

This is an Original Manuscript of an article published by Wiley in British Journal of Psychology on 17 Apr 2023, available at <https://bpspsychub.onlinelibrary.wiley.com/doi/10.1111/bjop.12656>.

Citation

Abu-Rayya, H. M., Berry, J. W., Sam, D. L., & Grigoryev, D. (in press). Evaluating the integration hypothesis: A meta-analysis of the ICSEY project data using two new methods. *British Journal of Psychology*. <https://doi.org/10.1111/bjop.12656>

Evaluating the Integration Hypothesis:

A Meta-Analysis of the ICSEY Project Data Using Two New Methods

Hisham M. Abu-Rayya^{1,2}, John W. Berry³, David L. Sam⁴, Dmitry Grigoryev^{5*}

¹University of Haifa, Israel, haburayya@univ.haifa.ac.il

²La Trobe University, Australia, h.abu-rayya@latrobe.edu.au

³Queen's University, Canada, elderberrys@gmail.com

⁴University of Bergen, Norway, david.sam@uib.no

⁵HSE University, Russia, dgrigoryev@hse.ru

* *Corresponding Author*

ORCIDs

Hisham M. Abu-Rayya ORCID: 0000-0003-2352-7414

John W. Berry ORCID: 0000-0003-2587-2879

David L. Sam ORCID: 0000-0003-4275-0697

Dmitry Grigoryev ORCID: 0000-0003-4511-7942

Data Availability Statement

The data that supports the findings of this study are available in the supplementary material of this article.

Author contributions

DG conceived the idea of the study. JWB and DG initiated the study. HMA and DLS provided the modified ICSEY dataset. DG conducted the data analysis. HMA and DG were involved in the reporting of the findings and methods. JWB, DG, and HMA provided conceptual arguments. HMA and JWB drafted the manuscript. DG and DLS provided critical revisions. All authors approved the final version of the manuscript for submission.

Evaluating the Integration Hypothesis:**A Meta-Analysis of the ICSEY Project Data Using Two New Methods****Abstract**

The Integration Hypothesis states that acculturating migrants who adopt the integration strategy (i.e., being doubly engaged, in both their heritage culture and in the larger national society) will have better psychological and sociocultural adaptation than those who adopt any other strategy (Assimilation, Separation, or Marginalization). This hypothesis was supported in the original evaluation of the ICSEY project data, using the mean adaptation scores for individuals in the four acculturation clusters. This conclusion was further supported by an analysis that used scores that were derived from the two underlying dimensions. The present paper further evaluates this hypothesis meta-analytically using two new methods: Cultural Involvement and Cultural Preference; and Euclidean Distance. The results showed that these two methods provided support for the integration hypothesis, for both psychological adaptation and sociocultural adaptation. The pattern of relationships was stronger for positive than for negative indicators of adaptation. Theoretical and practical implications of the results are discussed.

Keywords: acculturation strategies, integration hypothesis, psychological adaptation, sociocultural adaptation, assessment of acculturation.

Introduction

Acculturation is the process of cultural and psychological change among groups and individuals of different cultural or ethnic backgrounds who are in contact with each other. Research on the acculturation of migrants and members of ethnocultural groups has grown in recent years as migration has increased worldwide, societies have become more culturally diverse, and policymakers have been challenged with understanding and managing the resultant societal complexity (Sam & Berry, 2016). Much of this research has established two main findings: individuals and groups acculturate in different ways (i.e., the process); and they experience different levels of adaptation (i.e., the outcomes).

Research on this first feature of the migrant acculturation experience shows widespread variations in *how* they acculturate. They adopt different *acculturation strategies* according to their engagement with the many social groups in their daily lives: their heritage culture, and those in the new society into which they have settled. Four acculturation strategies have been defined by the intersection of peoples' preferences for two issues: (i) for maintaining their heritage cultures and identities; and (ii) for participation with others in the new society. Preferences range from positive to negative on these two issues. When these two preferences are crossed, four acculturation strategies are defined: *Integration*, by maintaining their heritage cultures and participating in the daily life of the larger society; *Assimilation*, by giving up their heritage cultures and joining the larger society; *Separation* by maintaining their heritage cultures, and avoiding participation in the larger society; and *Marginalization* by giving up their heritage culture as well as not participating in the life of the larger society. These four ways of

acculturating are neither fixed nor discrete; people and groups usually explore how they would like to acculturate and eventually settle on one preferred way (Berry, 2022). Moreover, the strategies that individuals adopt are not up to them alone. The dominant larger society plays a powerful role in constraining or promoting the strategies adopted by non-dominant groups and individuals through public policies and practices. For example, the integration strategy may be pursued when the larger society values cultural diversity and the equitable participation of non-dominant groups and individuals. When they do not, the only way for non-dominant peoples to acculturate may be to assimilate, separate or be marginalized (Berry, 1980).

Research on the second feature has shown that migrants and members of ethnocultural groups vary in *how well* they adapt psychologically and socioculturally to their experiences and challenges of the acculturation process. Psychological adaptation is defined by *feeling well*, and includes having high self-esteem and life satisfaction, and good mental health. Sociocultural adaptation is defined as *doing well*, including competence in the tasks of daily living in the new society, and success in employment and school (Sam & Berry, 2016).

Acculturation and adaptation unfold under different conditions depending on settlement contexts (e.g. Berry, 2017; Jasinskaja-Lahti et al., 2011) interacting with other factors, such as gender (e.g., Grigoryev & Berry, 2017; Güngör & Bornstein, 2013), generation (e.g., Berry & Sabatier, 2010; Tonsing, 2014), and so on. Multicultural societies characterized by mutual accommodation, positive perceptions of diversity, and policies to support cultural maintenance and equitable participation generally favour the integration strategy and adaptation. For example, the relationship between the integration strategy and adaptation was stronger in Canada than in

France, where there was more perceived discrimination and limited multicultural policies (Berry & Sabatier, 2010).

