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The Behavioral Inhibition System as a possible component of vulnerability to the development of acculturative stress related anxiety: A mechanistic approach to social identity conflict and integration

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The Behavioral Inhibition System as a possible component of vulnerability to the development of acculturative stress related anxiety: A mechanistic approach to social identity conflict and integration

A thesis submitted in partial satisfaction

of the requirements for the degree Master of Science

in Biology

by

Andrea Nichole Evans

2021

ABSTRACT OF THE THESIS

The Behavioral Inhibition System as a possible component of vulnerability to the development of acculturative stress related anxiety: a mechanistic approach to social identity conflict and integration

by

Andrea Nichole Evans

Master of Science in Biology

University of California, Los Angeles, 2021

Professor Daniel T. Blumstein, Chair

ABSTRACT:

For roughly two hundred thousand years, our species has been migrating across this globe. Increasingly, our migrations include intercultural contact. Those who immigrate face a dynamic process of acculturation, as they navigate and adapt to the mainstream culture of a new society. This process includes both challenges and rewards. Challenges may include pressure to adopt new cultural values and behaviors, or psychological stress when reconciling two cultures. Rewards may include the integration of new cultural identities. These experiences are increasingly reported to impact psychological well-being in distinct ways. Yet, it is not well understood *how* the acculturation process impacts mental health. Therefore, I investigate and test

a mechanistic-level explanation of how acculturation processes involving identity conflict and integration may impact mental health as it relates to the development of anxiety. While predictions are largely unsupported, results likely reflect limitations inherent in the use of a dataset collected using methods not designed with intention to test conceptual models reviewed from and integrated with prior literature. Direct tests of the models proposed are merited.

The thesis of Andrea Nichole Evans is approved.

Molly Fox

Daniel M. T. Fessler

Daniel T. Blumstein, Committee Chair

University of California, Los Angeles

2021

Dedication

I dedicate my thesis work to my parents and brother. Thank you for always giving, even when we might have had little to nothing to give. You have taught me that when you dig deep, there is more than enough to persevere and to love genuinely, warmly, and unconditionally.

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INTRODUCTION:

Acculturation refers to a dynamic process that immigrating humans and their families experience as they navigate and adapt to the mainstream culture of a new society. Those who immigrate face a number of adversities following the immigration process, including discrimination, racism, acculturation difficulties, language barriers, cultural conflicts, economic insecurity, employment difficulties, disruption of family ties, and other forms of systemic oppression (Benet-Martínez & Haritatos, 2005; Berry et al., 1987; Gil, Vega, & Dimas, 1994; Lee, Choe, Kim, & Ngo, 2000; Smart & Smart, 1995; Ward & Kennedy, 1999; Williams & Berry, 1991).

The process of acculturation may include changes in values, behaviors, perceptions, and attitudes as an immigrating individual continues to be exposed to, interact with, and internalize aspects of their new host culture. Some may experience acculturative stress, defined as negative reactions to intercultural contact or the acculturation process (Berry, 2006). For many, the acculturation process results in the acquisition of a bicultural identity with varying degrees of integration or harmonization (Benet-Martínez & Haritatos, 2005). Both acculturative stress and bicultural identity impact psychological well-being, though in distinct ways.

Acculturative stress, a type of psychosocial stress, often results in particular stress-related sequelae, including anxiety, depression, identity confusion, feelings of marginality and alienation, and increased psychosomatic symptoms (Mejía & McCarthy, 2010; Benet-Martínez & Haritatos 2005; Hovey & Magaña, 2002; Bae, 2019). External stressors which may impact the development of acculturative stress include pressures to adopt or resist host cultural values and behaviors. Acculturative stress may be experienced as psychological distress when one works to reconcile different cultural values, beliefs, and behaviors. In sum, acculturative stress is inversely

related with psychological well-being and is associated with increased anxiety (Revello et al., 2011, Hovey & Magaña, 2002; Bae 2019).

The development of acculturative stress in response to acculturation processes is not experienced uniformly (Fox, Thayer, & Wadhwa, 2017). Evidence suggests that strong bicultural identity may reduce the impact of acculturative stress (Hovey & Magaña, 2002; Bae, 2019), and evidence continues to support a positive relationship with strength of bicultural identity and psychological well-being (Revello et al., 2011, Hovey & Magaña, 2002; Bae, 2019). Biculturalism is the dual internalization and integration of both heritage and host cultural orientations. The strength of one's bicultural identity refers to one's proficiency with both heritage and host cultures (Yamaguchi, Kim, Oshio, & Akutsu, 2016) and one's ability to reconcile differences between cultural identities (Nguyen & Benet-Martínez, 2013; Yamaguchi, Kim, Oshio, & Akutsu, 2016). Those who more fully integrate different cultural values show strong bicultural identity well-being (Revello et. al, 2011, Hovey & Magaña, 2002; Bae, 2019).

Although previous studies have examined the relationship between acculturative stress, bicultural identity, and psychological well-being, the specific mechanisms that underlie these effects are not well understood (Bae, 2019; Fox, Thayer, & Wadhwa, 2017).

