A POTENTIAL DEVELOPMENTAL BARRIER FOR IMMIGRANTS? MIXED EVIDENCE THAT A SENSITIVE PERIOD AFFECTS ACCULTURATION

by

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Abstract

Although much research has found that younger immigrants acculturate to a new host culture better than older immigrants do, little work has been done to investigate whether this is due to one's duration of exposure to the new cultural environment, or one's age of exposure, while one may still be in a sensitive developmental period. We conducted two studies to determine whether duration of exposure or age of exposure has a greater influence on acculturation. Study 1 found an interaction between these two factors, such that participants' identification with North American culture increased the longer they stayed in Canada, but only for immigrants who arrived before the age of 15. It also showed that implicit measures may better show linear effects of acculturation than explicit measures. Study 2, however, failed to replicate findings from Study 1, and no consistent pattern emerged from the implicit measures that were used. Overall, there is inconsistent evidence for the existence of a sensitive period for acculturation, suggesting that more empirical investigations are required.

Preface

This project was a collaborative effort between Maciej Chudek, Dr. Steven J. Heine, and me. The research topic was conceived by Dr. Heine, who was awarded a grant from the Social Sciences and Humanities Research Council (SSHRC) for this project. Chudek, M. and I both contributed to the theoretical groundwork for this project.

Some results from Study 1 in Chapter 2 have been published in *Psychological Science*, an empirical psychological journal. I performed the statistical analyses for the published manuscript, in consultation with Chudek. I was also responsible for completing the first draft. All three collaborators reviewed and edited subsequent drafts of the manuscript. The published paper can be found at:

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For all studies in Chapter 2 of this manuscript, I was in charge of the administration of questionnaires in person, by mail, and online. I was also responsible for all communication with, and remuneration for, the participants.

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Dedication

To my parents, Lawrence and Venny Cheung

1 Chapter: Introduction

Imagine a scenario in which a 9-year-old youngster, named Zhang, arrives in a foreign country with his family as immigrants. As he grows up in this new host culture, will he enjoy watching this culture's television programs, listening to its radio shows, or participating in its cultural activities? After living in the foreign country for 20 years, how much will he identify with his new culture?

Imagine another scenario in which a 16 year-old youngster, named Fung, arrives with her family in the same country, and on the same day, as Zhang. As she grows up in this new host culture, will she enjoy the television programs, radio shows, and everything else that this new host culture has to offer? Compared to Zhang, who will enjoy these more, and why? And after also living in this culture for 20 years, how much will she identify with her new culture? On top of individual differences, is there some fundamental constraint that can address these questions?

The above scenarios serve to inspire readers to ask one question: What affects the degree to which immigrants adapt to their new host culture? Efforts to answer this question have led researchers to examine a variety of factors, including attitudinal variables and societal structures amongst host cultures (for review, see Sam & Berry, 2006). One important variable that has largely been ignored, however, is that of a possible developmental constraint in the form of a sensitive period. More specifically – is there a time frame in one's maturation process during which cultural adaptation, namely an immigrant adapting to the new host culture, is easiest? With this overarching question in mind, this paper will: (a) introduce and explain a form of developmental constraint, the "sensitive period"; (b) discuss the process of cultural adaptation, or "acculturation"; (c) explain how acculturation and sensitive period fit together; (d) discuss two studies that were

conducted to investigate a possible sensitive period for acculturation; and (e) offer

recommendations for future studies of a sensitive period in acculturation.

1.1 What is a sensitive period?

A sensitive period refers to a period of time during a member of a species'

development when certain traits exhibit variability as a result of sensitivity to its

environment, showing plasticity in trait expression (de Vries, 1905). Ever since de Vries

described this phenomenon amongst certain plants and insects, and coined the term

"sensitive period," evolutionary biologists have explored theoretical grounds for why such a

developmental process exists. As this section explains, the basis for the evolutionary

explanation of a sensitive period rests on an organism's resolution of a conflict between

survival advantages afforded by plasticity on the one hand, and fixedness in trait expression

on the other. The discussion below will detail this conflict by profiling the survival values

that plastic and fixed development differentially confer, especially taking into consideration

both the survival and the energy costs of maintaining the mechanisms for both forms of

development.

1.1.1 The evolution and adaptive value of sensitive periods

To simplify the issue, during an organism's maturation process, it can develop traits

in one of two ways: (a) environmental canalization, which entails a fixed development that

ignores or minimizes environmental input; or (b) plasticity, which entails a variable form of

development whereby trait expressions are dependent on environmental pressures and cues

(Auld, Agrawal, & Relyea, 2010). Environmental canalization for a trait has been theorized

to allow the organism to develop a trait that is optimally suited for the environment for which

it has evolved, leading to the best trait-environment match (DeWitt, Sih, & Wilson, 1998).

As such, the basic machinery responsible for developing a trait purely through environmental

canalization is relatively simple – the antecedents (genes) lead to the consequences (expected

phenotype). An important cost with regards to this form of development, though, is that a

canalized trait may also lead to the worst possible trait-environment match in certain

situations. In other words, a trait that is optimally adaptive in one environment may be

extremely maladaptive in another environment, where the organism lacks the mechanism to

manage this environmental challenge. Furthermore, the optimal adaptability of a canalized

trait is realized only if the organism has received the right cues that are representative of the

environmental state. If this condition is not met, then the organism may miscalibrate, leading

to a poor trait-environment match (Frankenhuis & Panchanathan, in press).

Conversely, plastic development leads an organism to develop traits that are

expressed differently in different environments by learning about what is adaptive in a given

environment, thus allowing it to survive under multiple conditions (Stearns, 1989)[1]. While

this allows for good trait-environment matches across a variety of environments and

minimizes worst possible trait-environment matches, the lack of time devoted to canalization

prevents the development of optimal traits for a specific environment (DeWitt et al., 1998).

Furthermore, because plastic development is dependent on environmental input, the

machinery responsible for this process is relatively more complex than the antecedent →

consequence process that characterizes environmental canalization. The plastic development

of a trait requires the organism to: (1) sense cues in the environment; (2) process the

information; (3) engage mechanisms that produce varied trait expression; and finally (4)

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[1] Note that, as Newman (1992) argues, an organism's plasticity is limited to the possible set of expressions that
is allowed by its genetic variability.

produce the appropriate trait expression given the cues from the environment (DeWitt et al., 1998). Importantly, an organism that develops a trait in a purely plastic process must have, and maintain, the necessary structures throughout its lifespan (e.g. sensors that give the organism a preparedness to assimilate environmental cues). There are several disadvantages associated with developing traits purely in this more complex form of development. For instance, the maintenance of structures necessary for each step in this developmental process incurs energy costs. This is especially salient when one considers the much simpler process of environmental canalization.

Taken together, this suggests that, in a homogeneous environment, environmental canalization for a given trait allows an organism to outcompete others who spend too much time and energy learning from and responding to the environment. On the other hand, if the environment shifts from one state to another, an organism with a trait that was developed for one specific environmental state would not have the same survival fitness in another environmental state. Since a trait that undergoes plastic development can be expressed differently according to environmental cues, this plastic organism would hold the survival edge in such circumstances. Thus, to the extent that the necessary genetic variation in plasticity exists in the organism, plastic development of a trait appears to be generally more adaptive than fixed development of the same trait. Despite this survival edge, plasticity is still too costly for an organism to maintain as a truly adaptive form of trait development, as has been discussed above. In order for plasticity to improve an organism's survival fitness, its benefits must overcome the costs that are incurred (Newman, 1992).

One way to resolve this conflict between the costs and benefits of plasticity and fixedness is to combine both forms of development, whereby an organism first goes through

a period of intense learning and absorption of environmental cues early on in its lifespan, followed by stricter specialization of the traits that they have developed. During the plastic period, the organism pays the costs for maintaining the structures necessary for plastic development of a trait. At some point during the organism's maturation process, this period closes, sparing the organism of much of the costs of maintaining plasticity, and allowing it to devote time and energy to specializing in the traits that it has developed (Nijhout, 2003). In essence, this phenomenon gives the organism the time to decide, amongst many possible trait expressions, one that allows for the best trait-environment match relative to the others, and then develop that trait. This is what is referred to as a "sensitive period," and mathematical modeling suggests that this form of development should emerge when an organism must balance the costs and benefits of learning and specializing in developing a trait (Frankenhuis & Panchanathan, in press). Indeed, the adaptive nature of a sensitive period can be seen in the fact that researchers in many fields have found a variety of traits across various species that follow this pattern of development. For example, swamp sparrows acquire bird song materials within 120 days after hatching, a process that is accompanied by large neuroanatomical changes. After this period, the birds concentrate on rehearsing these songs, accompanied by minimal neuroanatomical changes (Nordeen & Nordeen, 1990). This suggests that swamp sparrows' ability to learn bird songs occurs within, and is likely limited by, the developmental constraint of a sensitive period.

While humans *may* be perpetually plastic with regards to cultural learning, it seems more likely that human cultural learning follows the same pattern as many other species and traits in terms of being developmentally constrained by a sensitive period. Indeed, much research has shown that humans, too, have sensitive periods for the development of an array

of traits. For example, researchers have found a sensitive period for the acquisition of absolute pitch (Chin, 2003), being prone to the Muller-Lyer illusion (McCauley & Henrich, 2006), and holistic face processing (Le Grand, Mondloch, Maurer, & Brent, 2004; for a review, see Werker, Maurer, & Yoshida, 2009). More importantly, humans also have a sensitive window for a trait that is functionally similar to the swamp sparrows' bird songs described above: communication by way of language. Humans, too, have a sensitive period for acquiring language (see Werker & Tees, 2005). Furthermore, the capacity for language learning and our capacity for cumulative cultural learning have close phylogenetic origins. That is, over the course of evolution, *Homo sapiens* are the only species to exhibit either "language learning"[2] or "cumulative cultural learning." This is supported by linguists, including evolutionary linguists, who have argued that language and culture have evolved together and mutually influenced each other's development (Christiansen, 2005; Donald, 2005; Halliday & Webster, 2003). Furthermore, there are neural structures crucial to linguistic ability that are associated with the ability to engage in higher order mental representations and some forms of cultural learning (Greenfield, 1991; Higuchi, Chaminade, Imamizu, & Kawato, 2009). While these associations cannot make the claim that the two are necessarily the same adaptations, current evidence suggests that they do share an intricate relationship between them. Indeed, priming research has found that priming bilingual individuals with either of their language leads them to give responses that correspond to the culture that matches with the primed language (Ji, Zhang, & Nisbett, 2004). These apparent relationships provide for good theoretical grounds to use language learning as an appropriate

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[2] This is different from, but related to, the "language" used by sparrows in bird songs. While both forms of language communicate ideas, human languages have the unique characteristic of being generative and cumulative (see O'Grady & Archibald, 2003).

model based on which we can generate hypotheses about cultural learning. Thus,

understanding the sensitive period constraint for language acquisition can greatly inform us

about how culture acquisition may also be affected by a similar developmental constraint.

