How do the different sources of attachments affect intercultural adjustments? And how does biological sensitivity moderate these relationships?

H2a: Maternal overprotectiveness is expected to be positively associated with intercultural adjustment difficulties related to host nationals.

H2b: This positive relationship between maternal overprotectiveness and host-national difficulties is expected to be positively moderated by polygenic score.

H3a: Paternal overprotectiveness is expected to be positively associated with intercultural adjustment difficulties related to host environment adaptation in general.

H3b: This positive relationship between paternal overprotectiveness and host-environment adaptation difficulties is expected to be positively moderated by polygenic score.

H4a: Cultural attachment to Singapore is expected to be negatively associated with both aspects of intercultural adjustment difficulties.

H4b: This negative relationship between cultural attachment and intercultural difficulties is expected to be positively moderated by polygenic score.

The effect in change of macrosystems on adjustments is also examined. In the current study, a bigger change in macrosystems will be reflected in the bigger cultural distance between Singapore and the host country. Particularly for sojourners who are

more biologically sensitive, this need for greater change in host countries and to host nationals that are culturally very different from Singapore is expected to make adaptations even more difficult than it already is.

H5a: Cultural distance is expected to be positively associated with both aspects of intercultural adjustment difficulties.

H5b: This positive relationship between cultural distance and intercultural difficulties is expected to be positively moderated by polygenic score.

This study also seeks to examine the impact of having experienced a difficult cultural transition on the sojourners' attitudes toward the self (i.e., self-esteem) and home society (i.e., patriotism). Will having had a difficult intercultural experience result in lower self-esteem and higher patriotism? Can biological sensitivity and parental attachments buffer the negative impact of such difficult experiences?

H6a: The more cultural adjustment difficulty a sojourner has experienced, the greater drop in his or her self-esteem after staying overseas.

H6b: This negative relationship between intercultural difficulty and change in self-esteem is expected to be negatively moderated by maternal care, such that the impact of cultural adjustment difficulty will be lower for sojourners with high than low maternal care.

H7a: The more cultural adjustment difficulty a sojourner has experienced, the greater increase in his or her patriotism after staying overseas.

H7b: This positive relationship between intercultural difficulties and change in patriotism is expected to be positively moderated by polygenic score.

H7b: This positive relationship between intercultural difficulties and change in patriotism is expected to be negatively moderated by maternal care.

Figures 2a and 2b below summarize the hypotheses tested in this study. The hypotheses are separated into the different figures to illustrate the two models that were run.

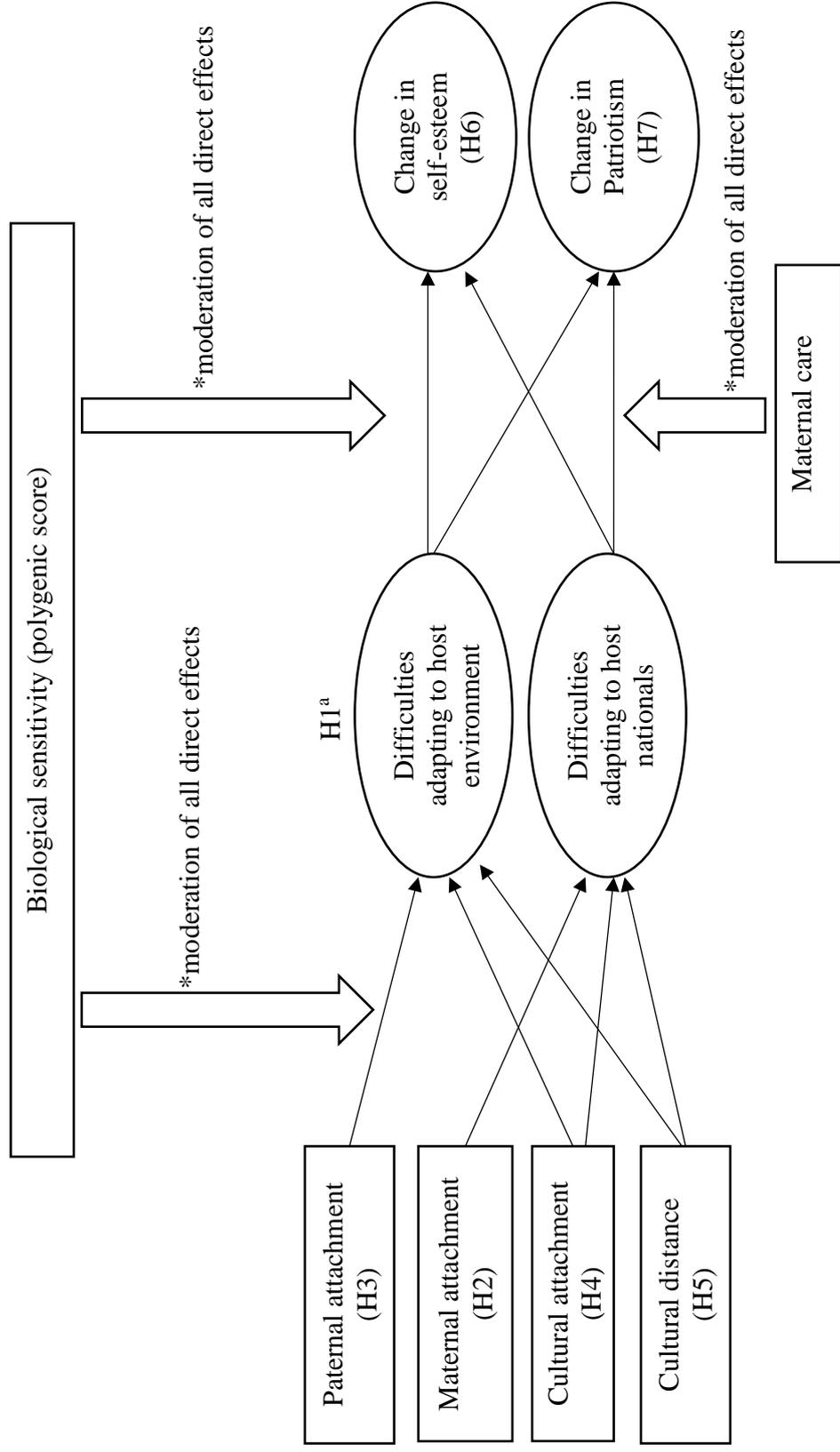


Figure 2. General conceptual map of hypotheses.

^aTwo latent factors of intercultural difficulties hypothesized in H1. *a single arrow represents moderation of all direct effects that are in the direction of the arrow.

Chapter 3

Methodology

This is a prospective study to investigate how the attachments and genetic predispositions influence local university students as they had to adjust to another culture for a semester-long exchange program. There were three phases: pre-trip (phase one), during the stay overseas (phase two) and post-trip when they returned to Singapore (phase three). The attachments (i.e., parental and cultural attachments) and individual differences (i.e., self-esteem and patriotism) variables were measured in phase one. In phase two, while sojourners were overseas, the measures on stress and adjustments were administered. In phase three, when sojourners returned from the exchange program, the self-esteem and patriotism scales were administered again to examine how these changed as a result of the intercultural experience.

Measures

Parental attachment. As mentioned in the previous chapter, parental attachment has been conceptualized into two dimensions -- Care and Overprotectiveness in the current study, as these are the two core influences of affectionate bond between a parent and child (Parker et al., 1979). The perceived care and overprotectiveness of parents were measured using the Parental Bonding Index (PBI; Parker et al., 1979). Participants completed this questionnaire twice, one to rate their perceptions of their mothers and the other of their fathers.

Participants rated a list of 25 attitudes of behaviors on how much each item described their father or mother in their first sixteen years of life (1 = very unlikely; 5 = very likely). For the Care subscale ($\alpha_{\text{mother}} = .89$, $\alpha_{\text{father}} = .90$), some sample items were "... spoke to me in a warm and friendly voice" and "... did not help me as much as I need" (reverse-coded); for overprotectiveness subscale ($\alpha_{\text{mother}} = .82$, $\alpha_{\text{father}} = .85$),

some items were "... tried to control everything I do" and "... gave me as much freedom as I want" (reverse-coded).

Cultural attachment. The affective identification subscale of the Tripartite Group Identification scale (Henry, Arrow, & Carini, 1999) was used as a proxy for attachment to Singapore. Affective identification ($\alpha = .64$) refers to the emotional attachment one feels towards the group (i.e., Singapore), such as "I enjoy interacting with Singaporeans" or "I would prefer to be of another nationality" (reverse-coded). Participants rated how much they agreed with each item on a scale of 1 ("strongly disagree") to 6 ("strongly agree").

The other two subscales of this questionnaire were also administered to demonstrate discriminant validity of cultural attachment from the other forms of national identification. The other two subscales are Behavioral identification ($\alpha = .56$), which refers to the perceived need for people in the group to work together (e.g., "All Singaporeans need to contribute to achieve Singapore's goals"), and Cognitive identification ($\alpha = .64$), which refers to the self-categorization that one is a member of the group (e.g., "I think of Singapore as part of who I am"). To disentangle the effect of affective attachment from the other forms of social identification, the other two subscales were added into analyses as control variables. This will demonstrate the discriminant validity of cultural attachment from the classic social identification with Singapore.

Psychological adjustment. Four measures were administered to measure participants' general psychological well-being. These measures were related to stress level, loneliness, depression and subjective well-being.

General stress level. Participants' level of stress was measured by the nine-items Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983), with internal

reliability of $\alpha = .75$. This was a measure of stress generally perceived by participants in the last one month. Participants rated how much they felt each of the feeling or thought (e.g., “how often have you felt that you were unable to control the important things in your life” in the last month, from 1 (“never”) to 5 (“very often”).

Loneliness. Loneliness was measured by the 20-items UCLA Loneliness scale (Russell, 1996), with internal reliability of $\alpha = .94$. Participants indicated how often they had the experience described by each item on a scale of 1 (“never”) to 5 (“never often”). Sample item was “how often do you feel that you lack companionship”).

Depression. Depression was measured using the 20-items Beck Depression Inventory (Beck, Steer, & Brown, 1996). Each item in the inventory consisted of four to seven statements pertaining to an aspect of depression. Participants were instructed to select one statement in each item that best described how they had been feeling for the past two weeks. For example, for the question related to sadness, the four statements were “I do not feel sad”, “I feel sad much of the time”, “I am sad all the time” and “I am so sad or unhappy that I cannot stand it”. Each statement carried a score ranging from 0 for least severe to 3 for most severe symptom. The overall depression score was the average of all the items scores ($\alpha = .90$).

Subjective well-being. Subjective well-being was measured by the five-items Satisfaction with Life scale (Diener, Emmons, Larsen, & Griffin, 1985; $\alpha = .85$). Participants rated how much they agreed with each item on a seven-points scale (1 = “strongly disagree” to 7 = “strongly agree”). Some sample items were “I am satisfied with my life” and “If I could live my life over, I would change almost nothing”.

Measures related to cultural transitions away from home. The other measures were related specifically to stressors unique to cultural transitions. As

mentioned, these include stress of intercultural adjustment, homesickness and worries about interactions with host nations, among others.

Cultural adjustment stress. Cultural adjustment stress was measured with the Acculturative Stress Scale (Sandhu & Asrabadi, 1994). Participants rated on a total of 35 items their experience living in the host country, from 1 (“strongly disagree”) to 6 (“strongly agree”), with overall reliability of $\alpha = .76$.

These items were divided into seven subscales, each representing different acculturation stressors: 1) stress of living in new environment ($n = 3$; $\alpha = .63$; e.g., “I feel uncomfortable adjusting to new foods”); 2) social stressors ($n = 9$; $\alpha = .88$; e.g., “I don’t feel a sense of belonging here”); 3) perceived hatred from host nationals ($n = 5$; $\alpha = .88$; e.g., “Others are sarcastic towards my cultural values”); 4) perceived discrimination ($n = 8$; $\alpha = .89$; e.g., “I feel that I have received unequal treatment; 5) homesickness ($n = 4$; $\alpha = .76$; e.g., “I miss Singapore and people from Singapore”); 6) fear of host nationals ($n = 4$; $\alpha = .82$; e.g., “I fear for my personal safety because of my different cultural background”); and 7) guilt from leaving home ($n = 2$; $\alpha = .68$; e.g., “I feel guilty that I am living a different lifestyle here”). As this research seeks to examine, to a greater depth, how genetics may moderate the effect of intrapsychic and external cultural environments on various aspects of intercultural adjustments, each of these subscales were analyzed as separate independent variables.

Homesickness. Participants indicated how much they agreed each item on the 23-items Homesickness scale (Archer, Ireland, Amos, Broad, & Currid, 1998) on a scale of 1 (“strongly disagree”) to 6 (“strongly agree”). Internal reliability was $\alpha = .92$. Some sample items were “I can’t help thinking about my home” and “I’ve settled really well in this country” (reverse-coded).

Although the acculturation stress scale did have a subscale of homesickness, a longer independent homesickness scale was included for convergent validity purposes. This also applied to the measure of perceived discrimination.

Perceived discrimination. The measurement of perceived discrimination was adapted from the 14-items Perceived Racism Scale (McNeilly et al., 1995).

Participants indicated how much each item described their experience in the host country, from 1 (“never”) to 6 (“always”). Some items in this scale were “Because of my ethnicity/nationality, people often assume I come from a poor and backward country” and “When I assert myself, I am looked upon as an exception to my ethnicity/nationality.” Internal reliability was $\alpha = .93$.

Nationality rejection sensitivity. Nationality Rejection Sensitivity scale consisted of twelve social scenarios that are ambiguous in whether discrimination was taking place (Mendoza-Denton, Downey, Purdie, Davis, & Pietrzak, 2002). For example, one scenario was “Imagine you are in a pharmacy, trying to pick out a few items. While you’re looking at the different brands, you notice one of the store clerks glancing your way.”

Participants were instructed to imagine themselves in each situation in the host country. Participants then rated how concerned or anxious they would be that they were discriminated against in that situation (e.g., “How concerned/anxious would you be that the store clerk might be suspicious of you because of your race/ethnicity?”) on a scale of 1 (“very unconcerned”) to 6 (“very concerned”). They also indicated how likely the situation would happen in the host country (e.g., “How likely that the store clerk suspects you of shoplifting because of your race/ethnicity?”) on a scale of 1 (“very unlikely”) to 6 (“very likely”). These two ratings were multiplied to give the

item score. The scores of all twelve items were then summed into a nationality rejection sensitivity score. Overall internal reliability was $\alpha = .92$.

Concern about being stereotyped. Participants' concern about being stereotyped by host nationals were measured by the Stigma Consciousness scale (Pinel, 1999). This is a measure about how concerned the participants were about being stigmatized or stereotyped because of their nationality. Participants indicated how much they agreed with each of the nine statements on a scale of 1 ("strongly disagree") to 6 ("strongly agree"). Some items were "Stereotypes about being a Singaporean have not affected me personally" (reverse-coded) and "When interacting with people from my host country, I feel like they interpret all my behaviors in terms of the fact that I am a Singaporean." Internal reliability was $\alpha = .62$.

Change measures. Measures of self-esteem and patriotism were administered pre- and post-trip to examine how these measures change as consequence of the intercultural experience.

Self-esteem. Self-esteem was measured by the ten-items Rosenberg Self-esteem Scale (Rosenberg, 1965), $\alpha = .87$. Participants rated how much they agreed with each item on a scale of 1 ("strongly disagree") to 6 ("strongly agree"). Some sample items were "I feel that I am a person of worth, at least on an equal basis with others" and "All in all, I am inclined to feel that I am a failure" (reverse-coded).

Patriotism. Patriotism to Singapore was measured by the ten-items Blind and Constructive Patriotism Scale (Schatz, Staub, & Lavine, 1999). There were two subscales – blind ($n = 6$, $\alpha = .73$) and constructive ($n = 4$, $\alpha = .72$) patriotism. Blind patriotism refers to the positive evaluation of and devotion to the country that is unquestioned and not tolerant of criticisms of country, e.g., "Singaporeans should not criticize Singapore as there is already too much anti-Singapore criticism in the world."

Constructive patriotism is defined as being critical of current practices or norms with intention bringing progress to country, such as “My love for Singapore makes me bold enough to oppose popular but harmful policies.” Participants rated how much they agree with each item on a scale of 1 (“strongly disagree”) to 6 (“strongly agree”).

Cultural distance. Cultural distance is used as proxy of the external environment or macrosystem that is expected to affect intercultural adjustment. The higher the cultural distance of the host culture, the more different it is from Singapore in terms of cultural norms and values. Participants indicated the host country they were in for the exchange program as part of their demographic data. Secondary data of these host countries were obtained from existing large-scale datasets, namely the Schwartz Value Survey, Hofstede and GLOBE. A cultural distance score was calculated for all subscale measures of each dataset. These subscale cultural distance scores were then summed into an overall cultural distance score for Schwartz, Hofstede and GLOBE. The three overall scores were then averaged into a single grand cultural distance score that was used for subsequent analyses.

The subscale cultural distance score was based on the Euclidean distance of the respective subscale scores from each host country and Singapore (Kashima & Abu-Rayya, 2014):

$$\text{Subscale cultural distance score } j = \sqrt{\sum \frac{(I_{ij} - I_{is})^2}{V_i}}$$

I_{ij} = host country j 's score on subscale i

I_{is} = Singapore's score on subscale i

V_i = variance of the subscale i 's scores across all 28 host countries and Singapore

Collection & processing of genetic samples. MasterAmp Buccal Swabs (Epicentre Technologies) were used to collect participants' buccal cells during phase one and three. Three to four swabs were collected per phase per participant and stored at -80°C. Genomic DNA were later extracted from the buccal cells using MicroElute Genomic DNA Kit (OMEGA Bio-Teck). The quality and quantity of DNA extracted were assessed using nanodrop spectrophotometers. Genetic samples from eight participants were not processed due to suspected mislabeling of the swabs by experimenters during the data collection phases. Of the remaining 555 samples collected during phase one, 522 samples were genotyped using the Illumina Infinium PsychArray BeadChip. The quantity and/or quality of DNA collected from the other samples were too low for microarray genotyping.

The PsychArray data was screened for quality and reliability in terms of call rate, minor allele frequency, Hardy-Weiner equilibrium and gender with PLINK 1.9 (Purcell et al., 2007). Samples that had call rate less than 97% were removed; these were samples that had less than 97% of all the SNPs (single-nucleotide polymorphisms) successfully called ($n = 25$). Gender was estimated using the X-chromosome heterozygosity information. If there was a mismatch between the estimated between the estimated gender and actual gender, the sample was also removed ($n = 5$). After removing samples due to low call rate and gender mismatch, the eventual sample size was 492 participants or samples. SNPs that had less than 1% minor allele frequency (291,611 variants removed), more than 5% missing data across samples (918 variants removed) or had statistically significant Hardy-Weiner disequilibrium at $\alpha = 0.01$ level (1143 variants removed) were removed. 277,382 SNPs or genetic variants survived the data cleaning process.