How does acculturative stress negatively impact psychological well-being? How do individuals internalize and integrate a bicultural identity? How does a strong bicultural identity positively impact psychological well-being?

A novel hypothesis on how acculturation processes that involve identity conflict and integration impact mental health as it relates to the development of anxiety

Adopting an evolutionary perspective, I will focus on a mechanistic-level explanation to identify a possible component of vulnerability to the development of acculturative stress-related

anxiety. I propose that a phylogenetically conserved cognitive system for conflict resolution is recruited in humans for acculturation processes which involve identity conflict and integration with implications for mental health as it relates to the development of anxiety.

The cognitive system I propose as a component of vulnerability to the development of acculturative stress-related anxiety is the Behavioral Inhibition System (BIS). In support of my proposal, I integrate theory and evidence across neuropsychology, social identity theory, acculturation research, and personality theory. I then test this hypothesis by analyzing data from a cohort of Latina-American pregnant women. I test four predictions informed by the literature and consistent with conceptual models cited within my review of the literature. The variables which are mapped onto these models quantify participant reported acculturative stress, bicultural orientation, cultural orientation of the participant's mother, familism, and anxiety. In the context of this research, the host culture is defined as U.S. 'mainstream' culture.

I hypothesize that the BIS 1) is activated in situations of identity conflicts where incompatible behavioral responses are triggered by dually internalized socio-cultural identities, and 2) influences the strength of bicultural identity by its impact on cultural conflict harmonization.

I hypothesize that greater socio-cultural identity conflicts will be experienced by participants who report both strong familism and a conflict between their own cultural orientation and their mother's cultural orientation. I hypothesize that those participants will have increased BIS activation, likely in duration and frequency, in response to more often encountering socio-cultural identity conflicts; I thus predict increased endorsement of anxiety by these women.

BIS and Social Identity Conflicts

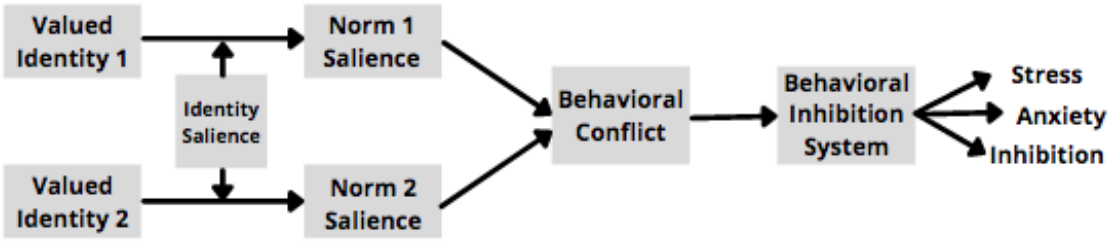
Based on prior neuropsychological research on BIS activation in both human and non-human species, evidence suggests the BIS is triggered as an organism works to resolve a conflict among two (or more) possible behavioral responses to a given situation (Barlow et.al., 2004, Gray & McNaughton, 2000; Grupe & Nitschke, 2013). The BIS is constantly surveying inputs, and, when a response conflict is detected, the BIS is triggered. Outputs of an activated BIS include a suite of emotional, behavioral, and physical responses that resemble human anxiety (Gray, 1982; Gray & McNaughton, 2000; Grupe & Nitschke, 2013). Indeed, Gray (1982), who first proposed and researched the BIS, stated the system to be the "seat of anxiety." Sustained or frequent activation may then lead to elevated or clinical levels of anxiety or other downstream mental health effects (Gray & McNaughton, 2000; Grupe & Nitschke, 2013).

In Hirsh and Kang's (2015) work to identify a mechanism of social identity conflicts, they note that while many situations are characterized by a single salient response option, other situations may be (or may be perceived to be) more ambiguous – and this ambiguity triggers multiple salient responses to the situation. The conflict arises when only one behavioral response for the situation can be chosen (Hirsh, Galinsky, & Zhong, 2011; Hirsh et al., 2012). Unfamiliar or ambiguous situations are more likely to trigger the simultaneous activation of competing responses, as no one response stands out as the clear choice for the individual or organism (Hirsh & Kang, 2015).

Hirsh and Kang (2015) extend the function of this conflict-resolution cognitive system to social identity conflicts. They suggest that dually internalized identities activate the BIS when an individual perceives a situation as triggering incompatible behavioral responses. Hirsh and Kang propose that in times of such conflict, as an individual works to identify the most appropriate

behavioral response given the socio-culturally informed situation, the BIS is activated and the experience of anxiety is initiated. Indeed, social identity conflicts have been reported to be negatively associated with psychological well-being (Hirsh and Kang, 2015; Hirsh, Galinsky, & Zhong, 2011; Hirsh et al., 2012). Figure 1 depicts the conceptual model proposed by Hirsh and Kang (2015).