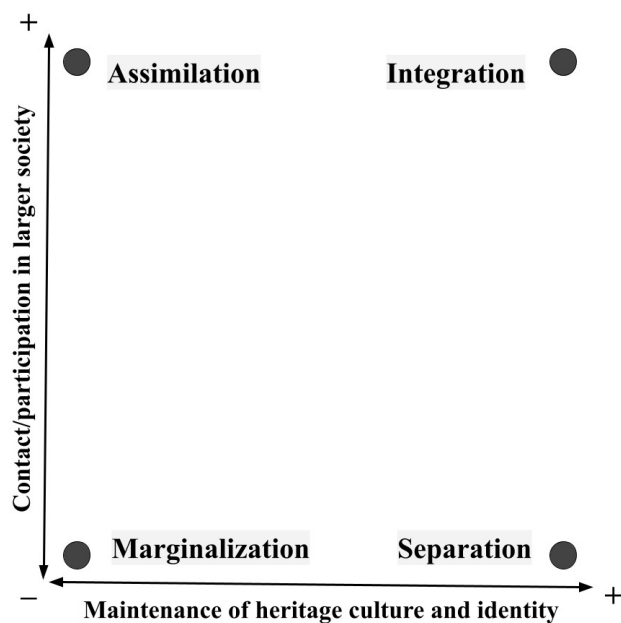


Figure 1. Berry's (1997) two-dimensional model of acculturation

The Integration Hypothesis

Knowing about a possible relationship between these two features (acculturation strategies and adaptation) is important because if there is a relationship, and if this relationship reveals a 'best way' to acculturate to achieve better adaptation, then these findings may be useful in developing policy and creating settlement programmes. Much research has indeed shown that the acculturation strategy people use is systematically-related to how well they adapt. Berry (1997, 2005) proposed this relationship between the *how* (acculturation strategies) and the *how well* (adaptation) aspects of acculturation by articulating the *Integration Hypothesis*: acculturating individuals who adopt the integration strategy (i.e., being engaged in both their heritage culture and in the larger national society) will have better psychological and sociocultural adaptations than those who adopt another strategy (i.e., being engaged in only one, or neither culture).

The Integration Hypothesis has found considerable support in many individual empirical studies across various acculturating groups in a variety of countries (e.g., Berry et al., 2006; Berry, 2017). This relationship has also been supported by several systematic reviews and meta-analyses (e.g., Berry et al., 2022; Nguyen & Benet-Martinez, 2013; Safa & Umaña-Taylor, 2021; Schmitz & Schmitz, 2022; Stogianni et al., 2021). For instance, Safa and Umaña-Taylor (2021) found that the integration strategy was systematically related to various physical (68%) and psychosocial (74%) health indicators, in line with the *Integration Hypothesis* prediction. Similarly, Stogianni et al.'s (2021) meta-analysis on a sample of 90 studies from 28 different countries reporting a total of 704 effect sizes (*rs*), found a significant positive association between integration and adaptation, which was present across both negative and positive operationalization of adaptation. The magnitude of the association was dependent on the type of adaptation being assessed (psychological or sociocultural) and by the manner integration was measured.

However, some researchers have claimed that there is either no relationship, or that the relationship is too weak and/or heterogeneous to warrant a sufficient basis for promoting integration as a way to achieve adaptation (e.g., Bierwiazzonek & Kunst, 2021; Rudmin, 2009). Bierwiazzonek and Kunst (2021) reanalyzed Nguyen and Benet-Martinez's (2013) meta-analysis data (322 effect sizes from 83 samples across 12 countries) using the weighted-mean approach to random effects, opposed to the counter null approach that Nguyen and Benet-Martinez applied, and claimed that a limited variance in adaptation with substantial heterogeneity was explained by acculturation. Besides, their new meta-analysis of longitudinal studies indicated that longitudinal evidence in support of the integration-adaptation relationship is minuscule. Despite the importance of Bierwiazzonek and Kunst's (2021) meta-analytic work, their conclusions have been challenged to some degree (see Grigoryev & Berry, 2022; Grigoryev, Stogianni, Berry et

al., 2022). For example, their meta-analysis of longitudinal studies relied on a relatively limited number of studies ($k = 19$) that included several different samples (e.g., migrant children, adolescents, international students), resulting in higher heterogeneity of effect sizes.

The present study attempts to provide additional meta-analytical insights into the association between integration and adaptation using the multi-country ICSEY project, which includes data on 42 samples of youth immigrants in 13 different countries. Major strengths of the present meta-analysis include the standard treatment of the ICSEY data, namely by ensuring that there was equivalence across study participants, measures, procedures, and response scales. As it, the study was conducted in several different countries and among diverse ethnocultural groups. Importantly, existing meta-analyses whether supporting (e.g., Stogianni et al., 2021) or not supporting the integration hypothesis (e.g., Bierwiazzonek & Kunst, 2021), relied on a particular way of measuring acculturation (i.e., dichotomization of scores on the two dimensions) that has received some reservations, as clarified below. The present meta-analysis applies two new scoring methods for measuring acculturation strategies (*Cultural Involvement* and *Cultural Preference*, e.g., Carlson & Güler, 2018; and *Euclidean Distance*, e.g., Arends-Toth & van de Vijver, 2006) that do not require any sort of data dichotomization.

Measuring Acculturation Strategies

The original way to assess the four strategies was to measure each one separately. Later, the four acculturation strategies were assessed by bilinear scales that measure separately the two underlying issues: the value of maintaining their heritage cultures and identities, and the importance of contact with and participating in the larger national society (first used by Dona & Berry, 1994).

However, turning the two bilinear measures into the four strategies requires some form of dichotomization, which poses a challenge to acculturation researchers. There is a disagreement among researchers on whether the scalar mid-point (i.e., the theoretical median) or sample mean or median should be the dividing point in the dichotomization (Arends-Toth & van de Vijver, 2006; Sam & Ward, 2021). While the scalar mid-point approach has the advantage of allowing for purer classification and hence cross-sample comparisons, dichotomization according to either strategy also has other problems (Schwartz et al., 2010). For instance, dichotomization ignores variation among individuals in each acculturation strategy, and by dichotomization, those whose scores fall on the dividing point are lost and the differences between those scoring very close on the opposite sides of the dividing point are exaggerated. More complex statistical methods such as Latent Profile Analysis, while providing some essential improvements, have generated either fewer or more than the four acculturation strategies within a single sample (e.g., Grigoryev & van de Vijver, 2017; Schwartz & Zamboanga, 2008). Being idiosyncratic to specific samples, they make cross-sample comparisons ambiguous.

To overcome the dichotomization issues, two new analytical methods of turning the two bilinear measures into four acculturation strategies have been proposed: *Cultural Involvement* and *Cultural Preference* (CI/CP; Carlson & Güler, 2018; see also Szapocznik et al., 1980), and *Euclidean Distance* (ED; Arends-Toth & van de Vijver, 2006; see also Möllering et al., 2014). The meta-analysis we report in the present study implements and contrasts the *CI/CP* and *ED* methods, as new ways of assessing acculturation strategies and their relationships to adaptation, and thus contributes further insights into the association between integration and adaptation. Both *CI/CP* and *ED* methods combine information from the two underlying acculturation dimensions defined in Berry's model: heritage cultural maintenance and contact/participation in

the larger society. They share the same advantage of being *continuous*-case approaches to measuring acculturation by preserving the variation observed in the underlying dimensions' scales and thus are best suited to overcome the problems associated with the dichotomization method. Instead of allocating a person to a particular acculturation strategy, ruling out all other three strategies for him, both CI/CP and ED methods calculate, for each individual, four scalar scores representing his four strategies. The scalar value for a person might be closer to one acculturation strategy than to another, but the two approaches retain his four scalar scores. Despite their shared advantage, the two approaches differ in that the ED method defines an ideal person (score) that represents each strategy. For instance, the ED method requires an equally highest score on each of the dimensions of heritage cultural maintenance and contact/participation in the larger society to define ideal integration as a reference point for the calculations of distances from integration. The CI/CP is perceived as more flexible and realistic in this regard, since a combination of any relatively high score on the heritage cultural maintenance dimension with any relatively high score on the contact/participation in the larger society can define a tendency to integration.