Calculation of polygenic risk score. Polygenic score is essentially the cumulative effective sizes of all the SNPs of interest to the study. Traditionally, the effect sizes and risk alleles are first determined through a discovery or training sample. This discovery sample will be used in a genome-wide association study (GWAS) by which the individual effect sizes of all the alleles across the genome to the phenotype-of-interest are calculated (Wray et al., 2014). Though effect of any individual gene on a particular phenotype is often small, the cumulative impact of these small effects can be quite substantial.

The cross-disorder GWAS sample from the Psychiatric Genomics Consortium (PGC) was used as discovery sample (Cross-Disorder Group of the Psychiatric Genomics Consortium, 2013). The effect of genes on the five psychiatric disorders in the discovery sample was used as proxy to sensitivity to environments. Due to the small sample size in the current study, only genes related to stress reactivity and social sensitivity were considered. The small sample does not have the statistical power needed for genome-wide study. As such, a targeted, theory-driven analysis allow for reduction of noise and thus higher statistical power.

As intercultural adjustment is a stress-provoking event, genes related to the biological stress response system were selected. This biological stress response system is also known as the hypothalamic-pituitary-adrenal axis (HPA axis). Variations in the genes related to the HPA axis have been shown to be related to individual differences in developing psychopathologies in response to environmental stress, such as post-traumatic stress disorder (Mehta & Binder, 2012), depression (Pagliaccio et al., 2014; Velders et al., 2011), suicidal behavior (De Luca et al., 2008; Wasserman, Wasserman, & Sokolowski, 2010) and alcoholism (Clarke et al., 2008).

The genes and SNPs selected for scoring were based on existing literature that examined the effect of the HPA axis on various psychiatric disorders (Arnett, Muglia, Laryea, & Muglia, 2015; Leszczyńska-Rodziewicz, Szczepankiewicz, Pawlak, Dmitrzak-Weglarz, & Hauser, 2013; Pagliaccio et al., 2014; Schatzberg et al., 2014; Stephens & Wand, 2012). The SNPs of interest to the current study were related to the *NR3C1*, *NR3C2*, *CRHR1*, *CRHR2*, *FKBP5*, *SLC6A4*, *TPH1*, *OPRM1*, *GABRA6* genes.

There were a total of 73 SNPs belonging to the above genes in this study's genetic dataset that overlapped with the PGC dataset. Of these SNPs, only those with *p*-values below 0.5 were selected for the calculation of the polygenic score. This *p*-value refers to the statistical significance value of the genetic effect size to the major psychiatric disorders in the PGC dataset. A highly lenient threshold was selected as many SNPs may not have statistically significant effect itself but their cumulative effects could have noteworthy impact on the biological system and subsequently the phenotype (Evans, Gray, & Snowden, 2007). The effect sizes of 63 SNPs had *p*-values less than 0.50 and were selected for calculation of the polygenic risk score. The effect sizes in the PGC dataset were the odd ratios of having the risk allele of the respective SNPs to having psychopathology. The odd ratios of the selected SNPs were log transformed and used as weights in the computation of the polygenic risk score of each participant (Wray et al., 2014).

The eventual polygenic risk score was calculated using PLINK 1.9. Higher score suggests a higher genetic sensitivity to environmental influences. The list of SNPs used, their reference or risk alleles, odd ratios and *p*-values from the PGC dataset are listed in Appendix A.

Overview of procedure

Recruitment. Participants who were going on exchange program in the following semester (henceforth referred to as “sojourners”) were invited to participate in this study either during their briefing sessions or via emails. The email addresses were obtained from the university’s international education office that was in charge of the exchange program. They were reimbursed with total of S\$80 for participating in all three phases of the study.

A control group was recruited to distinguish attachments and gene-by-environment effects that were unique to intercultural adaptations from effects on general well-being not particular to cultural transitions. These control participants (henceforth known as “controls”) who were not going overseas for exchange program were recruited via the school’s research participation portal that allow students to sign up for behavioral studies or experiments as participants. They were reimbursed with total of S\$50 for participation in all phases.

Due to the uniqueness of cultural transitions, paternal care and overprotectiveness are not expected to have any significant main effect nor interaction effect with polygenic score to affect psychological adjustment. Individuals’ exploration systems were expected to be activated only in situations that required exploration of novel and uncertain environments. As such, while control participants would also experience stress from other facets of life, these day-to-day stressors were unlikely to be related to the need to explore over a substantial period of time.

Phase one (pre-trip). For sojourners, this took place between one to three months before their departure. There was no specific time frame for controls. Participants (both sojourners and controls) were invited to the lab. First, they were reminded of the longitudinal nature of the study. After giving their informed consent

to participate, participants proceeded to complete the following set of questionnaires: PBI for both parents, identification with Singapore, self-esteem and patriotism.

Genetic sample was also taken from participants with the use of buccal swabs. Before providing the samples, participants first rinsed their mouth three times. Their buccal cells were then taken using cotton swabs for genetic and epigenetic analyses. These swabs were stored in -80°C freezer before being sent for DNA extraction.

Phase two (overseas adjustment). Phase two took place between two to three months after the sojourners' departure. For controls, this took place about three months after phase one. Participants emailed a link to complete a set of questionnaires online. Participants were administered the questionnaires on perceived stress, depression, loneliness and subjective well-being. Sojourners were given additional measures on acculturative stress, homesickness, perceived discrimination, nationality rejection sensitivity and stigma consciousness. They also indicated the host country they were in for the exchange program. This information was later used to calculate the cultural distance score.

Phase three (post-trip). Phase three took place within a month after sojourners' return to Singapore and about three months after phase two for the controls. Participants were once again invited to the lab for this phase. They completed the self-esteem and patriotism measures during this session. Participants were also debriefed about the entire study and reimbursed for their participation of the entire study.

Table 1 summarizes the measures administered during the various phases of the study as well as the difference in measures administered between the sojourners and control participants.

Table 1

Measures administered to sojourners and controls in the different phases of the study.

Measures	Participants	
	Sojourners	Controls
<u>Phase one:</u>		
Parental Bonding Index – mother and father	yes	yes
Tripartite Group Identification – affective, behavioral & cognitive identification with Singapore	yes	yes
Rosenberg Self-esteem scale	yes	yes
Blind and Constructive Patriotism Scale	yes	yes
Buccal swab – genetic sample	yes	yes
<u>Phase two:</u>		
Perceived Stress Scale	yes	yes
Beck Depression Inventory	yes	yes
UCLA Loneliness Scale	yes	yes
Life Satisfaction Scale (subjective well-being)	yes	yes
Acculturative Stress Scale – 7 subscales	yes	no
Homesickness Scale	yes	no
Perceived Discrimination	yes	no
Nationality Rejection Sensitivity	yes	no
Stigma Consciousness Scale	yes	no
Cultural distance	yes	no
<u>Phase three:</u>		
Rosenberg Self-esteem Scale	yes	yes
Blind and Constructive Patriotism Scale	yes	yes

Participants

A total of 819 participants were recruited for this study, 477 sojourners and 342 controls. Only participants who completed all three phases of the study were used

in the analyses. Total sample sizes for the analyses were 305 sojourners (63.9%; $M_{age} = 21.51$, $SD_{age} = 0.08$, 185 females, 120 males) and 258 controls (75.4%; $M_{age} = 21.28$, $SD_{age} = 0.11$, 162 females, 96 males). Of these participants, 259 sojourners (84.9%) and 232 controls (89.9%) were born in Singapore. There were no differences in the results of analyses using the full sample from those that excluded participants not born in Singapore. As such, the results reported in this thesis were from analyses using the full sample to maximize statistical power.

There were 521 participants who were of the Chinese ethnicity (92.5%), 12 Malays (2.1%), 15 Indians (2.7%), 2 Eurasians (0.4%) and 13 of other ethnicities (2.3%). Due to the high proportion of Chinese in the sample, ethnicity was not included as a covariate nor was it expected to affect the Hardy-Weiner disequilibrium test.

The 305 sojourners in final sample went to a total of 28 host countries. The host country with most number of sojourners was South Korea ($n_{Korea} = 40$) and the country with the least number was Russia ($n_{Russia} = 1$). The list of host countries in the current sample as well as the number of sojourners in each country is listed in Appendix B.

Chapter 4

Analysis plan & data screening

This study aims to examine (1) how biological sensitivity interacts with one's intrapsychic environment (in terms of parental and cultural attachment) and external environment (i.e., cultural difference between home and host countries) to affect intercultural adjustment, (2) whether parental and cultural attachments are distinctive in their effects on cultural adjustment, (3) the ways these effects relate differently to various aspects of cultural adjustment, and (4) how such differences in cultural adjustment affect the perceptions of self and society in terms of self-esteem and patriotism respectively.

Analysis plan

Before embarking on the analyses that answer the research questions, it is important that the adjustment measures first be analyzed for underlying latent factors or clusters, which is related to Hypothesis one. While many measures have been used in the literature to measure intercultural adjustments, these measurements are expected to be classifiable into two primarily latent factors – difficulties related to host environment adjustments and interactions with host nationals. These latent factors or clusters will then be used for subsequent analyses instead of using the individual scale scores of the adjustment measures taken in Phase two. As such, the next chapter (chapter five) will cover the modelling analyses of the phase two variables to discover the latent structure of intercultural adjustment.

After deriving the latent structure of intercultural adjustment, it will be incorporated into a bigger structural equation model that includes the variables on attachments and cultural distance as independent variables with polygenic score as moderator. This structure equation modelling will be detailed in chapter six.

Chapter seven will include the analyses involving change in self-esteem and patriotism as a result of the intercultural experience. Factor invariance of the constructs across phase one and three will first be tested to ensure that subsequent interpretation of results will be meaningful. When strict measurement invariance between the two phases is found, change in self-esteem and patriotism will then be tested using latent change models. Individual differences in cultural adjustment difficulties will be included as predictors of the latent changes.

The rest of this chapter will cover the preliminary data analyses regarding the demographics of the participants as well as differences between sojourners and controls, and between participants who completed all phases of the study versus those who dropped out.

Openness to intercultural experiences

As the university's exchange program is optional and students have to apply if they are interested in the program, there is a possibility of selection bias among the sojourners. It is possible that the controls may not be equally matched in terms of openness to intercultural experiences. This may cause confounding effects when they were used as comparison group to the sojourners. Furthermore, if there was a substantial number of controls who had already gone for overseas exchange, the control group would no longer qualify as a suitable control group as the prior acculturation experience may have unpredictable effects on the measures.

As sample validity check, a subset of controls ($n = 312$) indicated their prior experience with exchange programs and their interest level to go for overseas exchange. In this subset, only 30 controls (9.6%) had prior overseas exchange experience. The remaining 282 controls (90.4%) indicated, on a scale of 100, how interested they were in such exchange programs and how likely they would go if there

were no constraints hindering them from going overseas for exchange. The mean interest level was 81.26 ($SD = 22.46$) and likelihood of going was 92.24 ($SD = 15.71$). Given the high interest level in staying overseas for at least one semester, it was unlikely that the controls and sojourners were qualitatively different in their openness to intercultural experiences.

Difference between participants who dropped versus completed

Analyses were first conducted to find out if participants who completed all three phases were significantly different from those who dropped out of the study.

Gender difference. There was a significant gender effect in attrition, with males more likely to drop out than females ($\chi^2(1) = 9.78, p = .002$). The two groups seemed to be significantly different in their age as well, with those who dropped out being significantly older ($M_{\text{dropped}} = 21.71, SD_{\text{dropped}} = 1.52$) than those who completed ($M_{\text{completed}} = 21.40, SD_{\text{completed}} = 1.55$), $t(816) = 2.68, p = .01$. However, this significant age difference was due to the gender effect as male undergraduates in Singapore tend to be older than females. After controlling for gender, the age effect was indeed no longer significant ($p = .28$).

The gender difference was restricted to the sojourners ($\chi^2(1) = 8.20, p = .004$), as there was no significant gender difference between controls who dropped out versus controls who completed the study ($\chi^2(1) = 1.25, p = .26$). There was no significant gender difference between controls and sojourners in both the group who dropped out ($\chi^2(1) = 1.77, p = .18$) and the group of participants who completed ($\chi^2(1) = 0.27, p = .60$). With the significant gender effect in sojourners group between participants who completed and those who did not, gender was controlled for in all subsequent analyses unless otherwise stated.

Phase one measures. MANOVA was used to investigate if participants who dropped out were significantly different from those who completed in self-esteem, patriotism, social identification and parental attachments. There was a statistically significant overall difference between the groups, $F(10,687) = 2.26, p = .014, \eta^2 = .032$. Univariate analyses showed that the significant effect was driven by blind patriotism ($F(1,696) = 9.29, p = .002, \eta^2 = .013$) and affective identification with Singapore ($F(1,696) = 6.34, p = .012, \eta^2 = .009$). Participants who dropped out had lower blind patriotism ($M_{dropped} = 2.58, SD_{dropped} = 0.06; M_{completed} = 2.78, SD_{completed} = 0.03$) and affective identification ($M_{dropped} = 4.20, SD_{dropped} = 0.05; M_{completed} = 4.34, SD_{completed} = 0.03$) than participants who completed all three phases. However, though the differences were statistically significant, these may be trivial due to the large sample sizes and low effect sizes observed in the above tests.

Split file analysis was done to find out if these significant differences were unique to either the controls or sojourners. For controls, there were significant differences in blind patriotism ($F(1,283) = 5.28, p = .022, \eta^2 = .018$) and affective identification ($F(1,283) = 5.26, p = .023, \eta^2 = .018$) between those who dropped out and those who completed the study. Controls who dropped out had lower blind patriotism ($M_{dropped} = 2.66, SD_{dropped} = 0.09; M_{completed} = 2.89, SD_{completed} = 0.04$) and affective identification ($M_{dropped} = 4.17, SD_{dropped} = 0.09; M_{completed} = 4.39, SD_{completed} = 0.04$) than controls who completed the study. There were no significant differences between sojourners who dropped and sojourners who completed ($ps > .07$). The means, standard deviations and univariate analyses are detailed in Table 2. These significant differences among the controls might limit the external validity to a certain extent due to the attrition bias. However, given that sojourners are the main sample-of-interest, the lack of significant differences among the sojourners reduce this external validity

problem for the current study. Careful interpretations of results, particularly with results pertaining to controls, should suffice as countermeasure to this attribution bias (Ahern & Le Brocque, 2005).

Difference between controls and sojourners

Similar MANOVA analysis was done to examine whether there were significant differences in phase one measures between control and sojourners. This included participants who dropped out of the study later. A split file analysis was later done to investigate deeper if any differences found was limited to participants who dropped out of the study (see Table 3).

Overall, there was a significant difference between controls and sojourners in measures of parental attachment, identification with Singapore, patriotism and self-esteem ($F(10,687) = 3.36, p < .001, \eta^2 = .047$). Though the p -values showed that this difference was limited to participants who completed all phases ($F(10,524) = 2.33, p = .043, \eta^2 = .043$), this could be due to lower statistical power in the attrition group as there was a bigger effect size for participants who dropped out ($F(10,151) = 1.84, p = .058, \eta^2 = .109$).

A closer examination revealed that sojourners reported lower overprotectiveness from their mothers ($M_{sojourner} = 1.19, SD_{sojourner} = 0.02; M_{control} = 1.32, SD_{control} = 0.03; p = .001$), overprotectiveness from fathers ($M_{sojourner} = 0.91, SD_{sojourner} = 0.02; M_{control} = 1.07, SD_{control} = 0.03; p < .001$) and blind patriotism ($M_{sojourner} = 2.66, SD_{sojourner} = 0.04; M_{control} = 2.85, SD_{control} = 0.04; p = .001$). As such, caution needed to be exercised when interpreting results between groups for these variables. That said, most analyses in this study were within-group rather than between-groups. Moreover, between-groups comparisons in this study emphasized on differences in the effects within groups.

Table 2

Univariate analyses of differences in phase one measures between participants who dropped out of study versus participants who completed (sojourners; controls).

Phase one measures	Group	Mean	SD	F value	p-value	η^2
Self-esteem	Dropped	4.17 (4.19;4.11)	0.06 (0.09;0.09)	0.27 (0.06;0.11)	.604 (.815; .74)	<.001 ^a
	Completed	4.13 (4.17;4.08)	0.04 (0.05;0.05)			
Mother care	Dropped	2.10 (2.09;2.13)	0.04 (0.05;0.07)	0.29 (0.15;0.22)	.592 (.702; .639)	<.001 (<.001; .001)
	Completed	2.08 (2.07;2.09)	0.02 (0.03;0.03)			
Mother overprotectiveness	Dropped	1.19 (1.10;1.36)	0.04 (0.05;0.07)	2.24 (4.38;0.60)	.135 (.037; .439)	.003 (.011; .002)
	Completed	1.25 (1.22;1.31)	0.02 (0.03;0.03)			
Father care	Dropped	1.80 (1.78;1.84)	0.05 (0.06;0.07)	0.08 (0.15;0.02)	.779 (.702; .895)	<.001 ^a
	Completed	1.82 (1.81;1.83)	0.03 (0.04;0.04)			
Father overprotectiveness	Dropped	0.91 (0.84;1.04)	0.04 (0.05;0.07)	3.72 (2.65;0.22)	.054 (.105; .643)	.005 (.006; .001)
	Completed	0.99 (0.93;1.08)	0.02 (0.03;0.03)			
Blind patriotism	Dropped	2.58 (2.56;2.66)	0.06 (0.07;0.09)	9.29 (3.18;5.28)	.002 (.075; .022)	.013 (.008; .001)
	Completed	2.78 (2.70;2.89)	0.03 (0.04;0.04)			
Constructive patriotism	Dropped	4.00 (3.96;4.07)	0.06 (0.08;0.09)	3.06 (3.04;0.20)	.081 (.082; .654)	.004 (.007; .001)
	Completed	4.12 (4.12;4.12)	0.03 (0.05;0.04)			
Affective identification	Dropped	4.20 (4.21;4.17)	0.05 (0.06;0.09)	6.34 (1.82;5.26)	.012 (.178; .023)	.009 (.004; .018)
	Completed	4.34 (4.31;4.39)	0.03 (0.04;0.04)			
Behavioral identification	Dropped	4.40 (4.37;4.46)	0.05 (0.06;0.08)	2.26 (2.50;0.15)	.134 (.115; .704)	.003 (.006; .001)
	Completed	4.49 (4.48;4.49)	0.03 (0.04;0.04)			
Cognitive identification	Dropped	3.99 (3.99;4.00)	0.06 (0.07;0.09)	0.69 (0.06;0.97)	.407 (.806; .33)	.001 (<.001; .003)
	Completed	4.05 (4.01;4.10)	0.03 (0.04;0.04)			

Note. Gender was included as covariate. Values in parentheses refer to sojourners and controls respectively. ^aValues of η^2 were <.001 for both sojourners' and controls' analyses as well.