1.1.2   A sensitive period for humans: The case of language

Lenneberg's (1967) treatise argued that first language acquisition in humans is

limited by a developmental constraint that is much akin to the sensitive period described

above. During this period, experience is necessary for one to grasp basic language skills, and

it is also only during this period that one can successfully (and almost effortlessly) acquire a

first language. Exposure to a first language after this period is surmised to be of little use,

and there is some evidence based on case studies and experiments involving deaf learners of

American Sign Language that support this claim (Newport, 1990; O'Grady & Archibald,

2003; cf. Krashen, 1973). More related to our topic of immigrants adapting to a new host

culture, though, is the process of second language acquisition (SLA). Researchers have

expanded Lenneberg's treatise to explain SLA, and have found that SLA seems to also be

constrained by a sensitive period, albeit less stringent than that of first language acquisition

(Johnson & Newport, 1989; Mayberry, 1993; Mayberry & Lock, 2003). More importantly,

several studies involving immigrants to the United States (who had no prior experience with

English) showed that the age of immigration (serving as a proxy for exposure to English as a

second language) was a better predictor of proficiency than either length of experience with

English (Newport, 1990) or personal motivational and attitudinal variables (Oyama, 1978).

Moreover, Johnson and Newport (1989) found that age of immigration was highly negatively

correlated with language proficiency before age 15, while a non-significant correlation was

found for immigrants who immigrated beyond this age range. Furthermore, language

performance of the later immigrants was also significantly poorer than that of earlier immigrants. These results suggest that age of exposure to a second language is highly predictive of eventual proficiency in that language, and that the sensitive period for successfully learning a second language ends at approximately 15 years of age. Importantly, results from neuroimaging studies suggest that the sensitive period for language acquisition has neural constraints, such that neural representation of a language differs depending on when one is exposed to the language earlier rather than later in life (Kim, Relkin, Lee, & Hirsch, 1997). This suggests that during the sensitive period, the brain is designed to specialize on the language(s) to which one is exposed, and must devote another faculty to manage exposure to another language after this period closes. This has been found with Romance, Turkic, East Asian (Kim et al., 1997), and sign languages (Newman, Bavelier, Corina, Jezzard, & Neville, 2002), indicating that this biological constraint may be a universal phenomenon.

As previously mentioned, our capacity for language learning has close phylogenetic links with the capacity for cumulative cultural learning. This leads to the corollary that learning a second language and adapting to another culture are constituent parts of the same general cultural system. In other words, when one learns another language, one is effectively acquiring another cultural meaning system, with some researchers arguing for the inseparableness of language and culture (Jiang, 2000; see Kashima & Kashima, 1998). As such, this leads to the prediction that adapting to another culture would also have a similar sensitive period. In the following section, we explaining the concept of acculturation, or cultural adaptation, after which we will discuss evidence hinting at a sensitive window for acculturation.

1.2   What is acculturation?

The original conceptualization of acculturation was intended to describe interactions between people from different cultures, and the cultural adaptations that result for all participants (e.g. Redfield, Linton, & Herskovits, 1936); however, the aspect of acculturation that is most often studied is the process of cultural adaptation that people undergo upon relocating from a heritage culture to a new host culture (Sam, 2006). It is this latter aspect of acculturation that this paper refers to as "acculturation." Difficulty arises, though, when deciding on the meaning of culture. It has been defined as anything that spans from group labels (e.g. Chinese, Westerners, etc.; see Heine, 2008) to information that is shared between members of a species (e.g. technology, ideas, etc.; Richerson & Boyd, 2005). The definition that this paper will use is group identification, because it is both a group label that has been internalized, and can be a construct that is transmitted from one member of a species to another. It is within this context that this paper discusses acculturation.

Studies of acculturation generally fall under three banners: (1) Acculturation outcomes; (2) Acculturation orientations; and (3) Acculturation conditions (Arends-Tóth & van de Vijver, 2006). Research on acculturation outcomes usually uses one's degree of acculturation as an independent variable or predictor. From this branch of studies, researchers have found that acculturation is associated with a variety of outcomes including intergenerational conflict (Lim, Yeh, Liang, Lau, & McCabe, 2009), physical health and psychological well-being (Berry & Annis, 1974; Ying & Han, 2007), and school performance (Suinn, 2009; for review, see Trinh, Rho, Lu, & Sanders, 2009). For example, when immigrant parents and children acculturate at different rates, an acculturative gap results, which leads to intergenerational conflict (Lim et al., 2009). Furthermore, youths who

highly identified with both their heritage and their host cultures had more positive family relationships and less psychological distress (Nguyen, Messe, & Stollak, 1999). These studies profile the immense importance that acculturation has in various facets of life for immigrants. Thus, it is imperative that we better measure acculturation orientations, and understand what preceding or concurrent conditions facilitate or hinder acculturation.

Research on acculturation orientation describes the level or type of acculturation of various immigrant populations (Van Oudenhoven, Van der Zee, & Bakker, 2002), as well as validation studies for scales that measure one's degree of acculturation (Cuellar, Arnold, & Maldonado, 1995; Ryder, Alden, & Paulhus, 2000; for review, see Suinn, 2009). At the heart of this research is the question of whether acculturation is unidimensional, where one must choose between adoption of host culture and maintenance of heritage culture, or bidimensional, where adoption of host culture and maintenance of heritage culture are seen as orthogonal aspects of acculturation (Suinn, 2009). While the unilinear approach dominated early discussions of acculturation (Phinney, 1990), subsequent work has given more emphasis to the bidimensional approach. This latter approach has also been adopted by one of the more prominent models of acculturation, which has "cultural maintenance" as one dimension (motivation to maintain their heritage culture), and "contact and participation" as another (one's motivation to engage with the host culture; Berry, 1997). This conceptualization allows for participants to simultaneously have varying degrees of both heritage cultural maintenance and adoption of values espoused by the host culture. While debate remains over the theoretical and statistical validity of a bidimensional approach (e.g. Rudmin, 2003), more recent analyses have shown support for this bidimensional approach

(Schwartz & Zamboanga, 2008)[3]. Moreover, the majority of scales measuring acculturation, and recent studies examining acculturation, have also adopted this framework (Huynh, Howell, & Benet-Martínez, 2009). This further suggests that the bidimensional approach to acculturation has become the more prominent theoretical perspective in assessing acculturation.

One fundamental question that underlies all the research findings covered under the two banners previously mentioned is, "*What* affects acculturation?" Studies on acculturation conditions have examined a wide variety of factors, including characteristics of the receiving society (Ward & Leong, 2006), characteristics of the immigrant group (Van Oudenhoven, 2006), and personal characteristics (Ward, Leong, & Low, 2004; for review, see Sam & Berry, 2006). For instance, if immigrants from a culture with traditional sex roles move to a culture that endorses gender equality, they may experience difficulty adopting the values of the host culture, resulting in acculturative distress (Noels & Berry, 2006). Moreover, certain personality constructs such as less neuroticism and more conscientiousness have been associated with better psychological adaptation when immersed in another culture (Ward et al., 2004). Given the near exhaustive review of research topics regarding virtually all aspects of acculturation, it is interesting to note that one potential factor has mostly been ignored – whether or not there is a developmental constraint on acculturation, specifically in the form of a sensitive period, just as there is in SLA. Some work has examined this issue, and the following section will discuss some evidence that is suggestive of a sensitive period for acculturation.

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[3] For the reader's interest, there have also been some suggestions to broaden acculturation perspectives and adopt a multidimensional approach (e.g. Kim, Li, & Ng, 2005; for review, see Suinn, 2009).

1.3   Can acculturation have a sensitive period?

Evidence that cultural adaptation occurs amongst ethnic minorities can be found from two lines of research. The first line of research encompasses studies that compare psychometric responses of an immigrant group with those from its heritage cultural group and from the host cultural group. Two studies in particular are worth mentioning, and they highlight the importance of being cognizant of both dimensions of acculturation – heritage maintenance, and adoption of the host culture.

Norenzayan, Smith, Kim, and Nisbett (2002) examined whether or not European Americans, Asian Americans, and East Asians engage in different types of reasoning, based on their differences in the tendency to be either analytic or holistic thinkers. After comparing the three groups of participants, the authors found that the Asian Americans either scored similarly to European Americans, or were intermediate between the East Asians and the European Americans. This suggests that some cultural adaptation had occurred. One reason why the authors obtained inconsistent results regarding where the Asian Americans' responses lie may be due to the broad classification of participants in this category. Much like the early work attempting to determine the sensitive period for SLA (e.g. Patkowski, 1980), the group-based comparisons clearly show a linear pattern as a function of cultural classification; but the actual shape of the relationship cannot be determined. More refined subgroups are necessary to draw strong conclusions about the existence of any sensitive period for acculturation. Nonetheless, given that Norenzayan et al.'s (2002) classifications are based loosely on age of arrival in North America, the results are suggestive of a potential sensitive period for acculturation. Furthermore, this study shows one aspect of acculturation

varying as a function of one's age of arrival – a shift towards adopting the cultural system of the host culture.