Cultural Involvement and Cultural Preference (CI/CP)

This method retains information from both measures of the underlying dimensions: heritage cultural maintenance and contact and participation in the larger national society. Heritage cultural maintenance would be the measured by items such as 'I am proud of being ethnic member' or 'how often do you participate in traditional [ethnic] activities or customs', and contact/participation in the larger society would be measured by items such as 'how often do you hang out with host country friends' or 'how often do you participate in traditional activities or customs of the host country' (e.g., Berry et al., 2006). *Cultural Involvement* (CI) is defined by

the sum of scores on the two dimensions (Maintenance plus Contact), and *Cultural Preference* (CP) is defined by the difference between scores on the two dimensions (Maintenance minus Contact). In this way, the continuous properties of the original measures are retained, and each study participant can be characterized by scalar values on both of the generated measures — CI and CP. In concrete terms, the CI measure treats integration and marginalization as polar opposites with a high score defining integration and a low score defining marginalization. Total integration sits at the maximum CI score and total marginalization sits at the minimum CI score. The CP measure treats separation and assimilation as polar opposites from total assimilation at the minimum CP score to total separation at the maximum CP score (see Figure 2).

The CI and CP scores must be both defined and calculated simultaneously for each individual to provide a full understanding of their two-dimensional acculturation process. In other words, the information gained from CI cannot be gained from CP and vice versa. As illustrated by Carlson and Güler (2018), the CI score places a person somewhere along the marginalization-integration dimension, and by so doing it constrains the range of potential CP variation available to that person — the more extreme the CI score in either direction, the less room for variation in CP becomes. The CI score thus does not tell us how close that person might be to each side of the assimilation-separation dimension. This dynamic applies also to the CP score, with extreme separation or assimilation scores limiting the CI variation and knowledge about how close a person might be to each side of the marginalization-integration dimension.

In both the CI and CP calculations, the outcome scores are divided by two to align the scores with the same range of the two original measures, assuming these latter have comparable ranges. To demonstrate, assuming that the two underlying dimensions (heritage cultural maintenance and contact and participation in the larger national society) were each measured on

a Likert scale from one to seven, the maximum CI score can be 14 (total integration) and the minimum it can be is 2 (total marginalization). Dividing by two gives the outcome CI scores the same 7-point range as in the original scales. Likewise, the maximum CP score that can be reached is +6 (total separation) and the minimum that can be reached is -6 (total assimilation). Again, dividing by two transfers the outcome CP scores (from -6 to +6) to a 7-point scale (from -3 to +3 with zero sitting in the middle). Applying this new method to a sample of Turkish immigrants to the USA and in support of the *Integration Hypothesis*, Carlson and Güler (2018) found that respondents with higher cultural involvement scores (i.e., being closer to the integration end of the involvement dimension) reported significantly more positive affect and life satisfaction scores; and those with higher cultural preference scores (i.e., being closer to the separation end) reported significantly more negative affect and lower life satisfaction scores.

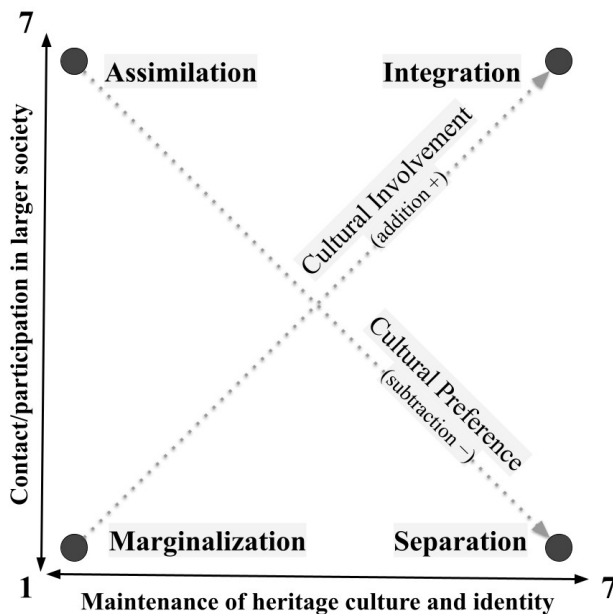


Figure 2. The CI/CP method for assessing acculturation (based on Carlson & Güler, 2018)

Euclidean Distance (ED)

An application of the ED method to Berry's four-fold model was initially suggested by Arends-Tóth and van de Vijver (2006). This requires that respondents be located on a two-dimensional matrix featuring each of the two underlying dimensions of heritage cultural maintenance and contact/participation in the larger society. The corners of the matrix represent the extreme scores that each of the four acculturation strategies should ideally achieve. As demonstrated in Figure 3, on a 7-point Likert-response scale for each dimension, the extreme scores would be (7,7) for integration, (1,1) for marginalization, (7,1) for separation, and (1,7) for assimilation. Then the distance of a particular individual's location from each of the extreme scores can be easily calculated by applying the two-dimensional space Euclidean distance mathematical formula as follows: $\sqrt{(Q1 - P1)^2 + (Q2 - P2)^2}$ where (P1, P2) and (Q1, Q2) represent the coordinates. The coordinate (P1, P2) represents the extreme score, here (7, 7) for integration, and the coordinate (Q1, Q2) represents a particular person's score on each of the heritage cultural maintenance (Q1) and contact/participation in larger society (Q2) dimensions. Thus, if a person scored (5, 4) on those dimensions his distance from the extreme integration score (7, 7) is $\sqrt{(5 - 7)^2 + (4 - 7)^2}$. Applying this calculation to all four strategies, each individual will have four scores featuring their proximity to each of the four acculturation strategies. The individual represented in Figure 3, for instance, is closer to the prototypical 'ideal' integration strategy, and by reversing his distance score, he will receive the highest score on this strategy, compared to his scores on the remaining acculturation strategies. Implementing this approach, Möllering et al. (2014) reported supporting evidence of a positive association between integration and wellbeing, as the *Integration Hypothesis* predicts, across various minority samples and settings.