Figure 1



BIS and Bicultural Identity Integration

Social identity theorists and bicultural researchers have increasingly focused on how diverse social identities interact within the same person (Kang & Bodenhausen, 2015; Morris, Chiu, & Liu, 2015; Ramarajan, 2014). As stated by cultural psychologist Jean Phinney (1999), ‘‘increasing numbers of people find that the conflicts are not between different groups but between different cultural values, attitudes, and expectations within themselves.’’

The process of negotiating multiple cultural identities is dynamic and multifaceted (Benet-Martínez & Haritatos, 2005; Hirsh & Kang, 2015). Indeed, bicultural individuals often describe the complexity of their dual cultural identities, endorsing both positive and negative perceptions (Padilla, 1994; Phinney & Devich-Navarro, 1997; O’Hearn, 1998; Benet-Martínez & Haritatos, 2005; Bae, 2019).

To help illustrate this complexity, included here are two quotes from bicultural participants who were involved in a research study conducted by Benet-Martínez and Haritatos (2005) as they investigated bicultural identity integration:

"Being bicultural makes me feel special and confused. Special because it adds to my identity: I enjoy my Indian culture, I feel that it is rich in tradition, morality, and beauty; Confused because I have been in many situations where I feel being both cultures isn't an option. My cultures have very different views on things like dating and marriage. *I feel like you have to choose one or the other*." —19-year-old second-generation Indian American

Emphasis added.

"Biculturalism seems to me to be *a dichotomy and a paradox*; you are both cultures and, at the same time, you are neither." —19-year-old first-generation Chinese American

Emphasis added.

Benet-Martínez and Haritatos (2005) were interested in the processes of bicultural identity construction and maintenance. To investigate such processes, they developed a new measure of bicultural identity integration (BII). Factor analyses revealed two distinct factors: cultural conflict and cultural distance. Cultural conflict is the degree to which one feels "torn" between two cultural identities, versus feeling that the two cultures are compatible. Cultural distance is the perception that an individual's two cultural identities are separate or dissociated, versus fused or "hyphenated" (Benet-Martínez & Haritatos, 2005). Both factors are expected to

be inversely related to BII, such that greater cultural conflict and greater cultural distanceeach independently predict lower BII (see Figure 2).

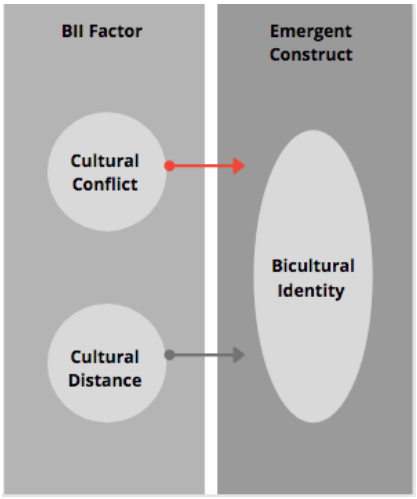


Figure 2

For the purposes of this research, I will focus on the first factor, the degree to which one feels that one's two socio-cultural identities are either in conflict or in harmony. Integrating Hirsh and Kang's (2015) mechanistic model of social identity conflict, I hypothesize that the BIS is linked to the first factor of BII, cultural conflict. Indeed, as I will discuss below, Benet-Martínez and Haritatos (2005) implicate a specific personality disposition, neuroticism – known within the personality literature and neuropsychology to be well explained by the BIS (Dirk and Boeck, 2006) – for its predictive, negative relationship with the first factor of BII (cultural conflict).

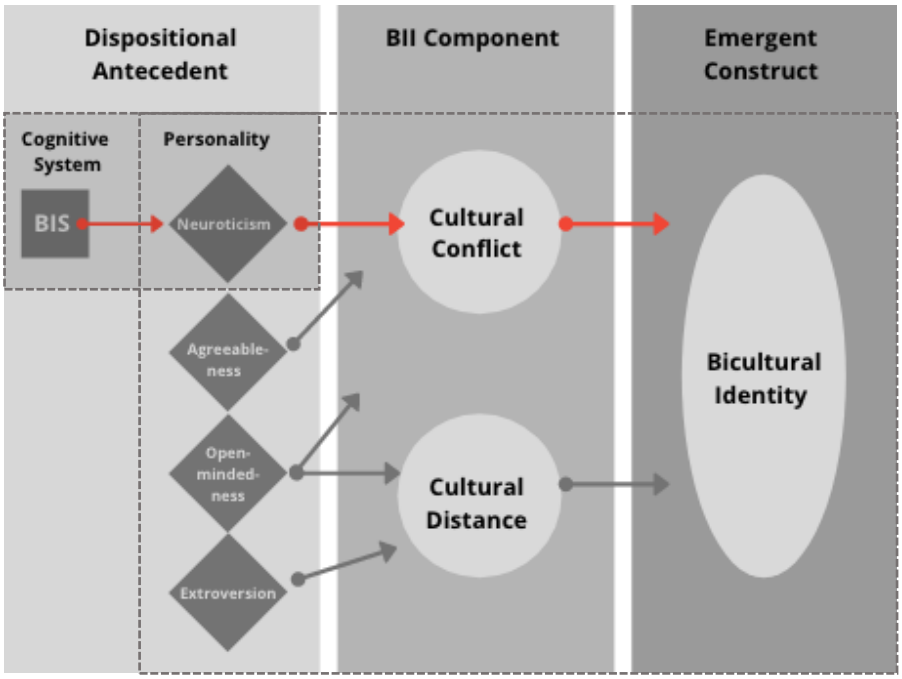
After completing their factor analyses, Benet-Martínez and Haritatos (2005) ran path analyses with their two newly identified factors, The Big Five personality dimensions, and specific acculturation variables to identify patterns of effect which might influence the process of BII and subsequently the emergence of bicultural identity. The Big Five personality dimensions are: neuroticism, extraversion, openness, agreeableness and conscientiousness (Benet-Martínez