Another notable study is worth mentioning because, while it shows cultural adaptation taking place, it also demonstrates how heritage maintenance may dampen our ability to detect indications of host cultural adoption. In an ambitious study, Heine and Lehman (2004) compared the self-esteem level of Asians who had been to Canada for varying amounts of time. To do so, they canvassed over 5000 university students from Canada and Japan, and then broke them down into the following groups: (1) Japanese who had never been outside of Japan; (2) Japanese who had spent some time in a Western country; (3) Recent Asian immigrants to Canada; (4) Long-term Asian immigrants to Canada; (5) Second generation Asian Canadians; (6) Third generation Asian Canadians; and (7) European Canadians. The authors found that as participants spent more time in Canada, both within one generation and across multiple generations, one's self-esteem increased. That is, self-esteem was lowest amongst the Japanese participants who had never left Japan; but this level progressively rises with each subsequent category. Importantly, the mean self-esteem scores for Asian Canadians are not level with those of European Canadians until they have become third generation Asian Canadians. The results of this study illuminate two caveats that apply to research on a sensitive period for acculturation. Firstly, the fact that even second generation Asian Canadians do not score as highly as European Canadians on the scale suggests that heritage maintenance (at least amongst Asian Canadian communities) may play a big role in buffering or slowing down adoption of the host cultural system. Secondly, age of arrival may be confounded with how long one has spent in Canada, given that the groups seem to be created based on how much experience they have had with

Western culture. Nonetheless, while these studies do not necessarily explicitly test for a sensitive period for acculturation, the results provide probative evidence for it.

The second line of research into a sensitive period for acculturation directly tests for the existence of this developmental constraint, and improves upon the precision of the first line of research by using either more continuous variables or more defined immigrant subgroups in examining eventual acculturation orientations. Thus far, only two studies have provided initial evidence of a sensitive period for acculturation. These two studies will provide a picture of what is currently known in terms of a sensitive period for acculturation, and what is still needed to be done.

The first initial evidence comes from Minoura (1992), who performed extensive interviews with Japanese mother-child dyads living in the U.S., as well as those who had moved back to Japan from the U.S. The children spanned from late elementary school students to mid high school students. These interviews primarily sought the child's subjective understanding and comfort with various aspects of American and Japanese culture. Based on their responses, Minoura categorized the participants into groups corresponding to the degree to which each person varied in their cultural alignment with both Japanese and American culture. The results reveal that one's age of arrival in the U.S. seems to predict which group one falls into. Because the age of arrival had a better-defined breakdown of its categories than seen in studies from the first line of research (i.e. using "9-10 years" and "11-13 years" vs. simply "Asian Americans"), Minoura showed that participants who moved to the U.S. before the age of 9 were much more culturally American than Japanese, signifying nearly complete American acculturation; conversely, those who moved at 9 years of age and older were much more culturally Japanese than American.

Interestingly, those who moved between the ages of 9 and 15 showed great flexibility in their use of the two cultural modes of behaviours, indicating more biculturalism. Minoura argues that because participants who arrived in the U.S. before the age of 9 were not able to sufficiently comprehend and acquire a cultural meaning system, they did not have a strong sense of cultural identification, and thus were more easily affected by the dominant U.S. culture. Between the ages of 9 and 15, however, was when one began to acquire a cultural meaning system. Hence, immigrants who arrived within this age range should be able to perceive discrepancies between their heritage and host cultures and even acquire both cultural systems; but they should also be sufficiently flexible to switch between them. After this age, though, Minoura argues that many people resist influence from a different cultural system. According to this study, it thus appears as though a sensitive period for acculturation may close at approximately the age of 15. There is one important limitation with this study, however. While qualitative data is useful in providing subjective and personally-relevant responses, validated measures are still needed to obtain responses that are more controlled and have less noise. By doing so, variations in acculturation may be more easily detected, allowing stronger conclusions to be drawn.

This weakness was addressed by Tsai, Ying, and Lee (2000), who used a validated measure of acculturation to examine the acculturation orientations of university students who had emigrated from China to the United States. The participants were divided into two groups for analysis: those who emigrated at or before the age of 12 (Pre-12), and those who emigrated after the age of 12 (Post-12). In general, they found that the Pre-12 group had stronger identification with an American identity, and also participated in more American activities than did the Post-12 group. Similar to what Minoura (1992) had suggested, Tsai et

al. argue that, because participants who immigrated before the age of twelve were probably too young to have developed a sense of cultural identity, they were more easily influenced by the dominant American culture upon arrival than the Post-12 group. To the extent that cultural identification and participation in cultural activities are indicative of a general acculturation process, this suggests that the sensitive period for acculturation may have closed at approximately 12 years of age for this sample. Thus, this study provided results that almost converged with those obtained by Minoura (1992).

One key finding that is not discussed in great detail despite having been found by both groups of researchers is the effect of one's length of stay in the host culture. In both studies, the researchers found that longer stays in the host culture were associated with feeling greater adjusted to American culture (Minoura, 1992) and stronger identification with an American identity (Tsai, Ying, & Lee, 2000). This leads to the possibility that a potential counterargument to a sensitive period for acculturation is that one adjusts increasingly well to a host culture as exposure to the host culture increases, devoid of developmental constraints. This suggests that any efforts to determine the sensitive period for acculturation must include an examination of how one's length of stay in the host culture may work independent of, and/or interact with, one's age of immigration.

Despite reporting promising results, both Minoura's and Tsai et al.'s studies share one important shortcoming, in that both studies involved a group of participants where the range and variability in age of arrival and length of stay in the host culture have been constrained. That is, Minoura (1992) focused on young children, while Tsai et al. (2000) focused on university students. This restriction of variables greatly hinders one's ability to disentangle the individual effects of each factor, or the interactive effects of both factors.

Given that both age of immigration and length of stay in the host culture may affect the degree to which one acculturates to the host culture, it is important to recruit a broader sample from an immigrant population in order to have the sufficient range and variability in both factors to reliably determine their individual (and perhaps interactive) effects on acculturation.

1.4   Tying it altogether

Taken altogether, much research from evolutionary biology and linguistics suggest that one should expect there to be a sensitive period for acculturation. Furthermore, work within the field has also hinted toward a possible sensitive period that closes approximately between the ages of 12 and 15. This latter finding also corroborates a similar sensitive period for SLA, strengthening our rationale for expecting the existence of a sensitive period for acculturation. As such, previous research findings lead to the following 2-part hypothesis, whereby confirmation of part A leads to (and is required for) the testing of part B:

(1A) There is a sensitive period for acculturation based on one's age of

immigration;

(1B) This sensitive period ends during one's mid-teens

2 Chapter: Methodology – Our Present Research

Conducting a study to find the sensitive period for acculturation requires one to be cognizant of two factors. Firstly, a bidimensional model of acculturation is a more suitable approach as it allows for simultaneous observations about the maintenance of one's heritage culture and the adoption of the host culture. And secondly, one must be aware of the potentially confounding effects of both age of immigration and length of stay in the host culture. To avoid this confound, we have recruited a community sample characterized by a wide range of age of immigration and length of time spent in the host culture.

2.1 Overview

The two studies presented in this paper sought to assess the evidence for a sensitive period of acculturation among Hong Kong immigrants in Vancouver, Canada. According to Citizenship and Immigration Canada (2009), Vancouver receives a disproportionately large amount of Asian immigrants to Canada each year, accommodating approximately 15% of them. Hong Kong immigrants, in particular, represent a substantial proportion of immigrants to Vancouver, constituting close to 10% of the population of Greater Vancouver (Statistics Canada, 2008b). Furthermore, several waves of Hong Kong immigrants have arrived in Vancouver over the past few decades, many of whom arrived with family members of different ages. This has created a substantial pool of potential participants with a broad range of both age of immigration and years spent in Canada. This makes Hong Kong immigrants in Vancouver an ideal population for this study.

We assessed acculturation via two routes. First, we used a scale that was specifically developed to measure acculturation amongst immigrants. Second, we chose several measures of cognition that have shown cultural differences in the past. Studying cultural

adaptation is hindered given the lack of a conceptualization for being culturally "fluent," is in contrast to being linguistically fluent. This is especially evident given the fact that, while linguistic fluency can be broken down into the components of language (i.e. syntax, morphology, phonology, etc.), there are no such analogue domains for cultural fluency. Hence, we decided to account for this by examining various measures that have revealed cultural variation in previous studies, treating them as "cultural domains."

A final note regarding our methodology pertains to the effect of the language in which the questionnaire is written. Because the language within which people are assessed can affect their responses (e.g. Ross, Xun, & Wilson, 2002), we controlled for this confound by creating both Chinese and English versions of the materials, and statistically controlling for the language version that participants received (English was coded as 1, and Chinese was coded as 2). Participants rated their reading comprehension in Chinese and English using a 6-point Likert scale (0 = Not at all able to use it; 5 = Perfectly fluent), and received the language version corresponding to language in which they were more proficient. Those who rated themselves as equally proficient in both languages were randomly assigned language versions. The Chinese version was translated by two bilingual speakers, and disagreements were reconciled through discussion to produce the final translation (see Heine, 2008).

2.2   Study 1 methods

2.2.1   Participants

Participants were 232 Hong Kong immigrants to Vancouver (141 females), ages 18 to 60 ($M = 33.05$, $SD = 14.15$). The age of immigration ranged from 1 to 50 ($M = 19.53$, $SD = 14.03$), and the number of years spent in Canada ranged from 2 to 39 ($M = 13.41$, $SD = 5.18$).

The sample was recruited from a local Chinese immigrant aid organization (n = 171) and from the student population of the University of British Columbia (n = 61). Participation was restricted to immigrants from Hong Kong who had not spent more than 2 years in a country other than Hong Kong/China, Canada, or the US.

2.2.2   Materials[4]

In addition to measuring acculturation, the cultural domains that we measured were Self-enhancement; Interdependence vs. Independence; Self-esteem; Dialecticism; Self-concept clarity; Holistic thinking; Preference for Uniqueness; Analytic vs. Holistic reasoning; Linear Trend Predictions; and Ideal Affect. These were measured using both explicit and implicit scales. Self-enhancement, interdependence, independence, self-esteem, dialecticism, self-concept clarity, and holistic thinking were measured using explicit scales, while the rest were measured using implicit scales.