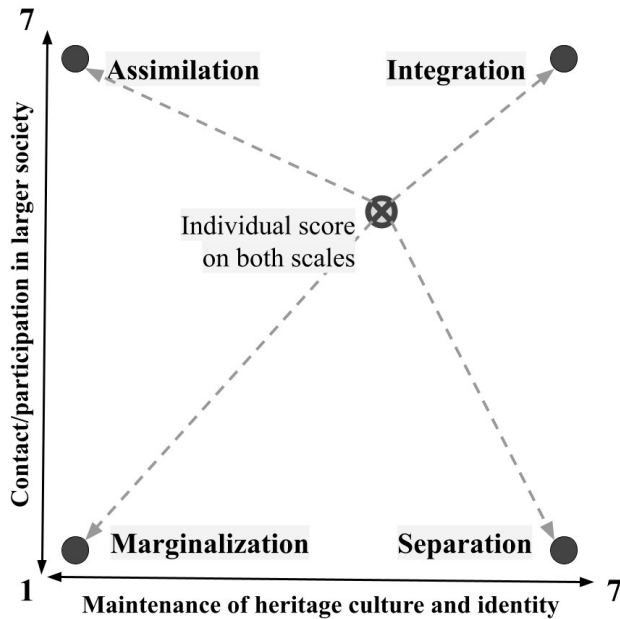


Figure 3. The ED method for assessing acculturation (based on Arends-Toth & van de Vijver, 2006)

Overview of The Current Study

The present study meta-analytically evaluates the *Integration Hypothesis* using *CI/CP* (Carlson & Güler, 2018), and *ED* (Arends-Toth & van de Vijver, 2006) methods with the data from the ICSEY project (Berry et al., 2006). Of importance in re-analyzing the ICSEY data using these different approaches is that it addresses the doubt that Rudmin (2008) cast on the manner in which the ICSEY data were originally analyzed. The original analysis (Berry et al., 2006, 2022) used cluster analysis to allocate over 5,000 immigrant youth to the four ways of acculturating (integration, assimilation, separation, and marginalization) using their scores on the four double-barrelled measures of acculturation strategies, as well as three intercultural variables (their scores on their language, identity, and peer relationship preferences). Mean scores on two adaptation measures (psychological and sociocultural) were compared across the four clusters. Rudmin (2008) questioned the validity of double-barrelled acculturation measures that Berry et al. (2006) implemented. These two new analyses (i.e., *CI/CP* and *ED*) go beyond the earlier analyses in

Berry et al.'s (2006) original publication as well as in Abu-Rayya and Sam's (2017) follow-up analysis which escaped Rudmin's (2008) critiques.

In the follow-up analysis by Abu-Rayya and Sam (2017), intercultural variables were assembled to create measures of the two underlying dimensions (heritage cultural maintenance and contact/participation). They then used the interaction between the two underlying acculturation dimensions and related them to adaptation, providing support for the *Integration Hypothesis*, even with contextual factors like perceived discrimination were controlled for in the analysis (see also Berry & Sabatier, 2010, for another study using a similar method).

Data from the ICSEY project have certain advantages for a meta-analysis using the new methods of acculturation assessment that go beyond the quality of datasets that served previous meta-analytical work such as Nguyen and Benet-Martinez's (2013) and Bierwiazzonek and Kunst's (2021). The ICSEY data were gathered for the most comprehensive comparative study of acculturation to date. As such, first, the ICSEY dataset is better distributed across countries: it includes 210 effect sizes nested in 42 samples in 13 different countries (Australia, Canada, Finland, France, Germany, Israel, Netherlands, New Zealand, Norway, Portugal, Sweden, United Kingdom, United States). Second, measurement equivalence (i.e., structural, metric, and scalar invariance) of the ICSEY's acculturation assessment instruments and adaption measures were ascertained (e.g., Vedder & van de Vijver, 2006), facilitating confident cross-cultural (sample) comparisons. We presume this will manifest in lower heterogeneity of effect sizes in our new meta-analysis compared, for instance, to the considerable heterogeneity (about 80%) in Bierwiazzonek and Kunst's (2021) paper. Third, all samples reported in the ICSEY dataset employed the same measures, procedures, and response scales. This strengthens the methodological equivalence required for valid cross-cultural comparisons in the form of a meta-

analysis. Last, Abu-Rayya and Sam's (2017) follow-up analysis used parallel ICSEY variables to create measures of the two underlying dimensions with comparable ranges. This is optimal for the deployment of the *CI/CP* (Carlson & Güler, 2018) method, one of the two new methods being used here in our multilevel meta-analysis of the ICSEY data.

Method

Description of the ICSEY Dataset

The sample consisted of 5,365 immigrant youth aged between 13 and 18 years ($M = 15.35$, $SD = 1.56$) who were distributed across 42 samples in 13 different countries. The sample included both first-generation youths (those who were born in country of origin and arrived at the receiving country after the age of 7; 34.6%) and second-generation youths (born in receiving country or arrived before the age of 7; 65.4%). There were slightly more girls (52.1%) than boys. A full description of the sample and the study procedures are explained in Berry et al. (2006). For the purposes of our meta-analysis, we used the ICSEY dataset that includes Abu-Rayya and Sam's (2017) further work, particularly creation of the two (multi-item) dimensions (heritage cultural maintenance; and contact and participation in the larger national society). These two dimensions provide the empirical basis for the creation of the *CI/CP* scores, and for the four strategies in the Euclidean method. These two methods are then used to evaluate the *Integration Hypothesis*, which cannot be tested directly by the dimensions themselves. A full description of the two underlying dimensions is provided in Abu-Rayya and Sam (2017). They reported the mean cross-country Cronbach's alpha reliability of the first and second dimensions as .85 ($SD = .05$) and .83 ($SD = .05$), respectively.

Following the steps of calculation explained above, a set of six new variables were generated and merged with this ICSEY dataset: two pertaining to *CI/CP*, and four related to

integration, separation, assimilation, and marginalization using the ED method. In line with other meta-analytic work (e.g., Bender et al., 2019; Stogianni, et al., 2021) and to consider whether the integration-adaptation relationship varies according to psychological vs. sociocultural measures of adaptation and according to the nature of the measure (negative such as psychological problems or positive such as self-esteem), we made use of all available adaptation measures in the ICSEY dataset. These consisted of three (multi-item) psychological adaptation indicators (psychological problems, self-esteem, and life satisfaction) and two (multi-item) sociocultural adaptation indicators (behavioral problems and school adjustment). A full description of these adaptation measures is provided in Berry et al. (2006). Except for the school adjustment measure characterized by a relatively low mean cross-country Cronbach's alpha, .65 ($SD = .10$), all other measures had good reliabilities, ranging between .75 ($SD = .11$) and .88 ($SD = .04$).

All research was conducted ethically within COPE and APA ethics guidelines.

Data Analysis

To evaluate the *Integration Hypothesis*, we conducted a series of three-level meta-analyses with random-effects (Viechtbauer, 2010). The effects sizes were treated as “nested” within cultural groups (e.g., Filipino in Australia, Indians in Canada, Portuguese in Germany, Turks in Norway, etc.) and cultural groups were “nested” within societies (e.g., Australia, Canada, Germany, Norway, etc.). This set of analyses allows for correlated sampling errors and true effects by using absolute values of raw bivariate correlations between differently measured acculturation preferences and both negative and positive indicators of psychological adaptation and sociocultural adaptation. In the set of meta-analyses we conducted, variance at three different levels was analyzed: (1) effect size variance (*Level 1*), (2) variance between effect sizes within cultural groups (*Level 2*), and (3) variance among effect sizes between societies (*Level 3*).