Table 3

Univariate analyses of differences in phase one measures between participants who dropped out of study versus participants who completed (dropped; completed)

Phase one measures	Group	Mean	SD	F value	p-value	η^2
Self-esteem	Controls	4.09 (4.12;4.08)	0.05 (0.10;0.06)	1.63 (0.47;1.10)	.202 (.494;.294)	.002 (.003;.002)
	Sojourners	4.17 (4.20;4.16)	0.04 (0.07;0.05)			
Mother care	Controls	2.10 (2.12;2.07)	0.03 (0.08;0.03)	0.39 (0.12;0.32)	.533 (.734;.573)	.001 (.001;.001)
	Sojourners	2.07 (2.09;2.07)	0.03 (0.05;0.03)			
Mother overprotectiveness	Controls	1.32 (1.37;1.22)	0.03 (0.07;0.03)	12.02 (11.02;4.32)	.001 (.001;.038)	.017 (.064;.008)
	Sojourners	1.19 (1.10;1.22)	0.02 (0.05;0.03)			
Father care	Controls	1.82 (1.82;1.83)	0.04 (0.09;0.04)	0.20 (0.17;0.06)	.653 (.683;.806)	<.001 (.001;<.001)
	Sojourners	1.80 (1.77;1.81)	0.03 (0.06;0.03)			
Father overprotectiveness	Controls	1.07 (1.04;1.08)	0.03 (0.06;0.03)	19.38 (6.54;12.00)	<.001 (.011;.001)	.015 (.039;.022)
	Sojourners	0.91 (0.84;0.93)	0.02 (0.05;0.03)			
Blind patriotism	Controls	2.85 (2.66;2.89)	0.04 (0.10;0.05)	10.91 (0.92;8.90)	.001 (.339;.003)	.015 (.006;.016)
	Sojourners	2.66 (2.54;2.70)	0.04 (0.07;0.04)			
Constructive patriotism	Controls	4.12 (4.09;4.12)	0.04 (0.11;0.05)	0.68 (0.74;0.08)	.411 (.390;.774)	.001 (.005;<.001)
	Sojourners	4.07 (3.98;4.10)	0.04 (0.08;0.04)			
Affective identification	Controls	4.35 (4.16;4.39)	0.04 (0.09;0.04)	1.79 (0.18;2.34)	.181 (.671;.126)	.003 (.001;.004)
	Sojourners	4.28 (4.21;4.10)	0.03 (0.07;0.04)			
Behavioral identification	Controls	4.49 (4.46;4.49)	0.04 (0.09;0.04)	0.50 (0.54;0.07)	.478 (.462;.787)	.001 (.003;<.001)
	Sojourners	4.45 (4.38;4.48)	0.03 (0.06;0.04)			
Cognitive identification	Controls	4.07 (3.97;4.10)	0.04 (0.09;0.05)	1.42 (0.01;1.62)	.234 (.945;.203)	.002 (<.001;.003)
	Sojourners	4.01 (3.98;4.02)	0.04 (0.07;0.04)			

Note. Gender was included as covariate. Values in parentheses refer to participants who dropped out and participants who completed respectively.

Chapter 5

Latent structure of intercultural adjustment difficulties

This chapter details the investigation on the latent structure of intercultural adjustment difficulties. Based on the multi-faceted nature of cultural transitions, intercultural difficulties are expected to be classifiable into multiple latent factors, each pertaining to a different type of difficulty sojourners experience while overseas. In other words, multiple latent factors are expected to exist among the adjustment variables measured during phase two of the study. Moreover, different groups of sojourners may respond differently to these different types of difficulties. This suggests the possibility of heterogeneity in adjustment among the sojourners. However, due to short period of the intercultural experience in the current sample, such heterogeneity is not expected. In summary, latent factors are expected among the variables, but sojourners are not expected to be classified into multiple latent classes based on their report of adjustment difficulties:

H1: The measures of adjustment difficulty can be clustered into two significantly separated factors, one pertaining to impersonal aspects and one to interpersonal aspects.

To understand the latent structure of intercultural adjustment mentioned above, different modelling techniques were used. While exploratory factor analysis (EFA) allows for examination of existence of different latent factors underlying intercultural adjustment, it assumes that the population is homogenous without subgroups. Conversely, latent profile analysis (LPA; or latent cluster analysis for binary variables) allows for testing of heterogeneity within the population or sample, but it assumes a single factor to the phenomenon in question. Running either EFA or LPA solely without considering the possible simultaneous existence of either latent classes or

factors can result in over-extraction of class or factors respectively (Lubke & Muthén, 2005). Factor mixture modelling (FMM) is a newer technique that combines factor analysis and latent profile/cluster analysis into a single model. This allows for the test of existence of subgroups within population responding differently to various latent factors underlying a multi-faceted phenomenon such as cultural transitions

Exploratory factor analysis and latent profile analysis were first run on data of the adjustment measures collected from the sojourners during phase two of the study. This was to discover the optimal number of factors that best explained all the acculturation measures or classes in the current sample. In addition, the best-fitting EFA and LPA models also served as comparisons to the FMM model to find out if there was a need to model latent factors and classes simultaneously within one model (Hallquist & Wright, 2014).

The optimal factor structure from the EFA analysis was also used in the subsequent FMM analysis. While it was possible to run a FMM-EFA model by which the factor structure varies between the latent classes, it is not recommended as the results will be too complex to interpret meaningfully (Clark et al., 2013; Hallquist & Wright, 2014). A FMM-CFA model was used instead. This model constrains the factor structure yet allows for heterogeneity between classes in terms of factor score means, intercepts and variances.

All EFA, LPA and FMM models were ran using MPLUS 7.4 (Muthén & Muthén, 1998-2012).

Exploratory factor analysis

EFA was run on the composite scores of the phase two measures (see Table 4 for descriptive statistics and correlations). The number of factors to be retained was determined with parallel analysis. Parallel analysis computes the mean eigenvalues of

randomly generated correlation matrices for comparison to the eigenvalues obtained from the observed data. If the eigenvalue of the factor from EFA using observed data is higher than the eigenvalue of corresponding factor from parallel analysis, the factor will be retained (Hayton, Allen, & Scarpello, 2004). The EFA was estimated with Maximum Likelihood Robust with Geomin rotation and parallel analysis was done with 1000 randomly generated matrices.

Results & discussion. The results of the parallel analysis suggested a two-factors structure. The eigenvalues (and mean eigenvalue from parallel analysis) for the first ten factors were 7.34(1.40), 1.38(1.31), 1.14(1.21), 0.84(1.18), 0.68(1.13), 0.66(1.08), 0.62(1.03), 0.49(0.99), 0.40(0.94) and 0.38(0.90). Only the eigenvalues of the first two factors from sample data were higher than the corresponding random eigenvalues. From the third factor onwards, the amount of variance accounted for by the factor in the observed data was worse than random.

Table 5 shows the factor loadings of the two-factor structure. The two factors were significantly correlated at $r = .70$, $p < .05$. Using factor loading of 0.40 as the cut-off, items that loaded on the first factor were homesickness (both the stand-alone and acculturation stress scales), acculturation stress, perceived stress and guilt of leaving home. This factor was named as “internal difficulties” as the items were related to how sojourners felt. Items that loaded on the second factor were perceived discrimination (both the stand-alone and acculturation stress scales), social acculturation stress, perceived hatred, nationality rejection sensitivity, fear of host nationals and stigma consciousness. This factor was named as “external difficulties” as the items were about difficulties arising from sojourners’ perceptions or worries about the reactions of host nationals towards them.

Table 4

Descriptive statistics and correlations of phase two acculturation measures (sojourners only).

Phase two variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 SWB	4.27	0.77														
2 Stress	2.80	0.47	-0.34**													
3 Homesickness	2.40	0.71	-0.24**	0.47**												
4 Acculturation-homesickness ^a	2.60	0.92	-0.21**	0.41**	0.75**											
5 Acculturation-stress ^a	2.20	0.83	-0.28**	0.43**	0.62**	0.67**										
6 Acculturation-discrimination ^a	2.29	0.82	-0.21**	0.31**	0.50**	0.56**	0.57**									
7 Acculturation-hatred ^a	1.86	0.75	-0.28**	0.34**	0.56**	0.60**	0.61**	0.80**								
8 Acculturation-guilt ^a	2.10	0.96	-0.14*	0.32**	0.42**	0.57**	0.45**	0.46**	0.50**							
9 Acculturation-fear ^a	2.03	0.86	-0.30**	0.42**	0.63**	0.68**	0.68**	0.73**	0.75**	0.52**						
10 Acculturation-social stress ^a	2.37	0.85	-0.22**	0.34**	0.54**	0.64**	0.63**	0.85**	0.77**	0.44**	0.79**					
11 Nationality rejection sensitivity	4.80	4.23	-0.11	0.31**	0.37**	0.37**	0.40**	0.50**	0.53**	0.27**	0.57**	0.55**				
12 Loneliness	3.03	0.70	-0.29**	0.43**	0.43**	0.40**	0.44**	0.44**	0.40**	0.23**	0.47**	0.51**	0.29**			
13 Perceived discrimination	2.14	0.87	-0.10**	0.30**	0.37**	0.37**	0.42**	0.64**	0.62**	0.30**	0.58**	0.63**	0.61**	0.38**		
14 Stigma consciousness	2.96	0.64	-0.18**	0.31**	0.31**	0.32**	0.31**	0.46**	0.50**	0.20**	0.46**	0.47**	0.34**	0.33**	0.48**	
15 Depression	5.76	5.65	-0.25**	0.48**	0.34**	0.30**	0.30**	0.30**	0.24**	0.28**	0.36**	0.36**	0.32**	0.44**	0.25**	0.28**

Note. ^aSubscales of the Acculturation Stress Scale. ** $p < .01$. * $p < .05$.

Depression, loneliness and subjective well-being did not load highly on either of the two factors. It was likely that depression, loneliness and subjective well-being were manifested symptoms of adjustments rather than the experience of intercultural difficulties. Two sojourners might report the same degree of intercultural difficulties yet differed in how depressed, lonely or satisfied they felt. This is similar to the idea in the stress literature, by which individuals in the same stress circumstances respond differently to the circumstances. As such, the two factors of acculturation difficulties describe the subjective environment sojourners were experiencing and the other three variables correspond to sojourners' ability to adjust in the host country.

Table 5

Exploratory Factor Loadings of Sojourners' Phase Two Measures

Variables	Internal difficulties	External difficulties
Homesickness	.87	-.05
Acculturation-homesickness ^a	.84	.03
Acculturation-stress ^a	.61	.22
Perceived stress	.57	-.03
Acculturation-guilt ^a	.47	.16
Depression	.34	.11
Loneliness	.32	.28
Subjective well-being	-.29	-.05
Acculturation-discrimination	-.05	.94
Acculturation-social stress ^a	.10	.84
Perceived discrimination	.13	.81
Acculturation-hatred ^a	.13	.77
Nationality rejection sensitivity	.03	.60
Acculturation-fear ^a	.38	.57
Stigma consciousness	.01	.53

Note. ^aSubscales of Acculturation Stress Scale. Boldface indicates factor loading >.40.

Confirmatory factor analysis (post-hoc)

Due to the low loadings of depression, loneliness and subjective well-being on both factors, two confirmatory factor analyses (CFA) were done to compare if a model without these three variables was better. This will validate whether these three variables refer to manifested symptoms related to ability to adjust and thus do not belong to the same factor structure as the other variables that described sojourners' subjective experience of the acculturation environment.

The full model refers to CFA model with all the variables and factor structure as indicated by the EFA results above. This included depression, loneliness and subjective well-being as part of the first factor (i.e., internal difficulties). The second CFA was the reduced model that excluded depression, loneliness and subjective well-being. These two models were compared in terms of the Akaike's Information Criteria (AIC), Bayesian Information Criterion (BIC) and sample-sized adjusted BIC (adjBIC). The better fitting model is one that has smaller values on these three indices.

The reduced model was also compared with an alternative model (see Figure 2), whereby depression, loneliness and subjective well-being were consequences of internal and external difficulties. This alternative model was included as depression, loneliness and subjective well-being are common psychological symptoms investigated as a result of being in difficult situations, such as trauma or crisis. As such, this comparison will allow for a clearer understanding whether these three psychological variables should be considered as separate adjustment variables or as psychological manifestations of experiencing intercultural difficulties.

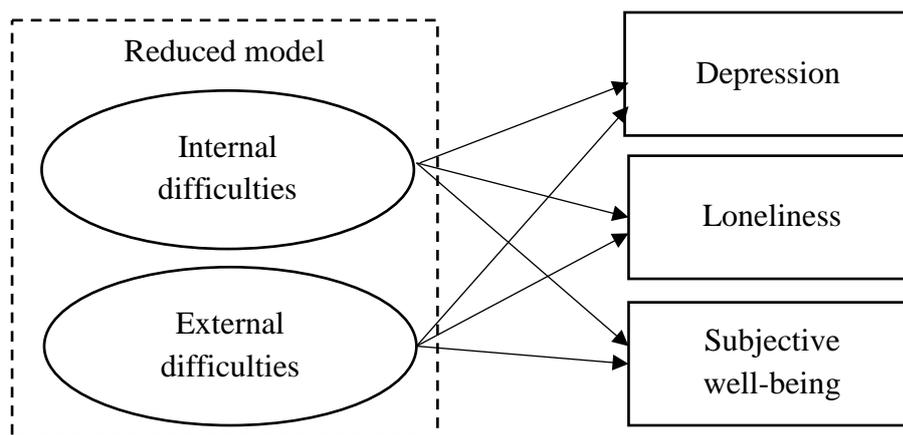


Figure 2. Conceptual diagram of the alternative model.

Results. The reduced model showed better fit with lower values on all the three fit indices: AIC at 7286.89 (versus 10397.72 for full model & 10571.75 for alternative model), BIC at 7424.54 (versus 10568.85 & 10780.08) and adjBIC at 7307.79 (versus 10422.96 & 10602.48). This suggests that depression, loneliness and subjective well-being should be regarded separately as stand-alone adjustment difficulties instead of being part of sojourners' experience of intercultural difficulties or as symptoms predicted by internal and external adjustment challenges. The latent factor of internal difficulties was subsequently modelled without these three variables.

Latent profile analysis

Latent profile analysis was done using all the Phase 2 composite scores, including depression, subjective well-being and loneliness. A total of four LPA models were run: two-, three- and four-classes models.

Results. There were inconclusive results with regards to the different LPA models. The AIC, BIC and aBIC kept decreasing with each additional class (see Table 6). However, only the two-classes model had statistically significant results on the Vuong-Lo-Mendell-Rubin (VLMR) and Lo-Mendell likelihood tests ($ps < .001$). This suggested that the addition of a third and fourth class did not significantly improve the

model's fit to data and thus should be rejected. Furthermore, the size of the fourth class was small with only 12 sojourners in the group (3.93%). As such, both the two-classes and three-classes models fit indices were used for subsequent comparison with the FMM models.

Table 6

Fit Indices and Sizes of Each Class of the Latent Profile Analysis Models.

	2-classes	3-classes	4-classes
Fit indices			
AIC	11434.85	10922.10	10689.95
BIC	11609.71	11160.20	10991.29
Adjusted BIC	11460.64	10957.22	10734.40
Entropy	.93	.93	.94
VLMR <i>p</i> -value	.0003	.13	.46
LMR <i>p</i> -value	.0003	.14	.47
Class size			
Class 1	201	114	101
Class 2	104	128	122
Class 3	-	63	70
Class 4	-	-	12

Note. AIC refers to Akaike's Information Criterion. BIC refers to Bayesian Information Criterion (BIC). Adjusted BIC refers to sample-size adjusted BIC. VLMR refers to the Vuong-Lo-Mendell-Rubin test. LMR refers to the Lo-Mendell-Rubin test.

Factor mixture model

The purpose of FMM is to examine whether the inclusion of both latent classes and factors can explain the data better than if only latent class or factor is modelled. In other words, FMM allows for closer examination of the data to whether there is heterogeneity among sojourners with regard to how they adjusted overseas.

Similar to LPA, multiple FMM models have to be fitted with varying number of classes and levels of measurement invariance. Models with strict measurement invariance and semi-invariance were tested. Strict measurement invariance, also known as metric invariance, restricts the factor loadings, variances and factors correlation to be class-invariant. This allows for direct comparison of factor scores between and within classes (Hallquist & Wright, 2014; Lubke & Muthén, 2005; Masyn, Henderson, & Greenbaum, 2010). In semi-invariance models, the factor loadings are allowed to vary between classes. This allows for the possibility of different factor structures between classes (Shevlin & Elklit, 2012).

A total of four FMM models were run; two- and three-classes models with strict- and semi-invariance restrictions. The factor structure of the reduced model was used in the factor structure modelling. Depression, subjective well-being and loneliness were included as variables that could influence the latent class membership of sojourners. The two latent factors, depression, subjective well-being, and loneliness were allowed to correlate. Gender was included as covariate. Figure 3 shows the conceptual path diagram of the FMM model.

Results. The strict measurement invariance two-class model showed the best fit among all the FMM models, with lowest BIC value of 10537.95 and statistically significant results on the VLMR likelihood ratio test ($p = .04$) and LMR-adjusted likelihood ratio test ($p = .04$). These significant results indicate that the additional class (i.e., second class) made significant improvement to the model fit. The sizes of the two classes were 249 and 56, with entropy at .89.

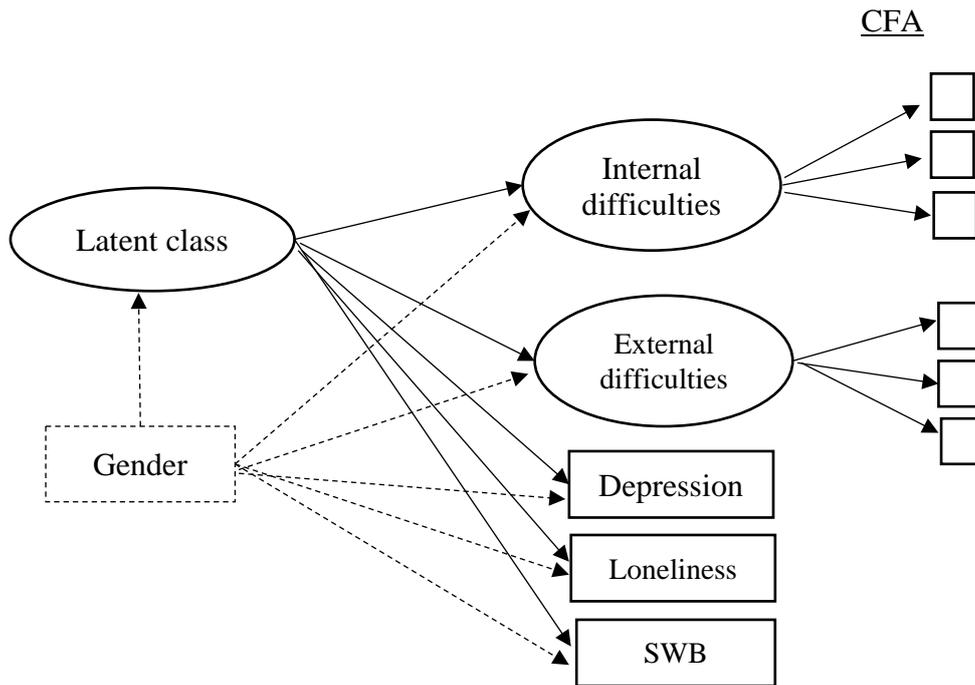


Figure 3. Conceptual path diagram of the factor mixture model. SWB refers to subjective well-being. CFA refers to confirmatory factor analysis portion of the model. Squares indicate the observed variables (exact number of items not illustrated due to space).