2.2.2.1   Acculturation measure

Acculturation was measured with the Vancouver Index of Acculturation (VIA: Ryder, Alden, & Paulhus, 2000), which has two orthogonal scales pertaining to one's identication with one's heritage (ten items) versus mainstream culture (ten items). Participants were first provided with a definition of the term "heritage culture." They were then asked to indicate their own heritage culture prior to completing the measure. The participants completed the measure using a 7-point Likert scale (1 = Strongly disagree, 7 = Strongly agree). This measure has been found to be highly reliable with Chinese samples (Huynh et al., 2009). The obtained Cronbach's alphas for each subscale are 0.87and 0.85 for

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[4] Unless otherwise specified, all scales were administered using a 5-point Likert scale (1 = Strongly disagree, 5 = Strongly agree).

the Mainstream and Heritage scales, respectively. Sample items for the Mainstream scale include "I enjoy typical North American jokes and humor," and "I would be willing to marry a North American person"; and some sample items for the Heritage scale, "I believe in the values of my heritage culture," and "It is important for me to maintain or develop the practices of my heritage culture." We made no predictions about one's score on the Heritage scale; but participants who have adapted to Canadian culture more would likely score higher on the Mainstream scale (see Appendix 0).

2.2.2.2 Explicit measures

We measured Self-enhancement by asking participants to read a list of twenty descriptive items (e.g. dependable, creative), and then convey how accurately each item reflected their personality (self-assessment), as well as that of the typical Canadian (other-assessment) using a 6-point Likert scale (1 = Not at all accurate, 6 = Completely accurate). Their other-assessment was then subtracted from their self-assessment, which yielded an index of self-enhancement. The more positive the index, the greater is the level of self-enhancement. As this is more characteristic of Western thought (Heine & Lehman, 1999), those who are more adapted to North American culture should have a more positive index.

Interdependence and Independence were measured using the Self-Construal Scale (Singelis, 1994), which has two sub-scales, measuring Interdependence versus Independence. These two sub-scales yielded satisfactory reliability, with Cronbach's alphas of .79 and .72 for the interdependent and independent sub-scales, respectively. An example of an Interdependence item is "I have respect for authority figures with whom I interact"; and a sample Independence item is "I act the same way no matter who I am with." To the extent that people have adapted to cognitions that are more characteristic of Western thought, they

should exhibit more independence, and less interdependence, in line with Markus and Kitayama (1991).

Self-esteem was measured using the Rosenberg Self-Esteem Scale (Rosenberg, 1965), which had high reliability, yielding a Cronbach's alpha of .82. Those who have adapted to more Western cognitions should show higher levels of self-esteem, as previous work has indicated (Heine & Hamamura, 2007).

Self-concept clarity was measured using the Self-Concept Clarity Scale (Campbell, Trapnell, Heine, Katz, Lavallee, & Lehman, 1996), and yielded a Cronbach's alpha of .85, suggesting high reliability. Note that most items on this measure actually pertain to a *lack* of self-concept clarity. As such, a higher score on this scale actually refers to a *lack* of self-concept clarity. Some items that denote this self-concept confusion are "My beliefs about myself often conflict with one another" and "My beliefs about myself seem to change very frequently." As Campbell et al.'s (1996) work suggests, participants who are more acculturated to Western thought should exhibit more self-concept clarity.

Holistic thinking was measured via the Holism Scale (Choi, Dalal, Kim-Prieto, & Park, 2003), yielding a Cronbach's alpha of .71, connoting satisfactory reliability. Some items that represent holistic thinking include "Everything in the universe is somehow related to each other," and "Nothing is unrelated." In accordance with Choi et al's (2003) findings, participants who have adapted to a more Western style of thought should exhibit less holism.

2.2.2.3   Implicit measures

Preference for uniqueness was measured by using Kim and Markus' (1999) task involving simple shapes. Each task involves a nine-figure configuration comprised of two kinds of shapes, with one shape being in the numerical majority, and a few unique shapes in

the minority (see Figure 2.1). Participants rank ordered the shapes on the basis of how much

they liked or disliked each shape from 1 (Most favourite) to 9 (Least favourite). The unit of

analysis here was the participants' averaged preference for all unique shapes. According to

Kim & Markus (1999), Western cultures have positive connotations regarding being unique

and standing out, while the opposite is true in East Asian cultures. Thus, those who have

adapted to Western styles of thinking should show greater preference for unique shapes.
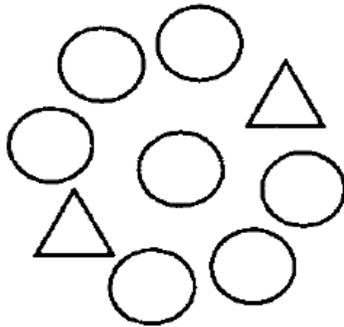
Figure 2.1   A nine-figure confirmation of two shapes, as used in Kim and Markus (1999)

We measured Analytic vs. Holistic reasoning by employing Norenzayan et al.'s

(2002) task that pitches the two types of reasoning against each other. The participant is

shown a target object, and is then given two groups of objects that resemble the target object

(see Figure 2.2). The task is for the participants to make a binary decision by determining

which group the target object was most similar to. Those who engage in analytic reasoning

(characteristic of Western thought) would make a similarity judgment based on the one

characteristic that links the target object with all the objects in one group. On the other hand,

those who engage in holistic reasoning (characteristic of East Asian thought) would base

similarity judgments on whether the shapes in a group *generally* resemble the target object.

To score this task, we assigned a value of 1 to a choice indicative of holistic reasoning, and a

0 to analytic reasoning. Participants whose cognitions are more characteristic of Western thought should use more analytic reasoning, thus scoring lower on this task.
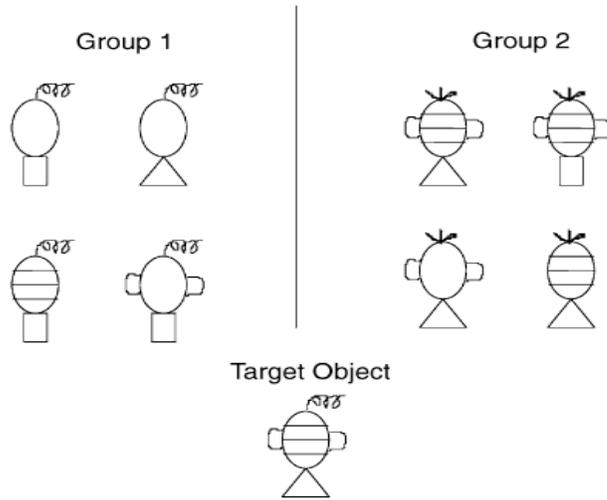
Figure 2.2   A similarity judgment task as used in Norenzayan et al. (2002)

Dialecticism was measured using the Dialectical Self Scale (Spencer-Rodgers, et al., 2008), which had satisfactory reliability, with a Cronbach's alpha of .75. Some sample items reflecting dialecticism include "I sometimes believe two things that contradict each other," and "My world is full of contradictions that cannot be resolved." Based on previous research (see Spencer-Rodgers, Williams, & Peng, 2010), those who have grown more accustomed to North American culture should score lower on this scale, reflecting less dialectical thinking .

We measured Linear Trend Predictions by using four short scenarios from a larger set used by Ji, Nisbett, and Su (2001), which ask the participants to make a prediction about the likelihood of a given outcome happening to the characters in the scenario by providing a probability ranging from 0% to 100%. Linear thinking, in this case, is represented by a propensity to not expect change given the information provided by the scenarios. All four items can be found in Appendix A.1. As linear thinking has been linked to analytic reasoning style (Nisbett, Peng, Choi, & Norenzayan, 2001), we predict that participants who

engage in more Western-style cognitions would assign a higher probability to an outcome if it seems to follow from the information given by the scenarios.

Ideal Affect was measured using Tsai, Knutson, and Fung's (2006) Affect Valuation Index, which examines the degree to which one idealises and actually experiences certain emotions. These emotions lie on two orthogonal dimensions – emotions can vary along either a positivity-negativity dimension, or a high activation-low activation dimension. Given that Tsai et al. (2006) primarily focus on (and have found) cultural variability for the degree to which people idealise low activation positive (LAP) emotions and high activation positive emotions (HAP), we follow this precedence and similarly focus our analyses on LAP and HAP. Just as Tsai et al.'s (2006) research indicates, participants who are more acculturated to Western styles of thinking should idealise HAP more, and LAP less, than those who are not as acculturated.

2.2.3   Procedure

Participants recruited by S.U.C.C.E.S.S. contacted us via email to sign up to participate, whereupon we obtained their addresses and mailed the paper questionnaires to them with a return envelope. A $20 cheque was sent to each participant upon receipt of their completed package. All participants lived in the Greater Vancouver Regional District.

University students were recruited through the Human Subject Pool (HSP) at the University of British Columbia. Participants simply completed the questionnaire, got debriefed, and were awarded with 1 credit.

For all participants, an initial contact email was sent to ascertain their self-rated proficiency in Chinese and English, which then determined the language version of the questionnaire that they would receive.

2.2.4 Results

Regression analyses were all performed using the following predictors: Gender, Language version, Self-rated English ability, Sample source, Age of immigration, Years in Canada, and an interaction between Age of immigration and Years in Canada. Regression results for all the scales, broken down into explicit and implicit measures, are summarized in Tables 2.1 and 2.2, respectively.