& Haritatos, 2005; Costa & McCrae, 1989, 1992, 1995; Digman, 1990; Goldberg, 1992; McCrae & Costa, 1997).

Benet-Martínez and Haritatos (2005) found that neuroticism exhibited a direct predictive relationship with the first BII factor (cultural conflict), such that increased neuroticism scores predict greater cultural conflict scores and lower BII. They note that neuroticism is an important precursor of BII through its impact on cultural conflict, suggesting that elevated neuroticism puts individuals at risk for negative acculturation experiences. Specifically, neurotic individuals, who tend to feel vulnerable and anxious, are more likely to perceive conflict between their cultural identities and, correspondingly, experience stress in specific acculturative stress domains (i.e., linguistic and intercultural relations).

Personality theory research consistently finds neuroticism to be highly positively related with the BIS, with neuroticism being well explained by individual differences in BIS sensitivity (Diaz & Pickering, 1993; Gomez, Cooper, & Gomez, 2000; Gray, 1970, 1987; Heubeck, Wilkinson, & Cologon, 1998; Jackson, 2002, 2003). Dirk and Boeck (2006), whose research is consistent with personality theory research, suggest that neuroticism can be understood as a configuration in which one's emotions depend strongly on external and therefore varying circumstances. Further, they suggest that BIS sensitivity in neuroticism reflects a reaction towards events that occurred or are expected, and hence a sensitivity to these events (Dirk and Boeck, 2006). Figure 3 presents a conceptual model combining The Big Five personality dimensions and BIS sensitivity (e.g., Dirk and Boek, 2006) with Benet-Martínez and Haritatos' (2005) bicultural identity integration model.

Figure 3



Left dotted overlay represents conceptual models from personality research in BIS sensitivity and neuroticism(e.g., Dirk & Boek, 2006); Right dotted overlay represents a simplified conceptual model of BII proposed by Benet-Martínez and Haritatos (2005) where acculturation interaction variables have been removed for simplicity (as a direct relationship was found for neuroticism and cultural conflict component).

The implication is that the degree to which one achieves harmonization among two internalized socio-cultural identities may in part be impacted by one's BIS sensitivity. Neurotic individuals may be at greater risk for the development of anxiety by virtue of their greater sensitivity to socio-cultural identity related acculturative stress (e.g., the challenge of reconciling heritage and host cultural differences).

In addition, the strength of one's overall bicultural identity has implications for one's proficiency in dually internalized cultures. Greater proficiency in both internalized cultures reduces perceived ambiguity in any given socio-cultural situation, resulting in fewer competing behavioral responses (see again Figure 1 and review of mechanistic model of social identity conflicts). There may be training or exposure exercises related to bicultural proficiency which might target therapeutically the first factor of BII (cultural conflict) for individuals characterized

by low BII. In other words, regardless of an individual's BIS sensitivity, if they are a low BII individual they might often perceive ambiguity in a socio-cultural setting. Such ambiguity might lead to conflict amongst multiple, seemingly equivalently salient behavioral responses, thus activating the BIS and increasing their risk to develop anxiety.

While I have chosen to focus on the BIS for its possible impact on the first factor of BII (cultural conflict), Dirk and Boek (2006) also find that The Big Five personality trait extroversion is well explained by the Behavioral Approach System (BAS). In Benet-Martínez and Haritatos' (2005) path analyses, extroversion showed an indirect predictive effect on the second factor of BII, cultural distance. Further experimental research investigating the relationship of the BAS, extroversion, and BII is warranted.

From an evolutionary perspective, I have focused on what mechanistic-level explanation might be identified as a component of vulnerability to the development of acculturative stress-related anxiety. I have attempted to add to our understanding of *how* processes of acculturation negatively impact psychological well-being and *how* people integrate and maintain two internalized cultural identities. I have further attempted to consider what *individual differences* might exist which influence the development of strong bicultural identity – an aspect of identity positively related to psychological well-being.

Beyond this literature review, I propose and test three predictions informed by the literature and consistent with the cited conceptual models of 1) social identity conflicts and 2) bicultural identity integration. I test these predictions in a cohort of Latina women residing in Southern California who participated in a study that involved questionnaires examining their cultural identities, social relationships, and mental health, among other constructs.