However, this best-fitting FMM model showed worse fit relative to the previous CFA two-factors reduced model. Table 7 summarizes the fit indices and class sizes of the four FMM models, together with the reduced-CFA, two- and three-classes LPA models for comparison purpose. Based on the fit indices, the reduced two-factors CFA model was the best fitting model, suggesting that the data was best explained by two latent factors without subgroups among the sojourners.

Table 7

Comparison of FMM, CFA and LPA models.

Fit indices	Factor mixture models						CFA (2 factors)	LPA (2 classes)	LPA (3 classes)
	Strict invariance		Semi-invariance		3 class				
	2 class	3 class	2 class	3 class	2 class	3 class			
AIC	10255.20	10186.51	10259.36	10171.77	10259.36	10171.77	7286.89	11434.85	10922.10
BIC	10537.95	10539.94	10586.75	10599.61	10586.75	10599.61	7424.54	11609.71	11160.20
adjBIC	10296.91	10238.65	10307.65	10234.89	10307.65	10234.89	7307.19	11460.64	10957.22
Entropy	.89	.90	.59	.84	.59	.84	-	.93	.93
VLMR <i>p</i> -value	.04	.26	.24	.36	.24	.36	-	.003	.13
LMR <i>p</i> -value	.04	.26	.24	.36	.24	.36	-	.003	.14
<u>Class sizes</u>									
Class 1 size	249	20	106	71	106	71	-	201	114
Class 2 size	56	54	199	191	199	191	-	104	128
Class 3 size	-	231	-	43	-	43	-	-	63

Note. CFA refers to confirmatory factor analysis. LPA refers to latent profile analysis. FMM refers to factor mixture model. AIC refers to

Akaike's Information Criterion. BIC refers to Bayesian Information Criterion (BIC). AdjBIC refers to sample-size adjusted BIC. VLMR refers to the Vuong-Lo-Mendell-Rubin test. LMR refers to the Lo-Mendell-Rubin test.

Discussion

This chapter detailed the various modelling of sojourners' phase two measures on sojourners' adjustment to answer the first research question: Are there multiple dimensions to intercultural difficulties, and are there different clusters of sojourners who differ in the dimension they have greater problems with? The data was explored with various modelling techniques that tested for latent factors, subgroups or clusters, or both.

The best fitting model across the modelling techniques was the two-factor CFA model that excluded subjective well-being, depression and loneliness in the factor structure. This suggests that difficulties sojourners encounter while adapting to host culture could be summarized into two factors or dimensions – internal and external. This is similar to other studies that examined multidimensionality of acculturation, such as the overt versus internal dimensions in cultural identity (Matsudaira, 2006) and public versus private domains of acculturation attitudes (Arends-Tóth & Van de Vijver, 2007).

The “internal difficulties” factor was defined by items describing homesickness, stress of having to adjust to a new culture, or general stress of living in the host country. These were mostly feelings experienced within the sojourners during the intercultural adjustment process. In the acculturation literature, this dimension is often merely referred to as acculturative stress. Such feelings or experience of difficulties living overseas within the sojourners can have significant impact on sojourners' quality of acculturation, particularly so for students (Bochner, 2006) who are younger and often less experienced.

The second factor “external difficulties” was defined by items related to perceptions or concerns about how the host nationals regarded or treated the

sojourners. These were mainly about being discriminated, stereotyped, rejected or even hated by the host nationals for racial or ethnic reasons. In other words, the source of these difficulties lies external to or outside the sojourner. Such difficulties with the host nationals can be very distressful and can result in poorer acculturation (Juang & Cookston, 2009), perception of identity discrepancies (Jung, Hecht, & Wadsworth, 2007), or poor psychological outcomes such as depression (Juang & Cookston, 2009; Jung et al., 2007) and lower psychological well-being in general (Jasinskaja-Lahti, Liebkind, Jaakkola, & Reuter, 2006).

Depression, loneliness and subjective well-being did not load well on either factor and were excluded from the factor structure of intercultural difficulties. This suggests that these three should be considered separately rather than as part of intercultural difficulties in general. The two factors of intercultural difficulties may be considered as emotional or cognitive appraisals of the overseas experience (Berry, 2006; Lazarus, 1998) which may or may not manifest into psychological symptoms such as depression (Rudmin, 2009). While, the two factors on internal and external difficulties may also be considered as the intrapsychic environment that predict depression, loneliness and subjective well-being, the modelling results did not support this alternative view.

The lack of heterogeneity among the sojourners may seem to contradict existing literature that demonstrated different patterns of acculturation in sojourners. For example, a recent study by Demes and Geeraert (2015) found that sojourners could be classified into five classes based on their patterns of cultural maladjustment. Another earlier study by Wang and colleagues (2012) found four classes of cultural adjustment trajectories. The presence of a homogenous sample in the current study could be due to the short acculturation period as compared to these two longitudinal

studies, both of which examined acculturation that spanned at least a year.

Comparatively, the duration of this exchange program was only one semester. As such, most sojourners were in the host countries for five months or less. This short period might not have allowed for much heterogeneity to take place among the current sample.

The concurrent use of factor analyses, latent profile analysis and factor mixture modelling allowed for a thorough examination into the nature of intercultural difficulties. This allowed for a deeper understanding on whether the observed data on intercultural adjustment is better explained by clustering the variables, the participants or both. Based on the fit indices (AIC, BIC and adjusted BIC), intercultural difficulties could be classified into two latent dimensions and sojourners were homogenous in how they responded to these dimensions. Furthermore, the factor analyses suggested that intercultural difficulties should be considered as separate constructs from psychological well-being. As such, subjective well-being, loneliness and depression will be considered as independent measures of intercultural difficulties that are distinct from two latent dimensions.

Chapter 6

Attachments, host culture & biological sensitivity

Structure equation model (Figure 4) was used to answer the questions on (1) how biological sensitivity interacts with one's intrapsychic environment (in terms of parental and cultural attachment) and external environment (i.e., cultural difference between home and host countries) to affect intercultural adjustment, (2) whether parental and cultural attachments are distinctive in their effects on cultural adjustment, (3) the ways these effects relate differently to various aspects of cultural adjustment. The final latent structure of intercultural adjustments from chapter five was used. The hypotheses related to these three research questions were:

H2a: Maternal overprotectiveness is expected to be positively associated with intercultural adjustment difficulties related to host nationals.

H3a: Paternal overprotectiveness is expected to be positively associated with intercultural adjustment difficulties related to host environment adaptation in general.

H4a: Cultural attachment to Singapore is expected to be negatively associated with both aspects of intercultural adjustment difficulties.

H5a: Cultural distance is expected to be positively associated with both aspects of intercultural adjustment difficulties.

The polygenic risk score was hypothesized to positively moderate the relationship between experience of internal and external difficulties to the manifested outcomes:

H2b: The positive relationship between maternal overprotectiveness and host-national difficulties is expected to be positively moderated by polygenic score.

H3b: The positive relationship between paternal overprotectiveness and host-environment adaptation difficulties is expected to be positively moderated by polygenic score.

H4b: The negative relationship between cultural attachment and intercultural difficulties is expected to be positively moderated by polygenic score.

H5b: The positive relationship between cultural distance and intercultural difficulties is expected to be positively moderated by polygenic score.

Internal and external variables were set to correlate with each other. Gender, behavioral and cognitive identifications with Singapore were included as covariates but not shown in the conceptual path diagram below. Significant interaction effects would be visually presented as simple slopes at average, one standard deviation below (i.e., low) and above (i.e., high) mean polygenic score for better understanding of the nature of the interaction. However, these simple slopes were not tested as there are no meaningful cut-off values for polygenic score to separate the individuals into high or low biologically sensitive groups. As such, tests of significance of the simple slopes cannot be interpreted meaningful and may instead be misleading (Dawson, 2014).

The results of controls were reported for effects that were significant for sojourners. This was to allow comparison between normal day-to-day stressors and stressors related particularly to cultural adjustments; significant effects not found in control sample suggest that these effects were unique to intercultural transitions. In

controls, internal difficulty is represented by the manifested variable of perceived stress. There are no comparative variables for external difficulties and cultural distance.

That said, the focus of the current thesis is on the sojourners and the controls were used as a comparison when needed.

Descriptive statistics and correlations of the observed variables presented in Table 8 below. All variables used in the analyses had been mean-centered to minimize issues of multi-collinearity with the interaction terms.

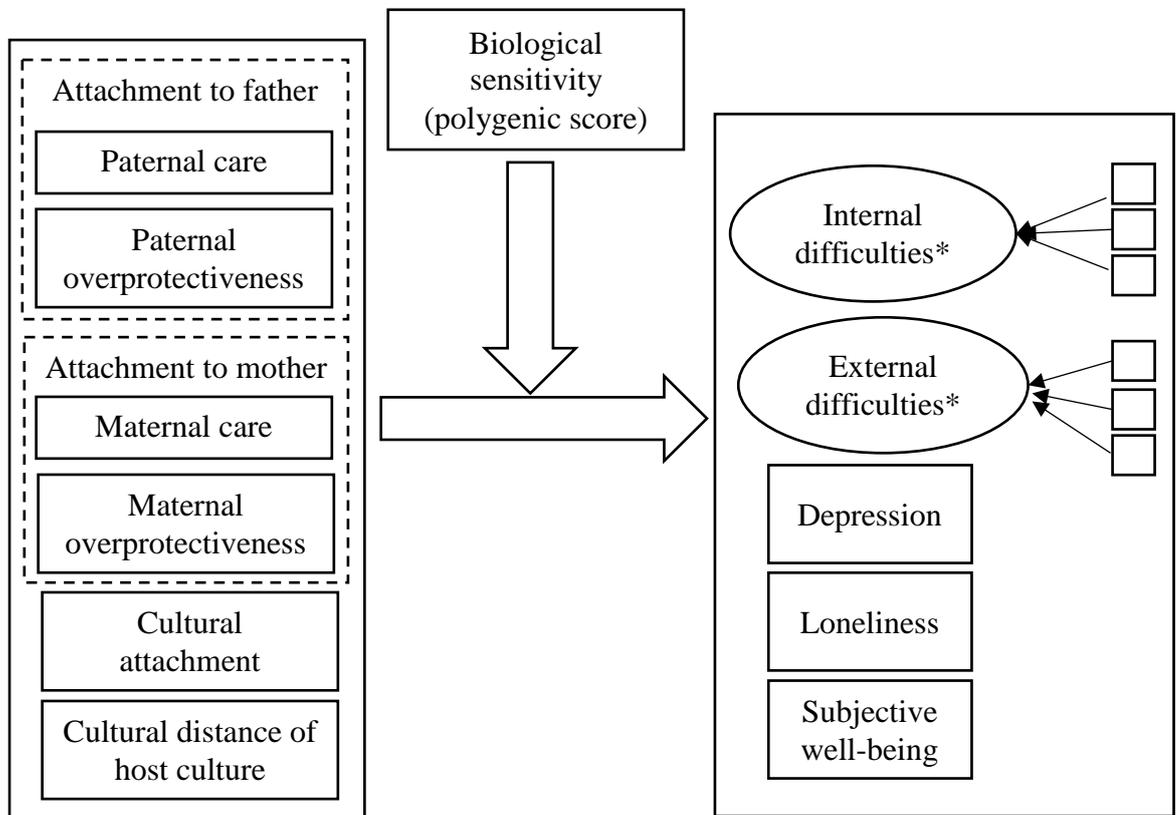


Figure 4. Conceptual structural equation model of attachments, cultural distance and polygenic score on cultural adjustments.

Note. * refer to Table 5 for items loading onto the latent variables of internal and external difficulties.

Table 8

Descriptive statistics and correlations of the measures of attachments, polygenic score, depression, loneliness and subjective well-being (sojourners only).

Phase two variables	Mean	SD	1	2	3	4	5	7	8	9	10
1 Maternal care	2.07	0.55									
2 Maternal overprotectiveness	1.22	0.49	-.20**								
3 Paternal care	1.81	0.63	.45**	-.14*							
4 Paternal overprotectiveness	0.93	0.48	-.05	.48**	-.11						
5 Cultural attachment	4.31	0.65	.14*	-.09	.16**	-.08					
6 Cultural distance	4.60	0.88	.07	.004	.09	-.09	.01				
7 Polygenic score	0.97 ^a	0.58 ^a	-.06	.01	-.08	.06	.11	.09			
8 Depression	5.76	5.65	-.27**	.09	-.07	.08	-.09	.08	.03		
9 Loneliness	3.03	0.70	-.13*	.13*	-.13*	.06	-.09	.02	.01	.44**	
10 Subjective well-being	4.27	0.77	.10	-.09	.21**	-.13*	.20**	.09	-.05	-.25**	-.29**

Note. ^aMultiplied by constant value 1000. * $p < .05$. ** $p < .01$.

Results

Hypotheses two to five were tested in the structural equation model. Results that supported the hypotheses will be presented first, followed by results that did not support the hypotheses. Overall, the model showed reasonable fit according to the fit indices; $\chi^2(263) = 599.47$ with normed $\chi^2 = 2.28$, RMSEA = .07, CFI = .88, SRMR = .04, AIC = 9311.15, BIC = 9824.21. Table 9 shows the coefficients of all the main and interaction effects.

Supported hypotheses. Maternal overprotectiveness was hypothesized to be positively associated with difficulties with host nationals (Hypothesis 2a). This hypothesis was supported, as external difficulties ($\beta = 0.16, p = .021$) and loneliness ($\beta = 0.14, p = .047$; $\beta_{controls} = 0.18, p = .058$) were significantly predicted by maternal overprotectiveness. Sojourners with more protective mothers experienced more difficulties related to host nationals than their counterparts with less protective mothers. We cannot test this effect on the control group because the control group has not responded to external difficulties and loneliness measures.

Paternal overprotectiveness was expected to be positively associated with internal difficulties (Hypothesis 3a). Results supported this hypothesis ($\beta = 0.16, p = .021$; $\beta_{controls} = 0.01, p = .888$). Sojourners with fathers who were more overprotective indeed experienced more difficulties navigating the host environment. In addition, this was unique to the intercultural context as there was no significant effect found among the controls.

Cultural attachment to Singapore was expected to be negatively associated with all aspects of intercultural adjustment difficulties (Hypothesis 4a). This hypothesis was partially supported. Cultural attachment was significantly associated with higher subjective well-being ($\beta = 0.23, p = .002$; $\beta_{controls} = 0.11, p = .257$) and

lower depression ($\beta = -0.25, p = .001; \beta_{controls} = -0.24, p = .010$) among sojourners, but not with internal nor external intercultural difficulties ($ps > .11$). However, the effect on depression was not unique to intercultural adjustments as similar effect was significant in the controls.

The effect of cultural attachment and intercultural difficulties was also expected to be positively moderated by polygenic score (Hypothesis 4b). This was also partially supported. The effect of cultural attachment on subjective well-being was positively moderated by polygenic score ($\beta = 0.19, p = .023$). As seen in Figure 5, the positive relationship between cultural attachment and subjective well-being was strongest for sojourners with higher polygenic score.

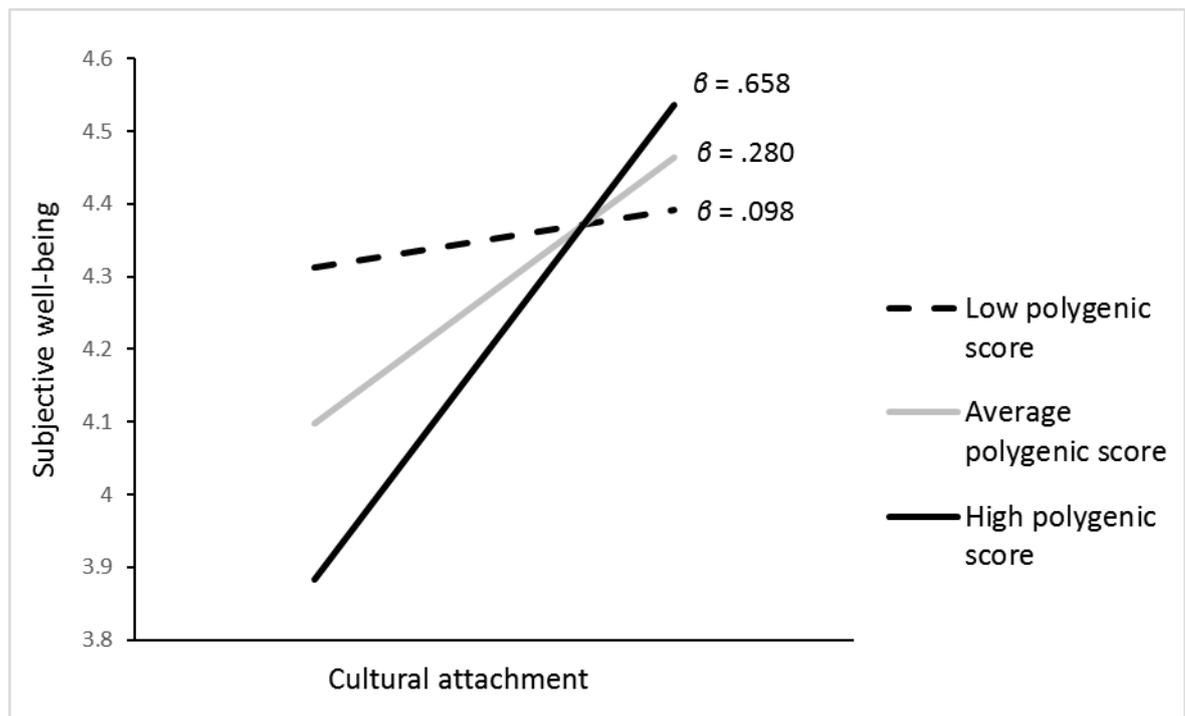


Figure 5. Simple slopes of sojourners' subjective well-being and cultural attachment at different levels of polygenic scores.

Unsupported hypotheses. The relationship between maternal overprotectiveness and difficulties related to host nationals was expected to be positively moderated by polygenic score (Hypothesis 2b). However, this hypothesis was not supported as there was no significant moderation on the effects between maternal overprotectiveness on either external difficulties ($p = .078$) or loneliness ($p = .265$).