	VIA-Mainstream	VIA-Heritage	Interdependence	Independence	Self-Esteem	Dialecticism	Self-Concept Clarity	Holistic Thinking
Language version	.109(.132)	.088(.113)	.156(.154)	.144(.144)	- .087(-.076)	.120(.177)*	.048(.038)	- .131(-.143)
Gender	- .266(-.132)	.231(.116)	- .036(-.035)	.069(.067)	.063(.054)	- .046(-.067)	.019(.015)	- .046(-.050)
English Rating	.318(.149)	.159(.070)	.048(.121)	.033(.087)	.029(.065)	.000(.002)	- .065(-.134)	.063(.177)
Sample Source	.056(.036)	- .011(-.005)	.065(.057)	- .030(-.027)	.123(.097)	.102(.136)	.035(.025)	.040(.039)
Age of Immigration	.008(.078)*	.034(.057)	.014(.386)	.010(.269)	.021(.011)	- .009(-.388)	- .027(-.600)*	.009(.270)
Years in Canada	- .024(-.350)	.014(-.031)	.026(.257)	.007(.072)	.019(.164)	- .007(-.109)	- .032(-.252)	.003(.035)
Age x Years	- .003(-.219)*	- .001(-.087)	- .001(-.391)	.000(-.188)	.000(-.232)	.000(.163)	.001(.258)	.000(-.039)

Table 2.1 Summary table of regression results for explicit measures from Study 1 with unstandardised coefficients. Standardised coefficients are given in parentheses. * $p < .05$

	Preference for Uniqueness	Analytic vs. Holistic Reasoning	Linear Trend 1	Linear Trend 2	Linear Trend 3	Linear Trend 4	Idealised LAP	Idealised HAP
Language version	.497(.146)	- .021(-.046)	- 1.645(-.041)	- 3.356(-.094)	.110(.002)	1.017(.025)	.142(.211)*	- .119(-.162)
Gender	- .005(-.035)	- .005(-.010)	1.695(.042)	- .640(-.018)	- 2.632(-.051)	2.942(.071)	- .045(-.066)	.070(.094)
English Rating	- .281(-.210)*	- .018(-.096)	- .492(-.032)	1.459(.105)	.926(.047)	.290(.018)	.024(.094)	- .031(-.110)
Sample Source	- .286(-.075)	- .034(-.069)	- 2.331(-.052)	.514(.013)	2.070(.037)	9.668(.213)*	.012(.016)	- .019(-.023)
Age of Immigration	.005(.037)	- .009(-.513)	- .432(-.299)	.071(.055)	- .603(-.329)	.425(.289)	- .002(-.081)	.008(.315)
Years in Canada	.019(.053)	- .013(-.276)	- 1.135(-.287)	- .145(-.041)	- .984(-.197)	.387(.096)	.003(.041)	.011(.147)
Age x Years	- .001(-.138)	.001(.445)	.041(.396)	.017(.189)	.034(.261)	.003(.026)	.000(.056)	- .001(-.580)*

Table 2.2 Summary table of regression results for implicit measures from Study 1 with unstandardised coefficients. Standardised coefficients are given in parentheses. * $p < .05$

2.2.4.1   Acculturation measure

With regards to the VIA, there was a significant linear relationship between Age of Immigration and VIA-Mainstream ($b = -.024, p < .001$). This suggests that participants scored .024 points lower on the Mainstream scale with each increasing year of Age of Immigration. Conversely, there was no such relationship between VIA-Mainstream and Years in Canada ($b = .008, p = .622$). Interestingly, there was a significant interaction between Age of immigration and Years in Canada ($b = -.003, p < .050$). Using the critical t value at $t(202, .025)$, we calculated that the relationship between Mainstream scores and Years in Canada is positive until approximately 14.5 years of age, after which the relationship is not significantly different from zero (see Figure 2.3). This is in accordance with our prediction. The same linear extrapolation showed that arriving after the age of 50 yields a significant negative relationship between Years in Canada and VIA-Mainstream; however, as no participants arrived after the age of 50, we cannot ascertain the reliability of this trend. In general, though, the same relationships did not hold for VIA-Heritage as there were no significant predictors.
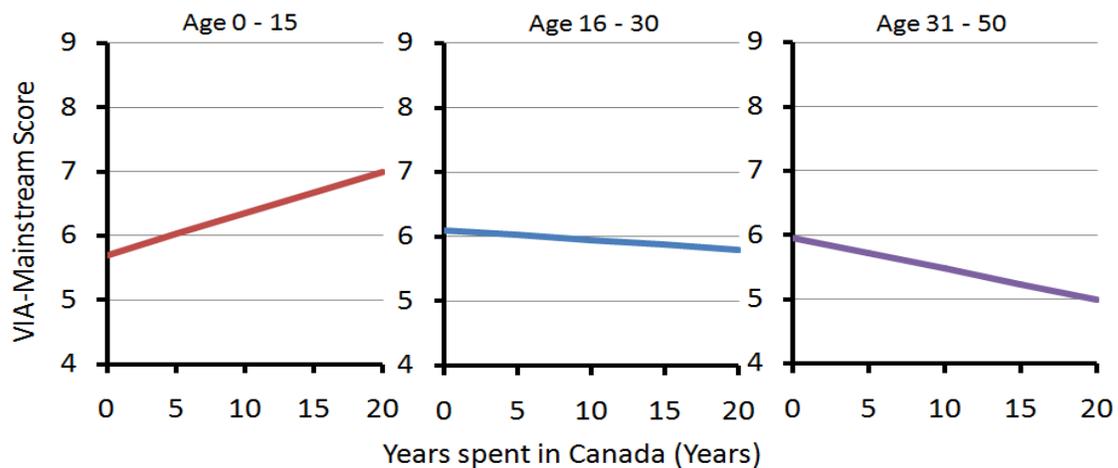

Figure 2.3   This figure shows the interactive effect of Age of Immigration and Years in Canada on participants' VIA-Mainstream scores, with Age of Immigration being broken up into three segments for clearer depiction of the data

2.2.4.2   Explicit measures

For Self-enhancement, Gender ($b = .200$, $p < .050$) and Age of Immigration ($b = .023$, $p < .050$) were both significant predictors. Specifically, males showed greater self-enhancement than females, and immigrants who arrived at an older age showed greater self-enhancement. This latter finding is counter to our prediction.

Dialecticism had a significant linear relationship with language version ($b = .120$, $p < .050$), suggesting that participants who completed the Chinese version of the questionnaire generally rated themselves as engaging in more dialectical thinking than did participants who completed the English version of the study. However, as it does not covary with age of immigration ($b = -.009$, $p = .124$), the results are not in line with our predictions.

Self-concept clarity also had Age of Immigration as a significant predictor ($b = -.027$, $p < .050$); however, this is counter to our prediction as this suggests that immigrants who arrived at an older age show greater self-concept clarity.

An analysis of Interdependence, Independence, Self-esteem, and Holistic thinking did not reveal any significant differences, counter to our predictions.

2.2.4.3   Implicit measures

There was a significant linear relationship between Preference for Uniqueness and self-rated English ability ($\beta = -.210$, $p < .050$), suggesting that participants who were better at English preferred the unique shapes more than participants who were not as proficient in English. However, counter to our prediction, scores on this measure did not vary according to Age of immigration ($b = .005$), Years in Canada ($b = .019$), or the interaction of these two predictors ($b = -.001$), all p's $> .500$.

Contrary to our predictions, an analysis of Analytic vs. Holistic reasoning and all of the Linear Trend Prediction items did not yield any significant predictors. The only

exception was with item 4 of the trend prediction task (see Appendix 0), which showed Sample source to be a significant predictor ($b = 9.668$, $p < .050$). This suggests that participants who were recruited via HSP were more likely than the S.U.C.C.E.S.S. sample to project a linear trend.

Participants' scores on the AVI were ipsatized in accordance with Tsai et al. (2006). Idealised LAP and HAP scores were analysed separately for this measure. An analysis revealed that LAP was predicted only by the language version of the questionnaire ($b = .142$, $p < .050$). This suggests that participants who completed the Chinese questionnaire idealized LAP more than did participants who completed the English questionnaire. An analysis on HAP, on the other hand, revealed a significant interaction between Age of immigration and Years in Canada ($b = -.001$, $p < .050$). Using the critical t value at $t(201, .025)$, we calculated the point at which the slope becomes significant. This linear extrapolation revealed a non-significant relationship between Years in Canada and idealized HAP at all years of Age of Immigration until after participants the age of 50; however, as was the case with VIA-Mainstream, as no one immigrated after the age of 50, this finding cannot be considered wholly reliable. In general, the results for idealized LAP and HAP are not in line with our predictions.

2.2.5 Discussion

Study 1 provided limited evidence for a sensitive period for acculturation, with much of the results running counter to our predictions. The results involving the VIA's Mainstream score seemed to be the most promising, as the analysis revealed that mainstream identification amongst younger immigrants increased the longer they stayed in Canada, but this effect disappears for older immigrants. It thus appears that a sensitive period may exist

for sensitivity to cultural information exposure about cultural identification, which closes at around 14.5 years of age. This is an especially significant finding given that it coincides with the sensitive period for second language acquisition previously discussed, as one may expect if the two were so closely phylogenetically linked. This also provides initial support for the claim that learning a new language and adapting to another culture both hinge on one's ability to acquire a general cultural system.

Examining Heritage scores, however, did not show that it varied as a function of any of our predictors. This maintenance of heritage culture may be explained by the readily available amenities in Vancouver that cater to the Chinese population. The fact that Chinese immigrants are the largest immigrant population in Greater Vancouver (of which 36% are from Hong Kong; Statistics Canada, 2008a), and that Vancouver's Chinatown is one of the largest of its kind outside of Asia (Burgess, 2005), suggest that Hong Kong immigrants can easily access symbols and amenities from their heritage culture. Just as regular exposure to one's native language in childhood allows for the maintenance of native-like performance on some language tasks (Oh, Jun, Knightly, & Au, 2003), constant contact with one's heritage culture may serve a similar function in maintaining one's heritage cultural identification.

Despite the lack of significant results in the predicted direction with regards to the other scales meant to act as different aspects of culture, one intriguing pattern emerged. The implicit measures, compared to the explicit measures, seemed to indirectly show more significant results in the predicted directions – indirectly in such a way that the predictors that are significantly associated with our dependent variables are also significantly correlated with Age of Immigration. Specifically, the three implicit measures that showed this effect were preference for uniqueness, linear trend prediction item 4, and idealized LAP.