This is a substantial improvement over commonly used meta-analytic methods, which assume independence of effect sizes even when this is not usually the case (Assink & Wibbelink, 2016). Our estimates were generated by *metafor* R package using ML estimation for the amount of heterogeneity (Viechtbauer, 2010).

Results

The effects sizes generated by our three-level meta-analyses are summarized in Table 1. Detailed results of the meta-analyses are displayed in Tables 2 to 6, which include: the effect size correlations (r_s) and their 95% confidence intervals (95% *CI*); standard errors (*SE*); 95% prediction intervals (95% *PI*; i.e., the variability in the correlations across studies); and the I^2 values (i.e., percentages of the total variability in effect sizes attributed to heterogeneity at different levels).

Estimated Effect Sizes

In support of the *Integration Hypothesis*, our estimated effects sizes showed a significant association between integration and adaptation (see Table 1). This was consistent for both assessment methods of integration (CI/CP or ED) and across the two types of adaptation (psychological and sociocultural), from -.06 (integration and behavioral problems) to .23 (cultural involvement and life satisfaction). However, our results indicated that integration is more strongly associated with positive (than with negative) indicators of psychological and sociocultural adaptation. Specifically, integration using the CI/CP method was statistically significantly linked to self-esteem (.22), life satisfaction (.23), and school adjustment (.20), and similarly using the ED method (effect sizes were: .15, .17, and .12, respectively). As far as negative adaptation indicators are concerned, the effects sizes using the CI/CP method were -.10

(for psychological problems) and $-.07$ (for behavioural problems), and were just $-.06$ for both of these indicators using the ED method.

On inspecting the patterns of effects sizes of the two methods, it is apparent that the CI/CP method demonstrated stronger effect sizes than the ED method, regardless of the adaptation and positive/negative type of indicators. Moreover, using the former method, the integration-adaptation relationship effect sizes were stronger than those between either (ethnic and national) dimension and adaptation. In addition, 95% *PI*, which reflects the uncertainty expected in the summary effect if a new study is added, did not include zero for the correlation between cultural involvement and both positive indicators of psychological adaptation (life satisfaction and self-esteem). This means that for all studies this correlation is expected to be positive.

Table 1.
Summary of Effect Sizes for Correlation between Acculturation Strategies and Adaptation

	Psychological adaptation			Sociocultural adaptation	
	Psychological problems	Self-esteem	Life satisfaction	Behavioral problems	School adjustment
Cultural dimensions					
Ethnic dimension	$-.04$.11	.14	-.06	.09
National dimension	-.08	.18	.15	$-.03$.17
CI/CP method					
Cultural involvement	-.10	.22	.23	-.07	.20
Cultural preference	$.02$	-.05	$-.01$	$-.02$	-.05
ED method					
Integration	-.06	.15	.17	-.06	.12
Assimilation	$.01$	$-.03$	-.07	$.05$	$-.02$
Separation	$-.03$.08	.11	-.05	.06
Marginalisation	.06	-.15	-.17	.08	-.14

Note. The significant effect sizes are bold.

With the CI/CP method, only self-esteem and school adjustment were significantly and negatively associated with Cultural Preference (i.e., the separation strategy), but their effect sizes

were very small, $r = -.05$. Effects sizes for the relationship between separation and the adaptation measures using the ED method were significant for 4 out of 5 adaptation outcomes. The effect sizes ranged from $-.05$ (for behavioral problems) to $.11$ (for life satisfaction), generally indicating a positive role of separation strategy in adaptation. But their comparative effect sizes for the relationship between Integration and adaptation, using the ED method, were very clearly higher. Finally, the results showed that assimilation and marginalization were not adaptive strategies.

Thus, the two methods converge to some extent regarding the integration strategy. They both show that integration plays a positive role in positive indicators of psychological and socio-cultural adaptation. The two methods however differ regarding the separation strategy. Scores derived from the CI/CP method for the separation strategy showed negative associations with self-esteem and school adjustment, whereas scores derived from the Euclidean method for the separation strategy showed positive associations with self-esteem and school adjustment, as well as for life satisfaction and negative association with behavioural problems. Given that the Ethnic dimension (i.e., heritage cultural maintenance) was associated with almost all adaptation measures (as shown in Table 1), it seems that the CI/CP method, in which a high score of cultural preference resembles separation, is imprecise for the assessment of separation strategy, since it showed an association with just self-esteem and school adjustment and the effect size of these were much smaller than the comparative ones with the ethnic dimension.

Estimated Heterogeneity

As displayed in Tables 2 to 6, the total heterogeneity of the meta-analytic effect sizes (i.e., I^2 values) for the integration-adaptation relationship varied from 41.4% (for life satisfaction or behavioral problems) to 60.6% (for school adjustment), based on the method of CI/CP, and ranged between 34.8% (for self-esteem) and 60.7% (for school adjustment), based on the ED

Society/Group (<i>n</i>)								
% of total variance - Level 1	35.63	65.61	58.58	39.14	39.80	34.00	35.54	41.13
% of total variance - Level 2	64.32	34.38	41.40	60.85	60.18	63.42	64.45	58.01
% of total variance - Level 3	0.05	0.01	0.02	0.01	0.02	2.58	0.01	0.86
Total <i>F</i> ²	64.4	34.4	41.4	60.9	60.2	66.0	64.5	58.9

Note. * *p* < .001

Table 6.

Sociocultural Adaptation: School Adjustment in 13 Societies (N = 5365; n = 42)

	CI/CP method				Euclidean distance method			
	Ethnic dimension	National dimension	Cultural involvement	Cultural preference	Integration	Assimilation	Separation	Marginalization
ES(<i>r</i>)	.09	.17	.20	-.05	.12	-.02	.06	-.14
[95% <i>CI</i>]	[.04, .14]	[.14, .21]	[.16, .25]	[-.09, -.01]	[.08, .17]	[-.06, .02]	[.01, .11]	[-.19, -.10]
<i>SE</i>	0.023	0.017	0.023	0.019	0.024	0.021	0.023	0.022
<i>z</i>	3.858*	9.831*	8.723*	-2.600*	5.193*	-1.017	2.558*	-6.266*
95% <i>PI</i>	[-.13, .31]	[.03, .31]	[-.01, .42]	[-.22, .12]	[-.10, .35]	[-.23, .18]	[-.16, .27]	[-.35, .07]
<i>Q</i> (<i>df</i>)	108.22(41)*	68.03(41)*	104.93(41)*	77.30(41)*	106.90(41)*	95.44(41)*	102.54(41)*	101.83(41)*
σ^2								
Society (<i>n</i>)	0.01 (13)	0.01 (13)	0.01 (13)	0.01 (13)	0.01 (13)	0.01 (13)	0.01 (13)	0.01 (13)
σ^2								
Society/Group (<i>n</i>)	0.01 (42)	0.01 (42)	0.01 (42)	0.01 (42)	0.01 (42)	0.01 (42)	0.01 (42)	0.01 (42)
% of total variance - Level 1	39.07	60.79	39.37	53.70	39.33	43.75	41.15	40.87
% of total variance - Level 2	55.47	39.20	50.94	46.29	51.23	56.23	53.19	53.64
% of total variance - Level 3	5.46	0.01	9.69	0.01	9.44	0.02	5.66	5.49
Total <i>F</i> ²	60.9	39.2	60.6	46.3	60.7	56.3	58.9	59.1