Hypotheses:

1. Participants with higher acculturative stress will report greater anxiety.

Confirmation of this prediction would provide indirect support for my hypothesis of the involvement of the BIS in identity conflicts. I expect that participants' reports of greater pressure to acculturate reflect discomfort experienced by BIS activation in situations – and corresponding anxiety – in contexts in which they must choose the correct behavioral response to a socio-cultural situation. For example, an item from this subscale reads, "I feel uncomfortable when I have to choose between Latina/Chicana and American ways of doing things." I thus hypothesize that such individuals will be at an increased risk for the development of anxiety by way of increased activation of the BIS.

2. Participants with higher bicultural orientation will report lower levels of acculturative stress and anxiety.

Confirmation of this prediction would provide indirect support for my hypothesis of the involvement of the BIS in identity integration. I hypothesize that participants who report higher bicultural identity will experience less cultural conflict and, correspondingly, reduced BIS activation in situations in which they need to choose the correct behavioral response; as a consequence, such individuals will be at a decreased risk for the development of anxiety.

3. Greater socio-cultural identity conflicts will be experienced by participants who report both strong familism and a conflict between their own cultural orientation and their mother's cultural orientation. Such individuals will be subject to increased BIS activation – and corresponding anxiety – in response to more often encountering socio-cultural identity conflicts.

METHODS:

Participants were recruited from a larger study of 361 participants, collected as part of Dr. Molly Fox's Mother's Cultural Experiences research project. All participants provided written informed consent and completed self-report questionnaires. Inclusion criteria were that women self-identified as Latina, Chicana, Mexicana, or Latin-American, were over the age of eighteen, and were either pregnant or within one year postpartum. The research project's ultimate goal is to investigate how the acculturation experiences of pregnant and postpartum Latina-American women influence the health and development of mothers and children, with attention to how the mother's cultural experiences might have effects that transmit across generations.

One hundred eighty-nine participants with complete data across all variables of interest were included in analyses.

Measures:

Acculturation Rating Scale for Mexican Americans-II (ARSMA-II) (Cuéllar, Arnold & Maldonado, 1995) is a scale designed to quantify the construct of acculturation. It measures acculturation along three primary factors: language, ethnic identity, and ethnic interaction. Normative data were obtained with a university student population in South Texas representing five generational levels of Mexicans, Mexican-Americans, and White non-Latinos from varying socioeconomic statuses, and representing both sexes equally.

For the purposes of this study, Scale 1 was used. Scale 1 has 30 items that assess four factors: (1) language use and preference; (2) ethnic identity and classification; (3) cultural heritage and ethnic behaviors; and (4) ethnic interaction. The four factors are organized into two subscales that measure orientation toward, respectively, Mexican culture and mainstream American (Anglocan) culture. The Mexican Orientation Scale (MOS) contains 17 items. It has a coefficient

alpha of .88, while the Anglo Orientation Scale (AOS) has 13 items and a coefficient alpha of .83. Each item is scored on a Likert scale from 1 (*not at all*) to 5 (*extremely often or almost always*). The ARSMA-II is able to generate linear acculturation categories (Levels 1-5 defined below). For each participant, a mean MOS score is computed by summing the scores of the 17 items and dividing by 17. Likewise, a mean AOS score is obtained by summing the 13 items and dividing by 13. The MOS mean is subtracted from the AOS mean to obtain an acculturation score that represents an individual's score along a continuum from very Mexican-oriented to very Anglo-oriented. Low scores indicate a Mexican orientation while high scores indicate an Anglo orientation.

ARSMA-II Cut Points for Low and High Bicultural. Low bicultural and high bicultural groups were determined by using suggested cut points for orthogonal typologies generated by the ARSMA-II. Typologies are derived using the MOS and the AOS of the ARSMA-II (Cuéllar, Arnold & Maldonado, 1995). Cut points used to determine low and high bicultural typology were obtained by following scoring instructions for the orthogonal acculturation categories, where cut point scores are based on standard deviation units or fractions thereof about the mean of the original standardization sample of ARSMA-II. Cut points for each of the four original typologies are as follows: Traditionals (MOS $\geq$ 3.7; AOS $\leq$ 3.24); Low Biculturals (Marginalized) (MOS < 3.59; AOS < 3.7); High Biculturals (MOS > 3.59; AOS > 3.7); Assimilated (MOS $\leq$ 2.44; AOS $\geq$ 4.11).