Preference for uniqueness was significantly predicted by participants' self-rated English ability, such that participants with greater English ability rated the unique shapes much more favourably than did participants with poorer English ability. This self-rated English proficiency, in turn, is negatively correlated with one's Age of Immigration ($r = -.589, p < .001$). Similarly, the fourth linear trend prediction item was significantly predicted by the source of our sample, such that HSP participants had a higher tendency to engage in making a linear trend prediction than did participants who were recruited by S.U.C.C.E.S.S. This sampling distinction is, in turn, negatively correlated with Age of Immigration ($r = -.480, p < .001$), such that HSP participants also immigrated at an earlier age on average than did the S.U.C.C.E.S.S. participants. Furthermore, idealized LAP was significantly predicted by the language version of the questionnaire, such that participants who completed the questionnaire in Chinese ideally wanted to experience more LAP. Language version, in turn, was positively correlated with Age of Immigration ($r = .517, p < .001$), with earlier immigrants generally receiving the English questionnaire. Taken together, these findings suggest that Age of Immigration may have some underlying effect that our explicit measures were unable to assess, and that our implicit measures were just barely able to assess. As such, we approached Study 2 with the aim of investigating the sensitive period of acculturation using only implicit measures.

2.3 Study 2 methods

2.3.1 Participants

Participants were 204 Hong Kong immigrants to Vancouver (114 females), ages 18 to 62 ($M = 37.34, SD = 13.84$). The age of immigration ranged from 0 to 58 ($M = 21.84, SD =$

14.37), and the number of years spent in Canada ranged from 1 to 43 ($M = 15.50$, $SD = 6.82$). Some participants were retained from Study 1 (n = 69), while the rest were newly recruited by S.U.C.C.E.S.S. (n = 135). Just as in Study 1, participation was restricted to immigrants from Hong Kong who had not spent more than 2 years in a country other than Hong Kong/China, Canada, or the US.

2.3.2 Materials

In keeping with our approach in Study 1, we used a measure of general acculturation in conjunction various measures of aspects of cultural adaptation. For general acculturation, we used the VIA again to try to replicate our results from Study 1. As for measures of aspects of cultural adaptation, we used implicit measures to assess the following: preference for uniqueness, graphical trend prediction, approach/avoidance orientation, self-enhancement, field interdependence, as well as internal vs. external attributions of behaviour.

Preference for uniqueness was once again measured by the figures used in Kim and Markus (1999). As such, the same prediction was made as in Study 1, that those who are more acculturated to Western thought should prefer the unique shapes more.

Tendency to make trend predictions was assessed via graphs as used in Ji, Nisbett, and Su (2001). Rather than merely presenting scenarios to participants (as in Study 1), these items include a graph with three pre-set data points showing various curvilinear slopes, comprised of positive and negative accelerating graphs (see Figure 2.4 and Figure 2.5). The task is to indicate on the graph where the participants predict the next two points will be. Given that these slopes are curvilinear, we were interested in whether participants predicted that the trend continues, or if the sign of the slope changes. For analysis, we will focus on the means of the two predicted data points. For positive accelerating graphs, a higher mean

is indicative of a prediction that the trend will continue. On the other hand, a lower mean for

negative accerating items is indicative of a prediction that the trend will continue. The graph

was arranged such that the y-axis ranged from -100 to 100, and with the last given data point

positioned at 0. As Ji et al. (2001) have shown, Western participants tended to maintain the

same direction of the slopes, whereas Asian participants tended to predict a change in the

direction of the slopes. Thus, we predict that participants whose cognitions characterize

Western thought more would predict less change in the direction of the slopes.

1. In 2005, 0.8% of the world's population was males older than 80. In 2007 and 2009, 1.0% and 1.1% of the world's population, respectively, were males older than 80, as indicated on the graph below.
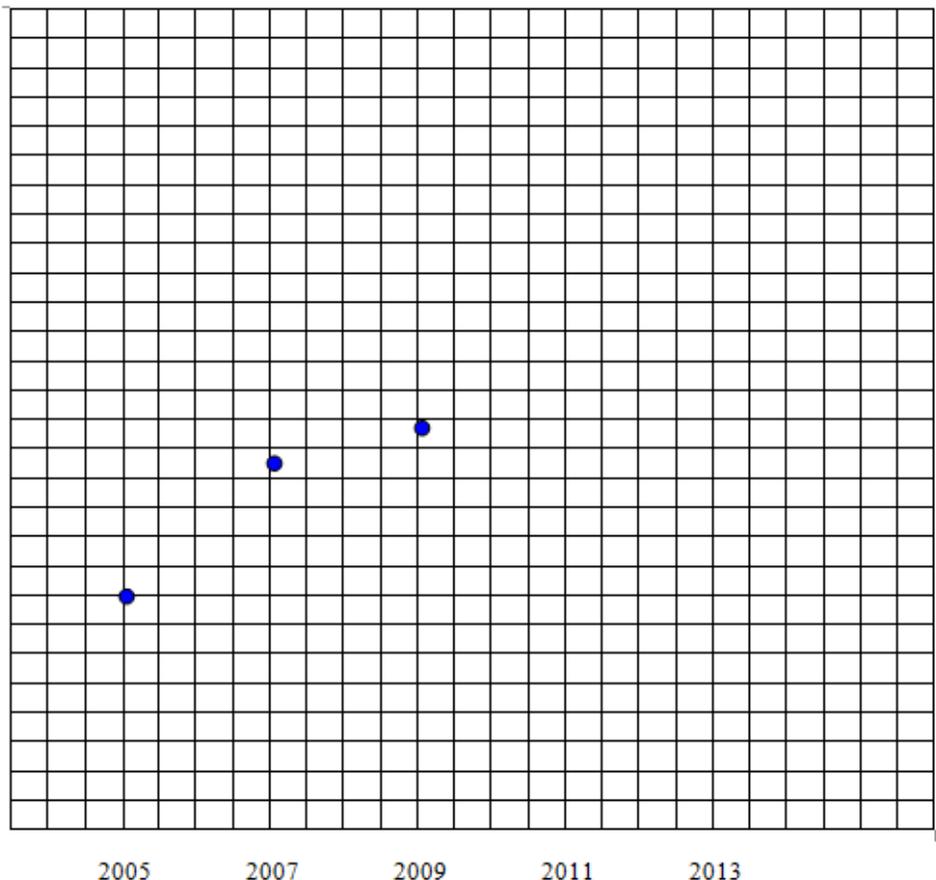
Please mark two points on the graph to indicate what you think the population of males over 80 will be for 2011 and 2013.

Figure 2.4   A graphical linear trend prediction item, as used in Ji et al., (2001). This item depicts a positive accelerating relationship.

3. In 2005, 86% of students ate breakfast, in 2007, 77% of students did so and in 2009 74% of students ate breakfast as indicated on the graph below.
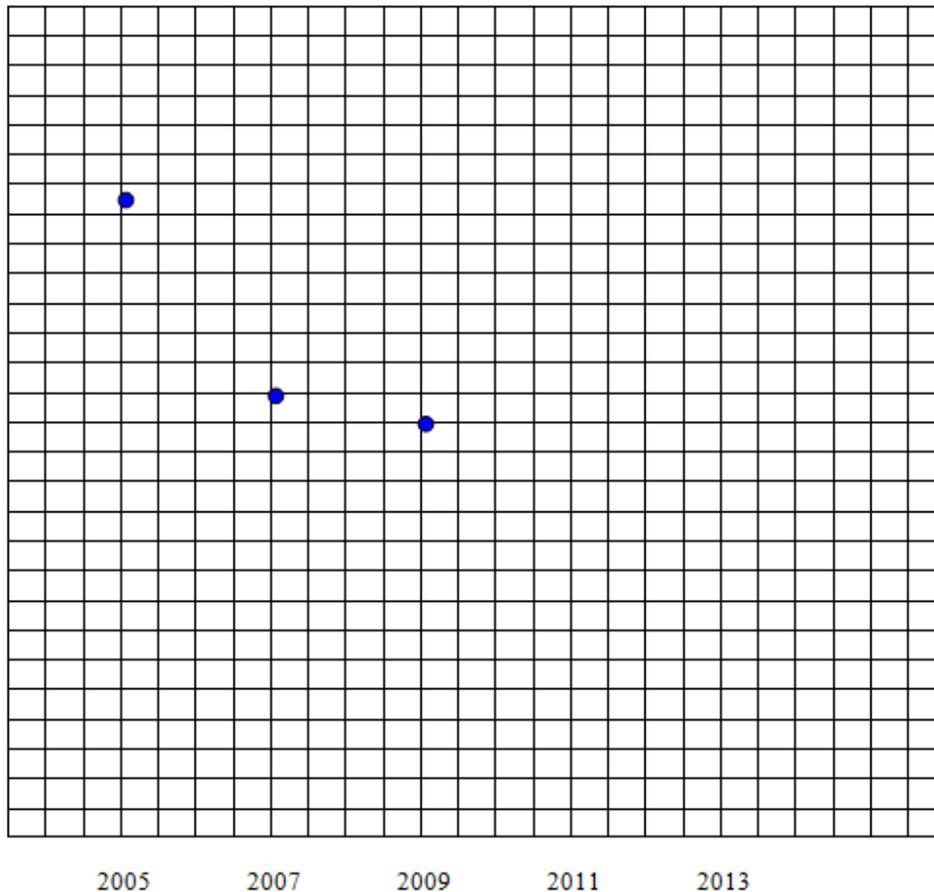
Please mark two points on the graph to indicate what you think the rate of children eating breakfast will be for 2011 and 2013.

Figure 2.5 A graphical linear trend prediction item, as used in Ji et al., (2001). This item depicts a negative accelerating relationship.

Approach/avoidance orientation was assessed via Emmons' (1986) personal strivings task, where participants are asked to provide a list of eight personal strivings, defined as "things that you typically or characteristically are trying to attain in your daily life" (p. 1060). This can either be in pursuit of positive outcomes (e.g. "I want to study harder.") or in avoidance of negative outcomes (e.g. "I want to stop embarrassing myself."). Following the analytical methods of Elliot and Sheldon (1999), each item was coded as being either

approach oriented or avoidance oriented by a coder who was blind to the hypothesis (0 = Approach, 1 = Avoidance). Because some researchers have noted that people from Western cultures have a more approach orientation (e.g. Lee, Aaker, & Gardner, 2000), we predict that those who have acculturated more towards Western culture will also be more approach oriented in their personal strivings.