The relationship between paternal overprotectiveness and host-environment adjustment difficulties was also expected to be positively moderated by polygenic score (Hypothesis 3b). At first glance, results suggested conflicting results between effect on internal difficulties ($\beta = -0.18, p = .01; \beta_{controls} = 0.13, p = .159$) and subjective well-being ($\beta = 0.20, p = .002; \beta_{controls} = -0.08, p = .411$). However, looking at the simple slopes of internal difficulties (Figure 6) and subjective well-being (Figure 7), both showed that sojourners with lower-than-average polygenic score were most affected by paternal overprotectiveness.

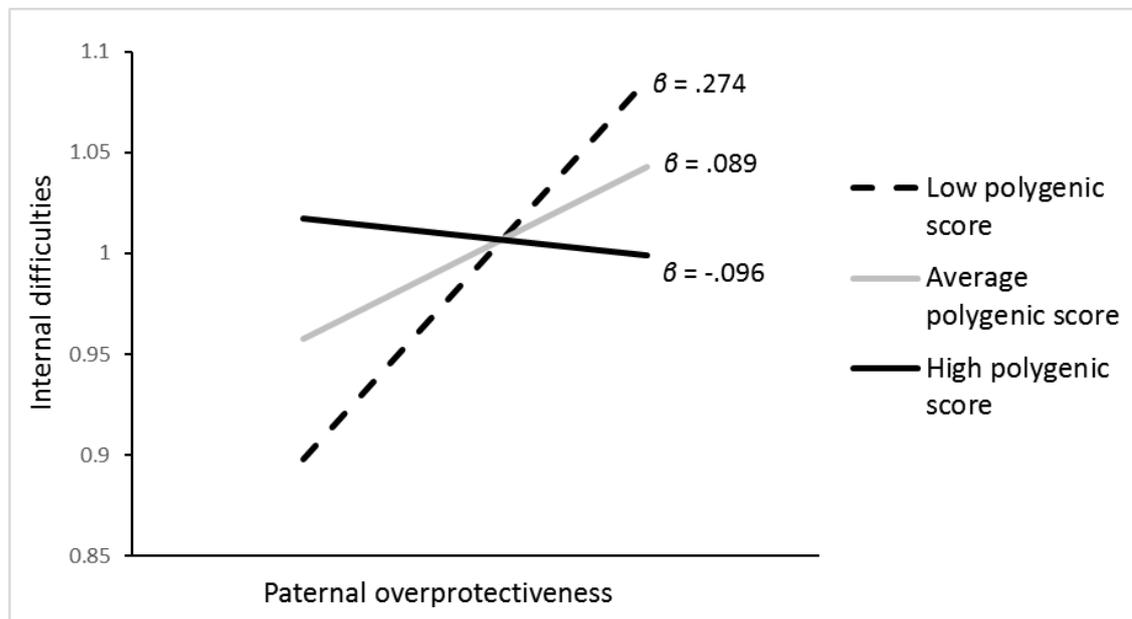


Figure 6. Simple slopes of sojourners' experience of internal difficulties and paternal overprotectiveness at low and high levels of polygenic score.

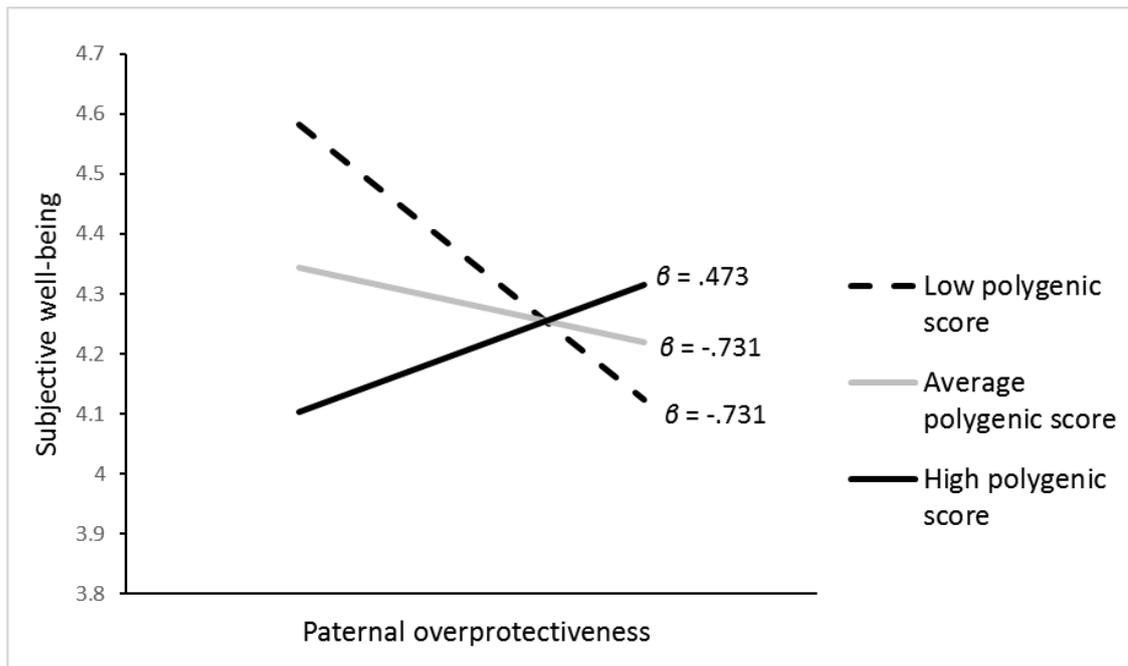


Figure 7. Simple slopes of sojourners' subjective well-being and paternal overprotectiveness at different levels of polygenic scores.

Cultural distance was hypothesized to be positively associated with all aspects of intercultural adjustments (Hypothesis 5a). However, there was no significant main effects of cultural distance on any of the adjustment measures ($p > .07$).

Polygenic score was also hypothesized to positively moderate the effect of cultural distance on intercultural adjustment (Hypothesis 5b). There were conflicting findings to this hypothesis. While polygenic score did indeed positively moderate the effect of cultural distance on sojourners' subjective well-being ($\beta = 0.21, p < .001$), it also negatively moderated the effect on loneliness ($\beta = -0.16, p = .011$). However, upon closer examination of the simple slopes on subjective well-being (Figure 8) and loneliness (Figure 9), sojourners with higher polygenic score adjusted better to countries very different from Singapore. In contrast, the reverse was true for sojourners with lower-than-average polygenic score with regards to their subjective well-being and loneliness while overseas.

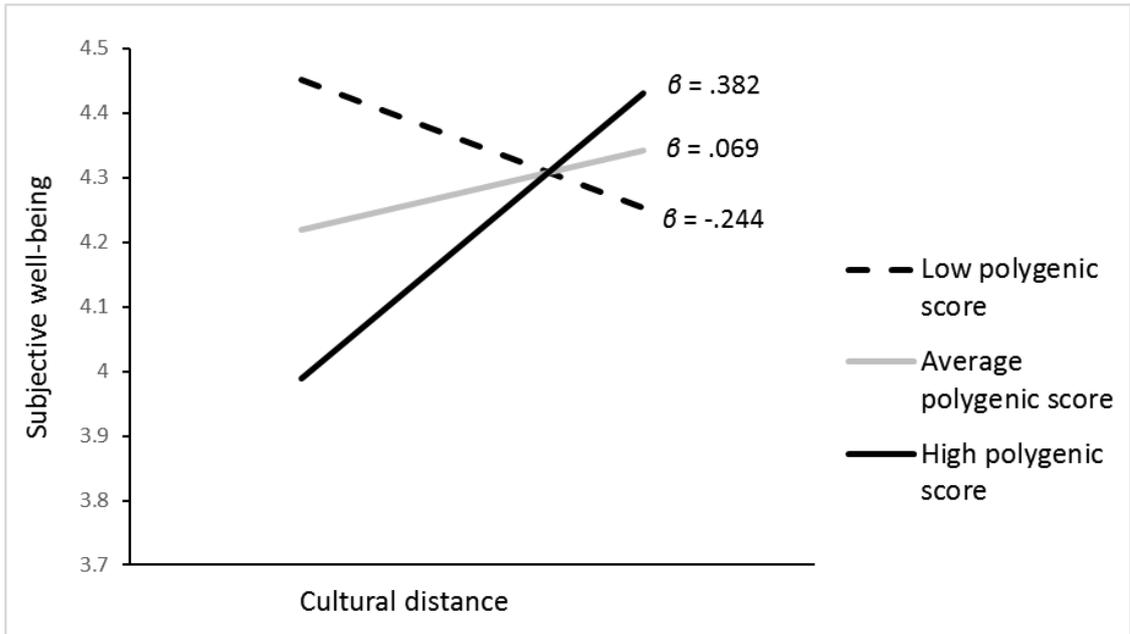


Figure 8. Simple slopes of sojourners' subjective well-being and cultural distance of host country at different levels of polygenic scores.

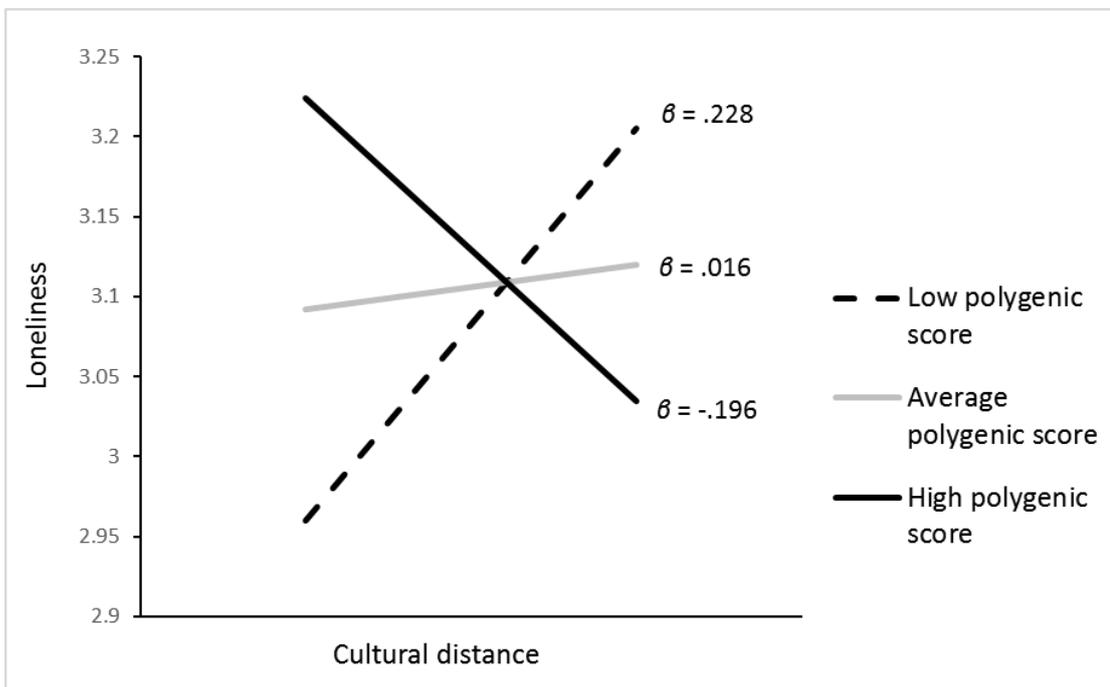


Figure 9. Simple slopes of sojourners' loneliness and cultural distance at different levels of polygenic score.

Unexpected but interesting findings. While these results were not hypothesized, due to the exploratory nature of gene-by-environment component of the current research, these findings are given special mention as they shed some light on the broader research question on how genes can moderate one's intrapsychic and external environments to affect intercultural adjustments.

While effect of maternal overprotectiveness was only hypothesized for difficulties related to host nationals, significant moderation effect of polygenic score was found for its effect on internal difficulties ($\beta = 0.17, p = .023$). Having higher polygenic score accentuated the relationship between maternal overprotectiveness and sojourners' experience of internal difficulties. The lack of significant main effect also suggested presence of cross-over interaction, as seen in Figure 10. The effect of maternal overprotectiveness on sojourners' experience of internal difficulties navigating the host environment depended on their genetic predisposition. General perceived stress was also significantly moderated by polygenic score for controls ($\beta_{controls} = -0.20, p = .037$). However, general stress might not be the best comparison to sojourners' internal difficulties as the latter included other stressors related primarily to intercultural adjustments. Indeed, when sojourners' general stress was analyzed independently, there was no significant moderation effect, thus suggesting that the effects of internal difficulties were primarily related to the other stressors encompassed within internal difficulties that were specific to intercultural adjustments.

Both maternal and paternal care also had significant, though different, effects on intercultural adjustment. Maternal care was a protective factor against depressive symptoms, as sojourners with more caring mothers also had lower depression scores ($\beta = -0.26, p < .001; \beta_{controls} = -0.09, p = .258$). Paternal care was associated with well-being in general, as sojourners with more caring fathers had higher subjective well-

being while overseas ($\beta = -0.18, p = .007; \beta_{controls} = 0.10, p = .184$). Moreover, these effects of parental care were unique to intercultural contexts as there were no significant effects found among the controls.

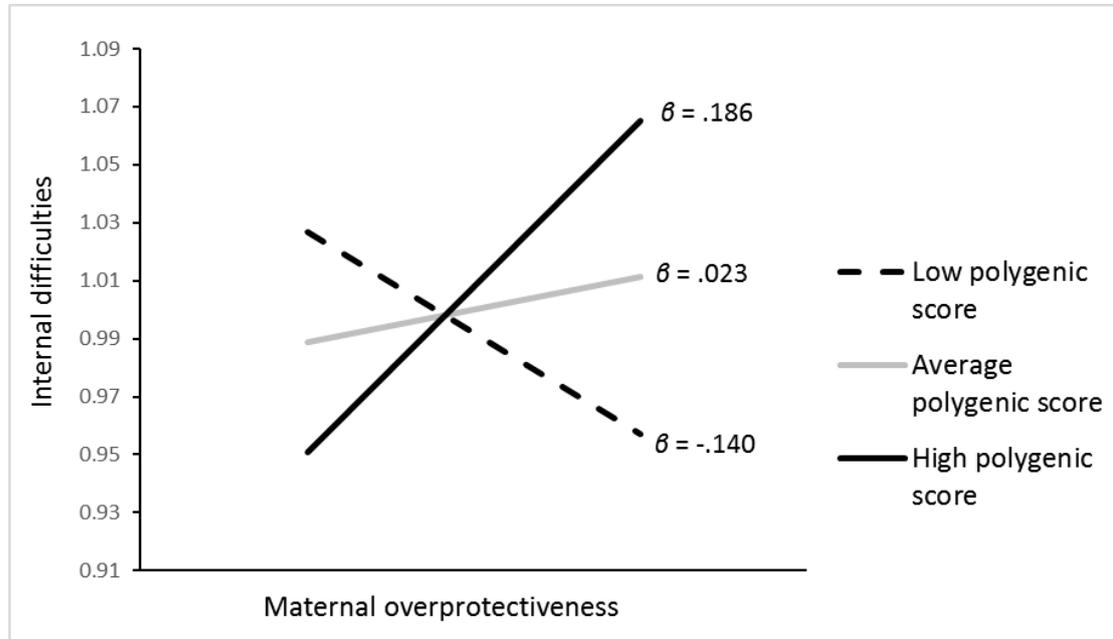


Figure 10. Simple slopes of sojourners' experience of internal difficulties and maternal overprotectiveness at different levels of polygenic score.

Table 9

Standardized Beta Coefficients of Internal and External Difficulties, Depression, Loneliness & Subjective Well-Being On Parental and Cultural Attachments, & Cultural Distance.

Cultural adjustment	Predictors	Main effect		Interaction with polygenic score	
		β	p	β	p
Internal difficulties	Maternal overprotectiveness	.042	.564	.168	.023
	Maternal care	.031	.658	.007	.921
	Paternal overprotectiveness	.163	.021	-.182	.010
	Paternal care	.039	.587	-.011	.880
	Cultural attachment	-.135	.110	-.066	.472
	Cultural distance	.033	.595	-.003	.964
	Polygenic score	.031	.622	-	-

Cultural	Predictors	Main effect		Interaction with	
External difficulties	Maternal overprotectiveness	.162	.021	.127	.078
	Maternal care	-.059	.392	.050	.469
	Paternal overprotectiveness	.071	.302	-.059	.401
	Paternal care	.035	.618	-.027	.709
	Cultural attachment	-.025	.766	.040	.653
	Cultural distance	.109	.074	-.005	.935
	Polygenic score	-.055	.372	-	-
	Depression	Maternal overprotectiveness	.008	.904	.075
Maternal care		-.256	< .001	.028	.662
Paternal overprotectiveness		.077	.235	-.025	.707
Paternal care		.048	.467	-.040	.549
Cultural attachment		-.251	.001	-.077	.358
Cultural distance		.076	.185	-.086	.149
Polygenic score		.052	.371	-	-
Loneliness		Maternal overprotectiveness	.136	.047	.079
	Maternal care	-.057	.394	-.067	.321
	Paternal overprotectiveness	-.018	.792	-.048	.484
	Paternal care	-.072	.295	.029	.676
	Cultural attachment	-.155	.054	-.107	.219
	Cultural distance	.020	.743	-.156	.011
	Polygenic score	.033	.582	-	-
	Subjective well-being	Maternal overprotectiveness	-.063	.340	-.063
Maternal care		-.048	.455	.001	.990
Paternal overprotectiveness		-.079	.222	.199	.002
Paternal care		.177	.007	-.029	.665
Cultural attachment		.234	.002	.189	.023
Cultural distance		.078	.174	.207	< .001
Polygenic score		-.09	.113	-	-

Note. Boldface indicates significant at $\alpha = .05$ level.

Discussion

This chapter aims to determine if there were differential effects between the various attachments on the different aspects of intercultural adjustments as well as a moderating effect of biological sensitivity to social influences defined by particular genetic variations between individuals. In general, the hypotheses related to the main effects of maternal (Hypothesis 2a) and paternal overprotectiveness (Hypothesis 3a), and cultural attachment (Hypothesis 4a) were supported, while the hypotheses related to cultural distance (Hypotheses 5a & 5b) and polygenic score (Hypotheses 2b, 3b, 4b, 5b) were either conflicting or not supported. There were also other interesting findings that were not hypothesized, but nevertheless give us better understanding of the relationships between attachments, genetic predisposition and intercultural adjustments.

Attachments. There were indeed differential effects of maternal and paternal attachments on the various aspects of intercultural adjustments. As hypothesized, paternal overprotectiveness (Hypothesis 3a) was a risk factor for difficulties related to host country adjustment (i.e., internal difficulties) and maternal overprotectiveness (Hypothesis 2a) was a risk factor for difficulties related to host nationals (i.e., external difficulties) or interpersonal connectedness (i.e., loneliness). Furthermore, maternal care was a protective factor to experiencing depressive symptoms. This is in line with existing literature that internalized acceptance and warmth from mothers contribute to greater emotional regulation, which thus translate into lower score on the depression scale.