Note. * *p* < .001

Discussion

For over five decades, psychological research on acculturation has accelerated to the point where it is now one of the dominant issues in cross-cultural psychology (Sam & Berry, 2016; Sam & Ward, 2021). Two findings stand out in past research: immigrants and members of ethnocultural communities learn to adapt to living in their new societies; and they use different strategies to achieve optimal outcomes. Of crucial importance in this work has been the question: are there any relationships between the strategies that are used, and the adaptations that are achieved?

Over the course of this research, different conceptions and measures of acculturation strategies have been suggested and studied. The early work on acculturation strategies proposed that two issues face acculturating individuals: their preferences with respect to their heritage cultural maintenance and their contact with and participation in the larger society. Four strategies were proposed as being at the intersection of these two issues (integration, assimilation, separation, and marginalization, as presented in Figure 1). Since then, other issues have been added, including the power relations between the groups in contact, and the adoption of the culture of the larger society (rather than participating in it). Along with these changing conceptualizations have come changing assessment procedures. Initially the four strategies were assessed separately using fourfold measures; later they were assessed by examining the two underlying issues.

Conceptualizations of adaptation have also evolved. Initially the focus was on psychological adaptation (personal wellbeing); then sociocultural adaptation was introduced (competence in living the new cultural surroundings); finally intercultural adaptation was proposed (establishing positive relationships, with limited prejudice and discrimination; Berry, 2005; Sam & Berry, 2016; Sam & Ward, 2021).

With the proliferation of notions of both acculturation strategies and adaptations, and their varying operationalization, there was a need to seek some coordination of the numerous studies: what can we make of all the research findings? One attempt was the proposal of the *Integration Hypothesis* (Berry, 1997): individuals who adopt the integration strategy will have better adaptations than those who adopt any of the other strategies. This was a generalization that could be evaluated across studies. Such evaluations have taken place numerous times and in numerous ways, sometimes by systematic reviews of the literature (e.g., Safa & Umaña-Taylor,

2021), but most recently by way of meta-analyses (e.g., Berry et al., 2022). These have generally provided support for the hypothesis, but there were some challenges (e.g., Bierwiazzonek & Kunst, 2021). The present paper has sought to contribute to this debate by using two new methods to measure acculturation and assess the *Integration Hypothesis*: CI/CP (Carlson & Güler, 2018), and ED (Arends-Toth & van de Vijver, 2006).

Our present series of multilevel meta-analyses of the ICSEY data supported the *Integration Hypothesis*, in line with previous and ongoing work (e.g., Berry et al., 2022; Grigoryev, Stogianni, Berry et al., 2022; Nguyen & Benet-Martinez, 2013; Stogianni et al., 2021). Extending previous meta-analytic work, the relationship between integration and adaptation in the current study emerged as significant, whether integration was operationalized using Carlson and Güler's (2018) or Arends-Toth and van de Vijver's (2006) methods. However, the effect sizes of the integration-adaptation link were stronger with the application of Carlson and Güler's (2018) method, across both types of adaptation (psychological and sociocultural). This lends further support to meta-analytic work indicating that the way integration is assessed impacts on the strength its association has with adaptation (e.g., Nguyen & Benet-Martinez, 2013; Grigoryev, Stogianni, Berry et al., 2022; Stogianni et al., 2021). This claim seems true with the applications of these new methods of measuring acculturation, despite the obvious methodological advantage of those new methods. Consistent with previous work (e.g., Nguyen & Benet-Martinez, 2013), findings of our meta-analysis showed that the integration-adaptation relationship effect sizes were stronger than those between adaptation and either of the two underlying dimensions (Maintenance and contact/Participation). In addition, our meta-analysis demonstrated that integration plays a more significant role in facilitating positive aspects of adaptation; its role in inhibiting negative aspects was limited across both new methods of

gauging integration. This pattern of relationship was reported in Abu-Rayya and Sam's (2017) re-analysis of the ICSEY data applying a multiplicative or additive terms, which in essence tap on the cultural involvement component of Carlson and Güler's (2018) method. However, the rigorous analytical foundation of the current study not only strengthens this pattern of relationships, but it does so also across two new methods of measuring integration.

The effect sizes of the associations between integration and positive adaptation measures fell in the range of .20 to .23 applying *CI/CP* method and .12 to .17, applying *ED* calculations. The strength of these effect sizes are comparable, and even stronger, than those reported in other meta-analytic studies evaluating the *Integration Hypothesis* (e.g., $r = .15$, Berry et al., 2022; $r = .10$, Nguyen & Benet-Martinez, 2013; $r = .12$, Stogianni et al., 2021). Although these effects sizes still seem small by Cohen's conventions, they *first* are comparable with influential social psychological research on theory and policy such as many cited meta-analyses on the intergroup contact (direct and indirect) effects on prejudice reduction ($r = .21$, Kende et al., 2017; $r = .28$, Lemmer & Wagner, 2015; $r = .20$, Pettigrew & Tropp, 2006). *Second*, in practical terms, given the very large number of immigrants and members of ethnocultural group who are living in multicultural societies, even a slight change in their integration endorsement may in reality be associated with increasing the adaptability of many members of those groups (for a similar argument see Berry et al., 2022; Grigoryev & Berry, 2022; Grigoryev, Stogianni, Berry et al., 2022).

Epidemiologists invented the term Number Needed to Treat (NNTT) to make similar arguments (e.g., Webb, Bain, & Prozzo, 2005). Other than its contribution to the adaptation of immigrants and ethnocultural groups, there is an added benefit of the integration strategy, making it theoretically and practically a valid and useful concept. Meta-analytic research (e.g.,

Berry et al., 2022) and current experimental research (e.g., Abu-Rayya & Brown, 2021) show that integration contributes to intergroup harmony, which may be in line with the third kind of adaptation (intercultural adaptation) that was not assessed in the original ICSEY study.