Self-enhancement was measured with the self-evaluation task used by Falk, Heine, Yuki, and Takemura (2009). Participants were presented with thirty personality traits, which they must categorise as characteristic of "me" or "not me." Once complete, participants are shown the same thirty personality traits, which they must now rate how desirable the trait is using a 7-point Likert scale (1 = Not desirable at all, 7 = Very desirable). Self-enhancement is thus conceptualized as a correlation between trait desirability and choosing "me" vs. "not me." A positive correlation thus indicates self-enhancement. Given that Falk et al. (2009) found that Japanese participants showed no self-enhancement whereas Euro-Canadians did, we also predict that those who have adapted to more Western styles of thinking will also exhibit greater self-enhancement.

We examined participants' field independence by using a modified version of the Rod and Frame task. In this task, participants must determine whether a rod is either perfectly horizontal (or vertical), or a few degrees off horizontal (or vertical). To do so, participants must ignore distracting information in the background (see Figure 2.6). Because previous researchers have found that Westerners generally outperform East Asians in this task due to Westerners' tendency to pay attention to focal objects while ignoring background information (e.g. Ji, Peng, & Nisbett, 2000), this leads us to predict that those who are more acculturated to Western attentional styles should be more accurate on this task.

Figure 2.6   A sample item from the modified Rod and Frame task

Internal vs. external attributions of behaviour was assessed via an attribution task used by Hong, Morris, Chiu, and Benet-Martínez (2000). Using a picture of a small school of fish (see Figure 2.7), participants were asked whether the fish at the front of the group was leading the group (internal attribution) or was being chased by the group (external attribution). Because Westerners have been found to attribute behaviours to internal forces more so than they attribute them to external forces (Hong et al., 2000), we also predict that those who are characterized by having more Western attributional styles would be more likely to make suggest that the fish is leading rather than being chased.
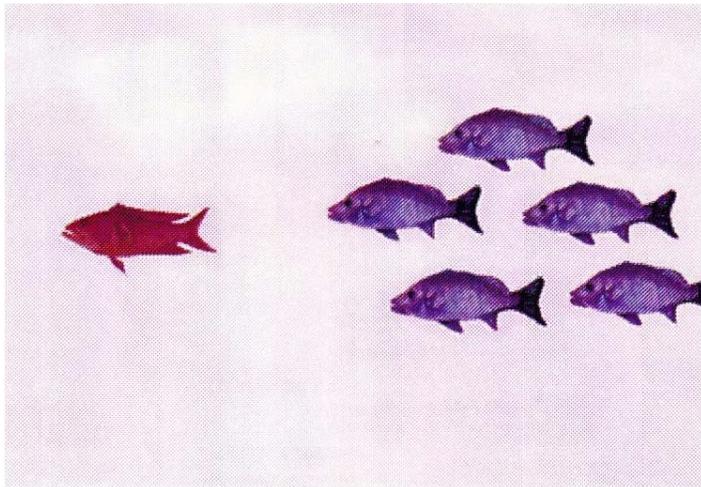
Figure 2.7   The attributional task used by Hong et al. (2000)

2.3.3 Procedure

Participants from Study 1 were originally asked to indicate whether or not they would be willing to participate in further studies, and to provide their email addresses if they were interested. Those who showed interest were contacted. 109 participants indicated that they were interested, but 69 actually participated in Study 2, yielding a retention rate of 63.33%.

The remainder of the participants was recruited by S.U.C.C.E.S.S. via newspaper and social media ads, as well as through community newsletters. We were then provided with a list of 200 participants, of whom 112 participated, yielding a response rate of 56%.

Because Study 2 was completed online, we were notified as soon as a participant had completed the study. We then ascertained their mailing address, and subsequently sent them a $20 cheque. All participants lived in the Greater Vancouver Regional District.

2.3.4 Results

Regression analyses were all performed using the following predictors: Gender, Language version, self-rated English ability (averaged between participants' self-rated proficiency in speaking, reading, and aurally comprehending English), Age of immigration, Years in Canada, and an interaction between Age of immigration and Years in Canada. Regression results for measures in Study 2 are summarized in Table 2.3.

	VIA-Mainstream	VIA-Heritage	Preference for Uniqueness	Self-Enhancement	Approach vs. Avoidance	Internal vs. External Attributions
Language version	.087(.050)	- .125(-.063)	.376(.094)	.015(.029)	- .010(-.038)	.154(.199)
Gender	- .051(-.029)	- .184(-.092)	- .110(-.027)	- .053(-.101)	.027(.102)	- .112(-.142)
English Rating	.134(.144)	.117(.111)	.268(.119)	- .045(-.160)	.007(.053)	.028(.069)
Age of Immigration	- .016(-.260)	- .020(-.290)	.020(.144)	- .004(-.216)	- .002(-.231)	.007(.271)
Years in Canada	.001(.008)	.010(.019)	.000(-.002)	- .009(-.231)	- .002(-.089)	.004(.068)
Age x Years	.001(.191)	.000(.001)	.000(.048)	- .000(-.050)	- .000(-.024)	.000(-.199)

	Linear Prediction 1	Linear Prediction 2	Linear Prediction 3	Linear Prediction 4	Field Independence
Language version	4.870(.060)	- 76.929(-.143)****	- 60.532(-.634)****	- 59.364(-.634)****	- .085(-.218)*
Gender	- .287 (-.004)	- 4.298(-.036)	- 3.300(-.034)	- 3.750(-.040)	- .009(-.024)
English Rating	- 13.562(-.316)***	4.693(.074)	3.691(.073)	3.096(.062)	- .028(-.132)
Age of Immigration	.491(.174)	- .733(-.175)	- .545(-.163)	- .350(-.107)	.000(-.009)
Years in Canada	.849(.141)	- 1.380(-.155)	- 1.046(-.147)	- .463(-.066)	.003(.096)
Age x Years	.022(.126)	.041(.157)	.037(.179)	.024(.117)	- .000(-.132)

Table 2.3   Summary table of regression results from Study 2 with unstandardised coefficients. Standardised coefficients are given in parentheses. * p < .05, ** p < .01, *** p < .005, **** p < .001

Unlike in Study 1, neither the VIA-Mainstream nor the VIA-Heritage scores had a significant relationship with any predictors, including an interaction between Age of Immigration and Years in Canada. Thus, in the case of the VIA-Mainstream score, we failed to replicate our results from Study 1.

We also did not find any significant relationships between our predictors and Preference for Uniqueness, Self-enhancement, Approach vs. Avoidance[5], and Internal vs. External attributions. On the other hand, the Trend Prediction items and the Field Independence items did have a significant relationship with some predictors.

Self-rated English proficiency was a significant predictor for the first trend prediction item ($\beta = -.316$, $p < .005$), which had a positive accelerating slope. In fact, participants who were the most proficient in English (with a rating a 5) predicted a higher mean ($M = 5.27$, $SD = 35.19$) than those who were less proficient in English (with a rating of 2; $M = -16.25$, $SD = 56.84$). This also suggests that less proficiency in English was associated with a greater tendency to predict a trend reversal.

All three remaining trend prediction items were significantly predicted by the language version of the questionnaire. Specifically, those who completed the Chinese version of the questionnaire generally predicted a larger drop in the two negative accelerating slopes ($M = -77.97$, $SD = 39.44$; and $M = -78.29$, $SD = 38.41$) than those who completed the English version ($M = -14.57$, $SD = 30.17$; and $M = -15.61$, $SD = 29.40$). This suggests that, for negative accelerating slopes, Chinese-questionnaire participants predicted an exacerbation of the slope rather than a reversal. The last trend prediction item saw the Chinese-questionnaire participants predict a larger drop ($M = -72.07$, $SD = 50.31$) than did

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[5] Because the results were not significant for this measure using one coder to code the personal strivings, we decided to not use a second coder. Thus, no inter-rater reliability is reported here.

English-questionnaire participants ($M = 10.09$, $SD = 32.21$). However, as this item had appositive accelerating slope, Chinese-questionnaire participants thus predicted a trend reversal rather than an exacerbation of the slope.

The Rod and Frame task assessing Field Independence yielded a main effect of questionnaire language ($b = -.085$, $p < .05$), such that participants who completed the questionnaire in Chinese performed poorer ($M = 56.04\%$, $SD = 18.28\%$)[6] than did participants who completed it in English ($M = 63.56\%$, $SD = 20.13\%$).

Despite finding effects from some significant predictors, none of the measures in Study 2 varied as a function of Age of Immigration.

2.3.5   Discussion

In Study 2, we tried to replicate the results regarding VIA-mainstream scores from Study 1, but our results did not yield any significant predictors. Similarly, Preference for Uniqueness was no longer predicted by English ability as it was in Study 1. One possibility is that participants from Study 1 and Study 2 were qualitatively different, despite being from the same population. There is some support for this claim, given that the inclusion of a dummy coded Retention variable (1 = Retained participants, 2 = New participants) yielded a significant effect on some measures. For example, controlling for all the usual predictors, retained participants generally had more avoidant-themed goals than did the new participants ($b = -.056$, $p < .05$). Furthermore, retained participants scored marginally higher on the VIA-heritage subscale than did new participants ($b = -.307$, $p = .065$). Also, we are currently conducting another study targeting various immigrant groups in the United States using the Mechanical Turk (MTurk) system. This study revealed at least a linear effect of Age of

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[6] This value is still greater than chance (50%), $t(88) = 3.117$, $p < .005$.

Immigration in predicting VIA-Mainstream scores ($b = -.028$, $p < .05$), suggesting less identification with one's host culture as one's age of immigration increases. Taken together, these data suggest that the newly recruited participants for Study 2 may have somehow been qualitatively different from those who were recruited for Study 1.

Another possible explanation is that, because this study was completed online rather than on paper (as in Study 1), there may have been more opportunities for participants to become distracted. We currently do not have the data to assess this explanation.

It is also of interest that for all of the trend prediction items, participants who were either were less proficient in English or completed the questionnaire in Chinese generally predicted that the trend would decrease regardless of the direction of the preceding trend. This may be a general bias that is indicative of a broader cultural worldview that awaits elucidation, and is not a finding that can be readily explained by current cultural psychological theories.