The effect of paternal care on sojourners' general sense of well-being was novel and not much work on fathers' care has been done in the existing literature. It is less clear whether paternal care buffered against low subjective well-being or it

contributed to sojourners experiencing higher-than-average subjective well-being. However, it is interesting that paternal care was only significant in affecting subjective well-being, which was the only “positive” measure in the current study. It is possible that paternal care, with its affiliation to the exploration system and confidence, may be related to optimism and positive outlook in managing change or navigating new environments.

The differential effects of maternal and paternal attachments thus support the idea of different contributions of the attachment and exploration systems to adjustment of new cultural environments. However, more research will be required to further understand the differential impacts of maternal versus paternal attachment, and parental overprotectiveness versus care.

Cultural attachment was expected to be negatively associated with intercultural difficulties related to both host environment (i.e., internal difficulties) and host nationals (i.e., external difficulties). This hypothesis (Hypothesis 4a) was not supported. However, cultural attachment to Singapore was a protective factor against depression as well as contributing to higher subjective well-being. Given the findings on the differential effect of overprotectiveness and care, cultural attachment is likely to contribute to psychological well-being in a manner akin to parental care. In other words, the significant effects on depression and subjective well-being suggests that cultural attachment might not affect sojourners’ social cognitions but the emotional aspects of cultural adjustments.

Moderation by genetic predisposition in biological sensitivity. Part of this study was designed to examine if genetic predispositions moderates the influences of environment on intercultural adjustments and psychological well-being in cultural transitions. Genetic variation has been found to be a significant moderator in external

environment influences, such as negative situations, but this study argues that the environment may not merely be external but intrapsychic as well. Genetic predisposition was expected to positively moderate the effect of attachments (i.e., intrapsychic environment) and cultural distance (i.e., external environment) on intercultural adjustments in general. While significant moderation of the effects of attachments and cultural distance were found, the direction of the moderations were mixed.

With the exception of the moderation of cultural attachment on subjective well-being, the simple slopes of the significant moderation showed cross-over effects. This is especially noteworthy because it highlights the importance of genetic predisposition; the effect of attachments or cultural distance on psychological well-being overseas depends on whether one's biological sensitivity. Depending on one's biological endowments, the effects of intrapsychic or external environments may be positive or negative. While existing literature has argued for the moderating effect of high polygenic score, or genetic variations that predisposes to sensitivity to environment, the current results suggests that lower than average polygenic score may also be consequential.

To summarize, for sojourners with high polygenic score, they fared better if their fathers were overprotective and they were in countries that were culturally very different from Singapore. For these sojourners, having more protective fathers was associated with lower internal difficulties and higher subjective well-being, contrary to expectations. Furthermore, if they were in a very different host environment from Singapore, they also experienced higher subjective well-being and lower loneliness. Yet, if they have overprotective mothers or less attachment to Singapore, they experienced more internal difficulties and lower subjective well-being respectively.

However, the reverse was true for sojourners with below average polygenic score. For sojourners with below average polygenic score, the effects were more congruent with expectations or past research. For these sojourners, having overprotective fathers corresponded with greater difficulties navigating the host environment and lower subjective well-being while overseas. Moreover, being in a host country culturally very different from Singapore (i.e., large culture distance) was associated with lower subjective well-being and higher loneliness.

This research started with the premise that environment may be understood as broader than merely the external environment; the mental models and social cognitions of individuals may also be considered as intrapsychic environment as they ultimately shape the reality that is perceived. Moreover, the moderating effect of genetic predisposition might be more complicated or indirect than expected, thus accounting for seemingly conflicting results among the sojourners.

One possibility is that individuals who are biologically more sensitive (i.e., higher polygenic score) might not only be more affected by environmental factors, they might also be more observant of subtleties in the environment and hence better able to respond appropriately. If high score is coupled with being more cautious due to overprotective paternal parenting (although these sensitive individuals might be less advantaged in exploring the new environment), they again are more aware of the differences and thus are better able to adapt or respond appropriately. Being more observant may also help them to adapt to host environments that are culturally very different. This is particularly true as sojourners going to cultures that are very different from Singapore are likely to be mentally and emotionally prepared for the differences, this expectation might prime them to be more cautious which in turn motivates them to make use of their natural sensitivity to adapt to the very different environment. This is

in line with some candidate genes studies that found that individuals with more sensitive genetic variations behave more normatively to their home culture (Kim et al., 2011; Kim et al., 2010) or are more easily influenced by environmental cues (McClernon et al., 2007; Settle et al., 2010; Simons et al., 2012).

Furthermore, this sensitivity is also directed internally towards one's emotional resources. The heightened sensitivity to emotions might translate into these individuals being more affected positively by the affectionate bond to home culture or negative by the anxious attachment to overprotective mothers. This is in line with past candidate gene studies that found sensitive genetic variations being associated with heightened attention to emotional stimuli (Beavers et al., 2011; Beavers et al., 2009), amygdala reaction (Gillihan et al., 2011; Gillihan et al., 2010) or emotional reactions to adversities (e.g., Caspi et al., 2003; Pluess et al., 2010; Uher et al., 2011). While these studies focused on external emotional stimuli, the current findings suggest that genetic sensitivity may also be directed inwards towards one's internal emotional resources such as significant attachments.

To further test the validity of using polygenic score based on the hypothalamic-adrenal-pituitary (HPA) genes as a measure of genetic predisposition to biological sensitivity to environment, similar analyses were run with a polygenic score that was based on dopamine genes. The dopamine system is most commonly associated with rewards, risk-taking and impulsivity. However, there were no significant results with the dopamine scores. Thus, this demonstrates discriminant validity of the HPA polygenic score used in the current study.

Chapter 7

Effect of intercultural adjustment on self-esteem and patriotism

Latent change models were used to examine the effect of intercultural exposure on change in self-esteem and patriotism. However, the intercepts and factor loadings had to be invariant across time to be interpreted meaningfully. In other words, strong factorial invariance must first be demonstrated (Geiser, 2013; Little, 2013; McArdle, 2009). Tests of factorial invariance for the self-esteem, blind and constructive patriotism were done on separate models. Further analysis was not done for any variable that did not have strong factorial invariance across the two time-points (phase one and three) as the meaning of the construct has changed across time, rendering interpretation of results meaningless.

Tests of factorial invariance across time

Three models were fitted for each variable: configural invariance, weak factorial invariance and strong factorial invariance (or metric invariance). Configural invariance across time is the least restrictive model as only the factor structure is constrained to be equal (Little, 2013; Vandenberg & Lance, 2000; Widaman & Reise, 1997). Weak factorial models refer to model that constrained factor loadings to be equal across time. Strong factorial invariance (or metric invariance) model is even more restrictive as it constrains the intercepts of factors to be equal as well. The fit of more restricted model was then compared to the less restrictive model. Higher level of measurement invariance was indicated by lack of significant difference in chi-square between the two models, as it indicated that adding more constraints did not significantly worsen the model fit.

For self-esteem, all the three models of varying measurement invariance across time showed reasonable fit to data. There was no significant chi-square difference

between the configural invariance and weak factorial invariance, $\chi^2_{\Delta}(17) = 18.13, p = .381$. There was also no significant chi-square difference between the weak factorial invariance and strong invariance models, $\chi^2_{\Delta}(9) = 16.16, p = .064$. This suggests the presence of strong factorial invariance of the self-esteem measures between phase one and phase three, thus allowing for subsequent analysis of latent change of self-esteem before and after the intercultural experience.

The subscales of Constructive and Blind patriotism were modelled separately. This allowed for the scenario that one of the subscales might not meet criteria of strong factorial invariance across time. For blind patriotism, there was no significant difference between the configural invariance and weak factorial invariance models, $\chi^2_{\Delta}(5) = 10.5, p = .062$. However, there was a significant difference in chi-squares between the weak invariance and strong invariance, $\chi^2_{\Delta}(5) = 17.23, p = .004$. Without strong factorial invariance across time, change in the means of blind patriotism between phase one and phase three could not be interpreted meaningfully as the intercepts were not equal across the two time points (Little, Preacher, Selig, & Card, 2007). As such, only constructive patriotism would be analyzed in the subsequent latent change models.

Latent change analysis

Change between phase one and phase three was modelled by a latent variable, thus correcting for random measurement errors to capture true change across time (Steyer, Eid, & Schwenkmezger, 1997). This modelling is also known as the latent change model (McArdle, 2009). The general conceptual latent change model is shown in Figure 11. The syntax was adapted from Geiser (2013). The general equation of a latent change model is as shown:

$$\text{latent change}_Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \dots + \beta_k X_k + e$$

The intercept (β_0) indicates the average increase or negative in the dependent variable (y), after taking all the other variables (Xs) into consideration. The coefficient of the independent variable (e.g., β_1) indicates the proportional effect of the variable X (e.g., X_1). If this coefficient is positive, it indicates that at higher levels of X, the latent change in Y is more positive (or less negative). On the other hand, if the coefficient is negative, the latent change in Y is less more negative (or less positive) at higher levels of X.

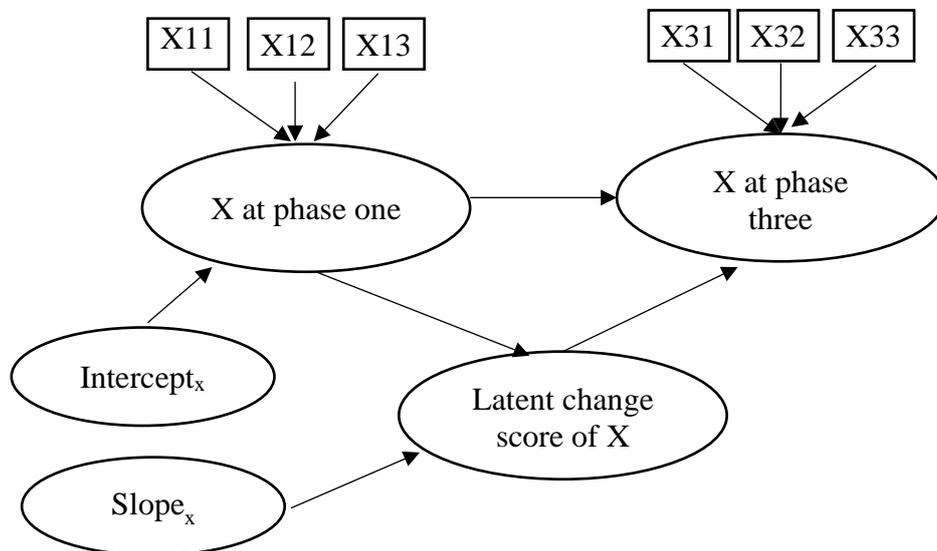


Figure 11. General conceptual model of latent change of variable X.

Two latent changes were examined – self-esteem and constructive patriotism. Blind patriotism was excluded due to lack of strong factorial invariance over time. Self-esteem and constructive patriotism were demonstrated above as being time-invariant and thus suited for longitudinal analyses. Latent change structures of these two variables (see Figure 11) were first entered into the model without the other predictors. Phase two measures (i.e., internal and external difficulties, depression, loneliness and subjective well-being) were then regressed onto the latent change scores

to examine if intercultural adjustment predicted change in any of the two latent change variables. Due to the need to reduce computational complexity, factor scores of internal and external intercultural difficulties were used for the analyses of moderation by attachments.

Lastly, the interaction terms of polygenic score and the various attachments (e.g., parental care) with intercultural adjustments (e.g., internal difficulties) were added into the model. Due to model complexity and lack of statistical power, moderation of polygenic score (Figure 12a) and attachments (Figure 12b) on adjustment difficulties were examined in separate latent change models.

Figure 12a (moderation by polygenic score) and 12b (moderation by attachments) illustrate the two structural equation models that were eventually tested.

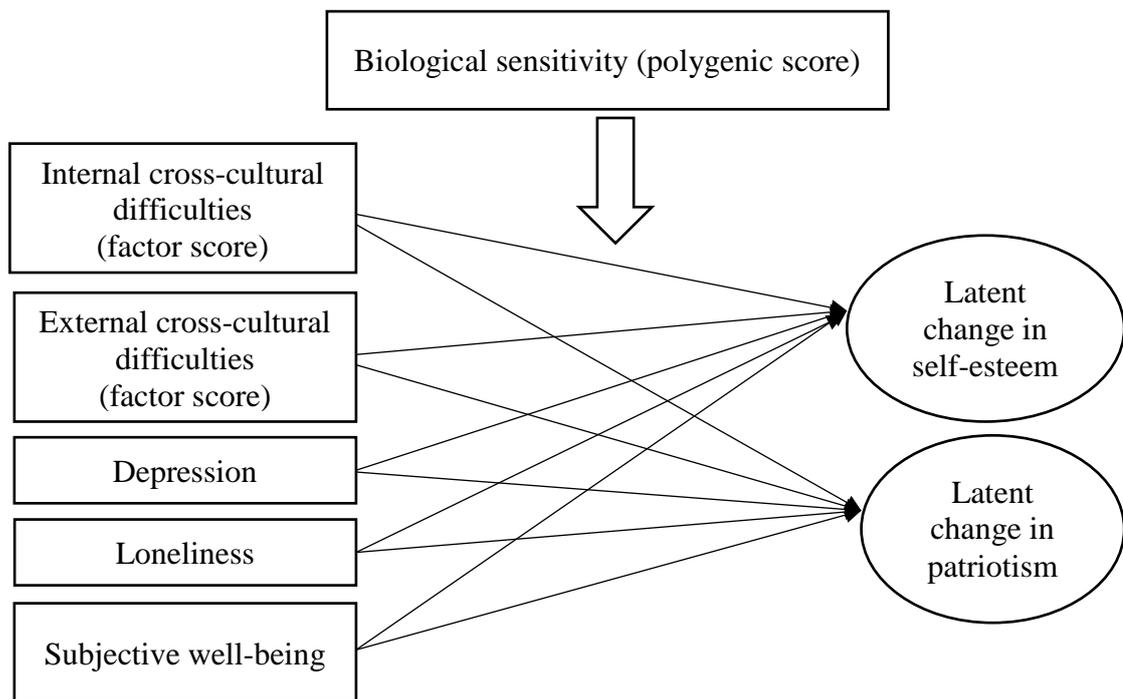


Figure 12a. Structural equation model of intercultural adjustment difficulties, polygenic score and latent changes.

Note. The block arrow represents moderation by polygenic score on all direct effects.

Structures of the latent changes were modelled but not shown here (see Figure 12).

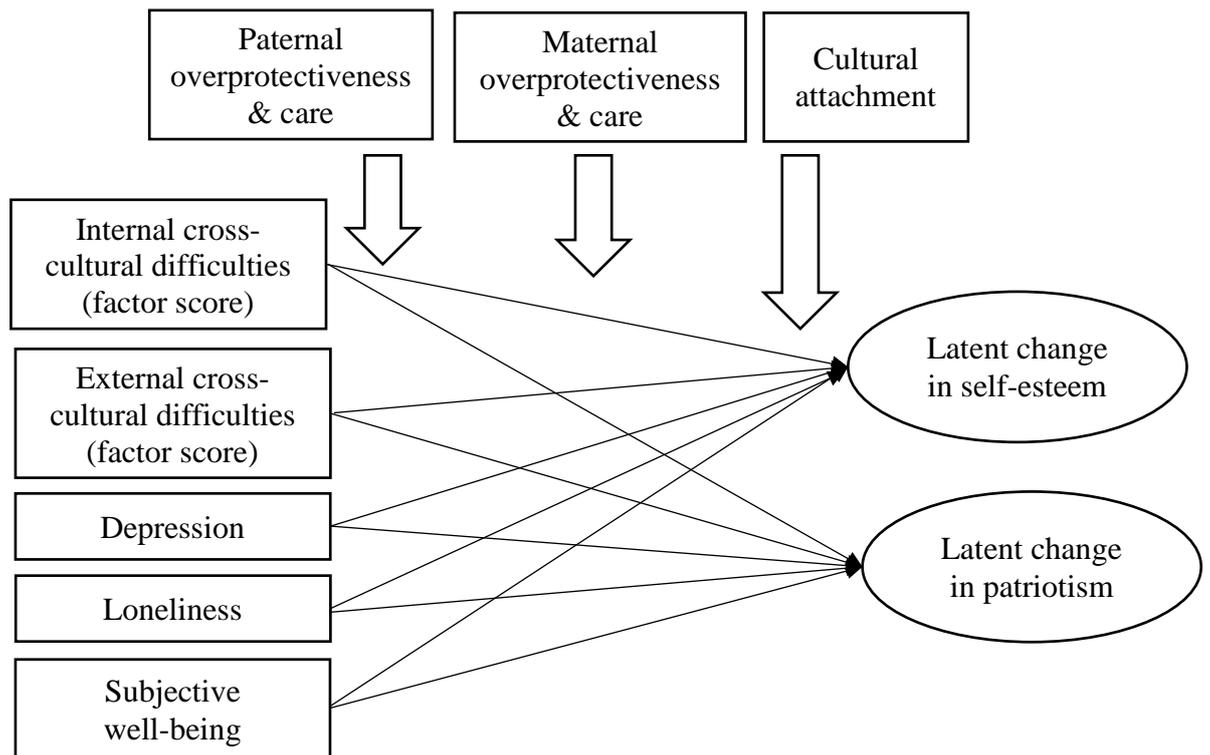


Figure 12b. Structural equation model of intercultural adjustment difficulties, attachments and latent changes.

Note. The three block arrows represent moderation of attachments on all direct effects.

Overprotectiveness and care were two separate variables entered into the model.

Structures of the latent changes were modelled but not shown here (see Figure 11).

Results

Model fit & comparison with controls. The latent change model without predictors or moderators showed acceptable goodness-of-fit on most of the fit indices, $\chi^2(597) = 1133.75$ (normed $\chi^2 = 1.90$), RMSEA = .054, CFI = .90, SRMR = .131.

Similar latent change models were tested for the controls. There were no significant changes in self-esteem ($M_{\Delta} = -0.01$, $SD_{\Delta} = 0.03$, $p = .683$) between phases one and three for the controls. However, there was significant increase in constructive patriotism ($M_{\Delta} = 0.13$, $SD_{\Delta} = 0.06$, $p = .029$). As such, the coefficients related to change in constructive patriotism in controls were also reported if the corresponding

coefficients in sojourners were significant. This was for comparison to illustrate the uniqueness (or lack of) of these effects to individuals who experienced cultural transitions. The coefficients related to change in self-esteem in controls were not reported as generally, this change had already been shown to be unique to sojourners.

The full structural models with predictors and moderators for sojourners showed acceptable goodness-of-fit on the fit indices. For the model moderated by attachments, the model fit indices were $\chi^2(1100) = 1844.77$ (normed $\chi^2 = 1.68$), RMSEA = .047, CFI = .843, and SRMR = .092. For the model moderated by polygenic score, the fit indices were $\chi^2(632) = 1188.96$ (normed $\chi^2 = 1.88$), RMSEA = .057, CFI = .874, and SRMR = .119. Coefficients of all the paths in the full models are reported at the end of the results section in Table 10.