We may suggest the answer to the question of *why* the integration strategy is the most adaptive and *why* the additive approach of the CI/CP method might be better for its assessment to some extent, as reflected in higher effects sizes for the relationship between integration and adaptation. The ecocultural approach to human behavioural ecology (Berry, 2018) suggests that, in contrast to other acculturation strategies, integration strategy should provide more behavioural flexibility to be adaptive to culture-changing contexts because acculturating individuals expand their behavioural repertoire (but not necessarily lose or replace one or another; Grigoryev, Stogianni, Berry et al., 2022). The CI/CP method is additive in assessing integration, no matter in what proportions this occurs. In contrast, the ED method requires equal high scores on both scales for ‘ideal’ integration. In real life, however, it is not necessary to have equally high scores (say a maximum score of seven) on both heritage cultural maintenance and contact and participation in the larger national society dimensions in order to display the integration strategy. Thus, the additive approach seems more advantageous in assessing the integration strategy in the sense that no perfect proportions of two dimensions are needed.

In contrast to this advantageous position of the CI/CP method, we suggest that the ED method assesses assimilation and separation strategies with more clarity. It treats assimilation and separation as ‘ideal’ points, which have the ultimate goal of either preserving the heritage behavioural repertoire or replacing it with a new one, rather than subtracting one repertoire from another (as the CI/CP approach). The advantageous position of the ED method in measuring

assimilation and separation, might explain why separation was correlated with adaptation, as would be expected, when it was assessed with the ED rather than the CP approach.

Conclusions

We have found support for the *Integration Hypothesis*. First, when acculturating youth follow a strategy of being involved in both their heritage culture and that of the larger society (by using the integration strategy), they adapt better than when they use any other strategy (assimilation, separation but especially, marginalization). Second, using two new methods to evaluate this relationship, we provide convergent validation to the previous accumulating single and meta-analytic studies. This pattern of findings provides evidence that the challenges to the integration hypothesis need not be taken as unchallenged themselves. Third, we believe that this emerging pattern of evidence supporting the integration hypothesis is informative to make recommendations for developing immigrant settlement policy and practice in many culturally-plural societies. In no case is there evidence that the other three strategies might benefit the adaptation of immigrants and ethnocultural group members to the level provided by the integration strategy.

Finally compared to previous meta-analytic works, our study deployed a multilevel meta-analytic technique with new methods to measure the integration strategy, using the ICSEY dataset, which has the advantage of methodological equivalence and lower heterogeneity of effect sizes. The accumulated evidence gained from various meta-analytic works converge into similar conclusions, despite being served by different methods and datasets collected on various groups under different political and economic conditions for migration. We are convinced that the obtained results contribute meaningfully to the theoretical and methodological value of the integration hypothesis, and to the practical value of the integration way of acculturating.

References

- Abu-Rayya, H. & Sam, D. L. (2017). Is integration the best way to acculturate? A re-examination of the bicultural–adaptation relationship in the ‘ICSEY dataset’ using the bilinear method. *Journal of Cross-Cultural Psychology*, *48*(3), 287–293. <https://doi.org/10.1177/0022022116685846>
- Abu-Rayya, H. M., & Brown, R. (2021). Living together: An integrated acculturation-contact strategy to promote ethnic harmony between young British Muslims and Anglo-Britons. *Group Processes & Intergroup Relations*. <https://doi.org/10.1177/13684302211019471>
- Arends-Toth, J., & van de Vijver, F. (2006). Issues in the conceptualization and assessment of acculturation. In M. H. Bornstein & L. R. Cote (Eds.), *Acculturation and parent-child relationships: Measurement and development* (pp. 33–62). Mahwah: Lawrence Erlbaum Associates Publishers.
- Assink, M., & Wibbelink, C. J. M. (2016). Fitting three-level meta-analytic models in R: A step-by-step tutorial. *The Quantitative Methods for Psychology*, *12*(3), 154–174.
- Bender, M., van Osch, Y., Slegers, W., & Ye, M. (2019). Social support benefits psychological adjustment of international students: Evidence from a meta-analysis. *Journal of Cross-Cultural Psychology*, *50*(7), 827–847. <https://doi.org/10.1177/0022022119861151>
- Berry, J. W. (1980). Acculturation as varieties of adaptation. In A. Padilla (Ed.), *Acculturation: Theory, Models and some New Findings*, (pp. 9–25). Boulder: Westview.
- Berry, J. W. (1997). Immigration, acculturation, and adaptation. *Applied Psychology: An International Review*, *46*(1), 5–34. <https://doi.org/10.1080/026999497378467>
- Berry, J. W. (2005). Acculturation: Living successfully in two cultures. *International Journal of Intercultural Relations*, *29*(6), 697–712. <https://doi.org/10.1016/j.ijintrel.2005.07.013>

- Berry, J. W. (2018). Ecological perspective on human behaviour. In A. Uskul & S. Oishi (eds.). *Socio-economic environment and human psychology* (pp. 3–32). Oxford, United Kingdom: Oxford University Press.
<https://doi.org/10.1093/oso/9780190492908.003.0001>
- Berry, J. W. (2022). Family and youth development: Some concepts and findings linked to the ecocultural and acculturation models. *Societies*, *12*(6), 1–12.
<https://doi.org/10.3390/soc12060181>
- Berry, J. W., Phinney, J. S., Sam, D. L., & Vedder, P. (2006). Immigrant youth: Acculturation, identity, and adaptation. *Applied Psychology: An International Review*, *55*(3), 303–332.
<https://doi.org/10.1111/j.1464-0597.2006.00256.x>
- Berry, J. W., & Sabatier, C. (2010). Acculturation, discrimination, and adaptation among second generation immigrant youth in Montreal and Paris. *International Journal of Intercultural Relations*, *34*(3), 191–207. <https://doi.org/10.1016/j.ijintrel.2009.11.007>
- Berry, J. W., Lepshokova, Z., MIRIPS Collaboration, & Grigoryev, D. (2022). How shall we all live together?: Meta-analytical review of the Mutual Intercultural Relations in Plural Societies project. *Applied Psychology: An International Review*, *71*(3), 1014–1041.
<https://doi.org/10.1111/apps.12332>
- Bierwiazzonek, K., & Kunst, J. R. (2021). Revisiting the integration hypothesis: Correlational and longitudinal meta-analyses demonstrate the limited role of acculturation for cross-cultural adaptation. *Psychological Science*, *32*(9), 1476–1493.
<https://doi.org/10.1177/09567976211006432>