Macarthur Scale of Subjective Social Status (SES) is a measure of an individual's perceived social standing. The scale consists of two 10-rung ladders on which respondents place an X to indicate their rank relative to others in their community, and to others in the general population, in terms of typical indicators of socioeconomic status, including income, education, and

occupational status. The score for each ladder is the number of the rung chosen to represent one's status, with a possible low score of 1 and a high score of 10. SES was used as a control variable in linear regression analyses. (Adler et al., 2000)

Mexican American Cultural Values Scale for Adolescents and Adults (MACVS) (Knight et al., 2009) is a 50-item measure of several cultural constructs relevant to Latino and mainstream American culture and is available in both English and Spanish. The scale measures familism, divided into three subscales of familism support (i.e., "parents should teach their children that the family always comes first"), familism obligations (i.e., "children should be taught that it is their duty to care for their parents when their parents get old"), and familism referent (i.e., "children should always do things to make their parents happy"), as well as respect (i.e., "children should respect adult relatives as if they were parents"), religion (i.e., "God is first, family is second"), and traditional gender roles (i.e., "families need to watch over and protect teenage girls more than teenage boys"). These subscales are combined into an overall Mexican American values scale. The scale also measures mainstream values of material success, independence and self-reliance, and competition and personal achievement that are combined into an overall mainstream values scale. Items are measured on a 5-point Likert scale ranging from 1 (not at all) to 5 (completely). The Family Referent subscale (i.e., "children should always do things to make their parents happy") was used in interaction analyses.

Multidimensional Acculturative Stress Inventory (MASI) (Rodriguez et al., 2002) is a 25-item measure assessing the sources of acculturative stress. The originally constructed scale was developed to assess the acculturative stress among persons of Mexican origin living in the United States. This scale yielded four factors scales: Spanish Competency Pressures (the pressure to retain competency in their language of origin; seven items); English Competency Pressures

(pressure to acquire competency in the host language; seven items); Pressures to Acculturate (pressure to acquire practices that are part of the dominant culture; seven items); and Pressures Against Acculturation (pressure to retain practices that are part of their culture of origin; four items). Spanish Competency Pressure items were modified to assess for Heritage Language Competency Pressure by changing the word Spanish to the general term heritage language (e.g., "I feel pressure to learn Spanish" was changed to "I feel pressure to learn my family's heritage language"). The items are rated using a five-point Likert scale ranging from 1 to 5 (1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree). The items are summed, with greater score indicating higher levels of acculturative stress.

Statistical Methods:

Statistical analyses were performed using RStudio Cloud (https://rstudio.cloud/). I used the lme4 library for fitting generalized linear-mixed models (GLMMs) with gamma errors and a log link function. Linear regressions included the log value of the outcome measure.

For control variable/random effects variable, I used age to control for possible relationships with outcome, predictor, and interaction variables. Socioeconomic status was used as a second control variable in linear regression models, though excluded in GLMM models due to convergence errors.

For hypothesis three, my predictor/fixed variable is a calculation based on values from the dataset. I created a "Conflict Score" which is the difference between the participant's own cultural orientation and her mother's cultural orientation. For the participant, I used the Acculturation Rating Scale for Mexican Americans-II (ARSMA-II) levels I (Very Mexican oriented) though V (Very assimilated; Anglicized) and converted to numeric ratings, 1-5. For the mother of the participant, I used the ARSMA-II variable (MxMatID), which reads, "My mother

identifies or identified herself as 'Mexicana.'" Ratings for this variable range from 1 (Not at all) to 5 (Extremely often or almost always). I reverse coded the variable which represents the cultural orientation of the mother to produce ratings directionally consistent with the participant's own cultural orientation. I then subtracted ARSMA-II level ratings from the reverse coded MxMatID ratings and used the absolute value of the result. Conflict Scores range from 0-4, with 0 being no conflict and 4 being greatest conflict. The Conflict Score represents conflict between the participant's own orientation and her mother's orientation fulfilling valued identities one and two in the mechanistic model of social identity conflicts.

I included an interaction variable, a subscale measure from the Mexican American Cultural Values Scale for Adolescents and Adults (MACVS): family referent. The family referent interaction variable fulfills the Identity Salience concept from the mechanistic model of social identity conflicts and is predicted to be an important indicator for the likeliness of experiencing conflict between valued cultural identities.

RESULTS:

Testing Prediction 1: Do those who report higher pressure to acculturate also report greater anxiety?

The Pressure to Acculturate subscale from the MASI was used as the predictor variable in linear regression models and fixed variable in generalized mixed-models analyses. Anxiety scores from the State Trait Anxiety Scale- Short Form was the outcome variable in linear regression models and served as the response variable in generalized mixed-models analyses. Control variables included in linear regressions were participants' age and socioeconomic status (SES) given the impact these variables may have on both the outcome variable, anxiety, and the predictor variable, pressure to acculturate/pressure against acculturation. For generalized mixed-

models analyses, adding SES to GLMM models led to errors of non-convergence in summary results; SES was therefore excluded in GLMM models. After reviewing results from GLMM for anxiety and pressure to acculturate, both GLMM and linear regression models were run for the MASI subscale for pressure against acculturation.

Linear regression yielded no significant relationship (p value = .71) between anxiety and acculturative pressure. See Figure 4a.

Linear regression also yielded no significant relationship (p value = .32) between anxiety and pressure against acculturation. See figure 4b.