Change in self-esteem. Among the sojourners generally, there was a significant increase in self-esteem before ($M = 4.14$, $SD = 0.70$) and after ($M = 4.42$, $SD = 0.69$) the intercultural experience ($t(303) = 7.20$, $p < .001$; $t(256)_{\text{control}} = 0.13$, $p_{\text{control}} = .897$). As such, all coefficients predicting change in self-esteem would be interpreted as more or less positive change in self-esteem.

Change in self-esteem was expected to be negatively associated with sojourners' experience of intercultural difficulties (Hypothesis 6a), such that sojourners who experienced more difficulties were expected to have less positive change in self-esteem. There was indeed a significant main effect of internal difficulties on change in self-esteem ($\beta = -0.25$, $p = .049$; $\beta_{\text{control}} = -0.03$, $p = .748$). This meant that when at average level of paternal and maternal attachments, higher internal difficulties experienced while overseas predicted less positive change in self-esteem. Neither maternal nor paternal attachments significantly moderated this relationship ($ps > .05$).

Change in self-esteem was expected to be positively moderated by polygenic score (Hypothesis 6b), such that the relationship between intercultural adjustment difficulties and change in self-esteem would be accentuated for sojourners with high polygenic score. This hypothesis was not supported. There were no significant moderation effects of polygenic score on all intercultural difficulties and change in self-esteem ($ps > .21$).

Change in self-esteem was also expected to be significantly and negatively moderated by maternal care (Hypothesis 6c), such that the impact of intercultural difficulties on change in self-esteem would be less positive for sojourners with highly caring mothers. This hypothesis was not supported as there was no significant moderating effect of maternal care ($ps > .07$). However, there was an unexpected significant moderating effect of paternal care, with paternal care negatively moderating the negative effect of loneliness on change in self-esteem ($\beta = -0.21$, $p = .016$; $\beta_{controls} = -0.07$, $p = .610$). The lack of significant main effect ($p = .856$) suggested the presence of cross-over interaction, as illustrated Figure 13. For sojourners with high paternal care, there was a negative relationship between their loneliness and change in self-esteem; for sojourners with low paternal care, this relationship was positive. In other words, for sojourners with high paternal care, experiencing less loneliness resulted in greater positive change in self-esteem; for sojourners with low paternal care, it was high loneliness that resulted in greater positive change in self-esteem.

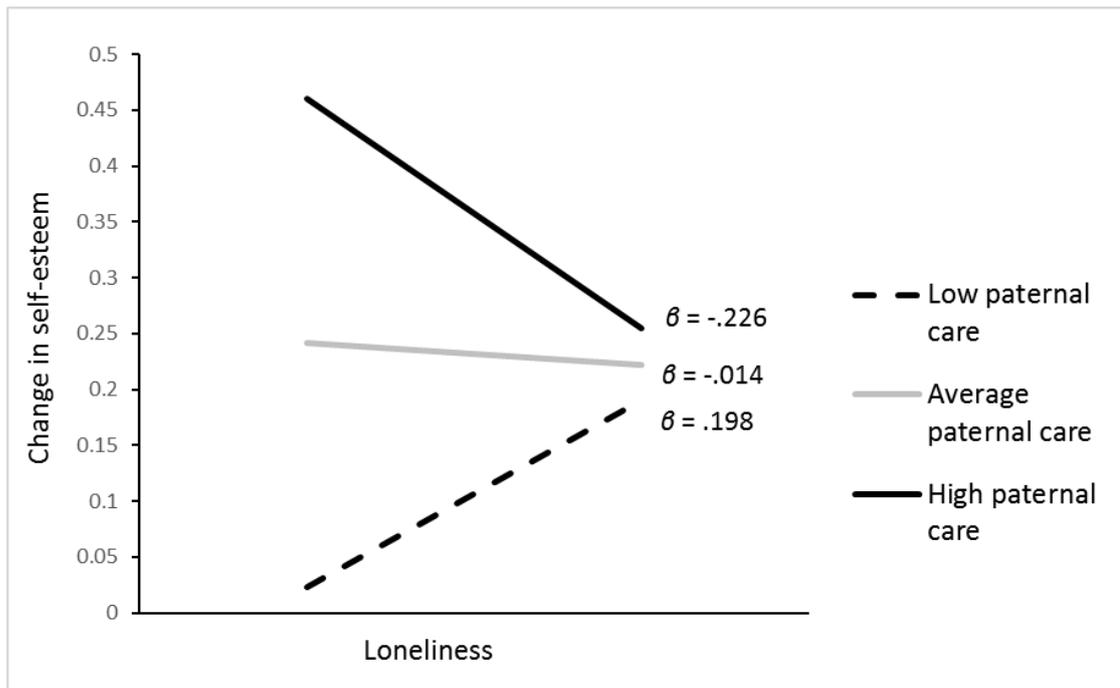


Figure 13. Simple slopes of sojourners' loneliness and change in self-esteem at different levels of paternal care.

Unexpectedly, maternal protectiveness significantly moderated the effect of subjective well-being on change in self-esteem ($\beta = -0.17, p = .03; \beta_{controls} = 0.20, p = .165$). Similarly, there was a cross-over interaction (Figure 14) by which the relationship between subjective well-being and change in self-esteem was negative for sojourners with high maternal overprotectiveness but positive for those with low maternal overprotectiveness.

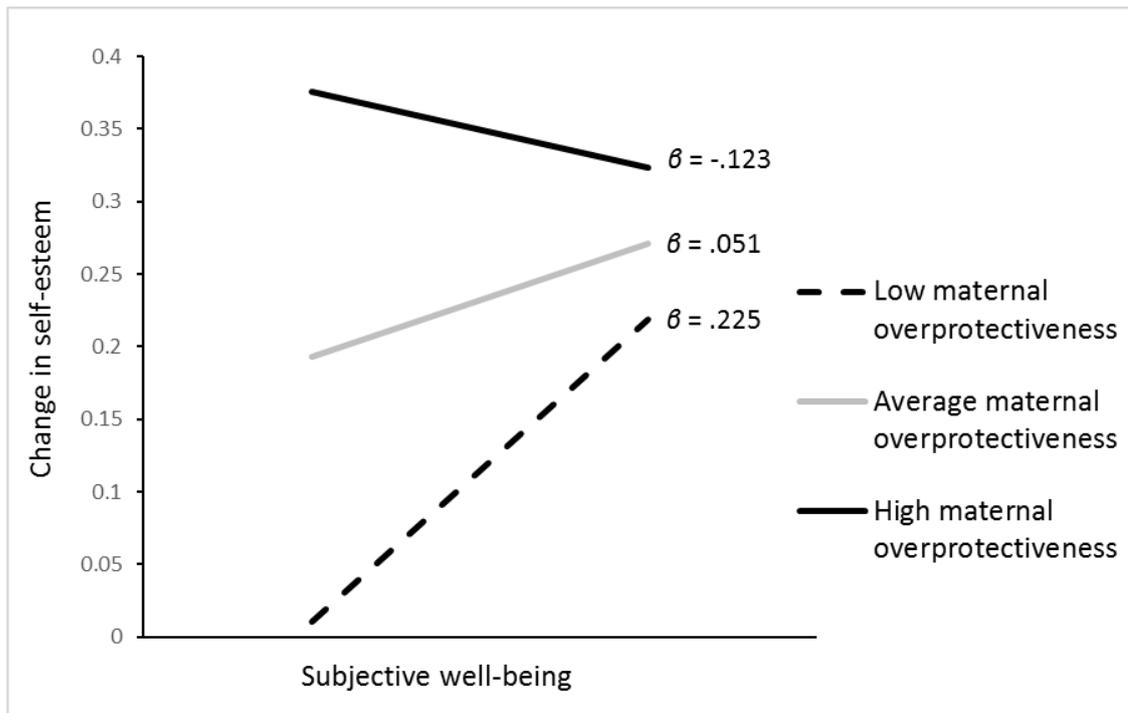


Figure 14. Simple slopes of sojourners' subjective well-being while overseas and change in self-esteem at low and high levels of maternal overprotectiveness.

Change in constructive patriotism. On average, there was a significant increase in sojourners' constructive patriotism before ($M = 4.11$, $SD = 0.77$) and after ($M = 4.29$, $SD = 0.74$) their intercultural experience ($t(303) = 4.50$, $p < .001$; $t(256)_{\text{controls}} = 1.60$, $p_{\text{control}} = .111$). As such, all coefficients predicting latent change in constructive patriotism would be interpreted as more or less positive change in constructive patriotism.

Change in constructive patriotism was expected to be positively associated with intercultural difficulties (Hypothesis 7a). In other words, sojourners who experienced more difficulties were expected to report greater change in constructive patriotism. There was indeed a significant effect of subjective well-being on sojourners' change in constructive patriotism ($\beta = -0.17$, $p = .041$; $\beta_{\text{control}} = 0.34$, $p_{\text{control}} = .002$). If sojourners had lower subjective well-being, thus suggesting greater

intercultural adjustment difficulties, they showed higher positive change in constructive patriotism. Interesting, the opposite was true for the controls; if they experienced lower subjective well-being in home country, they experienced lower positive change in patriotism.

The relationship between intercultural adjustment difficulties and change in constructive patriotism was expected to be positively moderated by polygenic score (Hypothesis 7b), such that sojourners with high polygenic score would be more affected by intercultural adjustment difficulties. This hypothesis was not supported across all intercultural difficulties ($ps > .073$).

The relationship between intercultural difficulties and change in constructive patriotism was also expected to be negatively moderated by maternal care (Hypothesis 7c), such that patriotism of sojourners with less caring mothers would be more affected by their overseas experience. The above relationship between subjective well-being and change in constructive patriotism was indeed negatively moderated by maternal care ($\beta = -0.24, p = .011; \beta_{control} = 0.02, p_{control} = .93$), thus supporting the hypothesis. The effect between sojourners' subsequent change in patriotism and their subjective well-being while overseas was accentuated for those who reported lower than higher maternal care (Figure 15).

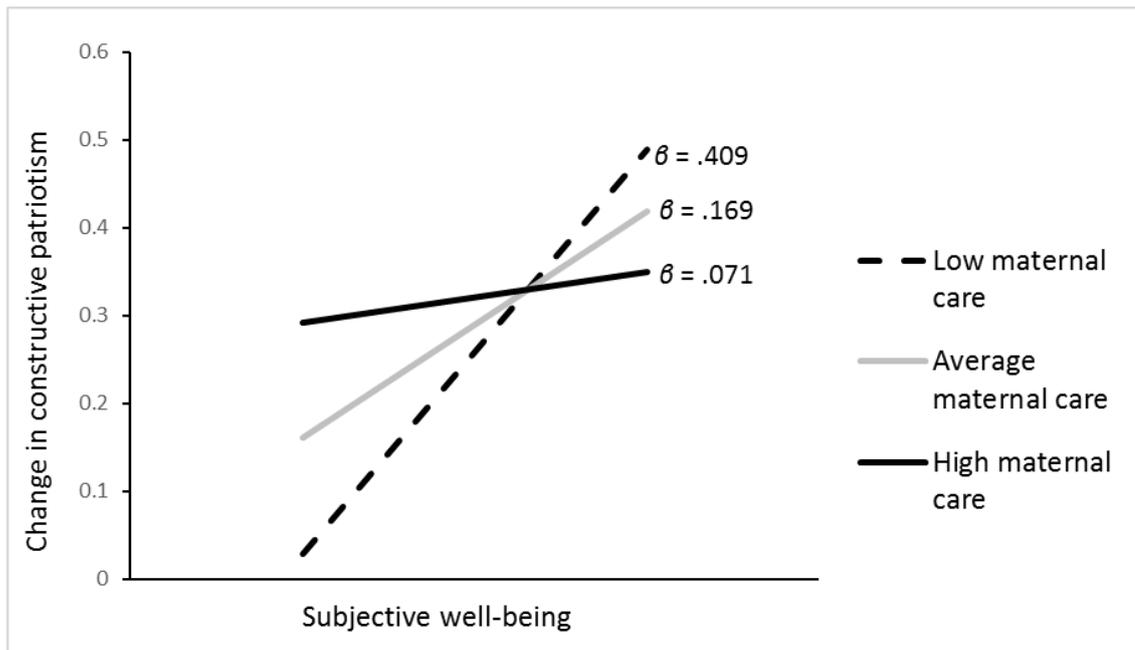


Figure 15. Simple slopes of sojourners' subjective well-being and change in constructive patriotism at different of maternal care.

Interestingly, paternal care also significantly moderated the relationship between subjective well-being and change in constructive patriotism, albeit in the opposite direction to maternal care ($\beta = 0.26, p = .008; \beta_{control} = 0.11, p_{control} = .49$). The effect of subjective well-being was strongest for sojourners who reported highly caring fathers (Figure 16). For sojourners who experienced low paternal care, their change in constructive patriotism was relatively consistently high and unaffected by their overall overseas experience.

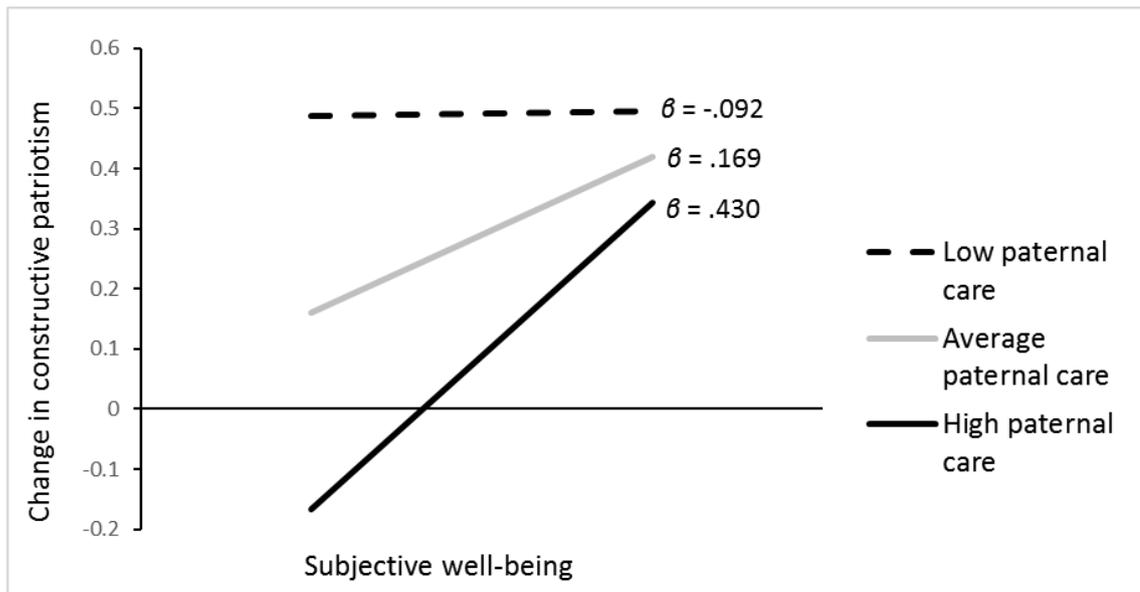


Figure 16. Simple slopes of sojourners' subjective well-being and change in constructive patriotism at different levels of paternal care.

Paternal care also moderated the relationship between experience of loneliness and change in constructive patriotism ($\beta = -0.21, p = .016; \beta_{control} = 0.14, p_{control} = .41$). The lack of significant main effect of loneliness ($p = .75$) suggested a cross-over effect, as illustrated in Figure 17. At lower levels of paternal care, loneliness was positively associated with change in constructive patriotism; however, at higher levels of paternal care, this relationship was negative. Similar to the effect of subjective well-being, for sojourners with highly caring fathers, good intercultural experience (i.e., low loneliness or high subjective well-being) was associated with higher change in constructive patriotism.



Figure 17. Simple slopes of sojourners' experience of loneliness and change in constructive patriotism at different levels of paternal care.

Table 10

Standardized coefficients of intercultural adjustment variables and their interactions with parental attachments on change in self-esteem and change in constructive patriotism.

Predictors	Change in self-esteem		Change in patriotism	
	β	p	β	p
Internal difficulties				
Main effect	-.245	.049	.070	.630
x polygenic score ¹	-.137	.219	.225	.073
x maternal care ²	.064	.669	-.158	.368
x maternal overprotectiveness ²	-.086	.554	.125	.464
x paternal care ²	.281	.055	-.044	.798
x paternal overprotectiveness ²	.171	.166	-.035	.810
External difficulties				
Main effect	.005	.969	.101	.487
x polygenic score ¹	.001	.993	-.142	.295
x maternal care ²	-.001	.995	.004	.982

Predictors	Change in self-esteem		Change in patriotism	
	β	p	β	p
x maternal overprotectiveness ²	-.023	.862	-.056	.720
x paternal care ²	.061	.678	.168	.341
x paternal overprotectiveness ²	-.032	.793	.164	.258
Loneliness				
Main effect	-.014	.856	-.029	.750
x polygenic score ¹	.003	.969	-.01	.918
x maternal care ²	.094	.322	.005	.963
x maternal overprotectiveness ²	.165	.078	.017	.881
x paternal care²	-.212	.016	-.146	.159
x paternal overprotectiveness ²	-.079	.329	-.170	.073
Depression				
Main effect	.045	.559	.049	.591
x polygenic score ¹	-.118	.431	-.029	.865
x maternal care ²	-.342	.123	.066	.801
x maternal overprotectiveness ²	-.309	.123	-.038	.874
x paternal care ²	-.286	.182	.212	.401
x paternal overprotectiveness ²	-.137	.503	-.063	.795
Subjective well-being				
Main effect	.051	.468	.169	.041
x polygenic score ¹	-.010	.890	.056	.480
x maternal care²	-.141	.076	-.240	.011
x maternal overprotectiveness²	-.174	.030	.056	.555
x paternal care²	-.064	.433	.261	.008
x paternal overprotectiveness ²	.077	.354	.078	.434

Note. x refers to interaction effect with the stated moderator. Patriotism refers to constructive patriotism. Boldface indicates significant at $\alpha = .05$ level. ¹latent change model 1 with polygenic score as moderator. ²latent change model 2 with parental attachments as moderators.

Discussion

This chapter sought to answer the research question on how a difficult intercultural experience impacts individuals and society through change in self-esteem and patriotism, and whether one's parents can buffer a negative overseas experience. To ensure meaningful interpretation of change, the constructs had to be checked for

metric invariance to be sure that their meanings to the participants had not changed before and after the intercultural experience.

Eventual latent change analyses were only done for self-esteem and constructive patriotism as blind patriotism did not fulfill the requirement of metric invariance across phase one and three. The lack of metric invariance across time for blind patriotism suggests the meaning of this construct changed over time. It is unclear how they changed nor whether the changes were due to the intercultural experience. More research is warranted to probe further into how understanding of these constructs can be affected by intercultural experiences.