- Carlson, W., & Güler, A. (2018). Cultural involvement and preference in immigrant acculturation. *International Migration & Integration*, 19(3), 625–647.
<https://doi.org/10.1007/s12134-018-0554-4>
- Donà, G., & Berry, J. W. (1994). Acculturation attitudes and acculturative stress of Central American refugees. *International Journal of Psychology*, 29(1), 57–70.
<https://doi.org/10.1080/00207599408246532>
- Grigoryev, D., & Berry, J. W. (2017). Acculturation preferences, ethnic and religious identification and the socio-economic adaptation of Russian-speaking immigrants in Belgium. *Journal of Intercultural Communication Research*, 46(6), 537–557.
<https://doi.org/10.1080/17475759.2017.1386122>
- Grigoryev, D., & Berry, J. W. (2022). “Causality crisis” in acculturation research a false alarm?: A commentary on Kunst (2021). *International Journal of Intercultural Relations*, 86(1), 158–162. <https://doi.org/10.1016/j.ijintrel.2021.12.003>
- Grigoryev, D., Stogianni, M., Berry, J. W., Nguyen, A.-M.T. D., Bender, M., & Benet-Martinez, V. (2022). *Critical evaluation of the role of engaging in both the heritage culture and the larger society for cross-cultural adaptation* [Manuscript in preparation].
- Grigoryev, D., & van de Vijver, F. (2017). Acculturation profiles of Russian-speaking immigrants in Belgium and their socio-economic adaptation. *Journal of Multilingual and Multicultural Development*, 38(9), 797–814.
<https://doi.org/10.1080/01434632.2016.1268145>
- Güngör, D., & Bornstein, M. H. (2013). Gender and developmental pathways of acculturation and adaptation in immigrant adolescents. In S. S. Chuang & C. S. Tamis-LeMonda

(Eds.), *Gender roles in immigrant families* (pp. 177–190). Springer Science + Business Media. https://doi.org/10.1007/978-1-4614-6735-9_11

Jasinskaja-Lahti, I., Horenczyk, G., & Kinunen, T. (2011). Time and context in the relationship between acculturation attitudes and adaptation among Russian-Speaking immigrants in Finland and Israel. *Journal of Ethnic and Migration Studies*, *37*(9), 1423–1440. <https://doi.org/10.1080/1369183X.2011.623617>

Kende, J., Phalet, K., van den Noortgate, W., Kara, A., & Fischer, R. (2017). Equality revisited: A cultural meta-analysis of intergroup contact and prejudice. *Social Psychological and Personality Science*, *9*(8), 887–895. <https://doi.org/10.1177/1948550617728993>

Lemmer, G., & Wagner, U. (2015). Can we really reduce ethnic prejudice outside the lab?. A meta-analysis of direct and indirect contact interventions. *European Journal of Social Psychology*, *45*, 152–168. <https://doi.org/10.1002/ejsp.2079>

Möllering, A., Schiefer, D., Knafo, A., & Boehnke, K. (2014). Acculturation and well-being among migrant and minority adolescents: A cross-national and cross-ethnic comparison. In R. K. Silbereisen, P. F. Titzmann, & Y. Shavit (Eds). *The challenges of diaspora migration: Interdisciplinary perspectives on Israel and Germany* (pp. 83–102). Routledge.

Nguyen, A.-M. D., & Benet-Martínez, V. (2013). Biculturalism and adjustment: A meta-analysis. *Journal of Cross-Cultural Psychology*, *44*(1), 122–159. <https://doi.org/10.1177/0022022111435097>

Pettigrew, T. F., & Tropp, L. R. (2006). A meta-analytic test of intergroup contact theory. *Journal of Personality and Social Psychology*, *90*(5), 751–783. <https://doi.org/10.1037/0022-3514.90.5.751>

- Rudmin, F. W. (2003). Critical history of the acculturation psychology of assimilation, separation, integration, and marginalization. *Review of General Psychology*, 7(1), 3–37. <https://doi.org/10.1037/1089-2680.7.1.3>
- Rudmin, F. W. (2008). Book Review: immigrant youth in cultural transition: Acculturation, identity, and adaptation across national contexts, edited by John W. Berry, Jean S. Phinney, David L. Sam, & Paul Vedder. London: Lawrence Erlbaum, 2006, 336 pp. ISBN 0-80-585156-9. *Journal of Cross-Cultural Psychology*, 39(2), 230–233. <https://doi.org/10.1177/0022022107313860>
- Safa, M. D., & Umaña-Taylor, A. J. (2021). Biculturalism and adjustment among U.S. Latinos: A review of four decades of empirical findings. In *Advances in child development and behavior* (pp. 73–127). Elsevier. <https://doi.org/10.1016/bs.acdb.2021.05.002>
- Sam, D. L., & Ward, C. (2021). Three generations of psychological acculturation research: Theoretical advancements and methodological challenges. In M. Bender & B. Adams (Eds). *Methods and assessment in culture and psychology* (pp. 17–40). Cambridge, Cambridge University Press.
- Schwartz, S. J., & Zamboanga, B. L. (2008). Testing Berry's model of acculturation: A confirmatory latent class approach. *Cultural Diversity & Ethnic Minority Psychology*, 14(4) 275–285. <https://doi.org/10.1037/a0012818>
- Schwartz, S. J., Unger, J. B., Zamboanga, B. L., & Szapocznik, J. (2010). Rethinking the concept of acculturation: implications for theory and research. *American Psychologist*, 65(4), 237–251. <https://doi.org/10.1037/a0019330>

- Schmitz, P. G., & Schmitz, F. (2022). Correlates of acculturation strategies: Personality, coping, and outcome. *Journal of Cross-Cultural Psychology*, *53*(7–8), 875–916.
<https://doi.org/10.1177/00220221221109939>
- Stogianni, M., Bender, M., Slegers, W. W. A., Benet-Martinez, V., & Nguyen, A. (2021). Sample characteristics and country level indicators influencing the relationship between biculturalism and adjustment: An updated meta-analysis. Unpublished Manuscript
<https://psyarxiv.com/8qymv/>
- Szapocznik, J., Kurtines, W. M., & Fernandez, T. (1980). Bicultural involvement and adjustment in Hispano-American youths. *International Journal of Intercultural Relations*, *4*(3–4), 353–365. [https://doi.org/10.1016/0147-1767\(80\)90010-3](https://doi.org/10.1016/0147-1767(80)90010-3)
- Tonsing, K. N. (2014). Acculturation and adaptation of first- and second-generation South Asians in Hong Kong. *International Journal of Social Welfare*, *23*(4), 410–420.
<https://doi.org/10.1111/ijsw.12079>
- Vedder, P., & van de Vijver, F. (2006). Methodological aspects: Studying adolescents in 13 countries. In J. W. Berry, J. E. Phinney, D. L. Sam, & P. Vedder (Eds.), *Immigrant youth in cultural transition: Acculturation, identity and adaptation across national contexts* (pp. 47–70). Mahwah, NJ: Erlbaum.
- Viechtbauer, W. (2010). Conducting meta-analyses in R with the metafor package. *Journal of Statistical Software*, *36*(3), 1–48. <http://doi.org/10.18637/jss.v036.i03>.
- Webb, P. W., Bain, C. J., & Pirozzo, S. L. (2005). *Essential Epidemiology: An Introduction for Students and Health Professionals*. Cambridge University Press.