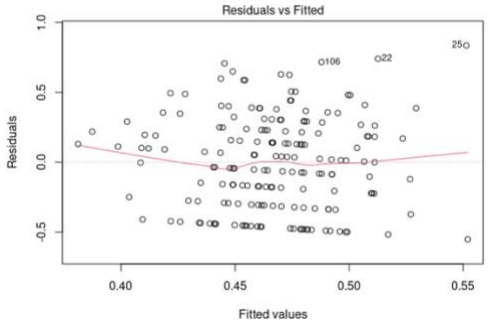


Figure 4a

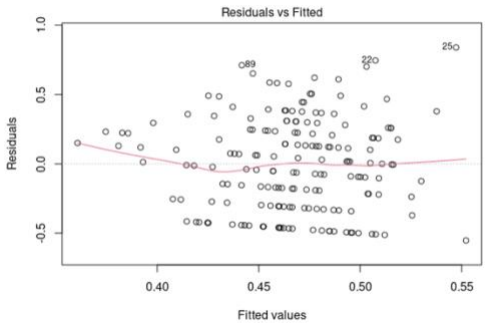


Figure 4b

When using a GLMM to account for non-normal distributions of the predictor, pressure to acculturate, a significant negative relationship ($p < 0.01$; p value = .003) between anxiety and pressure to acculturate emerged when controlling for age.

As the negative relationship between anxiety and pressure to acculturate was not predicted, I further explored the relationship of the second measure of acculturative stress collected, pressure against acculturation. I found a near significant negative relationship ($p < 0.1$; p value = .07) between anxiety and pressure against acculturation when controlling for age.

While linear regressions yielded null effects, the negative relationships between both pressure to acculturate and pressure against acculturation may warrant further statistical exploration. It is important to note that these are but two subscales of the MASI, which measures acculturative stress more broadly among four subscales (see Methods).

Testing Prediction 2: Are means scores on anxiety and pressure to acculturate lower in the high bicultural group than in the low bicultural group?

Two separate, two-sample t-tests were used to test the prediction that those in the high bicultural group would exhibit lower endorsement of pressure to acculturate and/or anxiety compared to the low bicultural group. For the first two-sample t-test, anxiety (recorded as a score from 1 to 4) was the outcome variable and bicultural orientation (categorized as either low or high) was the predictor variable.

Bicultural identity was not predictive of anxiety, $t(69) = 1.60$, p-value = 0.11. Mean values for anxiety scores of the high bicultural group were nominally lower than those of sthe low bicultural group (mean of anxiety score for high and low, respectively: 0.45; 0.57).

For the second two-sample t-test, pressure to acculturate (recorded as a score from 0 to 5) was the outcome variable and bicultural orientation (categorized as either low or high) was the predictor variable.

Bicultural identity was not predictive of pressure to acculturate, $t(73) = t = 0.49$, p-value = 0.62. Mean values for pressure to acculturate in the high bicultural group were nominally lower than those in the low bicultural group (mean of pressure to acculturate score for high and low, respectively: 1.75; 1.91).

While the direction of means are consistent with both my prediction and the prior literature, nonetheless, neither t-test reached significance. Samples for the t-test are subsamples from the larger group of 180, with low bicultural (n = 35) and high bicultural (n= 45).

Prediction 3: Is greater anxiety reported by participants whose cultural orientation is in conflict with their mother's cultural orientation and who also report high familism values?

Anxiety scores from the State Trait Anxiety Scale- Short Form served as the outcome variable in the linear regression model and served as response variables in generalized mixed-models analyses. A conflict score was calculated (see Methods) and used as the predictor variable for linear regression model and as the fixed variable in a generalized mixed-model. The Family Referent subscale of the MACVS was used as the interaction variable in both a linear regression model and a generalized mixed-model. Control variables included in linear regression were participants' age and socioeconomic status (SES), given known or presumed impact that these variables may have on both the outcome variable, anxiety, the predictor variable, and the interaction variable. For generalized mixed-models analyses, SES, when added to the GLMM model, led to errors of non-convergence in summary results; SES was therefore excluded from the GLMM model.

The linear regression yielded no significant relationship (p-value = 0.55) between anxiety, conflict score, and familism value family referent.

Results of the GLMM yielded a significant main effect ($p < 0.05$) for anxiety and conflict score, and an interaction effect for conflict score and family referent.

While linear regression results are null effects, GLMM results showing an interaction effect is in support of the prediction. Further exploration is warranted.

LIMITATIONS & FUTURE DIRECTIONS:

There are a number of limitations to my research and methods. However, these limitations do help to identify future directions in testing the hypothesis of BIS activation and sensitivity and its role in social identity conflicts, bicultural identity integration, acculturative stress, and anxiety.

Limitation 1: BIS was not measured directly. Although existing evidence links anxiety and BIS activation, nonetheless, using anxiety as a proxy for BIS does not provide a definitive test of the hypothesized model. Future studies should include the BIS/BAS scales (Carver & White, 1994).

Limitation 2: BII was not measured directly. BII is a key construct at issue, hence the absence of a measure of BII constrains our ability to test the theoretical link between BIS and BII. Future studies should include the Bicultural Identity Integration Scale-Version 2 (INSERT CITATION).