Change in self-esteem. On average, there was an increase in self-esteem when sojourners return to Singapore. This might thus account for the many positive sentiments about exchange programs. However, this positive effect of intercultural experiences was limited to sojourners who did not experience high internal difficulties, which supported Hypothesis 6a. Sojourners who experienced higher levels of internal difficulties had less change in their post-trip self-esteem. Development of self-esteem has not been studied much except in the developmental literature that examined self-esteem change of children and adolescents. The current results suggest that even an acute experience, such as living in another culture for a period of time, can have an effect on self-esteem in early adulthood. The lack of significant change for controls shows that this was not merely a developmental change but the result of the acculturation experience. However, it is unclear if this positive change in self-esteem is temporal or permanent.

High maternal care did not buffer the effect of intercultural adjustment difficulties on change in self-esteem (Hypothesis 6b). Instead, paternal care and maternal overprotectiveness were significant moderators; the effects of intercultural

adjustments depended on the care and overprotectiveness of sojourners' parents. However, the moderating effects of paternal care and maternal overprotectiveness were in opposite directions.

While only maternal care was expected to moderate the effect of intercultural difficulties on change in self-esteem, current results show that both maternal and paternal care matter in different ways. This further suggests the intricacy of parental attachments to an individual's worldview. On the one hand, parental overprotectiveness might affect sojourners' appraisal of the host country or the host nationals, which in turn affected their experience of difficulties adapting overseas. In a way, this is in an outward direction, from the sojourner towards the environment. On the other hand, the translation of intercultural difficulties into self-esteem change can be considered as inward as the experiences were internalized and appraised in relation to the self. These interpretations might thus be affected by parental care as it was related to sojourners' perception of the self. More research will need to be done to investigate more deeply at how parental overprotectiveness and care contribute to different perceptions about the world and self. Furthermore, the significant effects of paternal care also suggest the importance of fathers in post-evaluations of intercultural experiences.

The reversed effect of maternal overprotectiveness is interesting as low maternal overprotectiveness attenuated the positive effect of subjective well-being on change in sojourners' self-esteem. Unlike sojourners with mothers who are highly protective, the change in self-esteem of sojourners with relatively unprotective mothers was highly dependent on their sense of well-being while overseas. Even then, the change in self-esteem was not as high as sojourners with highly protective mothers. One possibility may be that after experiencing independent living in a foreign country,

sojourners with overprotective mothers might thus reinterpret the overprotectiveness as care and concern, thus allowing the returning sojourner to feel very loved and accepted (N. Y. Lee, 2013) which translated into increase in self-esteem.

Change in constructive patriotism. Sojourners who experienced greater intercultural difficulties were expected to show higher change in constructive patriotism (Hypothesis 7a). However, the current findings did not support this hypothesis. Rather, change in constructive patriotism was negatively associated with internal difficulties for sojourners. Interestingly, the hypothesized effect was supported for controls who experienced greater level of stress while in Singapore. In other words, experiencing stress overseas brought about less change in constructive patriotism while stress in home country was associated with increase in constructive patriotism.

The behaviors of constructive patriotism are related to being more critical of the country, supposedly in the name of improvement and progress. As such, stress overseas might have resulted in sojourners feeling more appreciative of their home country. However, if they had a really good time in the other country, this positive intercultural experience might then become a source of comparison to living back home, thus resulting in an increase in constructive patriotism when they returned home.

While only maternal care was expected to moderate the effect on constructive patriotism (Hypothesis 7b), both maternal and paternal care were found to moderate the effects of intercultural adjustments and change in constructive patriotism albeit in different directions. This further supports the idea that maternal and paternal attachments are distinct as they relate to different psycho-emotional systems. On the one hand, maternal care negatively moderated the effect, such that sojourners with low maternal care experienced greater effect of intercultural adjustments on change in constructive patriotism; higher maternal care buffered this effect for sojourners with

highly caring mothers. On the other hand, paternal care accentuated the effect such that sojourners with highly caring fathers experienced greater increase in constructive patriotism if they had a positive intercultural experience.

The difference in effect between maternal and paternal care is likely to be a reflection of the difference in attachment and exploration systems. As maternal care contributes to the individual's emotional regulation, sojourners with highly caring mothers might not have experienced the emotional need to compare host and home countries; however, those with less caring mothers might be highly affected by their experience overseas, regardless positively or negatively, which leads to an emotional reaction towards the home country bringing about a heightened change in constructive patriotism.

For paternal attachment, as uninvolved fathers have been shown to result in children being impulsive and reckless (Paquette & Bigras, 2010), the high change in constructive patriotism in sojourners with low paternal care thus suggest that these individuals might just want a change in their home country (Schatz et al., 1999) for the sake of change. This accounts for seemingly horizontal line in Figure 18, which suggests that sojourners with low paternal care were more critical and supportive of change in home country regardless of their experience overseas. For sojourners with high paternal care, their change in constructive patriotism depends on their overseas experience, suggesting that they might be more 'grounded' in their criticism towards the home country.

Moderation by polygenic score. Overall, polygenic score did not moderate the effect of intercultural adjustment difficulties on change in self-esteem and constructive patriotism. While biological sensitivity may moderate early parenting experiences to affect intercultural difficulties, the interaction with overseas experience

to affect post-trip change is less conclusive. Taking the duration of the overseas experience into consideration, it is possible that the experience might not have been internalized to a similar extent as early parenting experiences. In other words, while the short overseas experience might affect one's perception of self and home society, it might not be internalized to a depth to be considered as one's intrapsychic environment.

Chapter 8

General discussion & conclusion

This project started with the observation that it is a common perception that having lived and/or worked overseas for a period of time is good for personal and career development. However, existing literature on expatriates and international students has demonstrated that some sojourners do not adjust well, and such maladjustments often involve high financial, social and emotional costs to both the individual and the affiliated organization. As humans are intricate biological, emotional and social beings, the core research question in this study is how one's genetic endowments interact with the intrapsychic and external environments to affect intercultural transitions. This study also looked at the consequences of having a positive or negative intercultural experience on the attitudes towards one's self (i.e., self-esteem) and society (i.e., patriotism), and how parental attachments may moderate the effects of intercultural experiences.

As preparation to answer the core research question, one other question about the multi-faceted nature of intercultural adjustment was asked: are there different aspects of intercultural adjustments? Given the complexity of intercultural experiences, this is an important question to address as preparatory analysis because the effects of intrapsychic and external environments and genetic predispositions may vary for the different types of intercultural adjustment difficulties. It was hypothesized that intercultural adjustment difficulties could be classified into at least two aspects – one related to the host environment and the other more social aspect related to host nationals. This hypothesis was supported as results showed that intercultural adjustment difficulties could be classified into the internal and external aspects.

The internal aspect of intercultural adjustment difficulties pertained primarily to the sojourners' affective reactions to overseas adjustment, such as homesickness or stress. While the sources of these stresses can be quite diverse, ranging from living with uncertainty to missing home, they were generally difficulty in adjusting to a different environment. On the other hand, the source of external difficulties was clearer and more social in nature; it was about, or concerns about, the host nationals' reactions towards the sojourners, such as being discriminated against, facing prejudice or even hatred. While correlated, internal and external difficulties are distinct sources of stressors with different antecedents and consequences. Most research focuses on one or the other; studies on acculturative stress often focused on internal difficulties while studies on intergroup relations will focus primarily on the external. The current research not only demonstrates the existence of multiple aspects to intercultural distress within a single sample, but studies of both types of difficulties simultaneously allow us to better understand the nature of intercultural adjustments.

Furthermore, findings showed that intercultural difficulties were distinct from the manifested psychological symptoms of maladjustments, such as loneliness, depression or low subjective well-being. This suggests that even if individuals feel that it was a difficult experience, there may not necessarily be psychological symptoms. Moreover, alternative models tested suggested that the manifestations of psychological symptoms cannot be explained by the latent internal and external difficulties experienced by sojourners. Rather, the best model was one that examined these psychological symptoms as independent facets of intercultural adjustment difficulties. This is in line with the early understanding of diathesis stress, that while many individuals may experience the same stressful circumstance, it may not be detrimental to all of them (Lazarus, 1998; Schachter & Singer, 1962).

Genetic moderation on intrapsychic and external environments

This study also sought to expand the literature of gene-by-environment interaction by proposing that environment may not necessarily be restricted to the external environment or circumstances an individual is in, it can also include the intrapsychic environment which consisted of worldviews, perceptions, expectations et cetera. In this study, parental and cultural attachments were used as a form of intrapsychic environment; these attachments have far-reaching implications on one's social cognitions through one's mental models formed as a consequence of the quality of the individual's attachments with parents and home culture. Results showed that intrapsychic environment can indeed interact with one's genetic predisposition to affect intercultural adjustments, particularly with adaptation to the unfamiliar host environment and feeling of well-being during the experience.

While it was hypothesized that the direction of moderation would be positive, the results were mixed. There was both positive and negative moderation of genes on attachments, cultural distance and intercultural adjustments. Although the negative moderations were not expected, it may be due to the nature of the current sample. The calculation of the polygenic score in this study was based on effect sizes among Caucasian research participants. Some gene-by-environment studies on Asians have demonstrated opposite effects to what has been reported in Caucasian participants. For example, Caucasian and Asian populations not only showed opposite patterns of allelic frequencies in the serotonin transporter gene polymorphism (Gelernter, Cubells, Kidd, Pakstis, & Kidd, 1999; Goldman, Gleib, Lin, & Weinstein, 2010; Williams et al., 2003) but also showed opposite directions of associations with some disorders (e.g., Arinami et al., 1999; Hamer et al., 2000; Ishikawa et al., 1999). It is yet unclear why there might be divergent associations between Caucasians and Asians. The mixed

results of the current sample suggest that genetic moderation might be more intricately tied to the intrapsychic environment than we expected.

The significant moderations of genetic predispositions on sojourners' subjective well-being thus confirm the presence of vantage sensitivity. Genetic predispositions do not just interact with one's intrapsychic and external environments to result in sensitive sojourners experiencing greater difficulties adjusting to host environment, these sojourners also have higher subjective well-being given a positive intrapsychic environment, such as strong attachment to home culture.

Differential effects of attachments

The second core research question pertains to the differential effects of maternal, paternal and cultural attachments on cultural transitions. Parental attachments were also further examined in terms of care and overprotectiveness. In general, paternal attachment (particularly overprotectiveness) and cultural attachment were expected to play significant roles in cultural transitions due to the need to explore a new environment and increased salience of one's cultural identity respectively.

Results showed that there were indeed differential effects of parental overprotectiveness. As hypothesized, maternal overprotectiveness was a risk factor for interpersonal related difficulties such as difficulties with host nationals and sense of loneliness. On the other hand, paternal overprotectiveness was a risk factor for general difficulties related to living in a foreign environment. Furthermore, parental care was also protective, particularly for effects on emotional regulation. Interesting, there were differential effects between maternal and paternal care. Maternal care buffered against depressive symptoms, which corroborates the existing literature. The significant effect of paternal care on subjective well-being suggests that paternal care might not regulate

against negativity but promote positive emotions. Further research is required to understand the distinctiveness of maternal and paternal care.

The significant effects of affective identification to Singapore demonstrates the relevance of cultural attachment to cultural transitions. Similar to having caring mothers, cultural attachment buffered the experience of depression while overseas in general. Furthermore, cultural attachment contributed to higher subjective well-being, similar to the effects of paternal care. Moreover, the similarity with the care dimensions of paternal attachment would account for the lack of results with experience of difficulties. In the current study, cultural attachment was operationalized as affectionate bond with Singapore, which is parallel to the constructs of maternal and paternal care. This suggests that cultural attachment might serve as both buffer and promotive factor against negative emotions and towards positive emotions, respectively. However, more research is required to understand the working mental models behind secure or insecure cultural attachment.

Post-experience change

The final research question this study sought to address is the effect of cultural transition on self and society. Change in self-esteem was used as a proxy of effect on self; patriotism was a proxy for effect on society. While patriotism can be further separated into blind and constructive patriotism, the construct of blind patriotism changed after the intercultural experience, rendering longitudinal analysis meaningless. That said, further research could be done to understand why and how this construct changed as a result of immersive exposure to another culture.

In general, there was an increase in self-esteem in sojourners, which was not demonstrated in the control participants. This showed that the change in self-esteem within this short period of time was not due to developmental changes but a results of

the acute intercultural experience. Interestingly, the change in patriotism in sojourners was in the opposite direction to that of controls. In a way, it seemed that experiencing another culture made sojourners more vocal in the change they want to see in Singapore; however, for controls who stayed in Singapore, they might have become more politically apathetic over this short period of time. More research is needed to understand this change in perception of the nation.

Limitations and future research

While the prospective design allowed for a more definitive conclusion on causality and directionality of the effects, quality of intercultural adjustments was only measured once. As such, it was a cross-sectional snapshot of how well the sojourners were adjusting overseas. Moreover, post-trip change was only measured once. Future research should consider more time-points during and after the intercultural experience. This will allow for a clearer understanding of temporal change of adjustment and whether the post-trip changes are transient or permanent.

However, an intercultural experience of six months or less might be too short for significant fluctuations in overseas adjustments. As such, sampling sojourners who are overseas for a longer period of time will be more appropriate in examining the trajectory of overseas adjustment over time. The current research sample consisted of students who were going out for an exchange program. Future research can instead sample incoming international students or exchange students who come for a one-year program. This will allow for examination of adjustments over a longer period of time. Furthermore, while the current research allowed for examination of how host countries affect adjustment, the use of incoming students will allow for examination of how characteristics of home culture affect intercultural adjustments.

The use of young adult sample allowed for extension of existing research on gene-by-environment and self-esteem development to adulthood. Literature in these fields has predominately focused on children. However, this is also a limitation as different age groups might be more affected by different challenges. For example, according to Erikson's theory of psychosocial development, the students in the current sample were likely to be more sensitive to tasks or challenges related to identity and relationships than older adults. Future research may look into how these life tasks might interact with genetics to affect development at different stages of life.

Transition to another culture is essentially the transition to an environment with different shared knowledge, norms, traditions and behaviors. The control group in the current sample allowed us to test if the significant effects were indeed unique to the experience of having to adapt to another culture. However, the culture in the current study has been specified to national culture. Future research may be extended to include freshmen transitioning into local college as another experimental group. This will allow us to examine to greater depth if the significant effects are specific to national cultures or they could be generalized more broadly to adjustment to any shared body of knowledge.

This research is largely exploratory in nature. The distinctive effects of maternal, paternal and cultural attachments, as well as the difference between care and protectiveness, need to be further examined with experimental designs to investigate the social cognitive mechanisms in affecting one's perception of the social world and the self. The moderating effect of genetic predispositions on intrapsychic environment also needs to be examined deeper in experimental research. Building on the idea of critical periods in developmental literature and Erikson's life stages, future research

can look at how genetic predispositions moderate the effect of failure or satisfaction of specific life tasks for different age groups.

Conclusion

Though exploratory, this research demonstrates the discriminant effects of maternal, paternal and cultural attachments on intercultural experiences. Furthermore, genetic predisposition to being more sensitive to environment are not merely restricted to the objective environment but related to intrapsychic environment as well. Furthermore, it is possible for acute, intense, or immersive experiences such as intercultural change to effect change in self-esteem in adulthood. This research thus demonstrates many social-developmental and gene-by-environment phenomena in a naturalistic setting, setting the foundation for many different streams of further research in attachment, sociogenomics and human development.

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Appendix A

Table A

The genes and SNPs in each gene used in calculation of the polygenic score

Gene	SNP	Reference allele	Odd ratio	p-value
NR3C1	rs6196	A	0.9799	.23
	rs2918417	T	1.016	.22
	rs6877893	A	0.9808	.11
	rs13184611	T	1.012	.46
NR3C2	rs5534	T	0.9842	.20
	rs6840127	A	1.019	.24
	rs1403143	T	1.013	.29
	rs11736161	A	1.009	.47
	rs6856803	T	0.9767	.05
	rs11099681	T	1.016	.23
	rs6535594	A	1.01	.40
	rs11725509	A	0.97	.33
	rs1490453	A	1.017	.31
	rs1994624	A	1.018	.15
	rs7698307	T	1.014	.48
	rs17024708	A	0.9901	.49
	rs4635799	T	0.9896	.45
	CRHR1	rs393152	A	0.985
rs1635291		A	0.984	.25
rs7215239		T	0.984	.25
rs1724422		A	0.9868	.28
rs9303521		T	1.009	.48
rs1880753		A	0.9856	.23
rs12953076		T	0.9755	.16
rs17763104		A	0.9855	.42
CRHR2	rs2284216	T	1.015	.49
	rs2284218	T	0.9877	.33
	rs2014663	T	1.014	.42
	rs255112	A	0.9825	.20
FKBP5	rs3800373	A	0.9823	.19
	rs16878806	T	0.9532	.21
	rs16879378	A	0.9543	.21
	rs9470080	T	1.017	.18
	rs9394314	A	0.9871	.33
	rs2766533	A	0.9879	.31
	rs12200498	A	0.973	.08
SLC6A4	rs2020936	A	1.012	.42
	rs2066713	A	0.9899	.41

TPH1	rs7933505	A	1.011	.36
	rs211107	A	1.01	.40
	rs10832876	T	1.022	.12
BDNF	rs10835189	T	1.017	.16
	rs10734394	A	1.026	.07
	rs1387144	A	1.014	.26
	rs4074134	T	0.9754	.09
	rs6265	T	0.9757	.11
	rs10835210	A	1.018	.16
	rs7934165	A	1.017	.17
OPRM1	rs499796	A	1.014	.34
	rs4870268	T	0.9895	.38
	rs17085103	T	0.9576	.49
	rs12208947	A	1.013	.46
	rs7745499	A	0.9913	.47
	rs4626436	A	1.046	.09
	rs10485060	A	0.9654	.21
	rs1040822	T	0.9903	.43
	rs9322451	A	0.9722	.07
	rs1852629	T	1.009	.48
	rs2272381	A	1.027	.12
	rs6935927	T	1.008	.48
	rs7759388	A	0.9826	.28
GABRA6	rs4454083	T	1.016	.22
	rs11956731	T	1.017	.27

Appendix B

Table B

List of host countries and the number of sojourners in each country, in ascending order of frequency.

Host country	Frequency	Percentage
Russia	1	0.3
Austria	2	0.7
Belgium	2	0.7
China	2	0.7
Czech Republic	2	0.7
Thailand	2	0.7
Ireland	3	1.0
Italy	3	1.0
New Zealand	3	1.0
Turkey	3	1.0
France	4	1.3
Mexico	4	1.3
Norway	4	1.3
Spain	5	1.6
Finland	6	2.0
Japan	6	2.0
Australia	7	2.3
Denmark	7	2.3
Switzerland	11	3.6
Taiwan	15	4.9
Hong Kong	17	5.6
Canada	19	6.2
Germany- West	20	6.6
England	22	7.2
Sweden	26	8.5
Netherlands	32	10.5
USA	37	12.1
South Korea	40	13.1
Total	305	100