Despite such different results from Study 1, one point of similarity is that predictors that are significantly correlated with Age of Immigration still showed a linear effect in the predicted directions. For example, Self-reported English proficiency, which is negatively correlated with Age of Immigration ($r = -.558$, $p < .001$), predicted responses on one of the trend prediction items. Similarly, Language version, which is also negatively correlated with Age of Immigration ($r = -.494$, $p < .001$), predicted responses on three of the trend prediction items, as well as participants' performance on the Rod and Frames task. This suggests that, while Age of Immigration does not directly affect shifting of cultural cognitions (as a part of acculturation), language seems to play a big role. Given the close phylogenetic link between

culture and language, it is possible that age of exposure to English, in this case, may be a

better predictor for future studies of this sort.

3   Chapter: Conclusion

Over the course of two studies, we sought to determine whether or not a sensitive period exists for acculturation. Our results provide a mixed response to this query. We confirmed our two-part hypothesis in the domain of cultural identification, revealing a possible sensitive period of about 15 years from birth (Study 1); however, we failed to confirm any part of our hypothesis with the remaining measures examining different domains of culture (Studies 1 and 2). Although there is evidence of linear effects from certain factors that are correlated with one's age of immigration, we were neither able to determine definitively the effect of age of immigration on acculturation, nor replicate the interaction that was found in Study 1

There are several possible explanations for these results. One possibility is that the sensitive window associated with mainstream cultural identification was a Type I error. This account is weakened given that a similar window of approximately 15 years of age is theoretically consistent with what has been found in previous studies in both language acquisition (e.g. Johnson & Newport, 1989) and cultural adaptation (e.g. Minoura, 1992). In addition, our MTurk study yielded a linear effect with age of immigration in prediction VIA-Mainstream scores. All this suggests that our null results from Study 2 may be due to peculiarities in the sample.

A likelier explanation is that different domains of cultural adaptation may have different sensitive periods, an issue that may be complicated by the possibility that such sensitive periods may require more refined units of time measurement (e.g. months vs. years). There are instances of such a complex phenomenon in linguistics. Some researchers had noted that the ability to perceive phonological elements of a language requires the development of several subsystems, each with its own sensitive period of development

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(Werker & Tees, 2005). For example, there is a sensitive period for acquiring an understanding of the rhythmical properties of one's native language, after which there is a sensitive period for acquiring the ability to perceive specific phonemes in that language. Thus, while language acquisition as a general ability has a particular sensitive period, acquiring different components of language may have corresponding component-specific sensitive periods. There may be a similar distinction with regards to acculturation and specific domains of culture. Further complicating the issue are studies involving event-related potential responses suggesting that some sensitive periods of acquisitions of language domains may close off as early as thirteen months of age (Mills, Coffey-Corina, & Neville, 1997). A similar phenomenon may be occurring with cultural acquisition as well, potentially obscuring our ability to detect sensitive periods.

This latter account of the results leads to an interesting theoretical question. To the extent that cultural acquisition follows a similar pattern as language acquisition such that acquiring the superordinate construct (i.e. culture or language) is comprised of the acquisition of numerous subsystems, is the acquisition of each subsystem dependent on one another? For example, one's ability to perceive the phonemes of one's native language follows from (and depends on) the ability to perceive the rhythmic pattern of a language (Werker & Tees, 2005). Does a similar cascade of influences exist for cultural acquisition as well, or does culture differ in that cultural domains develop independently from each other, leading to independent sensitive periods? Addressing this question requires more refined methods of measuring one's lifespan for more sensitive predictors, which may include a focus on the acquisition of culture in early developmental periods.

Another possible account may be that certain cultural domains are subject to unidimensional acculturation while others are not. Our current data suggests that, while one's general cultural orientation may be a bidimensional construct, some other cultural domains may not be.

Overall, despite our inability to determine a sensitive period for adapting to various components of culture, we were able to provide initial evidence that acculturation, as defined by cultural identification, may have a sensitive periods. Importantly, this is the first such study to use both validated measures as well as a community sample with great variability in both participants' age of immigration and their duration of stay in Canada.

3.1   Limitations

An important limitation to our present research is the focus on one immigrant group in one cultural environment. As Noels and Berry (2006) have noted, the acculturation experience differs depending on certain characteristics of immigrant groups as well as the host culture. It is likely that the rate of acculturation (that is, the linear effect of one's duration of stay in the host culture) will differ from one immigrant group to another, and from one host culture to another. This is especially pertinent to the current case because, as previously mentioned, the fact that a large population of Hong Kong immigrants currently exists in Vancouver has created an environment that continues to inculcate various domains of Chinese culture. This likely dampens the effect of acculturation, creating a relatively homogeneous immigrant cultural group. Because of this, it is imperative that more work be done with other immigrant populations to more reliably ascertain both the rate of, and the sensitive period for, acculturation. Still, even though the *rate* of acculturation may differ, if the sensitive period for general acculturation is neurally constrained and seemingly universal,

as it is in language (e.g. Kim et al., 1997), then the moderating effect of one's age of immigration may not change.

The previous point leads to another limitation, which pertains to our reliance on psychometric scales. To establish that something has a sensitive window necessarily means that it must be represented in the brain. Thus, more compelling evidence for making the claim that acculturation has a sensitive window would be to go beyond purely psychometric scales, and employ neuroimaging technology. Much as researchers' ability to pinpoint specific language centres in the brain has greatly advanced our knowledge about the existence, and the effects, of a sensitive period on language acquisition, the same efforts should be made to aid our understanding of a sensitive period for acculturation.

3.2   Future directions

In addition to the suggestions that have been laid out throughout this concluding chapter, the field can still expand in two general directions: methodology, and theory.

Other than neuroimaging technology, acculturation researchers can measure a myriad of other constructs. For example, given that poor acculturation can lead to both physical and psychological distress, biological measures such as cortisol or other stress indicators can be used to determine whether these indicators vary as a function of one's age of immigration. Another construct that may be useful is Bicultural Identity Integration (BII; Benet-Martínez, 2003), which is the degree to which one perceives his/her two cultural identities as being compatible or in conflict. This differs from our use of the VIA because while the VIA allows us to assess the degree to which one potentially has two cultural identities, the BII allows us to assess the degree to which holding these two cultural identities is subjectively problematic. These are also two of the more important variables to examine because they have been

shown to have important consequences for both physical and psychological well-being (Benet-Martínez, 2003; Palacios & Sugawara, 1982).

The search for a sensitive period for acculturation can also be greatly informed by a good theoretical framework. Thus, it would be beneficial to the field for more integration of Tadmor and Tetlock's (2006) Acculturation Complexity Model. This model argues that acculturation occurs as a result of one's ability to pass through several stages, taking into account one's awareness of cultural differences, motivation to associate with the host culture, and success at resolving and internalising both sides of a given cultural difference. This provides a useful framework for both generating "components of culture" to measure, as well as covariates to control for when examining the effect of one's age of immigration. As such, it is likely that integration of this model into research will yield fruitful results, and greatly aid future endeavours to accurately define the sensitive period for acculturation.

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Appendix A – Items from select scales used

A.1   The Vancouver Index of Acculturation Scale (VIA; Ryder et al., 2000)

Please answer each question as carefully as possible by circling *one* of the numbers to the right of each question to indicate your degree of agreement or disagreement.

Many of these questions will refer to your *heritage culture,* meaning the culture that has influenced you most (other than North American culture). It may be the culture of your birth, the culture in which you have been raised, or another culture that forms part of your background. If there are several such cultures, pick the one that has influenced you *most* (e.g., Irish, Chinese, Mexican, Black). If you do not feel that you have been influenced by any other culture, please try to identify a culture that may have had an impact on previous generations of your family.

Please write your *heritage culture* in the space provided. _____

Please indicate your agreement to each statement below by circling the appropriate number beside them.

Use the following key to help guide your answers:

Strongly Disagree	Disagree		Neutral/Depends		Agree			Strongly Agree
1	2	3	4	5	6	7	8	9

1. I often participate in my *heritage cultural* traditions.	1 2 3 4 5 6 7 8 9
2. I often participate in mainstream North American cultural traditions.	1 2 3 4 5 6 7 8 9
3. I would be willing to marry a person from my *heritage culture*.	1 2 3 4 5 6 7 8 9
4. I would be willing to marry a North American person.	1 2 3 4 5 6 7 8 9
5. I enjoy social activities with people from the same *heritage culture* as myself.	1 2 3 4 5 6 7 8 9
6. I enjoy social activities with typical North American people.	1 2 3 4 5 6 7 8 9
7. I am comfortable working with people of the same *heritage culture* as myself.	1 2 3 4 5 6 7 8 9

8. I am comfortable working with typical North American people.	1 2 3 4 5 6 7 8 9
9. I enjoy entertainment (e.g., movies, music) from my *heritage culture*.	1 2 3 4 5 6 7 8 9
10. I enjoy North American entertainment (e.g., movies, music).	1 2 3 4 5 6 7 8 9
11. I often behave in ways that are typical of my *heritage culture*.	1 2 3 4 5 6 7 8 9
12. I often behave in ways that are 'typically North American.'	1 2 3 4 5 6 7 8 9
13. It is important for me to maintain or develop the practices of my *heritage culture*.	1 2 3 4 5 6 7 8 9
14. It is important for me to maintain or develop North American cultural practices.	1 2 3 4 5 6 7 8 9
15. I believe in the values of my *heritage culture*.	1 2 3 4 5 6 7 8 9
16. I believe in mainstream North American values.	1 2 3 4 5 6 7 8 9
17. I enjoy the jokes and humor of my *heritage culture*.	1 2 3 4 5 6 7 8 9
18. I enjoy typical North American jokes and humor.	1 2 3 4 5 6 7 8 9
19. I am interested in having friends from my *heritage culture*.	1 2 3 4 5 6 7 8 9
20. I am interested in having North American friends.	1 2 3 4 5 6 7 8 9

A.2   Linear trend prediction items, as used in Ji et al., (2001)

1. Lucia and Jeff are both seniors at the same university. They have been dating each other for two years. How likely is it that they will break up after graduation. _____ %

2. Vincent has been the chess champion for 3 years in high school. How likely is it that he will win in the next game against his strongest opponent? _____ %

3. Two kids are fighting at kindergarten. How likely is it that they will become lovers some day? _____ %

4. Richard grew up in a poor family but he managed to go to college. How likely is it that he will continue to be poor the rest of his life? _____ %