Limitation 3: Neuroticism was not measured directly. Given the postulated link between neuroticism and BIS sensitivity, there is unmeasured individual variation within the dataset used. Future studies aimed at better understanding individual differences in BII as explained by neuroticism, as well as studies investigating a possible link between the BIS, neuroticism, and BII, should include The Big Five Inventory (BFI) (John & Srivastava, 1999).

Limitation 4: Anxiety scores skewed low. Log of Anxiety was used (See methods) but the majority of women did not score high on our anxiety measure. It may be helpful to screen for high anxiety in bicultural women to observe possible associations.

While I have endeavored to conscientiously apply my variables in ways consistent with both Hirsh and Kang's (2015) model of social identity conflicts and Benet-Martínez and Haritatos' (2005) model of bicultural identity integration, the fit is surely imperfect. Missing

components of Hirsh and Kang's model include Norms one and two and BIS. Direct measures speaking to the integration of Dirk and Boek's (2006) model of the role of personality and Benet-Martínez and Haritatos'(2005) model of BIS were not available: for BIS, anxiety and acculturative pressure were used as proxies; no proxy variable for neuroticism was available; for BII, high and low bicultural orientation were used as proxies.

Future Directions

Understanding individual differences in BIS sensitivity may better inform consultation for and delivery of individualized mental health services to those who have immigrated or identify as bicultural. Additionally, situational or ecological conditions which may prevent BII cultural conflict harmonization and thereby implicate BIS activation should be empirically investigated. Two examples of situational or ecological conditions which might impact BII cultural conflict harmonization are conditions that 1) prevent or suppress the behavioral expression of an internalized identity; and/or 2) prevent or limit an individual's ability to internalize two or more socio-cultural identities to proficiency.

For future studies investigating BII, BIS, and anxiety, researchers should include social network analyses alongside capture of BII for a more dynamic understanding of BII. This paired collection method is suggested by the authors of the BIIS-2 (Huynh, Benet-Martínez & Haritatos, 2018). There may be implications with regard to bicultural proficiency, BII, BIS, and anxiety, as the authors acknowledge that diversity in social networks positively impacts strength of BII.

Future evolutionary medicine researchers may be interested in further investigating the BIS in social identity conflict and integration as the conservation and recruitment of the BIS in humans may have significant adaptive significance in our social, cultural, belief-driven species.

Future research could better examine both the mechanistic and adaptive aspects of the neurobiology of and adaptive implications for social identity construction, maintenance, and conflict.

DISCUSSION

There is a gap in our understanding of *how* processes of acculturation negatively impact psychological well-being, *how* people integrate and maintain two internalized cultural identities, and what *individual differences* may exist which influence the development of strong bicultural identity (Benet-Martínez & Haritatos, 2005). In reviewing literature relating to neuropsychology, social identity conflicts, acculturation, and personality theory, I have attempted to integrate conceptual models which may elucidate mechanistic-level explanations of the development of acculturative-stress related anxiety. Relating to my original BIS hypothesis, perhaps greater pressure imposes a force which reduces socio-cultural ambiguity, reducing BIS-specific conflict. Likely reflecting the limitations inherent in my use of a dataset collected using methods not designed for the purpose of testing my integrated model, predictions derived from that model were largely unsupported. Nevertheless, given the cogency of the conceptual model reviewed from and integrated with prior literature, fuller and more direct tests of the model are merited. Human migrations increasingly include intercultural contract and evolutionary medicine is well equipped to investigate processes of social identity creation and navigation for the impact such experiences have on human health and disease.

Conclusions and Implications

Understanding the role of the BIS in social identity conflicts and BII holds the promise of significant clinical and community implications, and can inform both research into health disparities research and anti-bias interventions.

Broader implications for conditions that prevent or suppress the behavioral expression of an internalized identity

Anicich and Hirsh (2017) introduce a new theory of power which integrates and extends current neuropsychological and social identity theories of power and situates power relations as continuous and contextual. Their theory, the approach/inhibition/avoidance theory of power (AIA), implicates the BIS when vertical code-switching is used to navigate between spaces of higher and lower power. Their theory suggests that frequent code-switching may involve BIS activation and may offer a mechanistic explanation for observed associations of frequent code-switching and negative psychological well-being. Experimental research is needed to test this theory of AIA and the role of the BIS in code-switching behaviors. By doing so, we may further investigate possible mechanisms of psychosocial embodiment and illuminate how oppression and power dynamics are transduced by the body and inform behavior.

Broader implications for conditions that prevent or limit an individual's ability to internalize two or more socio-cultural identities to proficiency

Further investigating what role the BIS may have in the construction and maintenance of social identities and BII may help us better understand the origins of unconscious biases and may elucidate bias-reinforcing processes, such as self-segregating behaviors which may arise from low cultural proficiency anxieties. Understanding the mechanisms of social identity conflicts and BII may thus help to identify best practices in reducing embodied forms of bias.

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